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DEPARTMENT OF THE INTERIOR AND RELATED AGENCIES APPROPRIATIONS FOR 1974

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS HOUSE OF REPRESENTATIVES

NINETY-THIRD CONGRESS

FIRST SESSION

SUBCOMMITTEE ON DEPARTMENT OF THE INTERIOR AND RELATED AGENCIES

JULIA BUTLER HANSEN, Washington, *Chairman*

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K. GUNN McKAY, Utah
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J. DAVID WILLSON and BYRON S. NIELSON, *Staff Assistants*

PART 3

Bureau of Mines
Federal Metal and Nonmetallic Mine Safety Board of Review
Geological Survey
Office of Coal Research
Office of Oil and Gas
Office of the Secretary
Office of the Solicitor
Office of Water Resources Research

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DEPARTMENT OF THE INTERIOR AND RELATED AGENCIES APPROPRIATIONS FOR FISCAL YEAR 1974

TUESDAY, MARCH 27, 1973.

GEOLOGICAL SURVEY

WITNESSES

VINCENT E. McKELVEY, DIRECTOR
WILLIAM A. RADLINSKI, ASSOCIATE DIRECTOR
HENRY W. COULTER, ASSISTANT DIRECTOR, ENVIRONMENTAL CONSERVATION
JAMES R. BALSLEY, ASSISTANT DIRECTOR, RESEARCH
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RUSSELL G. WAYLAND, CHIEF, CONSERVATION DIVISION
RICHARD P. SHELDON, CHIEF GEOLOGIST
JOHN M. DeNOYER, DIRECTOR FOR EROS PROGRAM

Mrs. HANSEN. The committee will come to order.

This morning we have the Geological Survey and our principal witness is Dr. Vincent E. McKelvey, the Director.

TRIBUTE TO DR. WILLIAM PECORA

Dr. McKelvey, may I say it is a distinct pleasure to welcome you this morning. At this time I would like to pay tribute on behalf of the committee to the former Director, Dr. William Pecora, whom we regret losing so much. He did such an unbelievably fine job before this committee for so many years before becoming the Under Secretary. We do miss him and we are grateful that we had the opportunity of having his knowledge for so many years.

Dr. McKelvey, we are always sorry to lose one of our top people.

Mr. McKELVEY. We much appreciate that, Madam Chairman. His loss was a tremendous one. There is no question about that. It was a real tragedy.

Mrs. HANSEN. It was a tragedy, particularly because this was the first time Interior to my knowledge had appointed a top flight scientist as Under Secretary. I thought this was a splendid new direction to go because your whole Department is so involved with the future of this Earth. We feel that the U.S. Government and the people of the United States have been the distinct losers.

INTRODUCTION OF WITNESSES

Dr. McKelvey, would you like to introduce the members of your staff who are present.

Mr. McKELVEY. Yes, Madam Chairman.

First, may I introduce, Mr. Frank Wiles of the Department, the Director of Budget for the Department of the Interior.

On my left, Mr. William Radlinski, Associate Director; and Mr. Jack Stassi, our Budget Officer; Mr. Frank Clarke, our Senior Scientist; and over in the corner, Dr. James Balsley, Assistant Director for Research; and then on my left over here at my back, Mr. Roy Hendricks——

Mrs. HANSEN. We are always glad to welcome Mr. Hendricks.

Mr. McKELVEY [continuing]. The Chief Hydrologist; Dr. Richard Sheldon, our Chief Geologist; and Dr. Wayland, Chief of our Conservation Division; Mr. Robert Lyddan, our Chief Topographic Engineer; and Dr. Henry Coulter, who is Assistant Director for Environmental Conservation; and in the next room are also Mr. Edmund Grant, Assistant Director for Administration; Dr. John DeNoyer, the Director of the EROS program; and Dr. Jim Anderson, who is our Chief Geographer. If we may, when we come to their programs we would like to bring them in.

STATEMENT OF DIRECTOR

Mrs. HANSEN. I am sure you have a statement, Dr. McKelvey, please insert it in the record and summarize it or you may read it, as you wish.

Mr. McKELVEY. I would like to place it in the record, Madam Chairman, and give a summary of it, if I may.

[The statement follows:]

Madam Chairman and members of the committee, I am pleased for this opportunity to make some general remarks about the Geological Survey's work and proposed program and budget for fiscal year 1974. If I may, I will speak first to the problems with which we are concerned, then I will report briefly on the approaches we are taking to them, and finally I will summarize the highlights of our 1974 budget request.

FUTURE NEEDS FOR RESOURCES AND ENVIRONMENTAL PROTECTION

Perhaps I can best describe the problems we are concerned with, and their gravity as well, by speaking of the needs of the second America. If we think of the first America as the sum total of man's activities in this country during all of our previous history, we can say that we will build a second America by the end of the century in the sense of equaling or exceeding the physical accomplishments up until now. This means that we will have used as much or more minerals and fuels as we have previously, that we will have had to build as much or more in the way of new structures—highways, factories, office buildings, homes, and so on—as we have up until now. And because degradation of environmental quality is more or less a function of our production and use of land and resources, it also means that we could do as much or more environmental damage as we have done throughout our history if we do not conduct our activities in ways that preserve environmental quality.

The growing difficulty of meeting these somewhat conflicting demands for increased resource production and increased protection of the environment is already manifested in local shortages of energy and in many regional and local environmental impacts. I believe we have the physical and human resources, Mr. Chairman, to meet the serious and difficult problems that face this Nation, but it is going to require concerted and imaginative efforts.

GEOLOGICAL SURVEY'S CENTRAL ROLE IN PROVIDING RESOURCE AND LAND INFORMATION

As the Nation's principal resource and land factfinding and research organization, the Geological Survey has a central role to play in helping the Nation surmount these problems. For example, topographic, geologic, and hydrologic maps and data we produce help to guide resource development and construction and to assess environmental problems as well. The information we develop about natural geologic processes and history furnishes a basis for reducing the effects of natural hazards, such as earthquakes and floods, and contributes to the understanding of natural processes that need to be reckoned with in maintaining an acceptable balance with nature. Work in the classification of the public lands and the supervision of mineral leasing operations aids in the wise management, use, production, and conservation of an important part of the Nation's resources.

In providing an information base that will make possible intelligent resource development and environmental conservation in the critical years ahead, it is important that we pay close attention to priority needs.

NEED FOR INTERPRETATION AND TRANSLATION OF BASIC DATA

As this committee knows from its close acquaintance with our work over the years, we have been constantly modifying our program to make it responsive to developing problems. We have been becoming increasingly aware, however, that it is not enough merely for us to identify the problems. To make our work more effective, we must know more about the kinds of information policymakers and decisionmakers need to solve these problems. And we need to know better the form in which our information can be understood and so be available in a practical way to such users. To enlarge our understanding of these needs, during the past year we have talked with many State and local officials, planners, developers, conservationists, and Federal land managers in other agencies. We still have much to learn in these areas, but the effort has already been fruitful in helping us to identify the ways in which the results of our work can be made more effective.

One of the things we are finding is that we need to make a greater effort to translate our scientific data ino terms that are readily understandable to nonscientists and that are directly applicable to their problems. We had already begun to move in this direction in our land resource analysis program, which we began last year, and in our urban area studies. Last year, I showed you a folio of interpretive maps from the Hartford, Conn., area. We have since completed 12 folios of other areas and have others in progress. These folios contain interpretative maps that are derived from basic data but are more directly usable by the planner and decisionmaker.

In the San Francisco urban arena study, we have completed over 50 interpretative maps showing such features as flood-prone areas, depth to bedrock, active faults that may lead to earthquakes, landslide-prone areas, and water supply and demand. We have found that some of these interpretative maps need to be carried a step further to be readily usable by planners, and we are continuing to cooperate with HUD and the planners in the bay area to develop such products. We are also planning to develop a primer to assist planners in the San Francisco area to make fuller use of Earth science data.

Still other interpretative products are being prepared in our basic programs, such as slope maps in the topographic mapping program, floodplain mapping and hydrologic atlases in the water resources program, and experimental thematic maps in the EROS program. Some of these interpretative products are in the experimental phase, and we are presently in the process of evaluating the users' reactions to them.

IMPROVEMENT IN DATA ACCESSIBILITY

We are also exploring and implementing a number of ways to make data more accessible to the users and to acquire data in more efficient ways. We are proceeding with the National Water Data Exchange (NAWDEX) and the National Cartographic Information Center (NCIC), which we discussed with you at previous hearings, as means of improving the accessibility of hydrologic and topographic data. During this past year, we started to operate the EROS Data Center in Sioux Falls, S. Dak., to provide a central source for ERTS-1

satellite data and aerial photography. And we are in the process of developing computer-aided information systems assembling existing data on mineral resources including oil, gas, and coal. An important input to this resource information bank comes from a comprehensive assessment of this country's known and potential resources of minerals and fuels, which we undertook and completed during this past year. It will be published this spring as Professional Paper 820.

NEW TOOLS AND PRODUCTS

Among other new approaches that we are developing is computer modeling of hydrologic data to increase the utility of hydrologic information in problem solving. The orthophotoquad, an example of which I showed you last year, is another approach that we are experimenting with as a means of quickly and inexpensively filling the need for a base map in advance of the completion of a standard topographic map, and of supplying up-to-date information on land use. Especially noteworthy among new sources and kinds of information are the images of the earth's surface coming from the Earth Resources Technology Satellite, which was successfully launched last July. Although a full assessment of it is already evident that ERTS imagery will be useful in such diverse problems as identifying some previously unknown geologic structures that may suggest targets for mineral exploration and inventorying crops and timber resources. And when combined with ground data radioed to the satellite, additional applications are possible, such as measuring the variations in water volume in playa lakes and other surface-storage systems.

INCREASE IN MULTIDISCIPLINARY PROBLEMS

To an increasing extent in recent years, we have found that many of today's resource and environmental problems cannot be solved within the context of one scientific discipline. We have frequently had to assemble ad hoc teams for various disciplines from within the Survey to work with experts from other agencies on special task forces, such as the one on the proposed Everglades Jetport, where it was necessary to understand the interaction of hydrologic and biologic regimes to analyze the environmental effects of such a development. The problems of the Alaska pipeline called for an understanding of such diverse phenomena as permafrost, seismic risk, availability of construction materials, and distribution and character of vegetation and wildlife. Similarly, environmental impact analyses in many areas involve consideration of mineral resources, hydrology, esthetics, vegetation, and rare or unique wildlife, such as the condors in the Los Padres National Forest case. Our geothermal investigations, on which we are making good progress now, are another example of studies that necessarily involve a range of scientific and engineering disciplines.

RESOURCE AND LAND INFORMATION PROGRAM

Madam Chairman, the various experiences I have described, coupled with our exploration of ways in which to make our work most useful in solving the critical problems ahead, led us to develop last spring a new interdisciplinary effort called the resource and land information program. Our purpose here is to determine how best to provide for the coordinated acquisition of comprehensive, multidisciplinary resource and land information; how to translate it into terms understandable to the user and applicable to his problems and how to provide interactive information systems that permit effective use of the full spectrum of information in problem analysis. Because of the interdisciplinary nature of this study, Secretary Morton established RALI as a departmental program, with the Survey as the lead agency. And, we undertook in fiscal year 1973 some experimental work to test certain of the coordinated approaches to land and resource problems and to explore the needs for such a program.

The RALI concept embraces many of the traditional Geological Survey activities and objectives, but goes beyond them in the attempt to bridge gaps between those who collect and those who use resource and land information. Although it is broader in scope than the urban area studies and the land resource analysis program begun in recent years, it is akin to them in its objective of providing multidisciplinary data interpreted and translated into terms understandable by the user and relevant to his needs. As the RALI program develops, we may want to include in it these related programs. In beginning

the program, however, we felt it best for budgetary purposes to restrict it to the new activities that are involved. For fiscal year 1974, we are requesting permission to redirect $1 million of our funds to investigate in more detail the kinds of earth science data users need, the opportunities for more effective coordination among Federal-State information programs and the possibility of developing more effective methods for collecting data and disseminating them to potential users. From the answers to some questions, we hope to design a resource and land information system which will provide the functions and actions needed to acquire and supply Earth-science data more effectively in the future.

REQUIREMENTS OF ACCELERATED OCS LEASING

Our fiscal year 1974 request includes a $2 million increase divided among the conservation and geologic and mineral resource programs to administer the Geological Survey's part of the program of accelerated oil and gas leasing on the Outer Continental Shelf which is intended to help alleviate the present energy crisis. We must take every possible step to insure that these resources can be produced safely. Therefore, a significant part of this increase—$730,000—will be used to strengthen our management program of the OCS leases by implementing a number of recommendations from the recent studies of our OCS lease operations. The acquisition of additional geophysical data and its analysis to assist in selecting specific tracts for leasing, to help determine a fair value for the leases, and to pinpoint subsurface conditions that may require special attention during the lease development to prevent accidents will require $1,040,000. The acquisition and evaluation of geophysical data for identifying new areas on the Outer Continental Shelf with high potential for oil and gas will require $230,000.

MOVE TO NEW NATIONAL CENTER

The fiscal year 1974 budget request also includes an increase to move into Survey's new national center that is being completed this calendar year in Reston, Va. This facility will bring together the personnel and operations that now are located in 23 places scattered about the metropolitan Washington, D.C. area. I am happy to report that the contractor is ahead of schedule with the building. We expect the first of our employees to be transferred to the new facility this summer, and the total relocation to be completed during the coming year.

Madam Chairman, these are the highlights of our thoughts about our problems, the directions in which we think we need to go, and our 1974 budget request. We believe that our work is filling important national needs and that we are taking the steps necessary to make it even more effective in the future. We have a number of charts with us today to illuminate some of the details of our program, and I will be happy to discuss them and to answer the committee's questions.

Mr. McKELVEY. My statement identifies some of the problems we are concerned about, reports on the approaches we are taking to them, and outlines the highlights of our 1974 budget request. I will be glad to summarize it.

PROBLEMS OF ENERGY AND MINERAL RESOURCES

In the work of the Geological Survey, we are concerned with many kinds of problems, large and small, but I am identifying here two of the most pressing and difficult ones that face the Nation; namely, how to meet continuing needs for energy and mineral resources and how, at the same time, to maintain a viable, satisfying environment. I say "at the same time," because the use of resources, including the land, is the main source of environmental degradation. The objectives of meeting resource needs and maintaining environmental quality are thus in natural conflict, and the difficulty of solving them individually is multiplied many times in trying to solve them in a compatible fashion.

ROLE OF GEOLOGICAL SURVEY IN MEETING PROBLEMS

The Geological Survey has a central role to play in helping surmount these problems. This is because sound information about the land and its resources is the basis for the intelligent resolution of problems of this kind, and the Survey is the Nation's principal factfinding agent in the area of Earth resources.

In our efforts to carry out our responsibilities in the most meaningful way, we have, of course, modified our activities many times to respond to new problems and to meet new needs. But we have found that it is not enough just to identify the problems. To be most effective in satisfying the needs for information, we must know more about the kinds of data that planners and decisionmakers need, and the form in which the data can be understood and used most expeditiously. We have also found that we need to make a greater effort ourselves to translate scientific data into terms understandable to nonscientists and in other ways to make the information more accessible to them.

Another area in which we are working to improve our capability is in the development of new tools and methods of data acquisition and display. Of great potential among recent advances is the use of repetitive, synoptic images of the Earth's surface obtained from the Earth Resources Technology Satellite successfully launched last July. Although it is too early to evaluate fully the ERTS experiments, it is already apparent that the data will have diverse applications.

In our work in recent years, we have found that to a growing extent the solutions to today's resource and land problems require a multidisciplinary approach, and the input of diverse kinds of information. This is especially true in evaluating the environmental impact of proposed projects such as the Everglades Jetport and the Alaska Pipeline, but it is true also in geothermal energy and other resource investigations

FISCAL YEAR 1974 INCREASE FOR RESOURCE AND LAND INFORMATION PROGRAM

Acting on the basis of these several kinds of experiences and exploratory efforts to make our work most useful in solving the critical problems ahead, we developed last spring a new multidisciplinary effort called the resource and land information program. A request to redirect $1 million to support this program is included in our fiscal year 1974 budget. The purpose of this program at this stage is to determine how to develop a comprehensive, usable, and accessible resource information base that will support policymaking, planning, and decisionmaking with respect to problems such as land use, resource development and management, environmental conservation, and public land management. It represents a concerted effort to make the results of our work more meaningful and useful to those who must make the difficult and critical decisions about resource development and environmental conservation.

FISCAL YEAR 1974 INCREASE FOR OCS LEASING

Our fiscal year 1974 budget also contains a request for an increase of $2 million to support the accelerated OCS leasing program the

administration has proposed. About $730,000 of this increase would be used to support our supervisory responsibility for lease operations and to strengthen our capability to improve the safety of offshore exploration and production. The remaining $1,270,000 would be used in the presale evaluation of lease areas for the purpose of planning the lease sales, establishing minimum bids, and identifying environmental problems.

FISCAL 1974 INCREASE FOR FACILITIES

We are also requesting $5,914,000 to help cover the cost of our move next summer to our new National Center at Reston. Bringing together our staff which is now scattered in 23 locations in the metropolitan area should have many dividends in the efficient conduct of operations.

I will conclude by saying that we believe our work is filling important national needs, and that we are taking the steps necessary to make it even more effective in the future. We have brought along a number of charts to illustrate various parts of our program and look forward to discussing them and to answering your questions. Thank you.

Mrs. HANSEN. I may say, Dr. McKelvey, I think your agency probably is at this particular time the most important one as a basis for knowledge. I hope you are providing the Bureau of Land Management with advice on technical matters.

Mr. MCKELVEY. We do our best to give advice to the rest of the Department on technical matters, Madam Chairman.

OCS LEASING PROGRAM

Mrs. HANSEN. Before the BLM issues any leases whatsoever do you give them all the information that you have available?

Mr. MCKELVEY. Yes, Madam Chairman. The purpose of much of our work on the Outer Continental Shelf is to lay an information base about not only the resource potential but the environmental conditions. We make that fully available to the Bureau of Land Management and work with them in helping them to understand its significance.

INFORMATION AVAILABLE FOR OCS LEASING

Mrs. HANSEN. You will recall several years ago before this committee, Dr. Pecora testified to the inability of the Geological Survey to do the kind of job that was necessary before leasing. At that time Dr. Pecora testified that the knowledge the Geological Survey had was not as great as that of the companies that were issued the leases.

Do you feel that you have now the same relative information as the companies that obtain the leases?

Mr. MCKELVEY. Madam Chairman, that perhaps is difficult to evaluate.

We don't know fully the capabilities of all of the companies involved, but I can say that we have extensive geophysical coverage. We buy proprietary data, which are the same data in many cases from which industry begins its evaluation.

Industry, of course, is specialized to a very high degree, has a high degree of competence in the exploration for oil and gas, in the aggregate far more than we do.

INDUSTRY AND THE GEOLOGICAL SURVEY EXPENDITURES FOR OCS LEASING INFORMATION

Mrs. HANSEN. What would you estimate industry spends on information gathering prior to bidding on a sale?

Mr. MCKELVEY. I couldn't give you that in the aggregate but a few years ago I was working on the problem of methods of leasing and other procedures on the OCS and I learned at that time that one major company spent $80 million a year approximately in its total exploratory effort.

Mrs. HANSEN. What does your Bureau spend?

Mr. MCKELVEY. We are requesting this year about $16 million, including our lease management responsibility. But of course we are not in our work attempting to appraise the prospects for petroleum occurrence to the extent that we are willing to risk large amounts of money, which a company has to do.

What we try to do is to identify the prospectively valuable areas and evaluate them to the extent that we can determine what is a reasonable minimum bid and determine the environmental problems that may be encountered.

The company, of course, is putting much more on the line then the Government.

Mrs. HANSEN. I understand.

BENEFICIARIES OF GEOLOGICAL SURVEY INFORMATION

The Treasury of the United States is the beneficiary of your direct application of knowledge; isn't that correct?

Mr. MCKELVEY. That is correct.

Mr. MCKAY. Madam Chairman, isn't also a byproduct of this a subsidy to corporations for you to do that initial exploratory work?

Mr. MCKELVEY. Sir, I am sure they would dispute that. I think it is of value, as Madam Chairman has indicated, to the general public. For example, we established minimum bids that led to the rejection of certain bids on drainage sales.

When those tracts were sold when offered a second time the aggregate of the bids was about $60 million, or $53 million greater than the bids that were rejected, so that certainly represents a substantial savings for the general public. Industry I am sure would have preferred to have the bids accepted the first time.

Mr. MCKAY. I am sure that is true.

Mr. MCKELVEY. But it is true, sir, that our work in very advanced stages of reconnaissance does lead, and has led, to the identification of broadly favorable areas.

PRUDHOE BAY AS FAVORABLE AREA FOR PETROLEUM

As a very hard and specific example, I might mention Prudhoe Bay. It was our work beginning in the twenties, thirties, and continuing on through the years, that led to the recognition of the North Slope as a broadly favorable area for petroleum.

Now, we did not discover Prudhoe Bay as a field. We didn't even do the geophysical work that led to the identification of the structures that were later considered favorable for drilling and were explored in

that way by private industry. But we did identify the broadly favorable area, the rocks that were favorable for the cumulation of petroleum, the source beds. We laid the geological framework to establish the North Slope as a province that later became attractive to industry.

Similarly in very recent years we have identified a number of basins offshore of Alaska that were not known to exist before but that were later considered favorable for drilling and were explored in occurrence of petroleum.

So in that way our work lays a broad framework that makes it possible for industry to select areas that are favorable for more detailed exploration and if they are lucky, discovery and development.

IMPACT OF GEOLOGICAL SURVEY ON LAND AND MINERAL DEVELOPMENT

Mrs. HANSEN. What if there was no Geological Survey, what would be the result?

Mr. MCKELVEY. Well, Madam Chairman, I have to admit a bias in advance on that, but I believe that the country would really be far worse off in many, many areas because, first of all, it would be stumbling and fumbling a great deal more than it has when it comes to the exploration and development of mineral resources, because our work has laid very broad framework over the years that has facilitated the development of resources.

But in countless other areas also, having to do with the development of the land itself, with conservation and so on, the information that the Geological Survey provides does make an extremely valuable contribution to land use and conservation, water resource problems, and so on.

In very broad terms, the Survey is a true exploratory body. Of course, in the early years that was in a very literal sense. Geographic exploration was an important part of our contribution. But exploration in science and about the earth is something that goes on and on, and the Survey in providing information about the character of the land and its resources which we think is performing a very valuable service.

I think also I should mention that it is not only important to provide information about the character of the land, its surface configuration, water resources, and so on, but it is extremely important also that that information be provided by a source that is credible, and the Geological Survey as an impartial objective factfinding agency, I believe, has the credibility that is important.

FEDERAL LAND MANAGEMENT

Mrs. HANSEN. Dr. McKelvey, the U.S. Government owns approximately 754 million acres of land, exclusive of the Department of Defense. You have a direct responsibility to provide the knowledge about what lies under the public lands of the United States.

Mr. MCKELVEY. Yes, ma'am.

Mrs. HANSEN. It is inescapable that you perform a meaningful analysis of our public lands.

Mr. McKelvey. That is correct. Approximately one-third of the Nation's land is public land and the Government in its role as landlord and manager of such a large part of the Nation's resources certainly needs the kind of information and the kind of knowledge about what it is that it possesses that the Survey provides.

MINERAL DEPOSIT DISCOVERIES WITHOUT GEOLOGICAL SURVEY ASSISTANCE

Mr. McKay. Madam Chairman, I agree with what you are saying, but do we have a chart anywhere or information which may show discoveries of minerals or wealth that has been discovered by companies without the use of the Geological Survey like the work that you do prior to open up or give general information that this is a probable area and so on?

Mr. McKelvey. We haven't——

Mr. McKay. You don't have any studies that would indicate that type of thing?

Mr. McKelvey. Well, I might say, Congressman, that most of the actual discoveries of minable deposits are made by private industry.

Except in times of emergency the Geological Survey doesn't attempt in its own work to actually discover and develop minable deposits.

Mr. McKay. Except you have laid the groundwork in saying this is a probable area for oil, this is a probable area because of our research for this, so that has preceded the discoveries you are talking about?

Mr. McKelvey. That is correct.

INVENTORY OF NATION'S RESOURCES

Mrs. Hansen. Also so that you have an inventory of what the Nation's resources are. I think in your statement you say you have limited knowledge on about 30 percent of the land.

Mr. McKelvey. Well, I don't recall having made that statement.

Mrs. Hansen. Maybe the statement was made in your justifications.

Mr. McKelvey. But it is true that there are many areas of the country where we don't know nearly enough about the geology.

Mrs. Hansen. Particularly Alaska.

Mr. McKelvey. Alaska is one. We have broad knowledge now of the general geologic character of the entire United States; but in the detail that is necessary for support to many kinds of activities, we don't have nearly enough in many parts.

Off shore, of course, our information is still in a much more primative stage than it is on shore and we have many surprises ahead of us I am sure as work there proceeds.

ASSISTANT DIRECTOR FOR ENVIRONMENTAL CONSERVATION

Mrs. Hansen. I am sure you do because I had an opportunity to be aboard your boat one summer when they were working on the offshore lands directly off the mouth of the Columbia River while you were exploring some possible mineral locations.

Dr. Coulter is the Assistant Director for Environmental Conservation. This is a new post. What are his responsibilities?

Mr. McKelvey. Madam Chairman, we created this position because of the increased demands in the general area of concerns of the en-

vironment, and for environmental impact statements. The requirements of NEPA have placed a very heavy burden on the Geological Survey, and we found it was necessary to coordinate from our office, our work in this general area, so part of Dr. Coulter's responsibilities have to do with the coordination of our work in the preparation and review of environmental impact statements.

COSTS OF ENVIRONMENTAL IMPACT STATEMENTS

Mrs. HANSEN. What percent of your budget involves environmental work?

Mr. MCKELVEY. Percentage wise it is a little less than 2 percent. In dollars this year it is about $2.1 million and it will be about $2.2 million we estimate in 1974.

Mrs. HANSEN. Is this an ever increasing item in your budget?

Mr. MCKELVEY. Well, it is going to increase for some time we think, Madam Chairman. As you know, the requirements of NEPA are really still being written in the courts. As precedents are set the tendency has been to require consideration of more and more actions. The language of the law is rather vague. It says, "Major Federal actions significantly affecting the quality of the human environment," and what is major and what is significant, those things are being determined by precedents that are set by the courts.

But the trend has been to increase the number of actions that need to be considered, also whether or not an environmental impact statement is to be prepared, for us, and I am sure for most other organizations, has to be determined on the basis of an environmental assessment. A study of the problem has to be made to see if indeed it is one that takes that step.

IMPACT OF ENVIRONMENTAL COST STUDIES ON BUDGET

Mrs. HANSEN. I don't view this item critically but I do want to say I don't think a budget as we look at it today is being fully explained to the general public. Many people see an increasing budget but don't realize that part of this increase is due to the ever-increasing costs as a result of inflation and environmental work. These are two items that are now a firm part of all budgeting so when you look at an increased budget you must realize part of the increase is a result of these two factors.

Congress sometimes is called big spenders because we have had to increase budgets just to be able to do the same amount of work that was accomplished 5 years ago. We found wrapped into the budget additional costs as a result of escalation, increasing environmental work, plus additional responsibilities because of the other Departments' desire to know or the people's desire to have certain answers rather quickly.

Budget procedures today aren't as simple as they have appeared in the past.

PROCEDURES FOR ENVIRONMENTAL IMPACT STATEMENTS

Mr. MCKELVEY. Yes. I might say also that Dr. Coulter has responsibility in another area having to do with the activities of our Conservation Division.

Again, because of increased concern about the environment and the management of operations conducted under leases on public land, both onshore and offshore, we are increasing our efforts in the management of those operations, both by further development of regulations and orders, and other procedures that we perhaps will get into later on, and we have found that we in the Director's Office simply need more help in that general area.

Mrs. HANSEN. Do you want to insert in the record a short summary of the new orders which you have issued in the past year so that the committee has some idea of the kind of inspection regulations you are requiring.

Mr. MCKELVEY. Yes, we will be glad to do that, Madam Chairman.

[The information follows:]

OCS order No. 5—Installation of subsurface safety devices.—This order was again recently rewritten to assure the shut-in of a well in the event of a failed surface valve or fitting. The objective is to get full opening subsurface safety valves down hole in all wells to minimize failure due to sand cutting. Additionally, wells with the new type full-opening subsurface safety valves may be shut in manually at the surface or automatically by remote control from the surface.

OCS order No. 11.—Interim oil and gas production rates.—Procedures for establishing production rates are now based on MER, instead of depth bracket allowances. MER is defined as that rate for each reservoir and each well which, if exceeded, would lead to avoidable underground waste through loss of ultimate recovery of oil and gas from that reservoir. It is dependent on the recovery mechanism operative for the current producing period, and is based on engineering and geological information.

Mrs. HANSEN. Thank you.

Mr. MCKELVEY. We have a chart which we will show you later on that shows many of the steps we have taken and some of the things we are thinking about.

AWARD TO DR. DAVID BREW

Mrs. HANSEN. We are looking with anticipation to your charts. We always enjoy them. Before we move on I would like to salute Dr. David Brew who is 1 of the 10 Federal careerists to win the 1973 National Civil Service Award for work done on environmental impact of the trans-Alaskan pipeline. The committee is very proud that one of your people in the Geological Survey won this very coveted award.

Mr. MCKELVEY. Thank you. We much appreciate that, Madam Chairman. Dave Brew is one of our outstanding young geologists and he really worked himself to the bone on that problem, we feel that it was very much deserved and we appreciate your comments on it.

Mrs. HANSEN. We are proud to work with your bureau.

Mr. McKay, do you have any questions at this point?

Mr. MCKAY. Maybe we will get into more detail as we get to topographic mapping.

Mrs. HANSEN. Mr. McDade.

Mr. MCDADE. Nothing right now.

Mrs. HANSEN. Mr. Veysey.

Mr. VEYSEY. No; I think mine relate to more details.

Mrs. HANSEN. I would like to discuss some of the items you have mentioned in your prepared statement. What are the results of your conversations with local officials, planners, developers, conservationists, and Federal land managers on the interpretation and translation of Geological Survey data?

Mr. MCKELVEY. We have had, as you say, many conversations during the past year with planners, managers, and we have found a great interest on their part in information in this general area, a desire on their part to have it in a form in which they can understand it. Some differ in their judgments as to the kind of things that are important.

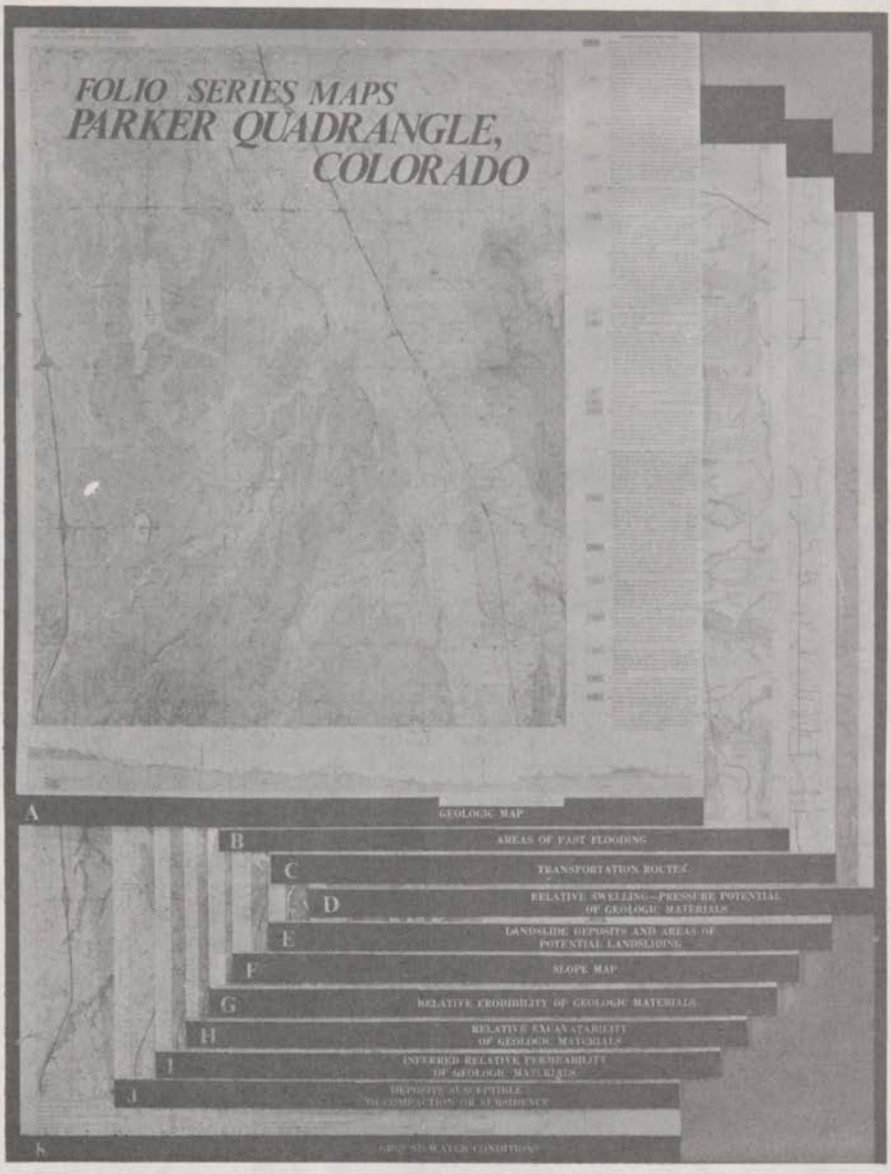
You may remember last year, I believe, we showed you a draft folio of the Hartford north quadrangle in Connecticut in which we had taken a geologic map, topographic map, basic information of the kind we ordinarily publish and then from that produced a series of maps giving information in terms that were more directly related to the problems of the planners and those concerned with resource development and land use.

During the past year we have carried that on with the production now of about a dozen of such folios, prepared really on an experimental and exploratory basis.

We have a chart here that contains the maps produced in one of those areas.

[The chart follows:]

A series of innovative maps of the Parker Quadrangle, Colo., have been derived from a basic geologic map. These summarize the physical characteristics, resources, and water supply conditions vitally needed for intelligent land-use planning and resource management and development.


FOLIO SERIES MAPS
PARKER QUADRANGLE,
COLORADO
A
GEOLOGIC MAP
B
AREAS OF PAST FLOODING
C
TRANSPORTATION ROUTES
D
RELATIVE SWELLING—PRESSURE POTENTIAL OF GEOLOGIC MATERIALS
E
LANDSLIDE DEPOSITS AND AREAS OF POTENTIAL LANDSLIDING
F
SLOPE MAP
G
RELATIVE ERODIBILITY OF GEOLOGIC MATERIALS
H
RELATIVE EXCAVATABILITY OF GEOLOGIC MATERIALS
I
INFERRED RELATIVE PERMEABILITY OF GEOLOGIC MATERIALS
J
DEPOSITS SUSCEPTIBLE TO COMPACTION OR SUBSIDENCE
K
GROUND-WATER CONDITIONS

Mr. McKelvey. This is the Parker quadrangle in Colorado and labeled at the bottom in the large letters are the kinds of information that each of those derivative maps show. In addition to the geologic map that we ordinarily produce, this one shows information on flooding, this one shows areas of swelling clays that occur in the area, and this one landslides.

The next one shows the slope of the land in terms that the layman can understand perhaps more readily than a topographic map, and shown here is the relative erodibility of geologic materials and on this one the relative excavatability of geologic materials. For maps of this kind, well, we have had just enormous enthusiasm on the part of the local people in the areas in which these have been prepared so we think we are on the right track.

We think we still have much to learn about their needs and the form in which they can use information, and that, of course, is the principal reason we are developing the RALI program, the resource and land information program, which we will probably talk more about later.

LAND USE INFORMATION FOR BUILDING PROGRAMS

Mrs. Hansen. You will recall several years ago, Dr. McKelvey, this committee asked that Government agencies before they went ahead with building programs to come to the Geological Survey for land use information.

The Government has had some rather disastrous accidents involving hospitals in Alaska and in other areas where Federal buildings were placed in unstable locations. Federal agencies apparently were not aware the Geological Survey had information in this regard.

Are other Government agencies now coming to you for this basic information?

Mr. McKelvey. We have been working with several other Government agencies, for example with the Veterans' Administration. It turned out that veterans hospitals were one of the best devices for finding faults and earthquake areas.

Mrs. Hansen. Also there were many hospitals in Alaska that were on the edge of the earthquake.

Mr. McKelvey. Yes.

Mr. McDade. We got into this a little bit with the Veterans' Administration. How many hospitals in the VA system were built in an unhappy location?

Mr. McKelvey. I can't answer that. Perhaps Dr. Coulter knows that.

Mr. Coulter. Our total cooperative program with them includes the analysis of 1,970 hospitals, 28 of them are in seismic zone 3, the highest seismic zone. Those we have taken first, and we are doing a very comprehensive analysis in each of the ones in seismic zone 3. We will then progress to zones 2 and 1.

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Mr. McDade. That is all in the State of California?

Mr. Coulter. No.

Mr. McDade. What other States are involved?

Mr. Coulter. There is one in Utah. Seismic zone 3 includes portions of Nevada, portions of Utah, much of California, a zone in the far Northwest, and the St. Lawrence region, the Boston area, the Charleston area, and the Lower Mississippi Valley.

Mrs. Hansen. Mr. Veysey.

VARIATION WITHIN EARTHQUAKE SEISMIC ZONES

Mr. Veysey. May I ask a question?

You have described roughly seismic zone 3 which groups a considerable area subject to seismic activity. Would it not be true that there would be a lot of variation within that area?

Mr. Coulter. Certainly. In seismic zone 3 the frequency and the size of events is much greater in the West than it is in the comparable zone in the East. The largest events are bigger. The frequency of large events is higher in the West than it is in the East.

Mr. Veysey. As I have found, HUD, for example, attempting to apply some earthquake standards have simply taken seismic zone 3 and said everything in there appears to them to have the same hazard or, at least receives the same regulatory treatment. It seems to me that this may not be squaring with the facts of what the seismic incidence has been or is likely to be.

Would that be corect?

Mr. McKelvey. That is correct. This charts here illustrates the very thing you are taking about.

(The charts follow:)

Damage or loss of life from earthquake hazards may be reduced by land-use planning and zoning that results in appropriate development in areas with high susceptibility to shaking or landslides. The Geological Survey is identifying and mapping active faults and areas of unstable ground in the San Francisco Bay area. Federal, State, and local officials are using the maps as guides for development and to identify potentially hazardous dams.

EARTHQUAKE HAZARDS REDUCTION

IN THE SAN FRANCISCO BAY AREA

ACTIVE FAULTS:

KNOWN PRIOR TO 1969

DISCOVERED SINCE 1969

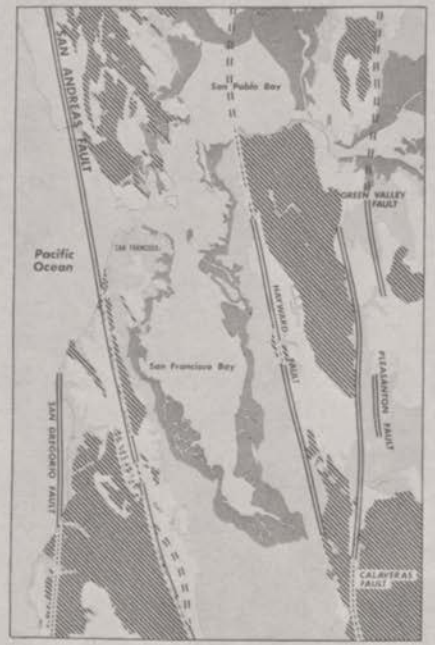
SUSCEPTIBILITY TO SHAKING:

HIGH . . . . .

MEDIUM . .

LOW . . . . .

LANDSLIDE-PRONE AREAS . . . . .



Geologic study warns of dangerous areas and guides future land use, such as sitings for:

- HOSPITALS
- SCHOOLS
- NUCLEAR REACTORS

A network of sensitive recording instruments is being established on the major faults in California. These are being used to monitor fault movement and determine earthquake activity patterns.

MONITORING...
THE CALIFORNIA FAULT SYSTEM

Used for active fault identification and earthquake prediction research



Mr. McKelvey. In the San Francisco Bay area the susceptibility to ground shaking varies considerably. What needs to be done, and we are embarking on this program as a part of our earthquake program that perhaps we will get into more fully later, is to map the susceptibility of the ground to shaking, which depends on its characteristics; also to identify the areas of active faults, and those are shown here, including some that have been identified just recently as a part of our work, and also the areas that are prone to landslides. Differentiating local areas such as this, then, is extremely helpful in zoning and in developing the building codes that govern the kind of construction that can be undertaken safely in each of these areas. It is not all the same, as you said.

Mr. Veysey. But the way HUD is applying it, it comes through as being all the same.

Mr. McKelvey. Because that is the only information that is available now, you see. I mean in terms of the ready identification of areas of various seismic risk. There is a seismic risk map of the United States prepared by NOAA on a very small scale that shows the seismic risk in very broad terms, and for the country as a whole that is the only thing available.

This kind of mapping has really only just started and does not cover presently a very large area.

Mr. Veysey. So you would not have covered, all of California or all of the West?

Mr. McKelvey. No. I believe about 3,000 square miles have been covered during the last year. We have only been working on this for a short time.

Mr. Coulter. I think if I could elaborate a bit, the HUD determinations are based on the uniform building code which is tied directly to the seismic zonation map. Those are in essence minimum standards which are probably acceptable for general construction.

When you get to something critical like a hospital or buildings that house large groups of people, the minimum standards really aren't enough and you have to go to a much more detailed site appraisal and do the analysis in much more depth.

The uniform building code is fine as a general guideline for single family, one-story residences and things like that but not for critical facilities.

Mr. Veysey. If I understand the HUD situation, they are working under what they call a circular letter which is not really an adopted regulation but it is, for all practical purposes, in effect as far as their operations are concerned.

Mr. Coulter. And it is tied primarily to the requirements of the uniform building code, which again is tied to the broad scale seismic zonation map.

Mr. Veysey. That generally says the building must be constructed in such a way it would sustain only minor damage in the event of a moderate earthquake and wouldn't collapse under a major earthquake.

Mr. Coulter. This is the intent of the code. They way it is actually phrased, for each of the seismic zones you have lateral force requirements. You apply a constant and for each successively higher zone you have to have more bracing. You have to have more lateral stability for a building in each of the successive zones.

It really is developed from the wind force code. They use the same approach as they do for the wind force code. It is a lateral force requirement and it is not very elaborate or detailed but it is a good rule of thumb to go on.

Mr. VEYSEY. But it doesn't recognize geological differences. I am thinking of southern California. We have had in some of the deep sedimentary area, such as Long Beach, a series of severe shaking situations.

In other places, Riverside, it is on granite, only a few miles away, but never the same problem.

Mr. COULTER. And you are both allowing hazard and at the same time you are penalizing the people who are on good ground with this general approach. You are permitting a hazard for the people that are on bad ground.

It simply isn't detailed enough for critical areas.

EARTHQUAKE PREDICTION

Mr. VEYSEY. I read last weekend in California newspapers that the next earthquake is now predicted by some group out there.

Mr. MCKELVEY. The Geological Survey.

Mr. VEYSEY. I don't know whether you want to take credit or not.

Mr. MCKELVEY. Oh, yes. This is one of the important components of our program on earthquake hazard reduction research; namely, to develop a capability to predict earthquakes. Now, this is a complex endeavor. We already have this capability in some respects. We can predict where an earthquake is going to occur by identifying active faults as we showed on that last map. The remaining components of the problem are when, and what will its magnitude be, and we are getting a capability in this area.

There are a number of premonitory phenomena that are being recognized, events that take place in advance of the breaking, the slippage of the blocks along a fault plane, which is what the earthquake actually constitutes, and there is a coherence about these premonitory phenomena.

They are the kinds of things that you could imagine taking place when the Earth's crust starts to distort under pressure. The land surface tilts. There are microearthquakes and so on. The earthquake that we are predicting in the Bear Valley area of California is in an area in which there have been a number of earthquakes of small magnitude recently.

Our seismic stations have shown precisely the parts of the fault that have been affected in this movement, and these movements, earthquakes, have each been preceded by a certain amount of microearthquake activity, and what has happened is that in this area in which these earthquakes have been occurring there remains one area that has not yet moved but in which microearthquake activitiy is beginning to take place.

Well, based on the size of this area, the frequency or the time interval between the preceding earthquakes, we can identify this specific area as one in which there is likely to be movement sometime within the next few months, and we feel from what we know about the fault and the past activity that it will be a magnitude of about 4.5

This is a first step and it isn't a very big one. We are glad we don't have to put our neck out in the case of a magnitude of eight or eight and a half or something of that sort. It is nice to take a first step that is small.

ANALYSIS OF EARTHQUAKE PREDICTION METHODS

Mr. VEYSEY. What does your statistical analysis of your predicting methods tell you about your reliability?

Mr. MCKELVEY. At this point, Congressman Veysey, we simply don't have enough experience to put this on a statistical basis. With this particular one we have a high confidence that it is going to take place and that it will be of a magnitude of about 4 or 4.5. Our biggest uncertainty, I think, is the time.

Mr. VEYSEY. Yes, you identified the area, the magnitude, and you said within the next 6 months. That is what I read in the paper.

Mr. MCKELVEY. No; the next few months. We expect it to be sooner.

Mr. VEYSEY. You allowed yourself a little running room there. I think it is pretty important to bring it within some type of probability as to the likelihood of your prediction being correct because a prediction of that sort that says on the first of January San Francisco is going to fall in the Pacific Ocean, causes people to do a lot of unexpected things. So you have to be pretty sure you know you are reliable.

Mr. MCKELVEY. One of the newspaper articles that reported our prediction said that we didn't know what to do about it, we didn't know how to inform the public. Well, that was perhaps an overstatement, but we are very much concerned with that aspect of the problem. We have been in touch with OEP to start exploration, as we begin to develop capability for prediction, of just what kinds of actions are to be taken, how best to inform the public in a way that will give them maximum advantage, and not at the same time cause a lot of disruptions out of fright and so on. So we have a lot to explore in that end of the problem.

But it is sort of like the tsunami warning system; even weather forecasting. Those systems are not perfect by any means but on balance they serve a very important purpose and are extremely valuable.

RESULTS OF EARTHQUAKE PREDICTION

Mrs. HANSEN. Dr. McKelvey, Dr. Pecora testified before this committee that they contemplated a landslide. They felt they had the problem before them and they did close a section of the highway. It was along the coast of California and by the very fact of closing, several thousand lives were saved. I think Mr. McDade was here the day he testified.

Mr. MCDADE. I remember that.

Mrs. HANSEN. This was a specific example of what they were able to do by notifying the Highway Department of California.

EARTHQUAKE PREDICTION CAPABILITY

Mr. MCKELVEY. I don't know, Madam Chairman, if we will ever get the capability to be able to say at 2 o'clock Saturday afternoon there will be an earthquake of a magnitude of 6.5. But even if we can get

it down only to the time interval of a few months, as the case with this particular thing, if this were a magnitude of seven, say, a quake that could cause considerable damage, there are many precautions that could be taken that would not involve evacuation of people or anything of that sort except perhaps from the most dangerous structures. The lowering of a reservoir as an example.

I will bet now if we were to go to California, to Palo Alto where I lived for several years, or Los Angeles, and visited the fire stations we would find the fire trucks all inside and where in the event of a bad earthquake they might be immediately disabled. Fire is a very common secondary effect of earthquakes, but yet a big part of the safety capability might have been wiped out in the course of the earthquake.

Well, advance warning, even if it weren't very precise in terms of exact time, would allow communities to take very important precautionary steps.

EARTHQUAKE PROOF BUILDINGS

Mr. McDade. Did you see the program on San Francisco?

Mr. McKelvey. I did not hear that particular one.

Mr. McDade. They had a lot of information similar to what you are talking about—location of police forces and hospitals and civil defense headquarters, et cetera. One of the things we discussed last year was whether or not there was an earthquake-proof building. There seemed to be a feeling on the part of the survey that you could design such a building. Do you still feel there is an earthquake-proof building.

Mr. McKelvey. I believe there is a developing capability—a substantial capability—for designing structures with a very high resistance to an earthquake event. I suppose to put it on such a positive basis as you ask might be a little too strong.

Mr. McDade. This film reportedly showed a series of buildings in South America that were designed with the latest earthquake-proofing techniques that allegedly collapsed in a quake in South America.

Mrs. Hansen. Didn't they say that the designs were based on standards developed in California?

Mr. McDade. Yes, they were U.S. standards, I believe, or standards that we used.

Did you see that section?

Mr. Coulter. I think there is a question about the quality control and the inspection of the construction.

Mr. McDade. You would not accept the comparison?

Mr. Coulter. I don't believe so. I believe the standards were the same, but that was the Caracas earthquake—and there was considerable question whether the quality control and inspection were up to U.S. standards.

IMPORTANCE OF SITE INVESTIGATIONS

Mr. McDade. Nevertheless, the partial conclusion of that study was that economic pressure in the city of San Francisco is so extraordinary that they will go high rise constantly.

Mr. Coulter. High rise in itself is not necessarily bad, except for the fact that if you have a high rise and your power and so on goes out, you have a lot of people stuck in that building that are going to be

quite uncomfortable for a period of time. There is no reason that a high rise cannot be designed to the same performance standards as any other kind of building, if the site investigation is properly done.

Mrs. HANSEN. Isn't the site investigation the first ingredient?

Mr. COULTER. Yes.

Mrs. HANSEN. For example, my own county suffered an earthquake. Where a house was built on rock, it swayed but was not destroyed, but the houses and docks that were on fill met with destruction.

EARTHQUAKE RESEARCH CENTER, MENLO PARK

Mr. MCKELVEY. That is correct. It might be of interest to you to know that we have an earthquake center at the Geological Survey in Menlo Park and we are beginning to explore the possibility of building a new building for it. Presently it is in rented space that is not the best in the way of seismic resistance. We are talking, in this concept, of trying to make this a model in the way of seismic design. The GSA has one or two other projects of this sort. I do not know the location, but one building is being developed to explore energy conservation and the best in the way of techniques of energy conservation. We think this would be a very important area and objective.

SITE INVESTIGATIONS FOR VETERANS' ADMINISTRATION HOSPITALS

Mr. MCDADE. Did the Survey advise the VA in the construction of the new hospital in San Diego which is supposed to be earthquake-proof?

Mr. MCKELVEY. I cannot tell you that myself.

Mr. COULTER. We did a site analysis when they were building it. We did not consult on the design of the hospital.

Mr. MCKELVEY. The actual design is beyond our competence.

Mr. MCDADE. I would ask you what the safety of that building is. Is that a fair question to you?

Mr. COULTER. I would say that I think the inputs insofar as the site characteristics and the design basis as to earthquakes were acceptable for that particular building in that place.

Whether the design was formulated correctly and executed correctly in compliance with that is beyond my capability.

Mr. MCDADE. That is a very new building, though. Wouldn't they at least have had a great deal of discussion with you not only on the site but the design of it? Isn't that an essential part of it?

Mr. MCKELVEY. The design is beyond the survey's capability. As Dr. Coulter indicated, the problems of site and evaluation of the ground motion and other characteristics of the site itself are ours, but architectural and structural engineering is the area that is involved in the construction and that is beyond our competence.

Mr. VEYSEY. May I ask a further question about another Veterans' hospital proposed near Loma Linda, near San Bernardino?

That hospital has been announced. Have you completed site examinations there?

Mr. COULTER. The site examination is still being done. They are doing trenching and borings and investigations. The investigation is not completed yet.

Mr. VEYSEY. Is it correct that may be on or adjacent to a fault?

Mr. COULTER. There are certainly faults in that area as far as we can tell so far. There are no faults within the immediate confines of the site, itself.

URBAN AREA STUDIES

Mrs. HANSEN. You mentioned in your statement the development of a "primer" to assist planners in San Francisco to make fuller use of certain science data.

Will you give us the status of that and whether they are accepting your judgments.

Mr. MCKELVEY. I cannot tell you the exact status of the primer Perhaps Dr. Balsley, can speak to that part of it.

BRIDGING INFORMATION GAP BETWEEN USERS AND SCIENTISTS

Mr. BALSLEY. Yes; we are working very closely with HUD on this. This is a very difficult step. It has not been done before.

It is trying to bridge the gap between the users and the scientists.

We feel it is our responsibility to bring the scientific data to the user but not to make the final decision. We have submitted some of our materials to the users and have received feedback from them as to how the material should be presented.

The first primer, so-called, will not be ready until next year.

Mrs. HANSEN. Supposing they go ahead in spite of the information available and do what they please? You immediately are going to be faced with the question, did you offer the right kind of advice.

Mr. MCKELVEY. This is one of the aspects we are very much concerned with in being sure we address ourselves and our advice to the needs that are of most concern, and especially in ways in which nonscientists can understand the significance of the information that we are giving them.

Mrs. HANSEN. Do the developers really care?

Mr. MCKELVEY. Yes, they care, and they care especially when building codes, and so on, place requirements on them. We are finding in the San Francisco area considerable acceptance of the kind of information that we are producing. Actually, some of the loan companies have become very much interested in it, because they make building loans and they want to know areas in which they can be sure that the collateral is going to be there.

Mr. MCDADE. They would probably get an FHA-insured mortgage anyway, so we end up with it.

Mr. MCKAY. That is right.

RESULTS OF UTILIZATION OF INFORMATION

Mr. MCKELVEY. I can give some examples of things that during the past year have happened in the San Farncisco Bay area as the result of the utilization of our information. There have been sites for the disposal of dredge spills that have been relocated.

The major airport sites proposed have been reevaluated.

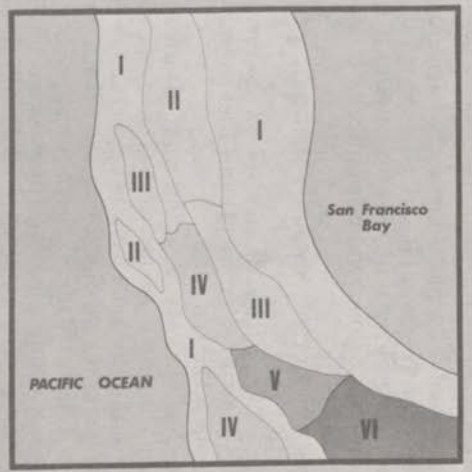
In the Mount Diablo area there was the denial of the proposal for a large subdivision by the county planning commission based on the geologic hazards that have been identified. Also revision of zoning ordinances in San Mateo and San Mateo County, and a number of things of this sort have taken place. The chart we have here shows on the map for the San Francisco Bay area a classification of the landslide potential, with the landslide risk that is least shown in the white and light colored areas, and the areas of extremely high risk shown in red and orange.

[The chart follows:]

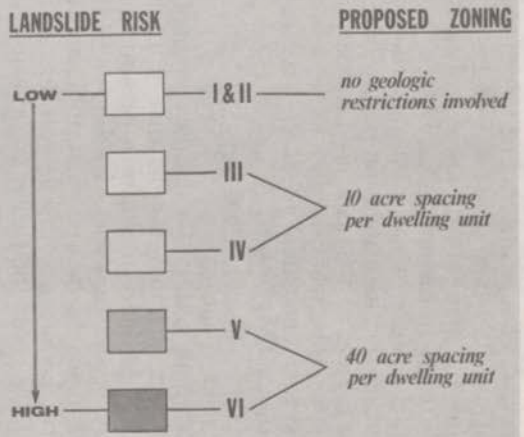
Geological survey maps of areas susceptible to landslides are being used by San Mateo County (Calif.) planners to rezone area of high landslide risk so as to allow only lower density development. Lower density will reduce the proportional amount of construction and other activities by man which increase the likelihood of landslides. The county is further requiring detailed engineering geologic reports for all development in class III or IV areas.

LANDSLIDE THREAT AFFECTS ZONING REGULATIONS SAN FRANCISCO BAY REGION

...present zoning based on socio-economic factors, proposed zoning based on geologic information...



proposed construction zones defined according to landslide risk



Dr. McKelvey. That is the kind of information we are providing—the classification of the landslide risk; we give that to the county. They are developing the zoning ordinances and their interpretation of the risk and what to do in facing the kind of a situation. So what is shown on the right, the zoning restrictions, are those being proposed by the county, based on our identification of the landslide risk.

Mr. Veysey. I am a little confused in making this transition here. If it is going to slide, what do they have to base housing on?

Mr. McKelvey. The extent to which it will slide may depend upon the construction activity itself.

Mr. Veysey. It may, but it may not.

Mr. McKelvey. That is true.

The construction activity in the development of a subdivision, and so on, involves additional weight that is bearing on the land, and especially what is done in the way of addition of water—watering lawns, cesspools, and that sort of thing—and that has been found in parts of California to be a very significant factor.

The county, I am sure, will have other elements in their zoning ordinances. But one of the things to take account of is the density of housing.

Mr. Balsley. Another additional factor within the high risk areas, is that there may be a place locally within a 40-acre zone where it might be possible to put a house. We are currently working with the zoners so that the regulations will say that in regions like this the developer or builder will have to present a local detailed site survey within high risk areas which would not be required within a low risk area.

ASSESSMENT OF NATION'S MINERAL AND FUEL RESOURCES

Mrs. Hansen. Please discuss for us the results of your yearly assessments of the country's mineral and fuel resources which you have noted in your general statement.

Mr. McKelvey. Madam Chairman, I am very pleased to be able to report that during the last year we have completed what I think is one of the most significant resource appraisals ever prepared in this country. This has come off the press just within the last 2 or 3 days, called The United States Mineral Resources.

It is a very comprehensive appraisal of our total resource potential, published as professional paper 820. We have at this point only 50 advance copies, but we plan to make copies available to the members of the committee. I think this is the most important resources document certainly since the Paley Commission Report, and I think perhaps the most significant one really ever prepared on U.S. potential mineral resources.

You may recall that last year I discussed a resource classification with the committee that I have developed over the years, with the collaboration of my colleagues in which we recognized that we must not only consider what are commonly known as proved reserves in explored deposits, the location and amount of which are known in great detail, but we also have to consider potential resources in the form of deposits that have not yet been discovered, but for which a geologic potential can be identified as existing. Also, deposits that are presently to lean or too thin or in other ways not producible now economically, but which may come within economic reach as technology advances.

That is what we have attempted to do in the consideration of all of the minerals that are presently in use in the United States in this study.

ENERGY CRISIS

Mr. McDADE. If I may interrupt you there, recognizing the stretch that you used in that definition, and applying that definition, is there an energy crisis facing the United States?

Mr. McKELVEY. Energy crisis is perhaps too strong a term, although crisis, in the sense of whether or not fuels are actually available, is a possibility, depending on what we do.

There certainly are near-term shortages of fuels. Over the longer period I feel that if we pursue exploration and technologic research aggressively our energy resources will last a very long time.

Mr. McDADE. Would you define for me short term and long term?

Mr. McKELVEY. I think for the short term I would perhaps use a period of 5 to 10 years, and be thinking beyond that for the longer term.

I might say, we recognize that resources are in the ground to be found. There is a difference in their geologic availability from place to place, but beyond that the amounts that become available for use depend on what we do in the way of exploration and technologic research. If we explore vigorously, if we attempt to develop technology, we can make things technically available.

UTILIZATION OF FUEL RESOURCES

Mrs. HANSEN. Dr. McKelvey, I think you have testified that we have a great supply of coal, but existing at the present time is the inability, because of environmental standards and other reasons, to be able to use these coals. With the knowledge of the availability of coal, do you feel there has to be research conducted for the use and implementation of our coal reserves? I think you also testified last year that there was still a residue of oil in the wells, but that technology had not developed far enough to be able to recover this balance of oil in the wells. Is this the kind of thing that you feel has to go hand in hand so that we better utilize what we have?

FACTORS INFLUENCING THE AVAILABILITY OF MINERALS AND FUELS

Mr. McKELVEY. Yes, I think that is exactly it. I could perhaps identify three broad things that influence the availability of mineral and fuel resources.

One is the exploration and technologic advance that we have just been talking about. Another is the economic conditions, the price we are willing to pay.

This has to do with not only the cost of making available a particular fuel from a particular area, but it has to do with the cost of fuels that might substitute for that.

That is another factor. The third broad factor has to do with the Government actions in the area, that is, the actions that the Government takes in making available areas for exploration, the actions it takes with respect to imports, environmental regulations, and so on.

These all influence the availability of fuel.

Mrs. HANSEN. Your predecessor used to say that the United States should always have its options open. Do you agree?

Mr. MCKELVEY. I certainly would agree with that.

IMPACT OF CONSERVATION ACTIONS ON ENERGY CRISIS

Mr. MCDADE. Doctor, on the three equations you mentioned, you did not mention anything about efforts at conservation, or redefining our life style.

Looking at the long term, do you think that is a highly important, a highly significant contribution to the so-called energy crisis, or would you put it in a relatively minor part of the scale?

Mr. MCKELVEY. Mr. McDade, in a realistic sense, looking from the standpoint of what is apt to happen, I would say it would be an important factor, but not overriding.

What I mean by that is that there is no doubt that we are extravagant in our use of energy. We are extravagant in our use of energy because it is extremely inexpensive and it does marvelous things for us. Just to illustrate, I might say that from each gallon of gasoline we get the energy equivalent of 25 days of hard human labor. In essence, we are getting hard physical labor for a cent and a half a man day. That makes it pretty attractive to use. When you flick on the switch, you are getting the energy equivalent of human effort at a very low cost. While I am confident that we can use energy more efficiently, even as we maintain our present life style, we can conserve energy in ways that will not really hurt us. To maintain our present lifestyle a substantial portion of what we are using now is going to be required.

I would look on the conservation potential as one of the elements, and a very significant one, but not the only one that is necessary to provide continuing supplies for the future.

I have developed an equation that represents the significance of the energy input in our lives, along with other things. It goes like this. If you take L to mean $\frac{L=R\times E\times I}{P}$ at our level of living in terms of our consumption of goods and services, leaving the quality and spiritual aspects out of it—just the matter of our consumption of goods and services—L is equal to our useful consumption of all forms of resources (R), and I mean that in the very broadest way to include minerals, soil, water, and so on; times our useful consumption of all forms of energy (E), ranging from muscle power to oil and gas and so on, times our useful consumption of ingenuity (I)—I mean that to be all forms of ingenuity, political, sociological and economic—can be divided by the number of people (P) that have to share in that total product. In very broad terms I think that this equation represents the mix of elements that make the difference between high and low level of living.

The extent to which we use our ingenuity in making productive use of Earth's resources is one factor which determines our level of living.

USE OF ENERGY AND MINERALS

Mr. McDade. That is very interesting. We see the statistic frequently that while we are 6 percent of the world's population, we use 33 percent of the world's energy. Do you have similar statistics for minerals that add up to the model of what might be our sort of life style there on the one side of your equation?

Mr. McKelvey. Yes. It is very similar.

Mr. McDade. Would you furnish that, for the record?

Mr. McKelvey. We are using about 30 percent of the world's production of other minerals. The two go together. It is other minerals that are used to make the machines that are run by energy, and so on.

There is no question that our use of these things is much higher than that of any other country.

IDENTIFIED AND POTENTIAL RESOURCES OF PETROLEUM AND COAL

Mrs. Hansen. Please discuss your chart on identified and potential resources of petroleum and coal.

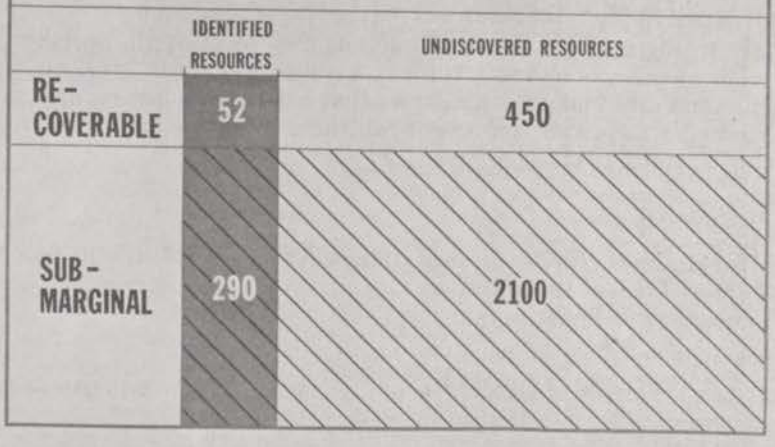
[The chart follows:]

Identified resources of liquid petroleum are much less than identified resources of coal. Identified resources include currently known and recoverable reserves as well as those whose exploitation will require more favorable economic or technological conditions than presently exist. Also indicated are estimates of undiscovered resources. These estimates are based on the best available geological information. U.S. Geological Survey Circular 650, "Energy Resources of the United States," includes similar information for all U.S. energy resources.

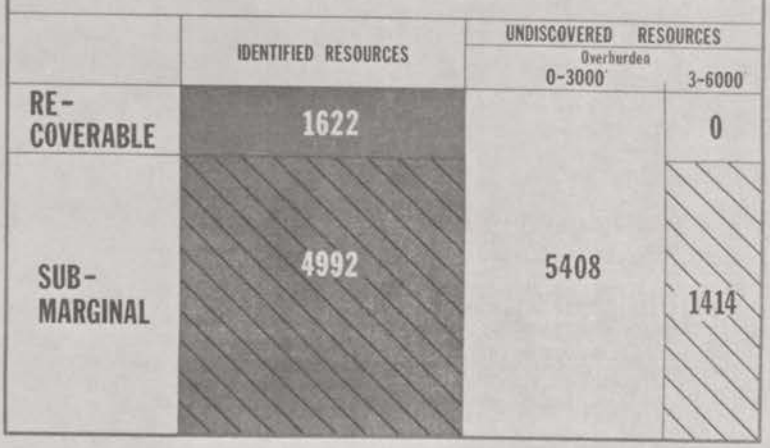
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ENERGY RESOURCES

LIQUID PETROLEUM (BILLIONS OF BARRELS)



COAL (BILLIONS OF BARRELS OF OIL EQUIV.)



Mr. McKelvey. Madam Chairman, we have shown our identified and potential resources of liquid petroleum and coal. Liquid petroleum is on the upper part of the chart, which shows that we have significant identified resources of petroleum that are presently recoverable, about 52 billion barrels.

Then it shows in the same fields that we already have found but are leaving in the ground a substantial amount, as you mentioned earlier.

Presently we are able to get only about one-third of the oil that is found in the ground to the surface economically.

FULL RECOVERY OF PETROLEUM

Mrs. Hansen. Is there any attempt at the present time to recover this petroleum?

Mr. McKelvey. Yes. The petroleum industry has been working at this for some time, first in developing what have been called secondary recovery methods. These are ways to artificially drive petroleum from the rock pores in which it occurs.

Mrs. Hansen. What is the economic balance?

Mr. McKelvey. I cannot speak to that, Madam Chairman, but I think it is significant that the amount of oil being recovered by secondary recovery methods has been increasing. As I said, it is now about a third. It used to be much less than that. They are developing now what they are calling tertiary recovery methods, in which they go back into the field again with the use of chemicals and other means to derive a still larger amount.

The National Petroleum Council—of course, no one can predict what the results of research will be as it is continued on in the future—has estimated that a reasonable target for ultimate recovery of discovered petroleum might be somewhere between 40 and 60 percent of the oil that is actually in the ground. If that were done, the potential reserves of materials already found would virtually double.

COST PRINCIPLE IN FULL PETROLEUM RECOVERY

Mrs. Hansen. Dr. McKelvey, considering the problems associated with the Trans-Alaska Pipeline involving the permafrost, et cetera, questions have arisen as to why it would not be better to develop technology to recover all the oil in the ground before tapping these other resources?

Mr. McKelvey. Madam Chairman, we tend in this country to operate on the least cost principle.

Mrs. Hansen. Is it coming to the time that we have to look at what the total cost is going to be?

Mr. McKelvey. I certainly think we need to look ahead and we need to have the information that allows us to make intelligent choices. I think presently we do not know how to obtain a recovery of 50 or 60 percent of the oil that actually occurs in the ground in a practical way. In the test tube sense, perhaps, but in an economic way, no.

Mrs. Hansen. How far down the road is that knowledge?

Mr. McKelvey. For a time—I don't know how long that trend could be extrapolated—for a time the secondary recovery capability was increasing at the rate of half a percent a year. As I say, it is

hard to extrapolate that and know how far you can extend that. I would say that one could not hope, without a miraculous breakthrough, for a recovery of 50 or 60 percent within the next decade. That is speculation, but the process is an incremental one. Nevertheless, it is one of the things to recognize that represents a potential if we work at it.

DAILY CONSUMPTION OF OIL

Mrs. HANSEN. I believe we were told the other day that we consume approximately 15 million barrels per day; is that correct?

Mr. MCKELVEY. I don't have the daily figures. It is about 5½ billion barrels a year.

Mrs. HANSEN. What is Trans-Alaska scheduled to produce per day?

Mr. COULTER. Two million barrels a day.

Mrs. HANSEN. That would not be a large percentage of the total consumption.

Mr. MCKELVEY. But a substantial percentage Madam Chairman.

It would be 15 million a day at our present consumption. I should have brought my slide rule. I am really accustomed to the annual figure and I just didn't have on the tip of my tongue the daily figure.

Mrs. HANSEN. Mr. McDade?

POLICY FOR OIL EXTRACTION ON OCS

Mr. MCDADE. I was going to ask you, do we have any kind of separate policy involving the amount of oil we require lessees to acquire in the Outer Continental Shelf? Is there anything in our agreements that stipulate the amount of oil they have to bring in?

Mr. MCKELVEY. Not in specific terms, Mr. McDade. We do, however, have a responsibility for monitoring their maximum efficient rate of production, the amount that can be recovered without damaging the reservoir such that some potential may be lost eventually. Presently we are not able to carry out that responsibility in detail for each individual field. We require the companies to furnish the information on which we can evaluate what should be the maximum production rate.

MAXIMUM RECOVERY OF PETROLEUM ON OCS

Mr. MCDADE. You talked about tertiary recovery of oil wells.

Mr. MCKELVEY. Yes.

Mr. MCDADE. We are sure that they are not tapping the oil in the OCS in such a way that they take the cream and leave the harder materials. We are sure of that.

Mr. MCKELVEY. I would like to be sure of that, Congressman, but I feel I cannot be at this particular time. It is in the company's interest to get the maximum recovery from each individual field. But because of the present value of money compared to its value in the future, it is also important for them to get the maximum production, and the maximum yield at the present time.

Their own interests in the future require them to be mindful of conservation practices.

Where I am uneasy is that we do not know really from our own work, or enough of it first hand, actually whether the practice is the best one desirable.

Mr. McDade. Is that because of the state of the art?

Mr. McKelvey. In part, and in part because of our capability.

Mr. McDade. Capability in terms of what?

Mr. McKelvey. Our inability, I should say, to monitor in detail all of the industry's operations in the Gulf of Mexico. There are about 1,800 or 1,900 platforms there now, about 6,000 producing wells. It is a very big operation.

FUTURE SUPPLY OF PETROLEUM

Mr. Veysey. Dr. McKelvey, do I understand this is the chart for all the United States?

Mr. McKelvey. Yes, sir.

Mr. Veysey. When you say liquid petroleum, you are not including oil shale?

Mr. McKelvey. No.

Mr. Veysey. Then relating that to your annual figure of 5.5 billion barrels, we have less than 10 years' supply.

Mr. McKelvey. Yes.

Mr. Veysey. That is not the same as saying if we stopped all importation now we could only furnish our needs for a 9- or 10-year period; that would not be true?

Mr. McKelvey. Our production capacity is presently not large enough to satisfy all of our needs.

As shown in the chart there on the right, we have, we believe, a potential in the form of as yet undiscovered resources—this is what exploration is about, of course—the search for additional deposits—the amount of that is pretty speculative, of course. As shown there, we think there is a substantial potential, maybe as much as 450 billion barrels of undiscovered oil.

Mr. Veysey. How do you know if it is not discovered?

Mr. McKelvey. Congressman, no one can know that, exactly for that very reason. There are several approaches to making such estimates. One is on the basis of geologic examination of sedimentary basins to compare the volume of sedimentary rock that is generally favorable to petroleum, with similar volumes in areas where there has already been substantial exploration.

Another is to do it on the basis of the surface area of comparable sedimentary basins.

Another is to do it on the basis of the projection of discovery trends, and so on.

REDUCTION OF PETROLEUM EXPLORATION

Mr. Veysey. Have not discoveries and developments slowed very dramatically in the past several years?

Mr. McKelvey. Yes; exploration has slowed.

Mrs. Hansen. Why?

Mr. McKelvey. I think for two reasons. One, that the price has not risen in proportion with cost, and petroleum is still a bargain in terms of constant dollars. Then I said we operate on a least cost principle. I think we also operate on the basis of the most attractive opportunities, to put that a different way, and the opportunities for investment capital have been greater in other fields and in other areas in other parts of the world.

So there has been a decline in domestic exploration.

Mrs. HANSEN. So the balance we seek actually is in our own production, by better use, plus the necessity to fill in with imports and with the continuing research and development in other energy sources such as coal. Is that correct?

Mr. MCKELVEY. That is correct.

This chart shows a comparison between the potential resources of liquid petroleum and coal. The coal, instead of being shown in tons, is shown in barrels of oil equivalent. Recoverable coal in identified deposits, as you see in the top line there, represents 1,622 billion barrels of oil equivalent compared with 52 for petroleum.

The same expanded ratio applies to the presently unrecoverable and undiscovered potential coal resources.

USE OF GEOTHERMAL AND NUCLEAR ENERGY AS FUEL

Mrs. HANSEN. What proportion of this fuel use do you see in the future being met by geothermal and nuclear energy?

Mr. MCKELVEY. Geothermal research and development is something that is really just beginning in the United States. Presently we are producing about 300 megawatts of electric energy from geothermal sources. That is scheduled to increase at the rate of about 100 megawatts a year. By 1975, I think, there will be perhaps 500 or 600 megawatts of production.

Mrs. HANSEN. Isn't location a limiting factor?

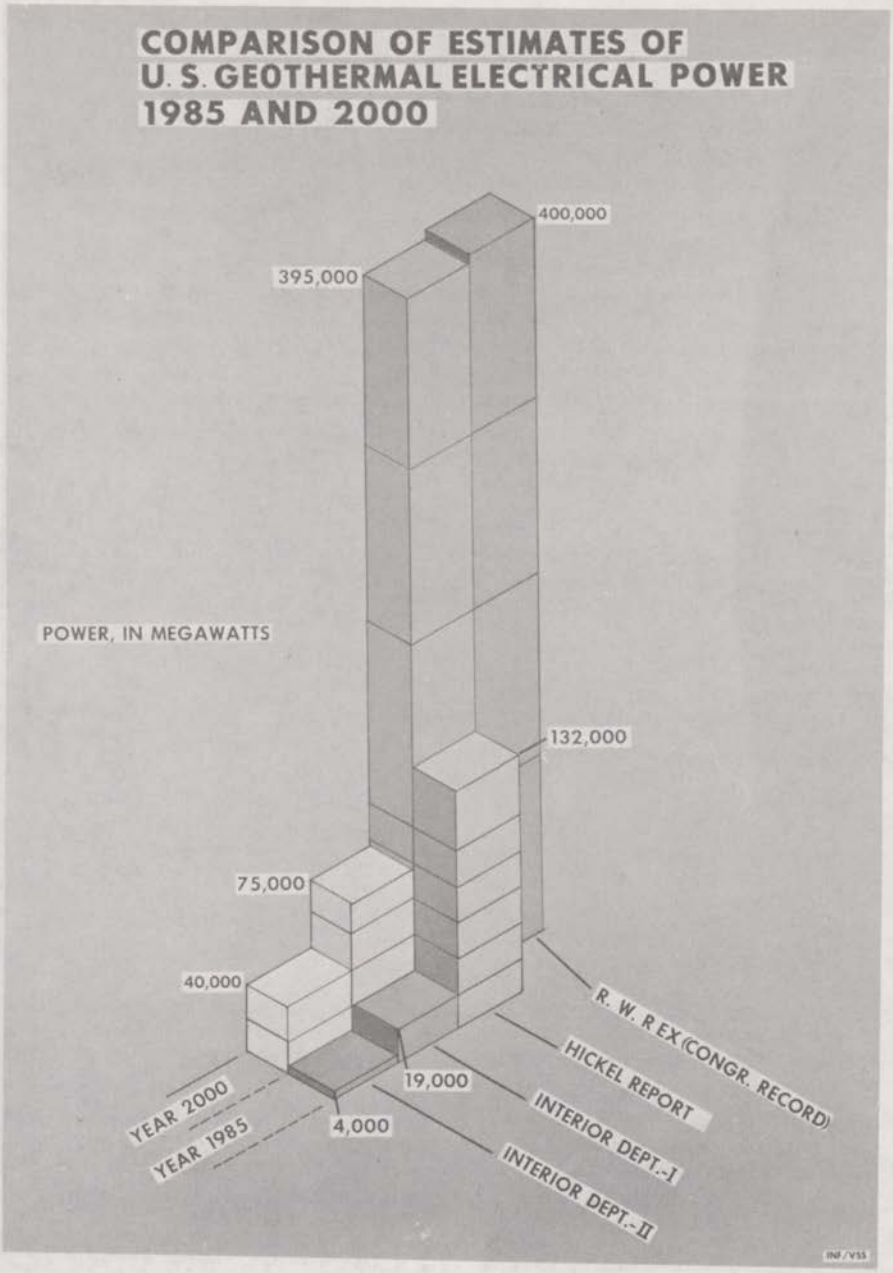
Mr. MCKELVEY. It is limited by the area to which it can be distributed. However, to show how significant that is, even though it is small in terms of national requirements, that amount, about 600 megawatts, is the equivalent of the energy requirement of the people in San Francisco, not the total electric energy requirement for industry and so on, but for people's needs in San Francisco.

That would be met by that amount of electric energy from geothermal sources.

We have a chart that shows the estimates that have been made as far as the potential of geothermal energy is concerned.

[The chart follows:]

Current estimates of U.S. geothermal energy resources vary widely. Illustrated here are four different estimates of the amount of electrical power that might be produced from U.S. geothermal energy. They span at least one order of magnitude. The variations in the estimates are due to the lack of factual knowledge of the resource itself, differing assumptions about technological developments, and different uses of the terms "resources" and "reserves." The Geological Survey is gathering data needed to evaluate the geothermal resources of the public domain.


COMPARISON OF ESTIMATES OF
U. S. GEOTHERMAL ELECTRICAL POWER
1985 AND 2000
POWER, IN MEGAWATTS
400,000
395,000
132,000
75,000
40,000
19,000
4,000
YEAR 2000
YEAR 1985
R. W. REX (CONGR. RECORD)
HICKEL REPORT
INTERIOR DEPT.-I
INTERIOR DEPT.-II
IND/VSS

Mr. McKelvey. At this stage of the development of this resource, it is highly speculative as to what may be the future potential. This chart illustrates the range of estimates that have been made. I said that we are now producing about 300 megawatts a year.

By 1985, the Interior Department has estimated the probability of a minimum of about 4,000 megawatts. Going on from that for 1985 are a series of other estimates which go up to as much as 132,000 megawatts, based on very optimistic assumptions. Those estimates were presented in the Hickel report.

We participated in that study. But those estimates assumed not only the maximum in the way of occurrence of the resource, but also the maximum in the rate of development of the technology for recovering geothermal energy and producing electricity.

ENVIRONMENTAL IMPACT OF GEOTHERMAL ENERGY

Mrs. Hansen. At this point, are you performing work on how the release of steam and brine will affect the Earth itself?

Mr. McKelvey. Yes, we are studying this problem also. Geothermal is often referred to as clean energy. That is true undoubtedly with respect to the electricity it generates. But many of the hot brines and the steam that represents this resource are highly saline. There is a problem in some areas of the disposal of salt that might be brought to the surface in this form.

There is also a substantial content of hydrogen sulphide in some geothermal systems. So there are impacts of this kind.

I might say, too, there is the possibility, in the recovery of these high pressure fluids, of a blow-out from the well or of local subsidence, the same kinds of thing we face in drilling for petroleum.

We think that these impacts are manageable ones, and as long as we understand them and know enough about them, we think they can be brought under control. There is another possibility, and that is in the re-injection of fluids back into the ground. If that is not done carefully and correctly, artificial earthquakes may result.

Mrs. Hansen. You have such a situation in Denver.

Mr. McKelvey. Yes, exactly.

INTERIOR DEPARTMENT ESTIMATE OF GEOTHERMAL ENERGY

Mr. Veysey. What is the difference between Interior Department I and Interior Department II on this chart, other than the magnitudes?

Mr. McKelvey. They were two different estimates based on different assumptions. One is based on much more conservative assumptions than the other.

Mr. Veysey. Do you favor one or the other, or do you just have two guesses?

Mr. McKelvey. This represents a prediction. This is an attempt to say how much power would be available from this source in the year 1985, and then in the other tier the year 2000. No one can predict the future. You do not know how much competition is going to develop from other sources, what effect environmental impacts may have, what regulations may come into effect that will affect future production.

So you have to approach the future with a variety of assumptions; models, so to speak, in which you say that under these circumstances there may be so much development and under other circumstances it would be another amount still.

Mrs. HANSEN. In other words, science is as precise as the imponderables allow it to be?

Mr. MCKELVEY. Yes, that is a good saying.

GEOTHERMAL LEASING LEGISLATION

Mr. VEYSEY. Interior has a more than 2-year-old piece of legislation authorizing leasing of Federal lands for geothermal and they have not yet gotten around to doing anything about that. How does that figure into this matter?

Are you going to get some leasing done or not?

Mr. MCKELVEY. As I understand it—the leasing responsibility is held by the Bureau of Land Management—as I understand it, the preparation for leasing has now reached a very advanced stage, and leasing should begin late this fiscal year or early next fiscal year.

Mr. VEYSEY. You are predicting what BLM is going to do?

Mr. MCKELVEY. Yes.

Mr. VEYSEY. I guess this is a different figure than they have stated. They have been saying for a year that it will be moved up several times.

Mr. MCKELVEY. Whatever estimate they gave you—I understand they met with you yesterday—certainly would be the most up-to-date estimate. As I said, it is their responsibility. I was merely reporting what my last understanding of the progress of leasing was.

BASIS FOR GEOTHERMAL ENERGY PREDICTIONS

Mr. VEYSEY. Do you happen to have or could you make available for the record what the assumptions are that underlie these various estimates you have had graphed here?

Mr. MCKELVEY. Yes, sir, we would be glad to do that.

I understand from Dr. Richard Sheldon that the Interior estimates Nos. 1 and 2 made no assumptions about the increase in technology.

Mr. SHELDON. Correction—the smaller one made no assumption of increased technology.

Mr. MCKELVEY. Interior estimate No. 2 was based on the assumption that no technological advances of an engineering nature will be made.

Dr. Sheldon could speak to this.

Mr. SHELDON. There are other factors going into those differing estimates. I do not have all of them at the top of my head but we would be glad to supply them for the record.

Mr. MCKELVEY. Yes, we would be glad to supply them for the record.

[The information follows:]

ASSUMPTIONS UNDERLYING THE VARIOUS ESTIMATES OF U. S. GEOTHERMAL ELECTRICAL POWER

Interior Department II assumes bringing on to line only those reserves that we have identified thus far, or can extrapolate to what present geologic knowledge, using power generating capabilities that exist today. It thus assumes very little in the way of research and development concerning geothermal resources.

Interior Department I assumes that we will realize success in the development of binary fluid power generating systems that will permit us to utilize hot water resources, as well as the dry stream resources that we are harnessing now. It further assumes that active exploration will ultimately yield a much larger reserve base.

The Hickel report assumes engineering breakthroughs that will bring on to line lower temperature hot water systems, geopressured brines from sedimentary basins, and hot dry rock resources. It thus starts from the assumption that we will realize success in every technological assault on the development of every kind of geothermal resource system.

R. W. Rex's figure for the year 2000 is quite similar to the Hickel report figure and is based on similar assumptions. Rex feels that we will ultimately be successful in harnessing much of the heat in the earth's crust even from relatively low temperature sources, through engineering achievements.

BLM GEOTHERMAL LEASING INCREASES IN FISCAL YEAR 1974

Mrs. HANSEN. The BLM is requesting an increase of $200,000 for geothermal leasing. There will be four geothermal lease offerings in fiscal year 1974. Funds will provide for identification of areas to be followed by appropriate land-use preparation and public hearings as necessary.

MULTIDISCIPLINARY PROBLEMS

You mention in your statement the increase in multidisciplinary problems. What organizational problems does this create?

Mr. MCKELVEY. Madam Chairman, it does create problems with respect to organizations. Our immediate concern here has been to bring about better coordination of work right within the Geological Survey. I would not say that is done without difficulty because, as you know, when you have different organizations of substantial size, to get them to work together does require effort.

The problem expands from that when we get to working with other agencies in Interior and in other departments. I have to say that the problem of how to bring about the coordination in these various activities is not a small one. We think, looking ahead, that the Department of Natural Resources that has been proposed, will help bring about this coordination. But there are many areas that need to be brought to bear and it is not always easy.

Mrs. HANSEN. The boundaries are not as precise as they were?

Mr. MCKELVEY. Yes.

Mrs. HANSEN. The two illustrations which you have given on the Everglades Jetport and the Trans-Alaska Pipeline are good examples. You had vegetation, esthetics, wildlife, permafrost, and everything else.

Mr. MCKELVEY. Yes.

Mrs. HANSEN. The committee will adjourn until 1 p.m.

AFTERNOON SESSION

IMPOUNDMENT OF EARTHQUAKE FUNDS

Mrs. HANSEN. The committee will come to order.

Last year the President requested and Congress approved a $7 million increase in your earthquake program, making a total program of $8,652,000. Now we find that $3 million is impounded and will probably be used to cover increased pay costs. What I want to know

is why the President's budget requested funds that were to deliberately be impounded?

Mr. McKelvey. Madam Chairman, before the end of last fiscal year the General Accounting Office completed a report in which they examined the earthquake research in progress in the Federal Government, principally in the Geological Survey, NOAA, and NSF, and they concluded that there was some overlap, on the one hand, and, on the other, that it really did not constitute a national program.

Mrs. Hansen. If GAO had been in the middle of an earthquake they would have changed their minds.

Mr. McKelvey. We felt that GAO had erred in some of its observations and conclusions. We have been coordinating with NOAA in the earthquake program for some time and a year ago January we established a coordinating committee, a very active one, which was responsible for coordinating activities between the two agencies clear across the board. But, nevertheless, the Office of Management and Budget felt that there might be justification in their criticisms and so they established a committee during the summer——

Mrs. Hansen. So we can really say the GAO, in spite of Congress and being hired by Congress, was recommending that the Office of Management and Budget should do the budgetary programing. Isn't this what it amounts to? This is the GAO, an arm of Congress, recommended that the Office of Management and Budget do the budget programing?

OMB REVIEW OF EARTHQUAKE PROGRAMS

Mr. McKelvey. In any case, OMB undertook a study then of the activities of the various bureaus involved in earthquake research. We were asked to furnish information. So was NOAA and, I believe, NSF also, and they did not complete their study until around the first of the year and by that time a substantial part of the year was over.

They did release to us then, however, $4 million of the $7 million increase. Now, the upshot of all of this activity—I say the upshot because we, of course, know nothing about all of the deliberations that may have been involved in OMB and elsewhere— but in any case the outcome has been that NOAA is closing out its work in seismology and some of it is going to be taken over directly by the Geological Survey with transferred funds and personnel slots and some of the remainder of it will be absorbed by the Geological Survey.

But in any case there will be now one single national earthquake research program.

Mrs. Hansen. Why was NOAA involved?

NOAA INVOLVEMENT IN EARTHQUAKE PROGRAM

Mr. McKelvey. How did NOAA get into it? Well, they have a long history in it, approaching it from a somewhat different direction than the Geological Survey approach, but their work goes back to the work of the Coast and Geodetic Survey primarily in the operation of seismograph stations and the collection of records on seismic activities.

Their background was largely from earth physics, if you like, whereas our involvement began from a geological standpoint. In any case, now there will be just one national earthquake program.

UTILIZATION OF FISCAL YEAR 1974 EARTHQUAKE FUNDS

Mrs. HANSEN. How do we know that you will be able to use the full $8.652 million you are requesting in 1974?

Mr. MCKELVEY. Madam Chairman, we are confident that we will be able to use it and use it effectively. As I said, we will be absorbing part of the NOAA capability from that increase and we are confident that given the funds we can sponsor and operate an effective program.

COORDINATION OF FEDERAL EARTHQUAKE PROGRAMS

Mrs. HANSEN. How do you coordinate your work, with Commerce, National Science Foundation, HUD, Office of Emergency Preparedness, et cetera?

Mr. MCKELVEY. As I mentioned, Madam Chairman, we have a coordinating committee that is chaired jointly by Mr. Radlinski, our Associate Director, and by the Associate Administrator of NOAA, and that committee meets frequently and has been most effective in coordinating our work in this area and other areas in which we interface with NOAA. We have established also close relations with NSF which does no work itself but sponsors work in the academic field, and we have established contact directly with the Office of Emergency Preparedness in this problem that I referred to earlier of attempting to find out just how earthquake prediction information can be handled and utilized most effectively.

REDUCTION OF EARTHQUAKE DAMAGE

Mrs. HANSEN. The comment has been made "why waste money on earthquake studies?" I think I read in one of the papers the other day that a major earthquake in San Francisco could cause several billion dollars worth of damage.

By having some knowledge of the earthquake, as you mentioned this morning, you can reduce the damage in both lives and property.

Mr. MCKELVEY. Yes, this can be done in several ways.

Incidentally, the estimates now of the cost of the damage from the San Fernando earthquake are of the order of $1 billion, and that was only a medium-sized earthquake. But savings in both lives and property, I think, can come from several directions as the outcome of the research that we are proposing and getting underway.

IMPROVEMENT OF BUILDING CODES

First of all is the zoning device and the improvement in the codes. The kind of map that I showed this morning delineating areas in which ground motion can be severe as a result of an earthquake establishes a high risk in specifically identified areas which can be taken into account by those developing the building codes and responsible for zoning, either to restrict building in those areas or at least to be sure that the buildings that are permitted meet certain high specifications, so that is an extremely important thing.

Mrs. HANSEN. At the very least you should be able to make the Federal Government listen to your recommendations.

Mr. MCKELVEY. Yes, and I don't anticipate that there will be great difficulty when this information is available in having it utilized rather fully by the local communities. And just to close that off, that is one important component of our work, earthquake hazard reduction by way of mapping active faults and delineating and classifying ground in terms of its susceptibility to strong ground motion.

EARTHQUAKE PREDICTION

A second area in which substantial savings can come is through the ability to predict earthquakes if indeed we can develop that to a high degree. As we discussed this morning, we are gathering capability in this area, have made our first prediction, taken our first small step. But if we are able to develop this capability to the extent of being able to say where and approximately when, then all of the savings that come through advance warning come into the realm of possibility, those things such as lowering reservoirs in the case of those back of dams that might rupture—an enormous saving in both life and property—and then other steps that can be taken to prepare for an emergency to be sure that safety equipment is operating, steps can be done to avoid a fire which, as I said, is a very common secondary effect of earthquakse, and so on.

So the prediction capability, if we are able to develop it with reasonable accuracy as to place and approximate time and magnitude, should result in very large savings in both dollars and lives.

EARTHQUAKE CONTROL METHODS

Then another component of our program which perhaps is further off in the future as far as its application is concerned has to do with earthquake control. As you may recall from our previous discussions, we acted on what was really a serendipitous discovery near Denver of the occurrence of earthquakes as a consequence of the waste water injection there in the Rocky Mountain Arsenal wells, we have taken that phenomenon as offering some promise in the way of being able to control earthquakes, not in a sense of preventing ground movement but in the sense of relieving strain gradually. We have been doing an experimental project in the Rangely, Colo., oil field where the Chevron Oil Co. is undertaking fluid injection for the purpose of secondary recovery and was creating seisms of the same kind that have taken place in Denver.

USE OF FLUID INJECTION TO CONTROL SEISMIC STRAIN

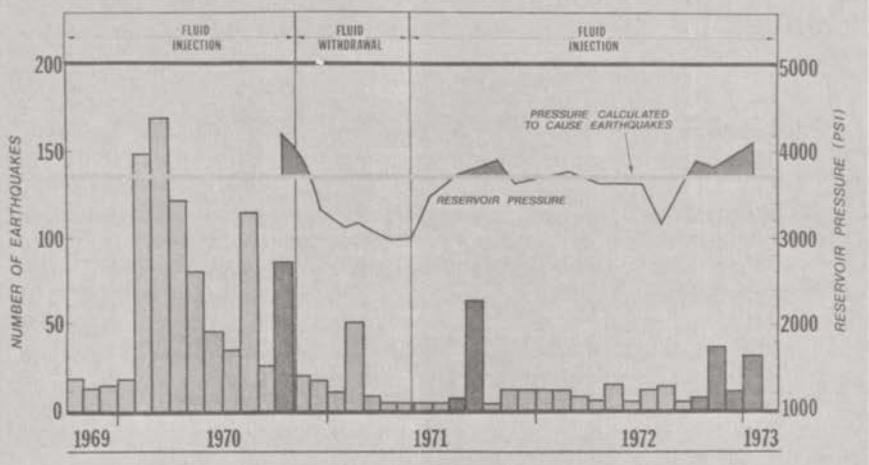
So when we learned about the problem we developed in cooperation with Chevron a program of pressurized injection to see if we could, on the one hand, release seismic strain artificially and, on the other, turn it off, and the chart here shows the record of those experiments.

[The chart follows:]

Feasibility studies for earthquake control are being conducted at Rangely, Colo. The graph indicated the correlation between seismic activity and subsurface reservoir pressures that have been artificially varied by the injection and withdrawal of fluids.

EARTHQUAKE CONTROL

FEASIBILITY EXPERIMENT IN OIL FIELD NEAR RANGELY, COLORADO, REACHES CRITICAL STAGE: EARTHQUAKE ACTIVITY RE-ESTABLISHED BY INJECTION OF WATER



Mr. McKelvey. We had some trouble with getting a pump that would produce high enough pressure, but shown on this chart by the bars is the number of earthquakes per month—now, these are very small earthquakes—but the number of earthquakes per month shown at the scale on the left, and the scale on the right shows the reservoir pressure in pounds per square inch. And the red line that goes across shows the reservoir pressure that we believe is necessary to produce earthquakes.

Now, you can see from the curved line, which shows the actual pressure in the reservoir, that when that actual pressure exceeded the amount calculated to cause earthquakes, the red line, then the number of earthquakes that has actually taken place increases. The record of the last year we thing is especially significant, or starting with 1971 when the reservoir pressure exceeded the calculated amount required to cause earthquakes.

And you see a very close correspondence in number of earthquakes between the increase and decrease in pressure, depending on where the pressure was actually maintained. So we think that we are learning here to relieve seismic stresses, and it is not inconceivable, we feel, that this technique has the promise of a tool that will allow us some day to relieve seismic strain gradually rather than allowing it to build up and be released catastrophically.

Mrs. Hansen. Is this possible in the so-called locked areas?

Mr. McKelvey. Well, we are not able to say that with confidence yet. It will depend in large part on the conditions on the fault plane, whether in effect we can lubricate the fault plane with injections or not, but with reference to the San Andreas, one thing that gives us hope there is that the San Andreas is one fault whose origin we do understand now.

Many earthquakes, for example, those in the East, are associated with tectonic phenomena that we haven't really nailed down yet. We don't really know what kind of structures and phenomena are involved. But the San Andreas has come to be understood now to be a boundary between two plates that are sliding by each other.

We know this has been going on for a long time, some 20 million years at least, and we know something about the rate of movement. So in a situation of that kind where we have some understanding of what really is happening we feel we have some hope to be able to manipulate it, at least to some degree.

But this capability is only just developing and how it is going to work out we don't know. However, we feel that it carries a very large dollar sign and life sign in terms of what savings would come about.

INTERNATIONAL COOPERATION PROJECTS ON EARTHQUAKE REDUCTION

Mrs. Hansen. Hasn't Japan had an earthquake program for some time?

Mr. McKelvey. Yes, they have.

Mrs. Hansen. And haven't they achieved some capability in forecasting small earthquakes?

Mr. McKelvey. Yes, and the Russians have also.

Mrs. Hansen. That is what I understand.

Mr. McKelvey. And as a result of President Nixon's visit there last summer one of the cooperative projects that was agreed on was in the area of earthquake prediction, so we hope to be working closely with them also in this area.

Mrs. Hansen. Please insert in the record at this point the total amount of money that the United States has spent on our earthquake program.

Mr. McKelvey. Yes, I will put that figure in the record.

[The information follows:]

TOTAL U.S. FUNDS USED IN EARTHQUAKE HAZARDS REDUCTION PROGRAM

From fiscal year 1969 through fiscal year 1973 the Geological Survey has spent $11 million, the National Oceanic and Atmospheric Agency has informed us that they spent $13 million, and the National Science Foundation provided us an estimate of $19 million. Although an appreciable portion of these funds has been invested in what might be classed as fundamental research in seismology, in the acquisition of seismicity data from around the globe and in structural engineering, all of these data are required in order to provide a base upon which to build a hazards reduction program.

RESOURCE AND LAND INFORMATION PROGRAM—REDIRECTION OF FUNDS

Mrs. Hansen. You are requesting to redirect $1 million from on-going geology, topographic mapping, and water resources programs to a new resource and land information program. What are the details of this new program and how will the redirections affect the ongoing programs?

Mr. McKelvey. To take the last first, the redirection involves $300,000 each from the topographic mapping and the hydrologic studies program and $400,000 from geologic and mineral surveys and research.

Actually under the RALI program a substantial part of those moneys will be spent by those very divisions as shown in this chart from which it is being redirected because it relates to the work that they are doing on the same subjects.

[The chart follows:]

ELEMENTS OF RESOURCE AND LAND INFORMATION (RALI) PROGRAM

Modern land use planning, resource management and environmental impact assessment require more effective ways of locating pertinent information, integrating them and interpreting them in terms of the questions which must be answered. The basic elements of the RALI program address these needs.

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ELEMENTS OF RESOURCE AND LAND INFORMATION (RALI) PROGRAM

- IDENTIFY USER NEEDS FOR RESOURCE AND LAND INFORMATION
- INVENTORY EXISTING DATA
- DEVELOP CATALOG AND REFERENCE CAPABILITY
- TRANSLATE DATA INTO MORE USABLE FORMS
- ASSURE EFFECTIVE DATA DISSEMINATION AND USE
- IDENTIFY AND TAKE APPROPRIATE STEPS TO REDUCE DATA DEFICIENCIES
- PROVIDE COORDINATION AND NECESSARY STANDARDS
- SPEARHEAD DATA ACQUISITION AND INTERPRETATION RESEARCH

Mr. McKelvey. Our purpose in the resource and land information program is to improve the usability of our information. We talked a little bit this morning about the problem of getting scientific data into the hands of people who actually need it in their ordinary work but who are not able to understand it in the form of scientific reports and maps which are customarily issued by us.

We feel that the country is facing the two conflicting problems that I mentioned previously of developing the resources necessary to sustain us as an industrial society and at the same time maintaining a viable environment. Both of these problems require a much better use of resource and land information throughout the entire society than has been made in the past. So our objective in the RALI program is to develop better ways of translating and communicating information, making information available that already exists but is simply not known to many of the people who need it—planners, developers, and conservationists—and to develop means of making better use of existing information in the solution of land-use and resource problems.

Now, much of what we propose for the next fiscal year is exploratory in nature. We know some of the directions that we need to pursue but we are not sure yet as to just what is the best way to proceed in all of these areas.

Mrs. Hansen. Give us one example.

PROBLEMS OF DISPERSED INFORMATION SOURCES

Mr. McKelvey. Well, just take as one example the problem of the dispersed sources of information. Here is a chart that shows the Powder River Basin and in red, the area immediately surrounding Gillette.

[The chart follows:]

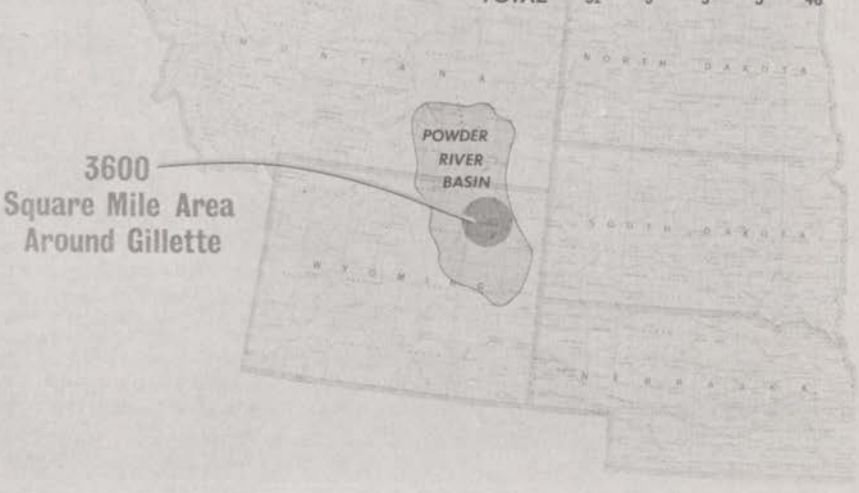
One of the objectives of the resource and land information program is improved access to existing data and information. As an example of the extent of the problem this exhibit illustrates the number and type of offices which have portions of the natural resource data required for environmental analysis of the Gillette, Wyo., area. The resource and land information program will provide a cataloging service which identifies the location of the required data and indicates how they may be obtained.

RALI Will Provide a Cataloging Service to Assure Proper Awareness of the Location of Natural Resource Data

Types of Natural Resources Data Required for Environmental Analysis

NUMBER AND TYPE OF DATA OFFICES

	FED.	STATE	LOCAL	UNIV.	TOTAL
Land Use	10				10
Land Ownership	1		5		6
Water Rights		1			1
Water Availability	3	2		1	6
Water Quality	2	1			3
Base Maps	1	1			2
Topographic Maps	1				1
Geology	1	1		1	3
Soils	2			1	3
Mineral Rights	3				3
Vegetation	2				2
Wildlife Management	2	1			3
Recreation	2	1			3
Climatological Data	1	1			2
TOTAL	31	9	5	3	48



Mr. McKelvey. This is an area in which coal seams occur that are 10 to 200 feet thick, an enormous coal resource, and the development of which poses problems that crosscut a host of different fields, all the way from wildlife management to water resources development and so on.

This chart shows the number of agencies, State, Federal, and local, in which information concerning that area resides, the number of places that one would have to go if he were going to take account of the full diversity of information that needs to be considered in the solution of problems that would be related to resources development in that area. A total of some 31 Federal agencies is involved, and when you take into account the State, local, and the academic community a total of about 48 organizations involved.

Simply cataloging the sources of information in itself would be a considerable contribution to those who are concerned with problems of land use planning.

COMPUTER MODELING

As another example, one of the approaches that we think will be very promising for the future has to do with computer modeling. We are doing some of this already in a rather limited way.

For example, in the Tampa Bay estuary we have put into a computer, information on current direction, current velocity, and other relevant information that has to do with the hydrologic regime in that estuary. We can call out from memory cells in the computer to be displayed on a TV tube, a cathode ray tube in front of you, the dynamic situation in Tampa Bay when any one of those variables is changed. We can show on the screen what happens if you locate a spoils bank here or what happens if you put an outfall there. By way of computer modeling one can examine complex situations, and can examine alternatives. You can imagine doing this with respect to a problem of this kind in which you put into the computer the information that is relevant to the determination of the environmental impact, for example, of strip mining on a very large scale.

You can put into it the information that would be relevant to the selection of a powerline route. You can ask the system given the following assumptions and conditions, what are the alternative powerline routes across the State of South Dakota, and questions of that kind.

Well, we feel that this is a technique that is coming into our grasp. It requires more muscle than we have now in the technology, but we believe that is the way in which complex information needs to be analyzed for maximum use.

PROVIDING INFORMATION TO POLICYMAKERS

Now, it is not our plan in this to develop a system in which we would say, "Well, this is the way it should be done. The powerline should go here."

Mrs. Hansen. What you do is show what will happen and then let the——

Mr. McKelvey. Policymakers.

Mrs. Hansen. The policymakers select their options. Isn't this, after all, Dr. McKelvey, the ultimate goal of research?

Mr. McKelvey. Yes; we feel very much it is, Madam Chairman. We feel that too often in the past we in the Geological Survey, and I think other scientists will have to make the same confession, we haven't done nearly enough in making our information available in forms——

Mrs. Hansen. You haven't provided sufficient information for those who are making policy to select the options?

Mr. McKelvey. That is correct. We perhaps have gathered the relative information but we haven't put it in the form in which it could be used for purposes of that kind.

Mrs. Hansen. We had a group of professors one time performing studies for the State of Washington on highways. All they did was present a conglomeration of facts, and I suggested to them one day that they might show the complete picture, what would happen if you imposed this tax or that. They said, "Well, the universities were to present challenges." That is very good and very typical, except that you get nowhere with that process.

Mr. McKelvey. Madam Chairman, you were asking this morning what would happen if there were not a Geological Survey. To turn that around and put it this way, I feel that a Geological Survey, an information agency, is not going to serve its maximum purpose, its maximum utility to the country, unless it can get its information in a form that is usable and get it into the hands of the planners, and decisionmakers, and policymakers, and so on.

REGIONALIZATION PROGRAM

Mrs. Hansen. I think the committee agrees completely because this is one of our problems. The Survey has recently completed implementation of a new regionalization program to more closely correspond to the standard Federal regions.

What impact has this had on the administration of your bureau?

Mr. McKelvey. Madam Chairman, we have established three new positions in response to the program, assistant directors for each of the three regions, the boundaries of which conform to the boundaries designated by the President between individual component regions. Our purpose in establishing these positions was to bring about a better coordination of the work we do within the Geological Survey itself, but especially to establish better rapport and fuller coordination with the States involved and the local agencies, and with other Federal offices in those regions also.

CONTRACTING PROGRAM

Mrs. Hansen. Last year we had a rather full discussion of your policy concerning contracting of work. What changes have been made in the last year in your contracting program? What kind of work is now contracted that was not contracted previously?

Mr. McKelvey. I don't believe there have been any changes during the past year from what was done previously with respect to the general type of work that is contracted out but we are doing an increased amount, have been doing an increased amount over recent years.

For example, we are now contracting for the publication of some maps as well as continuing our own printing program. We are con-

tracting in what might be called both service areas and research and factfinding areas.

It has not reached a very high level yet, but we are increasing our support for work of the State surveys and also for work to be undertaken in universities. We plan as a part of our earthquake research program, for example, to have a part of it undertaken—to fit in with our mission—but to be undertaken in the university community.

Mrs. HANSEN. You spent in fiscal year 1972 for "Other Services" $9,785,373. The estimate for 1973 is $19,047,235, and for 1974 it is $19,255,000.

Isn't this your contracting?

Mr. MCKELVEY. Yes.

Mrs. HANSEN. So you do intend to contract a great deal more?

Mr. MCKELVEY. Yes; that is correct, Madam Chairman.

Part of that is in the EROS program, for example, where we are contracting a cost-benefit analysis of the ERTS experiment.

Mrs. HANSEN. Please insert in the record the names of the contractors to whom you have awarded contracts in fiscal year 1972 and the program area for fiscal year 1973 and 1974, the amounts involved, and the purpose of each contract.

Mr. MCKELVEY. Yes; we would be happy to do that.

[The information follows:]

U.S. GEOLOGICAL SURVEY

Listed below are the contracting plans for fiscal years 1973 and 1974 for the Geological Survey as well as a detailed listing of the research and development contracts and grants for fiscal year 1972.

CONTRACTING PLANS, FISCAL YEARS 1973 and 1974

The Geological Survey has projected a total program for outside contracting of $19 million for both fiscal years 1973 and 1974 as compared to $10 million in 1972. The basis for the large increase in 1973 and 1974 compared with 1972 is primarily attributed to an increase in program needs coupled with restricted Federal employment. This has necessitated the Survey to increase its contractual requirements substantially during this fiscal year and 1974 in order to perform needed and essential operations.

The following tabulation reflects the major significant outside contracting plans with State, universities, private firms, and other Federal agencies.

TOPOGRAPHIC SURVEYS AND MAPPING

Aerial Photography — FY 73 $ 710,000; FY 74 $ 600,000

This is a continuing commerical program to secure photography for all phases of mapping--new and revised mapping and field updating.

Large-Scale Mapping — FY 73 $ 200,000; FY 74 $ 300,000

Contract to provide large-scale special purpose mapping.

Other Contracts — FY 73 $ 860,000; FY 74 $ 600,000

Continuing contracts to obtain map printing, to support Navajo cartographic scribing, to obtain photogrammetric and field equipment and provide helicopter support for field operations in remote areas.

GEOLOGIC AND MINERAL RESOURCES

Marine Geology — FY 73 $ 500,000; FY 74 $ 500,000

Contracts for seismic reflection studies and research contracts with industry, universities and other Federal agencies to purchase and analyze geophysical and other data.

Earthquake Hazards — FY 73 $ 700,000; FY 74 $3,522,000

Continuing contracts with States and universities primarily on the west coast for hazard and fault mapping studies and earthquake prediction and control.

Helicopter Contracts — FY 73 $ 200,000; FY 74 $ 200,000

Helicopter contracts for the Wilderness mineral surveys program and the Alaskan geological surveys program for field investigations in remote areas not readily accessible by other means of transportation.

SPECIAL PROJECTS

Geothermal Investigations — FY 73 $ 250,000; FY 74 $ 250,000

Research contracts and drilling contracts for continuation of the geothermal program.

Urban Studies — FY 73 $ 100,000; FY 74 $ 100,000

Continuing grants with States for studies in urban areas.

MINERAL LEASE MANAGEMENT

Outer Continental Shelf

a) Helicopters — FY 73 $ 699,000; FY 74 $ 869,000

Contract with a private company to provide 6 helicopter aircraft on annual basis at a daily fixed price plus an additional allowance for time in flight to transport inspectors to offshore facilities.

b) Production control (MER) — FY 73 $ 80,000; FY 74 $ 80,000

Continuing contract with industry to provide technical expertise to install computer base reservoir simulation procedures in the determination of maximum efficient production rates (MER) of selected OCS oil reservoirs.

c) Management study — FY 73 $ 62,000; FY 74 $ 50,000

Contract with private firms and engineering consulting groups to study ways to improve safety of OCS operations and the effectiveness of regulatory procedures.

Federal and Indian Lands — FY 73 $ 195,000; FY 74 $ 100,000

a) Management Study

Contract with private firms to determine ways to improve effectiveness of regulatory procedures.

RESOURCES EVALUATION AND CLASSIFICATION

Outer Continental Shelf — FY 73 $ 1,900,000; FY 74 $ 2,701,000

a) Geophysical data purchase
Contracts with geophysical service companies and universities to obtain geophysical data for evaluation of OCS lease tracts offered for sale and to identify geologic conditions which may pose a threat to development.

Federal and Indian Lands — FY 73 $ 16,000; FY 74 $ 49,000

a) Contract drilling
Contracts with private companies or state organizations to provide data on the existence and quality of coal to aid in mineral land classification and resource evaluation.

WATER RESOURCES INVESTIGATIONS

National Water Data Exchange (NAWDEX) — FY 73 $ 125,000; FY 74 $ 100,000

Contract with a private firm to design and develop a data handling system that will describe on-going data systems of major water-oriented Federal and Non-Federal agencies and design linkage mechanism to bring them into the overall system (NAWDEX); evaluate exchange problems; develop procedural techniques; identify areas of common data interest; and recommend procedures for establishing and maintaining an index to the Nation's water-data holdings.

Subsurface Waste Storage Program — FY 73 $ 131,000; FY 74 $ 185,000

Contracts with universities, State Geological Surveys, private drilling and service firms to perform investigations and research in selected aspects of subsurface waste storage.

Gulf Coast Hydroscience Center — FY 73 $ 240,000; FY 74 $ 300,000

Contract with NASA to provide technical and institutional services, computer time and software support for the research and problem-solving activities at the Water Resources Division Gulf Coast Hydroscience Center at the Mississippi Test Facility.

EARTH RESOURCES OBSERVATION SYSTEMS

Sensor Development

FY 73 $ 200,000
FY 74 $ 109,400

Contracts to conduct scientific and engineering studies to develop data collection instruments for use in satellites.

Applications Research

FY 73 $ 2,024,000
FY 74 $ 1,420,300

Contracts with industry, universities and other government bureaus for studies of the possibility of applying remote sensing from aircraft and satellites to resource and environmental surveys.

ERTS-1 Space Experiments

FY 73 $ 1,008,000
FY 74 $ 548,100

Contracts with industry, universities and other government bureaus to conduct research utilizing space data from ERTS-1 to determine the feasibility of its use in resource and environmental areas.

Economic Evaluation of ERTS-1 Data Use

FY 73 $ 1,000,000
FY 74 $ 373,500

A continuing effort directed by the sub-committee of the Earth Resources Survey Program Review Committee, Interior, to monitor the only cost-benefit study to be done on ERTS-1, utilizing the advice of OMB, NASA and other user agencies.

Satellite System Design

FY 73 $ 99,000
FY 74 $ 74,700

A contract with an aerospace firm for initial design of an operational earth resources satellite system for the purpose of determining the feasibility and cost as an input to the economic evaluation and cost benefit study.

FACILITIES

FY 73 $ -0-
FY 74 $ 2,975,000

Contract costs, for the physical move to the National Center, Reston, Virginia, and operation and maintenance services.

RESOURCE AND LAND INFORMATION PROGRAM

FY 73 $ -0-
FY 74 $ 265,000

Contract services for studies of graphic and display techniques; studies of system costs and user charges; investigations of existing information systems to define their interface with RALI; studies of data acquisition, analysis, and prediction techniques; and system design studies.

RESEARCH AND DEVELOPMENT CONTRACTS AND GRANTS, FISCAL YEAR 1972

The following tabulation reflects a listing of the research contracts and grants awarded by the Geological Survey in FY 1972, by grantee or contractor, the amount, and a brief description of the activity for which the grant was made or the contract was let.

CONTRACTS AWARDED, FISCAL YEAR 1972

CONTRACTOR	AMOUNT	PURPOSE
Long Island University	2,946	Sea Level Changes
University of Virginia	28,100	Remote Sensing
Texas A&M	29,780	Geophysical Seismic Data from the Continental Shelf, Gulf of Mexico
Geophysical Services Inc.	125,310	Seismic Data
Geophysical Services Inc.	12,500	Seismic Data
Information Processing Corp.	22,100	Paleontologic, Lithologic and Production Data
University of California	580	Research - Geographic Application Program
Decca Survey Systems Inc.	36,500	Geophysical Data
Continental Shelf Data Systems	18,500	Geobathmetric Study and Bathymetric Maps
University of Virginia	10,053	Remote Sensing
Dresser Olympic	40,250	Seismic Data
Western Geophysical Co.	85,800	Seismic Data
Petty Geophysical Co.	27,030	Seismic Data
Teledyne Exploration Co.	22,500	Seismic Data
South Dakota State University	11,000	Remote Sensing Data
Geophysical Service, Inc.	59,050	Seismic Data
Teledyne Exploration Co.	161,600	Seismic Data
Western Geophysical Co.	104,737	Seismic Data
Getty Oil Co.	56,871	Seismic Data
Geophysical Service Inc.	31,250	Seismic Data
Teledyne Exploration Co.	20,000	Seismic Data
Geophysical Services Inc.	47,240	Seismic Data
Dresser Olympic	6,325	Seismic Data
Western Geophysical Co.	26,880	Seismic Data
Geophysical Services Inc.	48,222	Seismic Data
Duke University	7,375	Study of the North Carolina Continental Margin Sedimentation
Lockwell, Kessler & Bartlett, Inc.	47,350	Coastal Wetlands Ecology
Mead & Hunt Inc.	4,850	Valley Cros Section
The Rand Corporation	84,175	Transient Flows in Waterways and Water Bodies

CONTRACTS AWARDED, FISCAL YEAR 1972 (Cont'd)

CONTRACTOR	AMOUNT	PURPOSE
South Dakota State University	150,000	Remote Sensing
University of Missouri	14,759	Spectroscopy Inreflectance
State of California Div. of Mines and Geology	15,000	Mineral Commodities of 9-County San Francisco Bay Region
Teledyne Exploration Co.	128,280	Seismic Data
Geophysical Service	14,043	Seismic Data
McMaster University	23,620	Study of ERTS (A&B) Data
California Institute of Technology	88,500	Effects of Fluid Injection and Surface Loading in Tectonically Active Regions
Chevron Oil Co.	62,200	Study of Earthquake & Fluid Pressure
Texas A&M	86,012	Mechanical Properties of Rocks Affecting Earthquake Generation
Columbia University	6,468	Seismic Effects Associated with Deep Injection Wells in Western New York State
Western Geophysical Company	144,000	Seismic Reflection Data in the Northeastern Gulf of Mexico
Delta Exploration Company	124,200	Seismic Reflection Data in the Northeastern Gulf of Mexico
Petty Geophysical Engineering Co.	58,500	Seismic Reflection Data in the Northeastern Gulf of Mexico
Seismograph Service Corp.	16,800	Seismic Reflection Data in the Northeastern Gulf of Mexico
South Dakota School of Mines & Tech.	24,630	Measurement of the Primary Stress Field at Selected Damsites in the United States
University of Missouri	8,000	Measurement of Spectral Reflectance & Perform A Kramers-Kroing Analysis
Chevron Oil Co.	98,802	East Coast Joint Seismic Survey
Texas A&M	2,500	Seismic Data
Earth Satellite Corp	14,990	Evaluation of Economic and Social Benefits and Cost of Data from ERTS-A (Phase I)
General Research Corp.	16,538	Evaluation of Economic and Social Benefits and Cost of Data From ERTS-A (Phase I)
University of Michigan	23,372	Evaluation of Economic and Social Benefits and Cost of Data from ERTS-A (Phase I)
University of Washington	30,961	Remote Sensing Data
D.R. McCord & Associates	82,110	Seismic Reflection Data in Eastern Gulf/Alaska

CONTRACTS AWARDED, FISCAL YEAR 1972 (Cont'd)

CONTRACTOR	AMOUNT	PURPOSE
D.R. McCord & Associates	60,000	Seismic Reflection Data in Eastern Gulf/Alaska
Dresser Olympic	108,550	Seismic Reflection Data in Eastern Gulf/Alaska
University of Washington	35,000	Remote Sensing Data
BBN Geomarine Service	61,790	High Resolution Geophysical Data in Gulf/Mexico
Mass. Inst. of Tech.	39,764	Continuous Monitoring of Electrical Resistivity and its Relationship to Strain Changes in the Earth
Western Geophysical Co.	27,550.55	Processed Seismic Reflection and Ancillary Data Offshore Texas
Petty Geophysical Engineering Co.	29,505	Seismic Reflection Data on Atlantic Outer Continetal Shelf
Southwest Research Institute	59,380	Hazard analysis studies for oil and gas drilling and producing operations on the outer Continental Shelf
General Electric Co.	65,612	Hazard analysis studies for oil and gas drilling and producing operations on the outer Continental Shelf
University of Oklahoma Research Inst.	75,000	Petroleum Data System for oil and gas fields and wells and oilfield brines
Amoco Production Co.	31,598.91	Reprocessing of Seismic Reflection Data from the Gulf of Alaska collected in 1967and 1968
Stanford Research Inst.	60,005	Research on Meterological Satellite Data
Exploration Surveys, Inc.	18,852.50	Gravity and Magnetic Data in the Georges Bank area of the Atlantic Outer Continental Shelf
Digicon, Inc.	27,978	Gravity and Magnetic Data in Baltimore Canyon area of the Atlantic Outer Continental Shelf
Texas A&M Research Foundation	165,000	Resolution Geophysical Data of the Louisiana Outer Continental Shelf
University of California, Berkeley	1,357	Investigation of Fluid Injection in Fractured Rock and Effect on Stress Distribution
Westinghouse Electric Corp.	29,864	Research Project in Image Data Processing
The Mitre Corp.	42,551	Nature Program
Massachusetts Institute of Tech.	65,000	The Mechanics of Crustal Earthquakes

GRANTS AWARDED, FISCAL YEAR 1972

GRANTEE	AMOUNT	PURPOSE
American Association of Petroleum Geologists	$55,000	Underground Waste Management and Environmental Implications
University of California	77,000	Retention of Waste Elements
Geological Survey of Alabama & State & Oil Gas Board	2,501	Identification of Users Categories of EROS Data in Alabama
Old Dominion University Resource Foundation	3,350	Suspended Sediment in the Entrance to Chesapeake Bay
Geological Survey of Alabama & State & Oil & Gas Board	18,523	Mineral Exploration Based on Space Acquired Data
Commonwealth of Penn. Dept. of Environmental Resources	30,000	Pittsburgh Urban Pilot Area Study
Prescott College	1,884	Aerial Remote Sensing Techniques in Archaeology
California Inst. of Tech.	96,000	A Telemetred Seismic Array Installation for Microearthquake
University of California, Berkeley	55,615	Measurement of Deep Resistivity Across the San Andreas Fault Zone
Columbia University	74,702	Seismic Effects Associated with Deep Injection Wells in Western New York
Maryland Geological Survey	18,000	Research Assistance on the Baltimore Washington Urban Study
Colorado State University	5,954	ERTS-A Data Analysis of Yellowstone National Park & South Central Colorado
Iowa Geological Survey	4,187	Study of Quaternary Land Forms
State of Montana	120,000	Field of Low Sulfur
State of Colorado	15,000	Environmental Geology Study
The Geological Engineering Foundation	9,325	Structural Mechanics Digital Computer Programs
State of Washington	10,000	Geologic & Mineral Resource Data
Pennsylvania State University	12,105	Thermal Stresses in Rock Induced by Fluid Injection Operations

PERSONNEL CEILING

Mrs. HANSEN. What is your authorized personnel ceiling for 1973 and 1974?

Mr. MCKELVEY. For 1973 the total for the Bureau on all funds, not just directly appropriated funds, is now 8,011. We had an increase of just four granted to us within recent weeks.

Mrs. HANSEN. For 1974?

Mr. MCKELVEY. For 1973 that is. Now, for 1974 we are requesting a total of 8,061, 50 new positions.

Mrs. HANSEN. What is your end-of-year ceiling for these years and what is your present employment?

Mr. MCKELVEY. As it would be projected now, our end-of-the-year ceiling for 1973 would be 8,011, and as we are requesting it for 1974 it would be 8,061. There is some uncertainty at this point, however, because of the functions that probably will come to us from NOAA. We hope that some of those will come with positions.

Mrs. HANSEN. Will they transfer the personnel in NOAA to the Geological Survey?

Mr. MCKELVEY. That is what we believe is going to happen.

Mrs. HANSEN. What is your present employment?

Mr. MCKELVEY. Our present employment is 7,873. We are down from our ceiling. That is as of February, I should say. We are down from our ceiling because of the personnel freeze that has been on since December 11, I believe it was.

SURVEYS, INVESTIGATIONS, AND RESEARCH

Mrs. HANSEN. Please insert justification pages 2 through 70 in the record at this point.

[The information follows:]

Funding of Geological Survey Programs (Obligations)

	Actual 1972	Estimate 1973	Estimate 1974
Special resource and environmental projects:			
Direct appropriation	$ 1,666,600	$ 3,753,000	$ 3,753,000
Alaska pipeline related investigations:			
Direct appropriation	1,338,900	1,339,000	850,000
Miscellaneous Federal agencies	62,000	--	--
Total	1,400,900	1,339,000	850,000
Topographic surveys and mapping:			
Direct appropriation	34,545,495	34,559,000	34,259,000
States, counties, and municipalities	3,204,288	3,800,000	4,000,000
Miscellaneous non-Federal sources	356,737	625,000	960,000
Office of Territories	21,351	8,300	--
National Aeronautics and Space Administration	137,700	306,600	275,000
National Science Foundation	255,700	250,000	200,000
Miscellaneous Federal agencies	215,639	275,000	800,000
Total	38,736,910	39,823,900	40,494,000
Geologic and mineral resources surveys and mapping:			
Direct appropriation	33,265,456	39,965,000	42,795,000
States, counties, and municipalities	1,358,886	1,376,000	1,350,000
Kingdom of Saudi Arabia	2,269,490	2,200,000	2,000,000
Miscellaneous non-Federal source	47,433	47,000	40,000
Bureau of Reclamation	23,424	5,000	--
Department of Defense:			
Military	3,113,331	2,158,000	350,000
Civilian	105,908	34,000	50,000
Department of Housing and Urban Development	280,646	287,000	250,000
Agency for International Development	1,986,756	1,920,000	2,300,000
Atomic Energy Commission	2,089,944	2,181,000	1,900,000
National Aeronautics and Space Administration	5,037,476	5,900,000	3,100,000
National Science Foundation	649,998	107,000	125,000
Miscellaneous Federal agencies	209,544	328,000	150,000
Bureau of Mines	80,371	44,000	50,000
Saline Water	31,476	154,000	100,000
Total	50,550,139	56,706,000	54,560,000
Minerals discovery loan program :			
Direct appropriation	330,000	441,541	277,000

	Actual 1972	Estimate 1973	Estimate 1974
Water resources investigations:			
Direct appropriation	$ 37,748,818	$ 40,129,000	$ 39,854,000
States, counties, and municipalities:			
Matched Federal funds	19,815,002	20,695,000	20,695,000
Unmatched	1,479,001	1,850,000	1,850,000
Permittees and licensees of the Federal Power Commission	533,132	550,000	550,000
Miscellaneous non-Federal sources	145,775	144,000	143,000
Bureau of Land Management	153,667	155,000	155,000
Bureau of Reclamation	632,608	806,000	765,000
National Park Service	507,695	597,000	465,000
Department of Agriculture	268,222	258,000	255,000
Department of Commerce	84,894	101,000	105,000
Department of Defense:			
Military	911,516	847,000	835,000
Civilian	4,967,716	5,660,000	5,400,000
Department of Housing and Urban Development	920,747	2,130,000	2,140,000
Department of State	245,484	241,000	234,000
Agency for International Development	557,283	600,000	600,000
Atomic Energy Commission	1,021,936	1,100,000	1,100,000
Environmental Protection Agency	627,067	754,000	735,000
National Aeronautics and Space Administration	265,595	517,000	255,000
Tennessee Valley Authority	198,468	258,000	245,000
Miscellaneous Federal agencies	340,372	424,000	420,000
Bonneville Power Administration	100,728	71,000	75,000
Bureau of Sport F & W	101,169	128,000	130,000
Total	71,626,895	78,015,000	77,006,000
Conservation of lands and minerals:			
Direct appropriation	13,392,954	14,259,000	16,029,000
Miscellaneous non-Federal sources	993	4,000	4,000
Miscellaneous Federal agencies	570	5,000	5,000
Department of Defense - Military	25,000	25,000	25,000
Total	13,419,517	14,293,000	16,063,000
General administration:			
Direct appropriation	2,884,518	2,831,000	2,831,000
Facilities:			
Direct appropriation	34,765	715,235	5,914,000
Earth resources observation systems:			
Direct appropriation	5,744,110	10,343,000	8,443,000
National Aeronautics and Space Administration	574,563	1,260,000	852,000
Total	6,318,673	11,603,000	9,295,000
Resource and land information program:			
Direct Appropriation	--	--	1,000,000

	Actual 1972	Estimate 1973	Estimate 1974
Miscellaneous services to other accounts:			
Miscellaneous non-Federal sources	$ 29,281	$ 30,000	$ 29,000
Computer services for other bureaus and agencies	1,511,033	1,894,000	2,467,000
Miscellaneous Federal agencies	487,150	418,000	434,000
Total	2,027,464	2,342,000	2,930,000
Summary:			
Direct appropriation	130,951,616	148,334,776	156,005,000
States, counties, and municipalities	25,857,177	27,721,000	27,895,000
Miscellaneous non-Federal sources	3,382,841	3,600,000	3,726,000
Other Federal agencies	28,804,747	32,206,900	27,347,000
Total	188,996,381	211,862,676	214,973,000

DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Surveys, Investigations, and Research

Appropriation, 1972	$130,400,000	
Supplemental appropriation, 1972	650,000	
Total appropriation, 1972		$131,050,000
Transferred to other accounts		-70,800
Total available, 1972		130,979,200
Appropriated, 1973		150,450,000

Summary of Increases and Decreases, 1974

	Base for 1974	Increase 1974	
Alaska pipeline related investigations:			
Reduction in activities and scope of program	$ 1,339,000	$ -489,000	$ -489,000
Topographic surveys and mapping:			
Redirection to support Resource and Land Information Program (RALI)	--	-300,000	-300,000
Geologic and mineral resource surveys and mapping:			
For acquisition and evaluation of geophysical data in support of OCS leasing program	4,478,000	+230,000	
Redirection to support Resource and Land Information Program (RALI)	--	-400,000	-170,000
Water resources investigations:			
To provide urgently needed water data in which Federal interest is paramount	15,037,875	+99,606	
To transfer funds and personal services to data program of higher priority	2,337,000	-100,000	
Redirection to support Resource and Land Information Program (RALI)	--	-300,000	
For reimbursement to Bureau of Employees Compensation	345,125	+25,394	-275,000

Conservation of lands and minerals:			
To increase capability, consistent with an accelerated leasing schedule to properly regulate operations on OCS oil and gas leases	$ 5,243,000	$ +730,000	$
To acquire and interpret OCS geophysical data for pre-sale tract selection and resource evaluation and inventory at a rate consistent with an accelerated leasing schedule	2,650,000	+1,040,000	+1,770,000
Facilities:			
For relocation of personnel and operations to the National Center, Reston, Virginia	--	+5,914,000	+5,914,000
Earth resources observation systems:			
General program reduction	10,343,000	-1,900,000	-1,900,000
Resource and land information program:			
Redirected funds to design and develop a Resource and Land Information Program (RALI)	--	+1,000,000	+1,000,000
Net increase, 1974			+5,550,000
Budget estimate, 1974			156,000,000

SURVEYS, INVESTIGATIONS, AND RESEARCH

Analysis by Activities

Activity	Fiscal Year 1972 Amount Available	Fiscal Year 1973 Total Appropriation	Transfers	Fiscal Year 1973 Amount Available
1. Special resource and environmental projects	$ 1,666,600	$ 3,753,000	$ --	$ 3,753,000
2. Alaska pipeline related investigations	1,338,900	1,339,000	--	1,339,000
3. Topographic surveys and mapping	34,545,495	34,559,000	--	34,559,000
4. Geologic and mineral resource surveys and mapping	33,265,456	39,965,000	--	39,965,000
5. Minerals discovery loan program	272,000	272,000	--	272,000
6. Water resources investigations	37,748,818	40,129,000	--	40,129,000
7. Conservation of lands and minerals	13,392,954	14,259,000	--	14,259,000
8. General administration	2,884,518	2,831,000	--	2,831,000
9. Facilities	--	--	--	--
10. Earth resources observation systems	5,744,110	10,343,000	--	10,343,000
11. Resource and land information program	--	--	--	--
Unobligated balance lapsing	120,349 1/	3,000,000 3/	--	3,000,000
TOTAL	130,979,200 2/	150,450,000	--	150,450,000

1/ Includes $107,000 in budgetary reserve that was not available for obligation.
2/ Excludes $70,800 transferred to Office of Secretary for Contract Compliance Program.
3/ $3,000,000 related to Earthquake Hazards Reduction Program in reserve.

SURVEYS, INVESTIGATIONS, AND RESEARCH

Analysis by Activities

Activity	FY 1972 Amount Available	FY 1973 Amount Available	FY 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973	Page Reference
1. Special resource and environmental projects	$ 1,666,600	$ 3,753,000	$ 3,753,000	$ --	9
2. Alaska pipeline related investigations	1,338,900	1,339,000	850,000	-489,000	16
3. Topographic surveys and mapping	34,545,495	34,559,000	34,259,000	-300,000	18
4. Geologic and mineral resource surveys and mapping	33,265,456	39,965,000	42,795,000	+2,830,000	26
5. Minerals discovery loan program	272,000	272,000	272,000	--	40
6. Water resources investigations	37,748,818	40,129,000	39,854,000	-275,000	42
7. Conservation of lands and minerals	13,392,954	14,259,000	16,029,000	+1,770,000	50
8. General administration	2,884,518	2,831,000	2,831,000	--	58
9. Facilities	--	--	5,914,000	+5,914,000	61
10. Earth resources observation systems	5,744,110	10,343,000	8,443,000	-1,900,000	64
11. Resource and land information program	--	--	1,000,000	+1,000,000	68
Unobligated balance lapsing	120,349 1/	3,000,000 3/	--	-3,000,000	
TOTAL	130,979,200 2/	150,450,000	156,000,000	+5,550,000	

1/ Includes $107,000 in budgetary reserve which was not available for obligation.
2/ Excludes $70,800 transferred to Office of Secretary for Contract Compliance Program.
3/ $3,000,000 related to Earthquake Hazards Reduction Program in reserve.

1. Special Resource and Environmental Projects

FY 1973, $3,753,000; FY 1974, $3,753,000; no change.

Analysis by Subactivities

Subactivity	FY 1972 Amount Available	FY 1973 Amount Available	FY 1974 Estimate	Page Reference
(a) Urban area studies	$ 969,700	$ 973,000	$ 973,000	11
(b) Responsibilities under the Mining and Minerals Policy Act of 1970	--	250,000	250,000	13
(c) Geothermal investigations	696,900	2,530,000	2,530,000	14
Total	1,666,600	3,753,000	3,753,000	

(a) Urban Area Studies: FY 1973, $973,000; FY 1974, $973,000; no change.

Program of Work:	FY 1974
San Francisco Bay	$300,000
Seattle-Puget Sound	30,000
Phoenix-Tucson	80,000
Denver	140,000
Pittsburgh	138,000
Connecticut Valley	155,000
Baltimore-Washington	130,000
Total	$973,000

Status of Program:

Rapid urbanization results inevitably in the outward spread of cities into areas where the natural characteristics of the land are unsuited for intensive development unless proper care is taken to identify potential hazards and problems. To improve the basis for regional urban planning and development, investigations involving geology, hydrology, topography, geography, geophysics and geochemistry--disciplines that represent the core expertise of the Geological Survey--are being conducted in selected urban centered areas throughout the Nation. Studies are currently underway in seven such areas, selected on the basis of need, geographic and geologic diversity, amount of basic data already in hand, availability of knowledgeable personnel in the particular area involved, and local interest and willingness to cooperate. Research grants made to State geological surveys (about 10% of total effort) are matched by contributions in their particular fields of expertise and experience.

An integral part of the Urban Area Studies program is the preparation and communication of basic earth-science data in a manner that will be of greatest use to urban planners and decision-makers. To achieve this goal, interpretive and special purpose maps are being designed for easy understanding and for direct application to the variety of problems that are encountered in urban land development. Critiques and evaluations of these products are actively solicited from user groups, with whom close contacts are being maintained in all project areas, in order to be fully responsive to the users' needs and to improve continuously the effectiveness of the program.

The San Francisco Bay study, begun in FY 1971 and conducted with partial financial assistance from the Department of Housing and Urban Development, serves as a model in terms of overall program objectives and their impact on urban and regional land-use decisions and policies. The acquisition of basic data is now virtually completed in the nine-county Bay area, and the preparation of interpretive and special purpose maps is well along. Nearly 50 maps and reports have been released, including basic data contributions showing geology, topography, landslides, active faults, slopes, flood-prone areas, distribution of rainfall, and current land use, and interpretive contributions depicting landslide susceptibility and seismic response characteristics of the various geologic units around the Bay. These items of information have influenced 20 or more significant land-use decisions to date in both the public and private sectors, including critical reviews of existing zoning and building regulations and the enactment of important legislation.

Investigations in the six other project areas in the Urban Area Studies program, although not fully implemented because of low funding levels, have shown significant progress in FY 1973. New topographic base maps are nearing completion on several areas, and numerous basic data and special purpose maps and reports are in various stages of preparation. In the Denver area, current studies are focusing on geologic mapping, geologic hazards, environmental geochemistry, coal resources, sand and gravel deposits, quality and quantity of water, population

density, and engineering properties of soils and rocks. Multiple basic data and special purpose maps for six 7 1/2-minute quadrangles in the Connecticut Valley are being readied for publication following the folio format of the Hartford North Quadrangle that was released early in FY 1973. Work in the Pittsburgh area includes the preparation of a structure contour map on the Pittsburgh coal seam, a map showing mined out areas of coal and consequent subsidence hazards, soil interpretation maps, an analysis of clay-shale utilization-potential, a stratigraphic framework chart, and a report on the flood caused by Hurricane Agnes. As part of the Baltimore-Washington study, a revision of the Montgomery County geologic map has been completed, and geologic, surficial deposit, hydrologic, and related maps are in progress. Engineering geologic maps showing areas of swelling clays and hazards due to subsidence are being prepared, and surveys of surficial deposits and of water and mineral resources are continuing in the Phoenix-Tucson urban area. Current studies in the Seattle-Puget Sound area are oriented toward appraisals of water resources and engineering properties of soils and rocks.

(b) Responsibilities Under the Mining and Minerals Policy Act of 1970: FY 1973, $250,000; FY 1974, $250,000; no change.

Program of Work:

The mineral resource base of the Nation is being appraised in response to the Mining and Minerals Policy Act of 1970 (P.L. 91-631) which directs the Secretary of Interior to submit an annual report to Congress that shall include a statement of the trend in utilization and depletion of mineral resources. National appraisals, which indicate the grade and volume of known resources, and the location of territory favorable for finding new resources are being made for the major mineral commodities. The national resource picture must be considered in the context of global abundance and these data are being gathered and evaluated. Exploration activities within the domestic private mineral industry, one measure of the "health" of this industry, are also reviewed and analyzed. The work is being done by commodity and regional geologists aided by a newly organized resource analysis group, and a computerized data system.

Status of Program:

A survey of 65 energy, metal, and non-metal commodities will be published in 1973. This report updates earlier studies in 1947 and 1952 and provides a solid base upon which more detailed commodity appraisals can be made. In-depth resource appraisals are underway for 13 commodities selected on the basis of their national importance. Ongoing studies in the mineral resources inventory program of five of the commodities--aluminum, fluorine, helium, manganese, and rare earths--provide direct support for these in-depth surveys and reports are scheduled for publication. New appraisals have been started for copper, gold, lead, silver, titanium, tungsten, uranium, and zinc.

The appraisal of the national mineral resource posture continues to be strongly supported by the minerals investigation program expertise in the new resource analysis group and the computerized resource information bank (CRIB).

(c) Geothermal Investigations: FY 1973, $2,530,000; FY 1974, $2,530,000; no change.

Program of Work:

1) $275,000 for supervision of operations on geothermal leases, classification of mineral retention areas for geothermal resources, and definition of Known Geothermal Resources Areas.

2) $1,590,000 for pre-lease evaluation of prospectively valuable geothermal areas and for improvement of geophysical, geochemical, hydrologic, and geologic techniques for identifying and evaluating geothermal areas.

3) $365,000 for reconnaissance exploration of the United States for geothermal resources.

4) $300,000 for monitoring and evaluating the environmental effects of geothermal developments.

Status of Program:

Geothermal resources constitute a large, practically untapped, source of clean energy, water, and minerals which could have a significant and far reaching impact for the Nation if developed properly and to the fullest potential. The potential electrical energy production alone has been reported to OST by the Panel on Geothermal Energy Resources (and supported by the NSF Geothermal Resource Research Conference chaired by Walter Hickel) to range from 19,000 to 132,000 megawatts by 1985 and 75,000 to as much as 395,000 megawatts by the year 2000, given an intensive, successful research and development program. (For purposes of comparison, the 1971 capacity of installed generating facilities in the Nation is about 367,000 megawatts.)

The Geothermal steam Act of 1970 (P.L. 91-581) authorizes the Secretary of the Interior to lease geothermal steam and associated geothermal resources on public lands of the United States. To do this job effectively, we need a much better knowledge of the nature and distribution of geothermal resources. Furthermore, implicit in the responsibilities imposed by the Act is a need for an adequate appraisal of the geothermal resource potential of the public lands. Geophysical, geochemical, hydrologic, and geologic techniques need to be developed and applied so as to provide for prompt, accurate assessment of the potential of this valuable and relatively non-polluting source of energy, demineralized water, and byproduct minerals.

The current program of geothermal investigations consists of the following main elements:

1) Supervision of operations on geothermal leases and the classification of additional geothermal resource areas;

2) Detailed geologic, geochemical, hydroloigc, and geophysical studies started in FY 1972 at the Geysers/Clear Lake and Long Valley/Mono Lake areas are being intensified and new geothermal studies are being undertaken in the Jemez Mountains, New Mexico. Geophysical studies of these and other areas, aimed both at pre-lease examination of promising areas and at improvement in exploration techniques, have been broadened to include micro-seismic and telluric methods as well as heat flow measurements at shallow to moderate depths. The physics and hydrology of geothermal areas are being modeled using computer technology in order to develop better methods for developing geothermal reservoirs. Sub-surface temperatures and hydrologic parameters in the Gulf Coast area are being studied in order to evaluate the geothermal potential of the hot brines found at depth in that area;

3) Reconnaissance geological, geophysical, hydrological, and geochemical surveys, including hot spring sampling and analysis, are being carried out in Oregon, Nevada, Idaho, and Alaska; and

4) Possible envionmental effects of geothermal developments will be monitored with initial emphasis on the Imperial Valley, California, where the Bureau of Reclamation and the Office of Saline Water are conducting a geothermal resource pilot study.

2. Alaska Pipeline Related Investigations

FY 1973, $1,339,000; FY 1974, $850,000; decrease, $489,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-489,000	-15	$850,000	29	Reduction in activities and scope.

Program of Work:

The FY 1974 program continues, on a diminishing scope and scale, the investigations begun in FY 1971 to provide geologic, geophysical, hydrologic and topographic data, and alternatives needed by the Federal Government for critical engineering and management decisions concerning right-of-way and construction permits, and environmental protection requirements of the proposed trans-Alaska hot-oil pipeline system. Assuming the permit is granted, the need for these data and advisory services will continue through the construction phase and into the initial operational and monitoring phase.

The demands for these data and services should gradually diminish, assuming all problems can be resolved to acceptable environmental impact levels and assuming that no new or alternative proposals are received that would require further or new investigations.

Status of Program:

1) Engineering geologic investigations of problem sites includes stability of slopes and surficial materials, possible permafrost effects, suitability and availability of geologic construction materials, definition of geologic and geophysical factors which may pose a threat to the integrity of the pipeline, and definition of geologic effects on the environment. Reconnaissance study of the proposed pipeline route has been completed and future work will be aimed at specific problem sites as final design plans are submitted for approval and construction progresses. The review of seismic factors as related to earthquake hazards has been completed and the results made available.

2) Hydrologic investigations having engineering design significance in the construction phase and monitoring significance in the initial operation phase are underway. These include continued data gathering from established baseline stations, flood frequency and magnitude modeling, research studies of special problems such as stream icings and breakup, channel migration and scour characteristics especially at stream crossings, drainage disturbances and changes, and the hydrologic effects of a hot-oil pipeline in permafrost. A preliminary analysis of these data has been made available.

3) Topographic surveys provide the base maps for all of the above as well as other engineering, resource, and environmental studies. The mile-to-the-inch topographic maps of the proposed oil pipeline route and adjoining area will be completed in FY 1974. Further needs for topographic mapping are not anticipated unless future developments involve new areas or require more detailed maps, such as the 1:24,000 orthophotomaps.

The Geological Survey's pipeline investigations program was begun by redirection of ongoing activities in late FY 1969 in response to the urgent needs for data and advice, created by the northern Alaska oil development and pipeline proposal. The above program of work outlines the type of studies that have been completed and are continuing. The basic data gathered to date have been published in various forms and provided to the Department of Interior and other concerned agencies through conferences and the inter-agency Technical Advisory Board. The Geological Survey had a major role in the preparation of the Environmental Impact Statement.

The follow through by the Geological Survey in FY 1974 is essential to the success of the design, construction, and operational phases and particularly to the monitoring of the environmental protection requirements established by the Department of Interior.

3. Topographic Surveys and Mapping

FY 1973, $34,559,000; FY 1974, $34,259,000; decrease $300,000. The decrease consists of:

Increase (+) or Decrease (-)				
Amount	Positions	Total program	Total positions	Explanation
-$300,000	-7	$34,259,000	1,779	Redirection to support Resource and Land Information (RALI) program.

Analysis by Subactivities

Subactivity	FY 1972 Amount available	FY 1973 Amount available	FY 1974 Estimate	Increase (+) or Decrease (-) 1974 compared with 1973	Page reference
(a) Standard quadrangle mapping	$27,943,188	$27,645,000	$27,495,000	-$150,000	20
(b) Map revision and maintenance	4,766,742	4,575,000	4,575,000	0	21
(c) Small scale & special mapping	1,835,565	2,339,000	2,189,000	- 150,000	22
Total	34,545,495	34,559,000	34,259,000	- 300,000	

(a) Standard Quadrangle Mapping [1/]: FY 1973, $27,645,000; FY 1974, $27,495,000; decrease $150,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total program	Total Positions	Explanation
-$150,000	-4	$27,495,000	--	Redirection to support Resource and Land Information (RALI) program.

Program of Work: During FY 1974 work will begin on 1,800 standard quadrangles. At the current production rate, published 1:24,000-scale maps of the entire Nation will be completed by about 1986. The number of quadrangles programed for resurvey (1:24,000-scale maps to replace older 1:62,500-scale coverage) increased from 26 percent of total new starts in FY 1973 to 32 percent for FY 1974, reflecting the fact that the smaller scale maps are not proving adequate in many developing areas.

Large-scale mapping work in FY 1974 will continue on pilot efforts started in FY 1973 in several cities. Preliminary study is underway for Ft. Wayne, Indiana; Charleston, S.C.; and Baltimore, Md. The number of cities in which large-scale mapping can be undertaken in FY 1974 will depend upon the extent, complexity and character of mapping problems, such as existing control density, format and extent of city maps, slope and relief of the land.

Status of Program: The primary objective of the standard quadrangle mapping program is to provide nationwide map coverage at scales most useful to federal, state, and local users for planning and management of numerous programs concerned with the physical environment. For example, the inventory of land use and mineral resources, environmental protection, urban development, management of water resources, transportation and communication, are programs of concern at all levels of government that involve topographic maps as an aid to problem definition, quantification and solution.

The published map coverage of 1:24,000-scale maps for the conterminous U.S., Hawaii, and outlying areas of sovereignty and jurisdiction was 52 percent complete at the close of FY 1972. An additional 20 percent is in progress. Figure 1 shows the status of mapping by state as of June 30, 1972.

The standard quadrangle for Alaska is the 15-minute (1:63,360 scale) map, and at the end of FY 1972, published maps were available for 79 percent of the state. In 1974, 30 quadrangles (7½-minute) will be started in the Anchorage area where larger scale maps are warranted by the past and proposed development in the area. Other built-up areas in Alaska also require 7½-minute mapping.

In FY 1973, the Map Information Office will be reorganized as the central office of National Cartographic Information Center (NCIC). The basic microfilm equipment for the central office is on hand and functioning. Additional equipment for three

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1/Except for Alaska, maps are compiled at a scale of 1:24,000 (1 inch on the map represents 2,000 feet on the ground), in 7½-minute quadrangle units, each containing about 57 square miles. In Alaska the norm is 1:63,360-scale maps (1 inch equals 1 mile), in 15-minute units, each containing about 225 square miles.

western offices will be ordered this year. Extensive microfilming of present records is underway. The design of the master index will be accomplished as well as the design and selection of the computer system to carry out the information research functions.

In FY 1974, a computerized system for the NCIC will be implemented with programing and debugging scheduled to be completed before year end. Microfilming of records will continue as the most active cartographic files of the principal federal agencies are converted. Agency agreements will be negotiated as to standardization of prices, ordering procedures, and catalogs.

A large scale mapping program has been established in response to growing federal and local requirements for general-purpose maps in urban areas at scales larger than presently published by the Geological Survey. Replies to letters the USGS sent to 44 mayors of major cities throughout the nation indicated a desire and need for federal involvement in large-scale mapping. Map scales requested ranged from 1:600 through 1:10,000. The Department of Housing and Urban Development recently expressed to the Geological Survey a priority need for large-scale orthophotomaps of the 65 largest Standard Metropolitan Statistical Areas. HUD stated that public and private agencies directly serving the needs of the nation's SMSAs need very large-scale maps for community management and development planning.

Several cities were selected for study in 1973, each representing different regions and mapping problems. These studies will identify the scales and products needed to fuse a national/regional/city mapping program under various conditions. A "family of maps" will be developed ranging from large scale to small scale.

It is planned to contract for much of this large-scale mapping which would be done to federal specifications and under federal inspection.

(b) Map Revision and Maintenance: FY 1973, $4,575,000; FY 1974, $4,575,000; no change.

Program of work: The ongoing map revision and maintenance program involves 2,300 maps, 950 of which will be completed in FY 1973. The FY 1974 program includes about $875,000 for revision mapping financed by State cooperative programs. (See figure 2.)

Status of program: The backlog of maps requiring revision is increasing in non-urban areas. More than 700 urban area maps per year require revision which consumes 70% of the current resources earmarked for the map revision program.

The revision backlog has been increasing as follows:

End of FY	Urban Backlog	Non-urban Backlog	Total Backlog End of FY
1971	700	7,200	7,900
1972	450	7,825	8,275
1973	300	8,025	8,325
1974	200	8,325	8,525

Many urban maps, previously updated by interim revision methods, will require more extensive (and expensive) revision, complete with field checks to insure that the basic accuracy and contour intervals are responsive to the needs of urban areas. Experience has verified the need for at least a 5-year cycle for revision in urban areas and many large cities are now undergoing their second 5-year cyclic updating using the interim revision procedure.

Several hundred 1:24,000-scale maps are being added to the backlog of maps in need of revision each year. About 4,000 maps per year will be subject to revision when complete coverage, presently projected for 1986, is attained. Studies such as the Resource and Land Information (RALI) program, census taking and urban regional planning make it imperative that revision production be increased to a level which will insure that mapping coverage of the nation will be kept up-to-date.

About 8.5 million copies of topographic maps were distributed in FY 1972, with sales of $2.1 million.

(c) Small Scale and Special Mapping: FY 1973, $2,339,000; FY 1974, $2,189,000; decrease $150,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total program	Total positions	Explanation
-$150,000	-3	$2,189,000	--	Redirection to support Resource and Land Information (RALI) program.

Program of work:

--1:250,000-scale topographic series. Complete revision of 55 to 60 maps now in work, and commence revision of 55 to 60 more. The series consists of 473 maps of conterminous U.S. and Hawaii, plus 153 maps of Alaska. This is the largest scale map series that provides complete coverage of the U.S.

--State map series (scale 1:500,000). Complete revision of four maps of 19 in work, and commence revision of three maps. The series presently consists of 46 maps, three of which show more than one State. Series is complete.

--International Map of the World--IMW (scale 1:1,000,000). Finish three of the ten new maps in progress and commence revision on two or three more. Sixty-four of the 71 maps in the series are complete. Many are considered provisional editions which require modification to meet the latest IMW specifications.

--United States map series (various scales). Publish a new edition of the U.S. 1:2,500,000-scale map, and expand the present program to include the replacement of several existing maps which are inadequate and obsolete, and to introduce other editions at useful scales with appropriate content.

--Geodetic control diagrams (scale 1:250,000). Complete the geodetic diagram series. About 440 of the 468 diagrams in the conterminous U.S. series have been finished, the remainder will be in FY 1973.

--Initiate a county mapping program. Commence work on 1-3 maps.

--Initiate slope mapping program at 1:24,000 scale and possibly the 1:250,000 scale. Commence work on 25-50 maps.

--National Park series. Complete revision of six maps in progress, and begin revision of three maps. Currently there are about 50 maps in the series.

--National Atlas. The bound volumes distributed through December 1972 total 9,117. Twenty-four individual Atlas sheets are available for sale separately; eleven are in progress and it is planned to add about 25 more.

--Continue research on new techniques for collection, processing, and presentation of environmental and natural resources data.

Status of program: The small scale and special mapping program is required by many national activities that include multi-discipline scientific programs, inventory of natural resources, regional environmental planning, and national defense. It constitutes about 6% of the annual direct appropriation for the National Topographic program.

The major component of the small scale program is the 1:250,000-scale series (1 inch equals about 4 miles). These maps are frequently used for reconnaissance surveys, regional studies, and military defense. They are also source material for preparing smaller scale maps such as the state base map, IMW's, U.S., and special maps such as those used in broad geologic and water resources studies. The series is currently being revised at an annual rate of 55-60 maps a year. It it anticipated that the series will be kept current on an 8-year cycle.

In addition to the programs listed, special projects are undertaken when requested and funded by other federal agencies. These special projects are on a reimbursable basis. Current projects are for the Bureau of Indian Affairs, Bureau of Land Management, Forest Service, Bureau of the Census, National Science Foundation (Antarctic mapping), and NASA (extraterrestrial).

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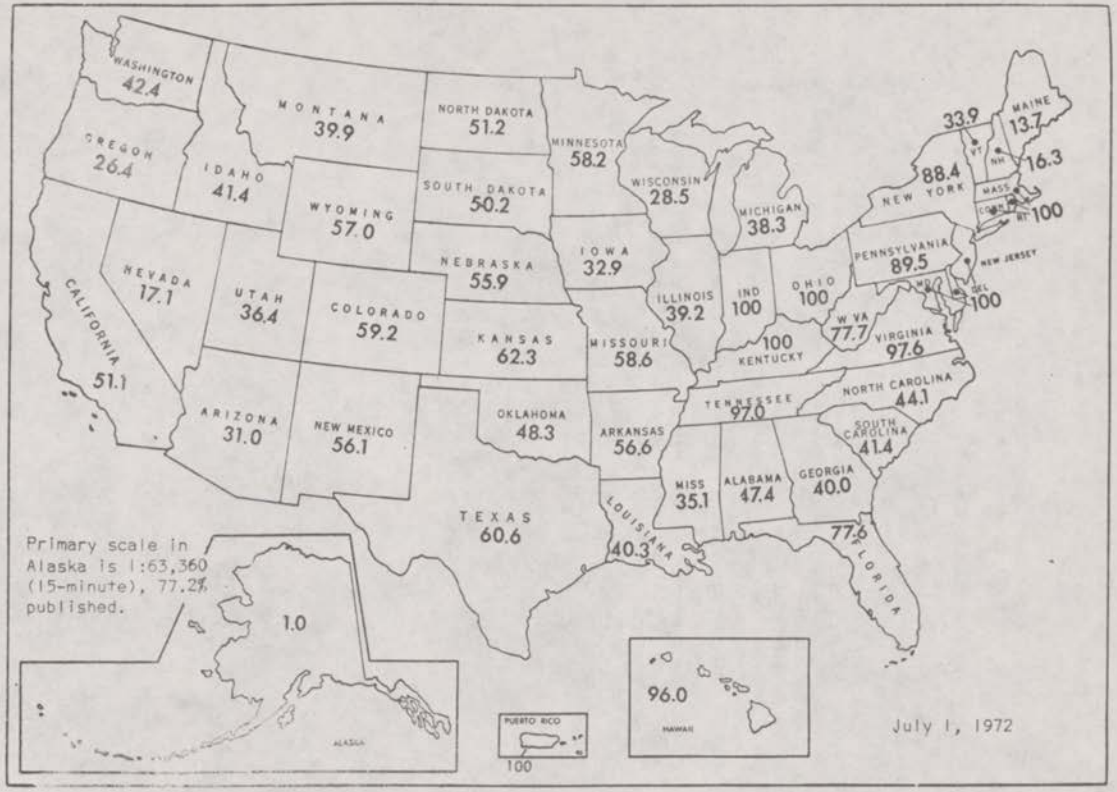


Figure 1. - Percentage of 7 1/2-minute maps which have been published in each state.

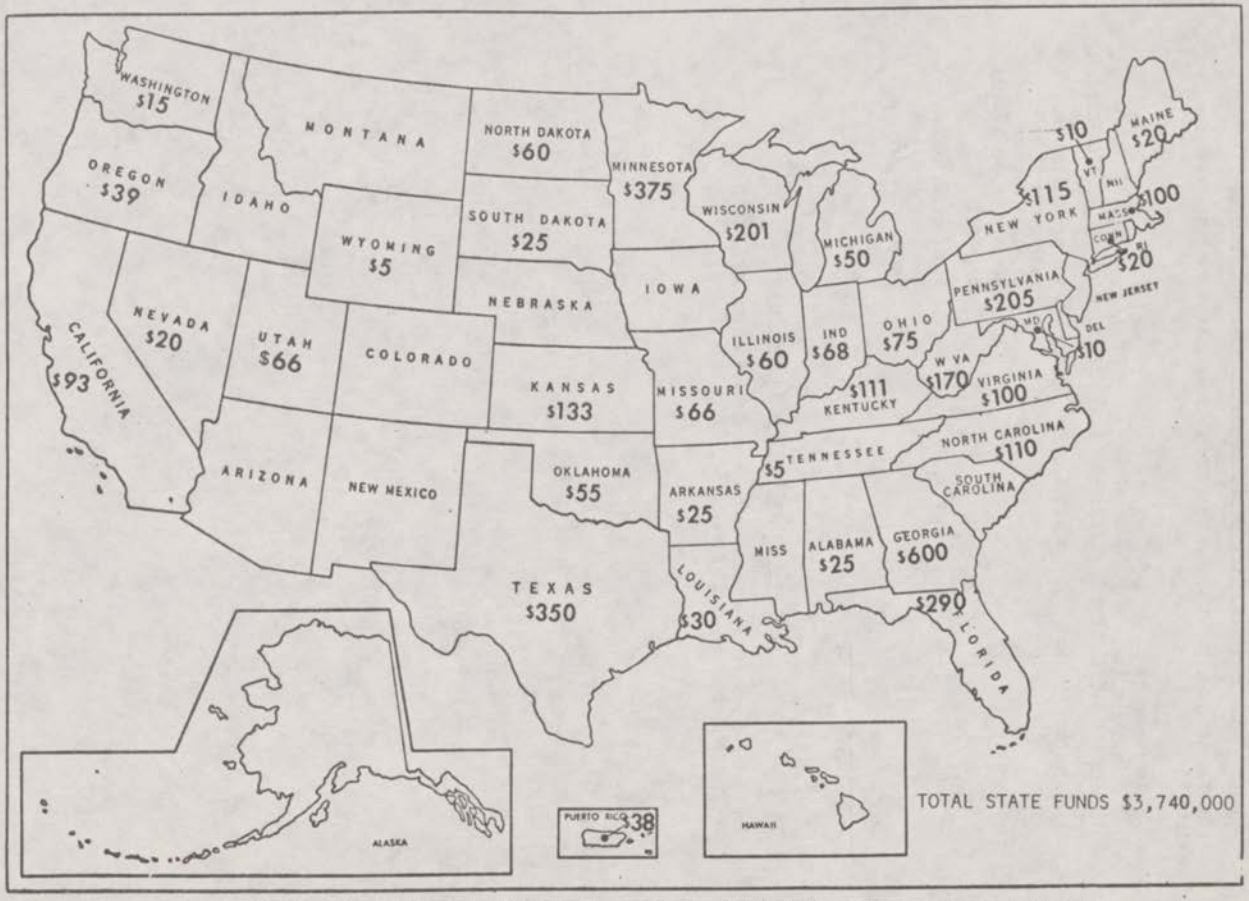


Figure 2. - Cooperative mapping program, FY 1973 (in thousands of dollars)

4. Geologic and Mineral Resources Survey and Mapping

FY 1973, $42,965,000; FY 1974, $42,795,000; decrease, $170,000. The decrease consists of:

	Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1)	$+ 230,000	+4	$ 4,708,000	60	For acquisition and evaluation of geophysical data in support of OCS leasing program.
(2)	- 400,000	-8	23,917,000	593	Redirection to support Resource and Land Information Program.
	$- 170,000	-4			

Cost Factors Involved in Increase

(1) 4 permanent positions at an average annual rate of $20,000, $80,000; acquisition of geophysical data, $150,000.

Analysis by Subactivities

Subactivity	FY 1972 Amount Available	FY 1973 Amount Available	FY 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973	Page Reference
(a) Land resource surveys-------	$16,861,742	$24,317,000 1/	$23,917,000	$-400,000	28
(b) Mineral resource surveys----	13,980,897	14,170,000	14,170,000	- -	34
(c) Offshore geologic surveys---	2,422,817	4,478,000	4,708,000	+230,000	37
Total	$33,265,456	$42,965,000 1/	$42,795,000	$ -170,000	
Unobligated balance lapsing-		- 3,000,000 1/			
Amount Available		$39,965,000			

1/ Includes $3,000,000 of the Earthquake Hazards Reduction program placed in reserve in FY 1973. The Office of Management and Budget undertook a thorough review of the programs of earthquake research conducted by the Geological Survey, National Oceanic and Atmospheric Agency and National Science Foundation to ensure a coordinated national program of earthquake research. Because this review could not be completed until after appropriations were made for NOAA, there did not remain enough time in FY 1973 for the execution of the full program of Earthquake Hazards Reduction planned by the Geological Survey.

(a) LAND RESOURCE SURVEYS: FY 1973, $24,317,000; FY 1974, $23,917,000; decrease, $400,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-400,000	-8	$23,917,000	593	Redirection to support Resource and Land Information Program.

Program of Work:

	FY 1974	
Regional Mapping and Analysis:		
Eastern States	$1,535,000	
Kentucky	629,000	
Central States	1,476,000	
Western States	1,147,000	
Alaska	559,000	
Paleontology and Stratigraphy	2,751,000	
Geophysical Surveys	2,279,000	
Geochemical Surveys	833,000	
Geochronology	932,000	
Geologic Processes	1,018,000	
Land Resource Analysis	500,000	$13,659,000
Earthquake Hazards Reduction		8,652,000
Volcano Hazards		546,000
Engineering Geology		1,060,000
Total		$23,917,000

Status of Program:

The growing and complex demands of modern society on the Nation's valuable land resources require sound land-use planning, resource management, and environmental control. To achieve these important goals, the Geological Survey's Nationwide program of geologic investigations and supporting activities and related geophysical and geochemical studies is directed toward the acquisition of basic earth science data and the translation and communication of these data in forms that are readily understood and of direct benefit to the widest range of land-use planners and decision makers. Interpretation of the accumulated geologic and associated information provides the means for determining the distribution and properties of surficial materials and rocks that lie on or beneath the earth's surface, evaluating mineral resources and construction materials, identifying natural hazards such as landslides and active faults, and appraising the suitability of the land for various uses and the cost of modifying it in the construction of roads, buildings, dams, tunnels, pipelines, and other man-made structures.

Geologic maps and related reports resulting from Regional Mapping and Analysis are data banks that store and display in compact form significant information about the land and its resources. The maps are prepared and published at various scales. Large scale maps (1 mile to the inch or larger) for detailed planning and evaluation of land resources are now available on about 24% of the country and are produced at the rate of less than 1 percent per year. Maps at smaller scales are also produced, particularly in Alaska where some areas are still virtually unknown geologically. Because of the increasing demand for more extensive coverage, geologic surveys are programmed to make most effective use of available personnel, equipment, and techniques to meet the most urgent needs; for example, greater use of 1:125,000 and 1:250,000 scale maps (2 miles to the inch and 4 miles to the inch) is being made to present geologic data pertinent to regional (as opposed to local) land-use planning and resource management.

Because of the somewhat greater emphasis that has been placed on obtaining adequate surveys and appraisals of the Public Lands, about 70% of the total regional mapping and analysis program is in the western states and Alaska. Although these studies were aimed chiefly at facilitating the discovery and evaluation of natural resources for many years, they are now being focused increasingly on environmental problems such as those concerned with the extraction of natural resources and the identification of geologic hazards including earthquakes. A number of current projects are oriented toward gaining a better understanding of the large volcanic fields and associated caldera structures in the Rocky Mountains, such as in the San Juan Range of Colorado, which are areas of potential mineralization. A new geologic map of the United States at a scale of 1:2,500,000 has been completed in preliminary form, and compilations of new or revised state maps of Oregon, Nevada, Wyoming, and Colorado are in various stages of completion.

Geologic mapping in the mid-continent and eastern regions (about 30% of total effort) has direct engineering and environmental as well as resource applications. Priorities in these regions are set in considerable part by requests from individual states accompanied by offerings of matching funds. The geologic mapping program in Kentucky, for example, is supported in part by a State appropriation of .5 million dollars. Nearly 80% of the State of Kentucky is now mapped in detail at a scale of 2,000 feet to the inch, and the remainder is being completed at the rate of about 2,000 square miles per year. Other areas in which cooperative programs are expected to provide complete geologic mapping coverage at large scale are Massachusetts, Connecticut, and Puerto Rico. Compilation of a new geologic map of Arkansas is continuing.

To ensure the fullest application of earth science information into the planning and decision-making processes, the Land Resource Analysis Program was initiated in FY 1973 to determine the most effective methods of presenting integrated geologic, hydrologic, topographic, and geographic data to a broad range of users not trained in earth science. Basic data, special purpose and interpretive maps are being prepared and published in folios that employ a minimum of technical terms and graphic symbols and contain the kinds of information considered to be of greatest value in the solution of land-use and resource management problems. Land resource analysis investigations are currently under way in the Snake River Plain (Idaho) and Knox County (Tennessee) areas. In addition, the objectives of 25 projects representing wide geologic and geographic diversity in the on-going regional mapping and analysis program have been expanded to include the preparation of special purpose and interpretive maps. To date, complete or partial folios have been published on 12 of these projects. The land resource analysis program also will include a continuation of the development of a land use information program. The FY 1974 effort will build upon the land use classification system developed in FY 1972 and FY 1973 to produce a limited amount of current land use data in computer and traditional map forms from high altitude and satellite images and to detect and analyze changes in the patterns of land use. The program will begin to integrate and synthesize such land use information with topographic, geologic, hydrologic, soils, socio-economic, demographic and other information to evaluate the capability or carrying capacity of environmentally sensitive areas to accomodate urbanization, recreation development and other intensive human activity.

The Geophysical program consists largely of investigations and interpretations of variations in the earth's magnetic and gravitational fields, although radioactivity, heat flow, electrical properties of the earth, and other physical properties are also studied. Aeromagnetic and gravity data are collected, compiled, and interpreted to define subsurface geologic structure and composition in mineral resource appraisals of Wilderness and other undeveloped Public lands, in ground water investigations and geothermal appraisals, and for synthesizing the geologic framework of large regions as an aid in geologic mapping and analysis of crustal structure and tectonic history. Ground resistivity, electomagnetic, induced polarization, magnetotelluric,

magnetic, self potential, and radioactivity surveys supplement the aeromagnetic and gravity data. The activity uses small aircraft for gathering detailed aeromagnetic data; for development of airborne spectral radiation (U, Th, K^{40}) and electromagnetic (time domain and very low frequency radiophase) mapping and prospecting systems; and for development of systems for the detection of pollution for Hg, SO_2, NO_2, Br, and F. Studies in airborne infrared and multispectral reflectance over chemically stressed, volcanic, geothermal, and urban areas are also carried out.

A significant breakthrough has been made during the past year in the interpretation of electrical resistivity sounding data. A technique has been devised whereby a digital computer is used to select a "best fit" interpretative curve of a complex electrical sounding profile. This system short cuts the laborious process of visual curve comparison, and it results in better interpretation of the overall shape of subsurface bodies of rock.

Continuing paleomagnetic investigations are aiding in the interpretation of past changes in the earth's magnetic field and movements of major crustal plates. Studies are conducted on the rates of flow of heat from the earth's interior and on the physical properties of rocks at high pressures and temperatures, factors that are essential to the understanding of earthquakes, volcanoes, geothermal reservoirs, and other geologic phenomena of potential destructiveness or usefulness.

Fundamental Geochemical properties and processes of the earth's crust are investigated in the field and laboratory. These investigations furnish essential information on the origin of important rock types, their chemistry, distribution, and relationships in time and space. Complex rocks that are the product of processes deep within the crust are investigated in selected areas throughout the country. Rock-water interactions that take place at relatively shallow depth are also of special concern, and the complex chemical relations between the two are currently being studied. The published results of these investigations serve as reliable guides to geologists in government, industry, and the academic community who are seeking to evaluate resource and land-use potentials. The age of rocks and ores are determined by isotopic analysis, and new techniques, such as the Ar^{40}/Ar^{39} and thermoluminescense methods, are being perfected and will soon become standard procedures. Regional geochemical studies examine the distribution and variation of metals and related elements in rocks, soils, plants, and water. The Survey's past experience in this field has recently been of unexpected benefit to medical researchers investigating the relationships between regional geochemistry and the geographic incidence of cardiovascular disease, congenital malformation, and other health problems. Currently, the Geological Survey is carrying out a program of state-wide collection and analysis of geochemical data in Missouri, which is coordinated with studies by epidemiologists at the University of Missouri. Such geochemical data also provide important baselines against which levels of pollution can be measured for potentially toxic materials such as mercury, cadmium, molybdenum, strontium, chromium, and nickel.

Earthquake Hazards Reduction: A great earthquake (magnitude larger than 8) in the densely populated areas of the Pacific Coast would cause damages in the range of 5 to 20 billion dollars and the loss of 1,000 to 10,000 lives. It is estimated that there is a 70 percent probability of such a quake within the next 30 years. Great earthquakes cause the most spectacular losses, but smaller shocks occur more frequently and are also capable of causing serious damage and loss of life, especially in densely populated urban areas. The pressure of increasing population in major urban centers is causing the spread of residential developments into areas long suspected of having high susceptibility to severe earthquake damage, a trend that gives urgency to the need for precisely delineating earthquake hazard zones. The possibility of major earthquakes exists for many areas of the

country in addition to the West Coast. Notable earthquakes, for example, have occurred at New Madrid, Missouri (1811-12), Boston (1755), and Charleston, South Carolina (1886), and in Utah, Nevada, and Montana.

Earthquake investigations have been conducted by the USGS since the early studies of the New Madrid and Charleston earthquakes by Fuller and Dutton. Since 1965 intensified earthquake research has been conducted at the Survey's National Center for Earthquake Research (NCER) in Menlo Park, California. A highly competent team of scientists has been engaged in a comprehensive multi-disciplinary research program spanning geology, geophysics, and soils engineering in order to understand what causes earthquakes and what can be done to decrease their dangers. Investigations have been centered on the San Andreas fault zone of California, the most dangerous earthquake fault in the United States.

In late 1972, the Survey undertook an expanded program in earthquake hazards reduction. The increased funds were used for expansion and development of the Survey's studies, purchases of equipment and services from industry, and contracts with universities and state governmental agencies. Attention was largely focused on California's San Andreas fault system, but important programs were inaugurated in other highly seismic areas including Alaska, western Nevada, Utah, Idaho, Montana, and southeastern Missouri.

The expanded program was based largely on geological and geophysical techniques developed in prototype studies carried out earlier in the central California Coast Ranges. Map representations of fault systems, potential landslide areas, physical properties of rocks, and other parameters important for planning and engineering design that were developed for the USGS-HUD cooperative program in the San Francisco Bay region are being applied in the Los Angeles Basin and elsewhere. The network of seismograph stations established in central California starting in 1965 was expanded into southern California, and similar networks were established or augmented in the other study areas. Trilateration survey techniques, used to measure large-scale horizontal crustal deformation, are also being employed.

The earthquake hazards reduction program is making use of a variety of advanced instruments and techniques that have been under development at the National Center for Earthquake Research over the past few years. Variations in seismicity are being analyzed using a dense network of seismograph stations. A tiltmeter that can be emplaced in a borehole is being used in an attempt to detect warping of near-surface rocks preceding earthquakes. Premonitory signals are also being sought using magnetometers and water-level recorders in wells. A flatjack, essentially a copper envelope filled with fluid and connected to a pressure gauge, is used to detect strain in rocks and soil. Efforts are underway to apply hydraulic fracturing, long a standard tool of the oil industry, to evaluate stress in rocks. An extensive field test of the technique is underway.

The earthquake hazards reduction program is comprised of six elements which are listed below together with important studies underway in each study area:

1) Earthquake hazard mapping - delineation of potential landslide areas and areas underlain by soils that could fail under strong earthquake motion; laboratory and field measurement of physical properties of soil and rock that are important for engineering design, such as shear wave velocity; estimation of expected bedrock motion from hypothetical earthquakes and of surface ground motion taking into account geologic structure,materials, variations in rock type,and historical seismicity.

2) Post-earthquake studies - determination of detailed aftershock distributions; mapping of surface ground breakage, fault displacement, landslides, areas of liquefaction and surface deformation; analysis of damage with respect to geologic foundation material.

3) Fault mapping - delineation of active faults; estimation of history of fault movement and earthquake recurrence intervals.

4) Earthquake prediction - evaluation of fault movement and strain in crustal blocks adjacent to the faults; evaluation of stress in rocks; detection and measurement of premonitory indications of earthquake occurrence, including ground tilting, electromagnetic anomalies and seismicity; automation of earthquake data processing.

5) Earthquake control - determination of chemical and physical properties of fault zone materials; measurement of fluid pressures and their influence on earthquake occurrence; computation of realistic models of the earthquake process; evaluation of possible sites for field tests.

6) Research on crustal failure - development of an understanding of fracture of rocks; computer modelling of crustal failure processes; determination of the relationship between tectonic pressures and regional seismicity.

Volcano Hazards pose potential threats in many areas near active or temporarily dormant volcanoes. A system of prediction is essential to mitigate these hazards. The major effort is carried on at the Hawaiian Volcano Observatory, where long-term monitoring has provided advanced warning to the more than 35,000 people who live downslope from potentially active eruptive vents on Kilauea and Mauna Loa volcanoes. The continuing acquisition and interpretation of data at Kilauea has advanced our understanding of volcanic processes and has provided an important record that serves as a basis for future fundamental studies. Kilauea has been in eruption for a total of about 8 months during the past year, and lava flows have continued to cover roads and ranch lands on their way to the sea. Progress has continued to be made in the monitoring networks and our understanding of the underground "plumbing" of the volcano; the seismic network has been expanded and largely converted to radiotelemetry; the ground deformation network, which monitors the swelling of the volcano as lava forces its way upward prior to eruption, has also been expanded. Data from both networks are routinely analyzed using automatic data processing. In collaboration with HUD, a volcano hazards study has been initiated on the island of Hawaii, and a text and accompanying map outlining areas of relative danger posed by volcanic eruption will be available by June 1973. This material will be of value to Federal agencies and to the officials and citizens of the County of Hawaii who are concerned about real estate development in areas subject to potential volcanic hazards. In collaboration with NASA, two experimental thermistor arrays have been deployed near the summit of Kilauea volcano, and temperature data obtained from steaming fissures are relayed to Washington, D.C., via the Nimbus IV satellite. In the Cascade Range of the Pacific Northwest, volcano hazards studies are continuing on Mt. Saint Helens. A program of volcano surveillance has been initiated, in which seismicity, ground deformation, and temperature will be monitored. Trilateration networks to measure horizontal strain have been established on Mt. Saint Helens and Mount Hood. In collaboration with NASA and as part of the ERTS-A experiments, seismic event counters, borehole tiltmeters, and thermister arrays are being placed on Lassen Peak, Mt. Saint Helens and Baker Peak. This surveillance marks the first important steps toward developing an operational volcano warning system that eventually will indicate which, if any, of the Cascade volcanoes are showing signs of returning to activity.

The Engineering Geology program has at its core detailed geologic studies in urban areas that provide information on foundation conditions, slope stability and landslide potential, drainage characteristics, and engineering properties of rocks and soils. Such studies are continuing in Los Angeles, San Francisco, Denver, Salt Lake City, Rapid City, Boston, Anchorage, and Juneau. In addition, longer range research in engineering geologic problems is conducted in both the field and laboratory. In the laboratory at Menlo Park, California, ground motion studies of unconsolidated materials are being done in order to better predict the effects of earthquakes in areas of differing geologic conditions. In the Denver

area research in rock mechanics includes observations in mines and tunnels as well as laboratory investigations. This work is directed toward a fuller understanding of the conditions that lead to rock failure during engineering modification, such as the triggering of landslides during construction and the causing of rock bursts and collapses during tunnelling and mining. In conjunction with urban area studies, such as in the San Francisco Bay and Denver areas, and in the land resource analyses program, engineering geologic maps and analyses are being further interpreted and synthesized with data from other disciplines for particular application in regional and urban land-use planning.

(b) MINERAL RESOURCE SURVEYS: FY 1973, $14,170,000; FY 1974, $14,170,000; no change.

Program of Work:

		FY 1974
Energy investigations:		
Organic fuels	$1,959,000	
Uranium-thorium	822,000	$ 2,781,000
Mineral investigations:		
Metallic minerals	$5,005,000	
Non-metallic minerals	683,000	
Geochemistry of ore deposits	2,027,000	
Exploration research	1,871,000	
Mineral resource inventory	734,000	10,320,000
Wilderness investigations		1,069,000
Total		$14,170,000

Status of Program:

A broad spectrum of scientific investigations, which comprise the mineral resource surveys program, is required to support national mineral raw material supply and management decisions. This program includes studies of the origin, occurrence, magnitude, and quality of energy and metallic and non-metallic deposits. New concepts and techniques of mineral exploration are being developed and evaluated, and appraisal of the Nation's mineral resources continues.

A bountiful supply of energy resources--oil, gas, coal, and uranium--is the natural foundation on which the great industrial productivity and high living standard of the United States were built and are maintained. Conspicuous strains in this supply have resulted from the relatively advanced state of development of our resources coupled with rapid increases in per capita consumption and population. Environmental considerations and an adverse balance of payments worsen the strain and complicate policy choices. If energy consumption is to double during the next 20 years, as all projections show, the rates of discovery and production of domestic energy raw materials will have to increase dramatically to avoid greatly increased dependence on imports of crude oil and liquified natural gas from foreign sources. The current energy program of the Geological Survey is addressed to these needs.

Continental shelf exploration for new oil and gas deposits will play a key role in holding down the level of U.S. dependence on hydrocarbon imports. Reconnaissance investigations of the geology of selected parts of the shelves are underway in four major areas considered to hold promise for future petroleum prospects. Additionally, research investigations have been undertaken to develop new and improved methods and instruments for exploring for hydrocarbons in excessive water depths characteristic of the continental slope and rise where it is anticipated that many of our longer-term energy requirements will have to be satisfied. These aspects of our energy investigations are important parts of our Offshore Geologic Surveys subactivity and are described more fully there.

Although newly found oil and gas from the outer continental shelves will play an ever increasing role, the mainstay of domestic hydrocarbon production will continue for many years to come from onshore production in the "lower 48" and Alaska. New discoveries of deeper and/or harder-to-find (and generally smaller) oil traps will supplement continued production from old fields, much of it obtained by refinements in secondary recovery technology. Program emphasis pertaining to onshore oil and gas is highly selective. An experimental effort to investigate methods of prospecting for stratigraphic and other subtle traps without dependence solely on geophysical and subsurface structure mapping

has been launched. Investigations of novel logging methods for searching for bypassed hydrocarbons in developed fields continues with noteworthy success. Basic research into mass properties of sedimentary rocks is being supplemented by investigations of reservoir rock porosity and permeability relationships to problems of formation of reserves and recovery efficiency. Systematic mapping (surface, subsurface, or geophysical) of a few specially selected local areas favorable for further prospect drilling, especially for gas, continues.

In terms of long-range importance to the nation, domestic resources and reserves of coal greatly overshadow those of oil and gas. However, most of the coal reserves contain sufficient sulfur to be environmentally objectionable or unacceptable for many current needs, and shortages of low-sulfur and special purpose coals exist or can be foreseen, especially in the east and southeast. Program emphasis is particularly on improving knowledge of the reserves and resources of low-sulfur coal, and on research aimed at clarifying the relationships between sulfur contents of coals and geologic characteristics of the rocks closely associated with them. Trace element distributions in coals have also received increased attention because of problems of atmospheric pollution caused by some toxic metals released during coal utilization.

Looking toward rapid increases in production and consumption of uranium as an alternative source of energy to replace scarce hydrocarbons for the large-scale production of electrical power, systematic mapping of uranium-bearing rocks is being continued at a fairly high level for purposes of improving knowledge of the resource base. Special studies of local deposits are aimed at better understanding of processes of ore formation and improving exploratory techniques.

The Nation's requirements for metallic and non-metallic raw material commodities, already enormous in terms of per capita consumption, are projected to rise appreciably in the next decades. Program emphasis is placed on those metallic and non-metallic commodities for which shortages exist or are anticipated, and for which the application of geologic knowledge may be expected to result in new domestic discoveries, and ultimately, in increased domestic production. Clues to the existence of buried deposits are few and subtle; the search for new ore deposits increasingly must be based on the coordinated application of geology, geochemistry, and geophysics. The Geological Survey program is geographically broad based; active field projects in 30 states and Puerto Rico are focused on detailed mapping, sampling, and analysis of base, ferrous, and precious metallic mineral deposits such as porphyry copper in Arizona and Utah, platinum and mercury in Alaska, iron in Michigan, and tungsten in North Carolina. Regional geologic, geochemical, and geophysical appraisals (scale 1:250,000) of broad regions of potential mineralization have begun in northeast Washington, along the Cortez-Uinta belt in western Utah and eastern Nevada, and as part of a program of resource potential in urban areas, in the Connecticut River Valley of Connecticut and Massachusetts. Comparable studies in 14 states are focused on non-metallic mineral deposits such as phosphate (fertilizer) in Wyoming, barite in Nevada, oil shale and saline minerals in Utah and Colorado, borates in California, and clay deposits in Pennsylvania. Similar programs supported through other agencies, such as AID, provide additional information on foreign mineral resources. During 1972 the Geological Survey provided the public and geoscience users with the results of some of these research projects, that included 34 maps and book reports and 41 reports in scientific journals.

Investigations of the geochemistry and geophysics of ore deposits provide information that is basic to improving the efficiency and effectiveness of the search for new ore deposits. Geochemical investigations include detailed studies and sample analysis of selected ore deposits and areas in which ore deposits occur; identification and examination of minerals to determine their significance as indications of past conditions; development and testing of new methods of chemical assay and analysis and of new geophysical instruments. Significant progress has been made in deducing from the chemical and isotopic compositions of minerals and fluid inclusions, the origins of waters (volcanic, ground water,

etc.) responsible for the deposition of many ores. This fundamental work promises to increase our understanding of ore forming processes markedly and enhance our ability to predict ore occurrences. The recent implementation, on the Geological Survey computer, of a program that uses fundamental chemical properties of minerals and natural waters to predict chemical changes causing ore deposition has greatly increased our ability to evaluate the relative importance of a wide variety of geochemical processes to the formation of ore deposits. Highly sensitive laboratory techniques that permit the measurement of minute background traces of gold in unmineralized rocks are providing data that are changing our ideas on the formation of gold ores because they indicate that gold has been concentrated in basaltic rocks rather than in the more granitic rocks as was previously believed. Geophysical investigations during the past year have centered on the construction and testing of electromagnetic equipment and the development of new interpretation models. The use of gravity methods in wilderness area studies has been added to support the information gathered in the past by aeromagnetic methods.

The exploration research program utilizes laboratory- and field-derived geologic, geochemical, and geophysical concepts and data to develop and field-test new mineral-finding techniques. Continuing programs include studies to find the distribution and abundance of pathfinder elements or suites of elements in and around mineral districts, which may occur in a variety of host rocks and climatic belts, to detect geochemical anomalies by remote sensing techniques, to improve analytical techniques for field and laboratory use, and to manipulate and analyze large volumes of analytical data by computer methods. Patterns of element distribution and redistribution are recognized around some types of ore deposits and will provide previously overlooked clues to buried deposits; the search to refine these clues and the types of deposits for which these are indirect indicators continues. Recognized patterns of elemental zoning are being studied also to verify whether they may allow not only the detection of the presence of an ore deposit, but the depth to the deposit.

A new mineral resources appraisal program emphasis to assess and interpret mineral resource data, begun this year, will provide a firmer basis for future decision-making by the Government on questions of mineral supply, land use, and environment policies. A beginning has been made to appraise the mineral resource potential of selected urban areas and other Federal and private land areas not included in the Wilderness Act program; a mineral resource computer data bank being developed, has become operational; and the Office of Resource Analysis was organized to combine the expertise of advanced mineral economic theory, and statistical and computer techniques. This group will provide support for exploration activities as well as increasing the quality and speed of land appraisal for potential mineral resource.

Geological Survey and Bureau of Mines joint wilderness investigations under authority of the Wilderness Act of 1964 (P.L. 88-577) have resulted in mineral surveys of all 34 primitive areas and 9 of 37 known wilderness candidate areas, which the Department of Agriculture recommends be included in the National Wilderness Preservation System, and of 10 of the 54 Wilderness areas already in the System. Presently the candidate wilderness areas comprise more than 5 million acres of Forest Service lands, which represent about one-third of the number of acres that will be recommended by them as candidate areas. Mineral resource study of these areas must be completed within the next 10 years.

(c) OFFSHORE GEOLOGIC SURVEYS: FY 1973, $4,478,000; FY 1974, $4,708,000; increase, $230,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Positions	Explanation
$ + 230,000	+4	$4,708,000	60	For acquisition and evaluation of geophysical data in support of OCS leasing program.

Need for Increase:

An increased pace of regional geophysical data acquisition and evaluation is required for acceleration in the schedule of OCS leasing. The increase will support work aimed at reconnaissance understanding of the geology, hydrocarbon resources potential and associated environmental hazards of the deeper-water portions and the more marginal areas of the OCS in the Gulf of Mexico. Experiments to develop or evaluate new and improved techniques for identifying and assessing areas favorable for oil and gas resources will also be conducted.

Program of Work:

Appraisal of the mineral resource potential of the continental shelves surrounding the United States is the major objective of the program. To accomplish this objective systematic efforts to map the geology of the seafloor and to discern as well as possible the structure, stratigraphy, and lithologic characters of the rocks below the seafloor are underway on a broad front. Unlike geologic mapping on land, exposed rock and surface samples play a minor role. Rather, interpretation of geophysical measurement--seismic, gravity, and magnetic--controlled wherever possible by ties to known rock units, drillholes, or bottom samples, form the principal basis for the mapping. For this reason, well coordinated teams of geologists and geophysicists are required to conduct such investigations, and maximum use must be made of knowledge gained from geologic experience gained in onshore areas contiguous to the shelf areas being investigated.

Geophysical data required for systematic mapping and analysis of the continental shelves are being acquired from many sources. Some of the data have been collected through our own efforts, utilizing the USGS vessel Polaris or by using ships working under contract or in cooperative efforts. Other data have been obtained by purchase; particularly extensive networks of relatively detailed deep penetration multichannel processed seismic data purchased through contracts for proprietary use from industrial sources. Still other data have been made available from other government agencies; particularly magnetic and gravity data gathered by NAVOCEANO to satisfy DOD needs. Last but not least are data obtained from reworking published results of others, particularly academic scientists. These masses of geophysical data not only pose a massive accounting and housekeeping chore, but for their full utilization, they must be extensively analyzed and subjected to intensive and exacting quantitative interpretation by teams of specialists.

Status of Program:

The continental shelf mapping program is here summarized by major geographic areas.

Atlantic Continental Margin--An intensive effort began in January 1972 to study systematically, through analysis and interpretation of substantial amounts of proprietary geophysical data, the structure and stratigraphy of that part of the Atlantic Shelf between Canadian waters and Cape Hatteras. This study is expected to be complete by January 1974, and rests on a foundation of experience and knowledge gained during ten years of reconnaissance studies along the entire Atlantic Shelf and a much longer history of geologic work on the exposed rocks of the Atlantic Coastal Plain. Present results reveal a much more extensive, involved, and longer sedimentary history for portions of the offshore shelf than one could have guessed from previously available data, and consequently a greater and more promising resource potential than hitherto realized.

Collection and analysis of detailed structural and stratigraphic data are being continued in selected areas where such data are required to identify environmental problems or resource opportunities of local extent at shallow depths.

Gulf of Mexico and Caribbean--Compilation of all basic data and geologic interpretations for the entire Gulf of Mexico basin have been completed at a scale of 1:2,500,000, and a multidiscipline report prepared for publication. Emphasis has been on broad structural characteristics and the petroleum resource potential, including that in the deep water portions of the basin. Cooperative studies with the Commonwealth of Puerto Rico continue and are being intensified. These studies combine research and systematic mapping, training, and resource evaluation.

Pacific Continental Margin--Four major and diverse programs continue along the Pacific Shelf. On the Southern California Borderland work has been completed, aimed at better understanding of the near-coastal offshore regional geology sufficient to identify zones of active faulting and to evaluate earthquake frequency and magnitude risks. In a larger part of the same area, systematic regional geologic mapping has been accelerated for purposes of providing a firmer basis for evaluating the petroleum resource potential of a highly prospective but geologically extremely diversified region from Pt. Concepcion south to the Mexican border. This regional study and evaluation is not restricted to areas accessible through current exploration and drilling technology. It covers the entire Borderland, including the basins, some of which are under more than 6,000 feet of water, and some of which are likely to contain hydrocarbon resources that will be made accessible technologically in the future. Large-scale geologic mapping and selected topical investigations of San Francisco Bay continue. New insights have been gained into trace-element contaminant distributions by fine sediment particle dispersal as an unexpected by-product of the estuarine circulation and flushing studies. In the central California Shelf region efforts continue to locate and map possibly active faults and potentially unstable sea floor sediments, as well as systematic geologic mapping for purposes of resource appraisal. A program of geologic and geophysical mapping in the Straits of Juan de Fuca (in part conducted with informal cooperation with Canadian earth scientists) provided new knowledge of the

structural and stratigraphic complexities north of the Olympic Peninsula.

Alaska Continental Margin--Reconnaissance investigations in the western Gulf of Alaska are being closely coordinated with resource appraisal studies (farther east and south) carried on by the Conservation Division. Emphasis is on structural investigations appropriate for better understanding of the petroleum resource potential and on improved understanding of seismic activity and attendant hazards in offshore operations. Broad reconnaissance investigations in the Chukchi and Beaufort Seas done in cooperation with the Coast Guard (ice breakers) continue to provide geophysical data of considerable value in these operationally difficult shelf areas of high petroleum resource potential.

5. Minerals Discovery Loan Program

FY 1973, $272,000; FY 1974, $272,000; no change.

Status of Program:

Financial assistance to explore deposits of 36 eligible minerals is offered on a participating basis to private industry by the Office of Minerals Exploration (OME) under the Geologic Division. Under the current level, $272,000 is received to support loans and to administer exploration contracts provided to those who are unable to borrow the necessary funds at reasonable terms from commercial sources. The program involves processing applications, conducting geologic and engineering field examinations, preparing and monitoring contracts, and collecting royalties on production. OME also administers contracts with royalty obligations remaining from a similar program conducted by the former Defense Minerals Exploration Administration (DMEA).

Minerals Discovery Loan Program

	FY 1972 Amount Available	FY 1973 Amount Available	FY 1974 Estimate	Decrease (-) 1974 Compared with 1973
(a) Financial assistance	$ 137,000	$ 248,541	$ 84,000	$ -164,541
(b) Technical and administrative expense	193,000	193,000	193,000	-
Total obligations	330,000	441,541	277,000	-164,541
Financing:				
Unobligated balance available, start of year	53,271	164,541	-	-164,541
Recovery of prior year obligations 1/	169,270	5,000	5,000	-
Budget authority	272,000	272,000	272,000	-
Total amount	494,541	441,541	277,000	-164,541
Unobligated balance available, end of year	-164,541	-	-	-
Total obligations	330,000	441,541	277,000	-164,541

1/ Funds returned (estimated for 1973 and 1974) because contracts were terminated or not completed.

6. Water Resources Investigations

FY 1973, $40,129,000; FY 1974, $39,854,000; Decrease, $275,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+ 99,606	+3	$16,048,481	607	To provide urgently needed water data in which Federal interest is paramount
-100,000	-3	2,487,000	94	To transfer funds and personal services to data program of higher priority
-300,000	-7	--	--	Redirection to support Resource and Land Information program
+ 25,394	--	370,519	--	For reimbursement to Bureau of Employees Compensation
-275,000	-7			

Cost Factors Involved in Increase

Personal services made available through discontinuance of elements in ongoing program equivalent to 3 man years at an average annual rate of $15,000, $45,000; transportation and subsistence, $5,000; supplies, material and equipment, $25,000; contractual services, $25,000.

The Water Resources program of the Geological Survey proposed for 1974 will require direct appropriation of $39,854,000 (52% of total program). In addition, the Survey performs extensive water-data acquisition for other Federal agencies under a reimbursable arrangement ($14,607,000; 19% of total program), and receives fiscal support from the States through the Federal-State program of cooperative work ($22,545,000; 29% of total program), making a total projected program of $77,006,000 for 1974.

Analysis by Subactivities

Subactivity	FY 1972 Amount Available	FY 1973 Amount Available	FY 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973	Page Reference
A. National Water Data System:					
(1) Federal Program	$14,840,460	$15,948,875	$16,048,481	$+ 99,606	44
(2) Federal-State Program.....	20,008,002	20,948,000	20,948,000 a/	--	45
B. Critical National Water Problems..	2,597,317	2,887,000	2,487,000	-400,000	48
C. Employee Compensation Payments....	303,039	345,125	370,519	+ 25,394	49
	37,748,818	40,129,000	39,854,000	-275,000	

a/ Includes $253,000 for administration of the cooperative program and $20,695,000 for matching State offerings.

A. National Water Data System

The National Water Data System embraces the total effort of government (Federal, State, local) to acquire, process, store and disseminate water-resources and water-use information. The Geological Survey is the principal Federal water-data agency. As such, its programs constitute a major part of the system.

(1) FEDERAL PROGRAM: FY 1973, $15,948,875; FY 1974, $16,048,481; increase, $99,606. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+99,606	+3	$1,135,000	29	To increase the collection of baseline water-quality data

Need for increase:

The increase for collection of baseline water quality data will provide for the operation of an additional 12 stations at strategic sites on the Nation's rivers as a further step in implementing a National Stream Quality Accounting Network designed to yield balanced information nationwide on the state of the Nation's surface-water resources.

Program of work:

The water-data collection, resources investigation, and research activities included in this program support that segment of the National Water Data System in which the Federal interest is paramount, including the public domain, river basins and aquifers that transcend State boundaries, and other areas of international or interstate concern. Major program segments are: streamflow, ground-water and water-quality data acquisition, analysis, storage, and dissemination (including baseline water quality data) $7,327,000; regional resource appraisals including ground-water studies ($589,000); basic hydrologic investigations and research aimed at increased understanding of the operation of hydrologic systems ($4,298,000); hydrologic investigations on public lands managed by Bureau of Land Management ($274,000); International Hydrological Decade studies, $195,000; training, publication and other supporting services ($2,476,481); coordination of National water data activities ($689,000); National Water Data Exchange ($200,000).

Status of program:

Although many data have been and are being collected, there remain major deficiencies in the geographical distribution and in the kinds of data required. This situation exists not only because of population growth and shifts and depletion of some local sources of water but also because the development and management of water requires on a regional and national basis more and better supporting data.

While the long established streamflow program is responsive in general to the current need, there is a severe shortage of data on the very large number of small streams. In addition, the lack of adequate data on the ground water resource and quality of water, especially in urban areas and in estuaries, reduces the effectiveness of planning, design, development, management and use of the Nation's waters and poses a problem to concerned Federal and State planning and enforcement agencies.

The following table indicates the approximate level of adequacy of principal kinds of water data and information activities on a nationwide basis.

Kinds of information	% of current need being met
Surface water:	
Average streamflow	80
Floods	50
Low flows	25
Stream systems studies	10
Ground water:	
Resource appraisal	45
Subsurface waste storage	5
Systems studies	20
Water quality:	
Resource appraisal	35
Surveillance	20
Urban hydrology	10
Estuaries	5
Water use	20

In keeping with the Survey's responsibility for national leadership in water data, the 1974 Federal program component of the National Water Data System is aimed at alleviating the most critical of these deficiencies in areas where the interest is primarily Federal.

(2) FEDERAL-STATE PROGRAM: FY 1973, $20,948,000; FY 1974, $20,948,000; no change.

Program of work:

Cooperative projects are jointly planned by State and Federal representatives at grass-roots level which assures optimum melding of Federal and State priorities. Major program activities and estimated 1974 funding are:

	Federal matching funds	State and local funds
Collection, analysis, and dissemination of streamflow, ground-water, and sediment data	$10,140,000	$11,000,000
Areal resource appraisal	5,680,000	5,800,000
Studies related to critical water problems	2,200,000	2,300,000
Other data collection and applied research	2,675,000	3,445,000
TOTAL	20,695,000	22,545,000

Projects approved for cooperative funding contribute to solution of urgent national and State problems and strengthen the National Water Data System effort, thereby appreciably reducing the amount of data collection requiring all-Federal funding. At present, the total increase in offerings for matching by the more than 500 cooperating agencies for FY 1974 is expected to approximate $5,300,000. Because there is no increase proposed in Federal funds, this $5,300,000 offering will go unmatched. Programs of utmost urgency may be initiated or broadened only by decreasing or eliminating ongoing programs of lesser priority.

Status of Program:

Efficient and effective conservation, development, and utilization of the Nation's water resources is impossible without an adequate data base. This program provides more than half of that base and is a continuing program with direct response to changing and increasing mutual needs of Federal and local governments for data in support of water resources decision-making.

As problems arise and as the need for new kinds of water information develops (e.g., pesticides, radioactive materials in water, systems modeling, urban hydrology), the States increase their requests and offerings for the cooperative program. Although the studies are often linked closely to local water problems, they are of substantial national, as well as local, interest because they yield information that has applicability to similar problems elsewhere. More importantly, they comprise segments of the regional or national picture.

Data collection activity through operation of network stations is primarily a long-term continuing function. Areal appraisals and interpretive studies, which are an important segment of this program, comprise hundreds of individual projects which, for the most part, are completed in one to three years with a published report.

On-going activities are distributed as follows:

Site data collection, analysis and dissemination; includes 7,400 continuous record and 5,400 partial record streamflow stations, 1,200 lake or reservoir stations; 2,800 water quality stations, 13,500 ground water observation wells and 11,800 project type short term wells.

Areal resource appraisals and problem studies include urban hydrology, sedimentation, estuaries, lakes, hydrobiology, stream system modeling, aquifer modeling; water quality modeling; saline waters; flood frequency and magnitude; floods and droughts; waste disposal and others totaling 400 projects.

Studies related to critical problems include 42 projects on urban and flood mapping; 23 projects on deep waste emplacement; 10 projects on estuarine problems and 20 projects on artificial recharge.

WATER RESOURCES INVESTIGATION: FEDERAL-STATE PROGRAM
ESTIMATES OF STATE AND MUNICIPAL OFFERINGS FOR FY 1974
(Thousands of dollars)

State	State Offerings to be Matched 1973	Estimated Offerings for Matching 1974	Increase (+) Decrease (-)
Alabama	378	450	+ 72
Alaska	224	302	+ 78
Arizona	483	562	+ 79
Arkansas	228	253	+ 25
California	1,855	2,307	+452
Colorado	496	629	+133
Connecticut	202	286	+ 84
Delaware	39	59	+ 20
Florida	1,432	2,476	+1,044
Georgia	339	419	+ 80
Hawaii	314	311	- 3
Idaho	330	466	+136
Illinois	249	265	+ 16
Indiana	454	528	+ 74
Iowa	261	292	+ 31
Kansas	554	580	+ 26
Kentucky	348	408	+ 60
Louisiana	531	689	+158
Maine	55	60	+ 5
Maryland	310	426	+116
Massachusetts	224	255	+ 31
Michigan	307	380	+ 73
Minnesota	329	459	+130
Mississippi	253	305	+ 52
Missouri	288	330	+ 42
Montana	183	338	+155
Nebraska	281	354	+ 73
Nevada	178	200	+ 22
New Hampshire	55	68	+ 13
New Jersey	413	452	+ 39
New Mexico	484	656	+172
New York	1,015	1,534	+519
North Carolina	361	425	+ 64
North Dakota	313	328	+ 15
Ohio	419	456	+ 37
Oklahoma	233	303	+ 70
Oregon	343	419	+ 76
Pennsylvania	835	994	+159
Rhode Island	39	46	+ 7
South Carolina	200	323	+123
South Dakota	165	210	+ 45
Tennessee	244	350	+106
Texas	1,462	1,746	+284
Utah	452	478	+ 26
Vermont	58	60	+ 2
Virginia	297	368	+ 71
Washington	892	934	+ 42
West Virginia	131	212	+ 81
Wisconsin	430	486	+ 56
Wyoming	265	304	+ 39
American Samoa	36	40	+ 4
D.C.	1	1	0
Guam	20	25	+ 5
Puerto Rico	347	353	+ 6
Trust Terr. Pac.	58	84	+ 26
Virgin Islands	2	5	+ 3
SUBTOTAL	20,695	26,049	+5,354
Adjustments to be made (shortfall)		-5,354	
Program admin.	253	253	
TOTAL Federal funds, Coop program	20,948	20,948	

B. Critical National Water Problems

The activities in this program are directed toward providing hydrologic data required for the evaluation and solution of urgent existing and emerging problems.

FY 1973, $2,887,000; FY 1974, $2,487,000; decrease, $400,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-100,000	-3	$ 2,487,000	94	Transferred to Federal program for water-quality data
-300,000	-7	--	--	Redirection to support Resource and Land Information program
-400,000	-10			

Program of work:

Major program components and estimated funding are: Continue field investigations to evaluate the feasibility of ground-water recharge techniques in different geohydrologic environments, and research on chemical and physical phenomena that control artificial recharge ($1,041,000); continue and extend field investigations on subsurface waste disposal and research on fundamental problems related to waste injection ($977,000); delimit flood hazards on about 800 standard quadrangle maps ($348,000); extend data collection and studies of currents and dissolved and suspended solids of specific estuaries necessary to develop models for identifying and alleviating coastal problems ($121,000).

Status of program:

Ground-water recharge studies are in three different geohydrologic environments, the semi-arid High Plains, the glacial deposits of Long Island, and in fractured carbonate rock. The field studies identify the physical, chemical, and organic controls that determine whether or not injection and water spreading are successful water-management techniques to use ground-water storage to supplement surface reservoirs. Supporting research on the principles of ground-water recharge continue. Investigation of recharge through a well penetrating fractured limestone overlying a sandstone aquifer near St. Paul, Minn., showed that the recharge water was distributed over a large area of the sandstone aquifer by the fractured limestone. This technique prevents the usual problem of plugging of the well bore that occurs when sandstone wells are recharged directly. A report describing the experiment is in preparation. The project on the High Plains has developed methods to sample water moving down from spreading ponds to the deep water table in order to observe geochemical changes in the recharge water and the effects on soil permeability to improve capability in predicting changes that will have transfer value.

The objective of the subsurface waste storage studies is to provide an information base for decision-making on the use of the subsurface for waste storage without endangering valuable fresh water and potentially valuable saline water resources. An initial assessment of nationwide ground-water contamination

completed early in FY 1973 indicates that surface and near-surface disposal of wastes, accidental spills, and the incidental results of industrial and agricultural activities have caused some pollution of ground water in every State in the Nation. So far, these individual areas of contamination have been relatively small and the effects have been serious but not disastrous. The prevention of surface-water and shallow ground-water pollution has stimulated requirements for better methods of deep-well injection. Studies are continuing on the chemical reaction of organic substances in ground water, physical and chemical reactions with aquifer materials, the movement, dilution, and dispersion of pollutants in the subsurface, and the measurement of existing stresses to relate to potential injection aquifers are also continuing. A second symposium on deep well injection will be cosponsored in early FY 1974 to bring together industrial representatives, well designers, ground-water consultants, and Federal and State officials responsible for evaluating and regulating subsurface waste disposal to exchange advances in the state of the art.

The objective of the flood-hazard mapping component is to provide flood information as a guide for flood-plain management. The program was started in 1969 in response to recommendation 1(B) of the Task Force on Federal Flood Control Policy (House Document 465, pages 21-22). About 60 percent of the 8,800 maps projected for the program will be completed by the end of FY 1973. Plans for 1974 are to publish 800 maps and 80 descriptive pamphlets concerning flood hazards in municipal areas.

Estuarine and coastal studies will be continued on the geochemistry and circulation patterns in San Francisco Bay and the effects of quality of water on estuary biota in Chesapeake Bay. Coupled with hydrologic studies and data that have been collected in Port Royal Sound, Delaware, Tampa, and other bays under the Federal and the Federal-State cooperative program, models are being developed that will permit assessing the usability of fresh water supplies now naturally present in coastal areas and forecasting the impact of man-made developments on the hydrologic environment.

C. Employee Compensation Payments

FY 1973, $345,125; FY 1974, $370,519; Increase, $25,394. The increase consists of:

	Increase (+) or Decrease (-)				
	Amount	Positions	Total Program	Total Positions	Explanation
(1)	$ +25,394	--	$ 370,519	--	For reimbursement to Bureau of Employees Compensation

Need for increase:

The increase is required to reimburse the Bureau of Employees Compensation, Department of Labor, for payments made during FY 1972 for Geological Survey employees injured since December 1, 1960 (Public Law 86-767, Section 209).

7. Conservation of Lands and Minerals

FY 1973, $14,259,000; FY 1974, $16,029,000; increase, $1,770,000. The increase consists of:

	Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1)	+$ 730,000	+29	$5,973,000	206	To increase capability consistent with an accelerated leasing schedule, to regulate operations properly on OCS oil and gas leases.
(2)	+1,040,000	+17	3,690,000	61	To acquire and interpret OCS geophysical data for pre-sale tract selection and resource evaluation and inventory at a rate consistent with an accelerated leasing schedule.
	+1,770,000	+46			

Cost Factors Involved in Increases

(1) $580,000 is needed for 29 new positions at an average rate of $20,000, which includes salaries, benefits, hazard duty pay for inspectors, operating expenses, travel and subsistence, supplies and other normal expenses. $150,000 is needed for helicopter services to transport inspectors.

(2) $340,000 is needed for 17 new positions at an average rate of $20,000, which includes salaries, benefits, operating expenses, travel and subsistence, supplies and other normal expenses. $700,000 is needed for purchase of Common Depth Point (CDP) and high resolution geophysical data for pre and post sale evaluation and operations.

Analysis by Subactivities

Subactivity	FY 1972 Amount Available	FY 1973 Amount Available	FY 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973	Page Reference
A. Mineral Lease Management					
(1) Outer Continental Shelf	$ 4,917,000	$ 5,243,000	$ 5,973,000	+$ 730,000	53
(2) Federal and Indian Lands	4,558,000	4,954,000	4,954,000	--	55
B. Resource Evaluation and Classification					
(1) Outer Continental Shelf	2,681,000	2,650,000	3,690,000	+1,040,000	56
(2) Federal and Indian Lands	1,237,000	1,412,000	1,412,000	--	57
TOTAL	13,393,000	14,259,000	16,029,000	+1,770,000	

Revenues from Leased Mineral Lands
(in thousands of dollars)

Land Category	FY 1971		FY 1972		FY 1973 1/		FY 1974 2/
	Royalties	Bonuses	Royalties	Bonuses	Royalties	Bonuses	Royalties
Outer Continental Shelf	$324,079	$943,601	$359,592	$ 96,304	$364,000	$3,550,000	$354,000
Federal Lands Onshore	109,205	8,790	107,695	1,118	110,200	900	112,200
Indian Lands	20,885	19,337	21,279	6,117	21,500	8,000	25,300
TOTAL	454,169	971,728	488,566	103,539	495,700	3,558,900	491,500

1/ Royalties and bonuses estimated.

2/ Royalties estimated, but no projection of bonuses.

A. Mineral Lease Management

(1) Outer Continental Shelf: FY 1973, $5,243,000; FY 1974, $5,973,000; increase, $730,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
+$730,000	+29	$5,973,000	206	To increase capability, consistent with an accelerated leasing schedule to regulate operations properly on OCS oil and gas leases.

Need for Increase: The increase will enable initial implementation of an improved safety and pollution control program for the current level of drilling and producing activities on the OCS. The safety and pollution control program activities to be implemented by this increase are those arising from recommendations of a NASA study team, National Academy of Engineering, and internal studies of the OCS program considered to have highest priority and greatest effect on safety and pollution control. The increase will also provide for additional inspectors and helicopter transportation, to inspect and monitor increased OCS oil and gas drilling and producing operations resulting from an accelerated OCS leasing program.

Program of Work: In FY 1974 there will be 900 multi-well production platforms, and 1140 other OCS facilities such as single-well structures and production handling platforms. About 940 new wells will be drilled, and approximately 10,400 completed well zones will be capable of production on the OCS in fiscal year 1974. Responding to these developments, the program of work includes:

- Engineering, geophysical and geologic analysis of all technical factors prior to approval of applications to drill the 940 new wells. All technical data are reviewed to identify unstable bottom conditions, faults, possible zones of abnormal pressures or temperatures, or presence of zones where circulating drilling fluid could be lost. Engineering analysis includes design of proposed individual well casing programs, mud programs, and the adequacy of all drilling plans to meet best practices and regulatory requirements.

- Geologic and engineering analysis and review prior to approval of about 13,250 industry applications to conduct development or production operations, or to change approved operational plans. Examples are applications to erect platforms, install pipelines, change productive zones in wells, alter the mechanical condition of producing wells, initiate secondary recovery operations, and unitize leases and commingle production.

- Review and establishment of maximum production rate (MPR) for 400 new well zones to be completed in the undisputed area of the OCS; modification of MPR's for half (4400) of 8800 producing well zones in the undisputed area; calculation of the maximum efficient rate of production (MER) for 10-12 producing reservoirs; and monitoring, for control of actual producing rates in accordance with the approved MPR.

- Development of plans to initiate program activities that will implement those NASA, NAE and other recommendations judged to be most essential. These activities include system safety analyses of drilling and production operations; establishing failure reporting and corrective

action systems; analyzing need for research and development of safety equipment; and establishing standards for operations and procedures.

- Inspection of industry's field activities to enforce compliance with regulations, orders and approved plans.

  -- Daily inspection of OCS operations in the Santa Barbara Channel off California. One inspector monitors Sun Oil Company's Hillhouse Platform for an average of 8 hours each day and another inspector splits an average 8-hour shift between Union Oil Company's Platform A and B. Other Channel drilling operations are inspected at least weekly and other producing operations are inspected twice weekly. In addition, pollution inspection by air and a "beach-walk" are made of the Santa Barbara Channel beach areas weekly.

  -- In the Gulf of Mexico, inspection of each new drilling well and every multi-well production platform will be possible in fiscal year 1974. Pollution overflight inspections are made in the area traversed flying to and from regular inspection work. The presence of the inspector force in the field provides an additional benefit beyond inspection of individual operations, for it is a "visible deterrent" to willful violation of regulations and orders. On the average, this presence is evident at 8 different places on the OCS at any given time of day.

- Maintenance of 924 OCS royalty production accounts, and 726 accounts for minimum royalties and rentals. Approximately 70% of the royalty production accounts (647) will be audited during the year. It is expected that total royalty income from OCS oil and gas operations will reach $354 million in FY 1974, nearly a million dollars a day.

Status of Program: Because of unanticipated delays in FY 1972 due to national environmental issues the Department was unable to hold to its schedule for oil and gas leasing of additional OCS lands. However, an accelerated schedule -- three sales -- will be achieved in FY 1973 and annually thereafter. Increasing the number and size of OCS lease sales will have a direct impact upon industry activity. Program management workload in FY 1974 is expected to increase 7-8% over FY 1973 workload levels.

Oil production levelled off in FY 1972 and early FY 1973 with indications of the beginning of a decline. Such trends can primarily be attributed to the normal decline of established producing oil and gas fields coupled with the delay of OCS lease sales and its accompanying curtailment of exploratory efforts by industry in discovering and opening new OCS areas to production. Very likely only 390 million barrels of oil will be produced in FY 1974 -- compared to 416 million barrels in FY 1972.

(2) Federal and Indian Lands: FY 1973, $4,954,000; FY 1974, $4,954,000; No change.

Program of Work: In FY 1974 there will be 11,650 producing oil and gas leases and 3,900 properties producing other minerals. About 1,860 new oil and gas wells will be drilled during the year. The proposed program of work includes:

- Review of approximately 12,000 noncompetitive oil and gas lease applications to determine if lands involved should more appropriately be leased competitively.

- Investigations of about 700 coal and other mineral prospecting permit applications to determine whether the deposits are subject to the prospecting or leasing provisions of the Mineral Leasing Act.

- Examination of approximately 800 applications under the mining reclamation regulations relative to measures to control erosion, reclaim lands, prevent water and air pollution, protect wildlife, and prevent hazards to the public.

- Geologic and engineering analysis, review, and action on about 12,500 industry applications for initial approval to conduct exploration on development operations, for changes in operational plans, etc., or Federal and Indian leases. Included are intensive environmental analyses of applications on exploratory oil and gas wells and new mining plans which are expected to result in the preparation of about 20 environmental impact statements.

- Inspection of industry's lease and permit field activities to enforce compliance with regulations, stipulations, and approved plans. Approximately 7,300 regularly scheduled inspections on oil and gas leases and about 2,300 inspections of mining operations will be made in FY 1974. In addition, about 300 inspections of field operations in large areas of concentrated production will be made in order to identify and correct existing or potential pollution hazards. Oil and gas test wells, operations on prospecting permits, field examinations related to proposed surface mining operations, and producing operations on oil and gas and other mineral leases will be field checked.

- Review of the findings of the management study being conducted in FY 1973 to determine which study recommendations are to be implemented. Develop action plans to implement those study recommendations.

- Maintenance of 14,800 oil and gas, coal, and other mineral revenue accounts. About 20% of these accounts will be audited to assure proper and timely payment of an expected $137.5 million royalty and rental income in FY 1974.

Status of Program: Oil and gas production from onshore Federal and Indian lands supplies about 5 to 6% of the Nation's total domestic oil and gas production. The production of minerals such as potash, phosphate, and sodium is expected to remain relatively stable, but their production from Federal and Indian lands will continue to have a significant impact on the total domestic production. In 1971, 80% of potash, 9% of phosphate, 64% of sodium and 37% of lead production for the Nation came from Federal and Indian lands. Coal production in FY 1974 is expected to about double reaching nearly 40 million tons or about 6% of the Nation's total coal production. Even without the increased coal production onshore, the management workload continues to grow and add to a residual workload base because existing lease producing operations require more attention, primary production is replaced by secondary recovery methods, mining operations become larger, the concern for environmental protection increases, and the multiple use concept receives wider acceptance.

B. Resource Evaluation and Classification

(1) Outer Continental Shelf: FY 1973, $2,650,000; FY 1974, $3,690,000; increase, $1,040,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
+$1,040,000	+17	$3,690,000	61	To acquire and interpret OCS geophysical data for pre-sale tract selection and resource evaluation and inventory at a rate consistent with an accelerated leasing schedule.

Need for Increase: The increase will provide for an accelerated level of geophysical data acquisition in the Gulf of Mexico primarily in the slope area off Louisiana. Both Common Depth Point (CDP) and high resolution data will be purchased. Also, it will enable the addition of 17 people to the evaluation staff to provide for an increased level of geophysical data interpretation and geologic and engineering analysis for evaluating an increased number of OCS tracts offered for sale under the accelerated leasing program.

Program of Work: Three general OCS lease sales, one off Alabama, Mississippi and Florida (500,000 acres), which had been previously scheduled for FY 1973, one off Louisiana and Eastern Texas (1,000,000 acres), and one off Louisiana/Texas (1,000,000 acres) are tentatively scheduled for FY 1974. These three general sales will also include tracts determined to be subject to drainage.

Pertinent geologic and engineering data obtained from industry's operations on leased lands will be merged with subsurface structure maps developed from purchased geophysical data in extending basic knowledge of geologic structures and reserves of virgin areas. These basic data are needed for the selection and evaluation of nearby unleased tracts which will be offered for sale. About 25,000 line miles of Common Depth Point (CDP) geophysical data will be interpreted for use in the selection, evaluation, and determination of the pre-sale value of tracts to be offered in general (wildcat) sales. These data will subsequently supplement available geologic data to identify and evaluate drainage tracts. In addition to the selection and evaluation of sale tracts, about 10,000 line miles of high resolution geophysical data will be acquired and interpreted for environmental impact analysis and hearings for the three sales tentatively scheduled for the Gulf of Mexico during FY 1974. These high resolution data will also be used in the identification of potential hazards to drilling, platform implacement, and other development operations.

Status of Program: This program, initiated in FY 1968, utilizes geologic data obtained from industry for leased areas and geophysical data purchased by contract from service companies and universities. The program has expanded since that time to the point that all sale tracts offered are evaluated prior to sale and a sound data base is acquired for use in the review of development plans and MER determinations.

Data needed to support FY 1974 lease sales will be acquired in FY 1973 and early FY 1974. Some data will also be acquired in FY 1974 to prepare for FY 1975 lease sales.

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(2) Federal and Indian Lands: FY 1973, $1,412,000; FY 1974, $1,412,000. No change.

Program of Work: Geologic mapping, supplemented by sampling, drilling and trenching will be undertaken to acquire basic classification data on Federal mineral lands (thickness, quality, depth and extent). Identification of potential water reservoir sites, including those for pumped-storage, and studies and evaluation of the development potential of Public land presently withdrawn or classified for waterpower or reservoir sites will be made. This will provide for:

- Continuing investigation of withdrawn and prospective areas identified as having potential value for leasable minerals, and classification of mineral lands for disposal, retention, exchange and selection.

- Further elimination of outstanding waterpower and reservoir site withdrawals thereby clearing title to Federal lands found to have insufficient development potential to warrant retention in a withdrawn status.

- Definition of mineral areas (KGS, KGRA, KLA) sufficiently evaluated in advance of lease applications to warrant competitive rather than non-competitive leasing.

- Evaluation of mineral lands being offered for competitive lease to assure receipt of fair value to the public in return for leasing of Federal mineral deposits.

- Publication of all non-confidential mineral resource data resulting from these activities in order to encourage exploration and development of nationally important domestic mineral resources.

About 2,650,000 acres of Federal mineral and water resource site lands will be classified under this program in FY 1974, of which 1,400,000 acres will be coal land classification. About 20,000 mineral and water resource classification and evaluation reports will be made in connection with Federal land and leasing programs.

Status of Program: About 600 million acres of Federal lands have been identified as having potential for various leasable minerals and water resource development. About 90 million acres are withdrawn or identified as potentially valuable for coal. Of the 90 million acres of potential Federal coal lands, approximately 29 million acres have been identified as target areas having the greatest potential and will require about 500,000 feet of drilling. These target areas are located in the states of Colorado, Montana, New Mexico, North Dakota, Utah, Washington and Wyoming and will receive priority attention in the programming of 1,400,000 acres per year for coal land classification. About 350,000 acres will be classified each year for leasable minerals other than coal with priorities for work based on areas containing a high percentage of Federal lands, high potential leasing interest, and withdrawn status. Approximately 20 years at the scheduled rate of progress will be required to evaluate the 90 million acres of highest potential coal targets.

A continuing program is being conducted to identify and assure availability of reservoir sites on Federal lands for regulation, storage, and conservation of surface water. This program serves to preserve Federal land in such sites from disposal or incompatible uses that would forestall efficient river basin development.

Early withdrawals and classification made when streamflow and map data were limited or nonexistent are being systematically reviewed to eliminate from withdrawal lands in those sites with low development potential. About 450,000 acres located in 10 river basins in 6 western states will be reviewed during FY 1974.

8. General Administration

FY 1973, $2,831,000; FY 1974, $2,831,000; No change

	FY 1972 Amount Available	FY 1973 Amount Available	FY 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973
General administrative expenses	$2,885,000	$2,831,000	$2,831,000	--

General administrative expenses provide for management, executive direction and coordination, and administrative support to the Bureau as a whole. This includes such essential functions as budget, finance, personnel, contract negotiation and administration, property management, organization and methods and management analysis.

Other administrative funding:

General administrative expenses of the Geological Survey are financed in part by assessments on direct program funds and on funds from other Federal agencies and sundry non-Federal sources (no assessment is levied on cooperative funds from State and local governments). These resources are allocated to all areas of administrative support--both at headquarters and in the field in support of the expanded substantive program. Areas of special emphasis are shown below:

Executive Direction - Interdisciplinary projects such as Resource and Land Information Program, the EROS program, planning and undertaking the move to the Reston headquarters; environmental impact reports; and the preparation of numerous studies and reports in response to natural resource and energy concerns are continuing to require increased special attention and coordination.

Personnel - Increasing activity of the unions to organize and negotiate agreements with agencies necessitates that extensive training, strong leadership and technical guidance be provided to assure a successful labor-management relations program.

The Equal Opportunity Act of 1972 has further emphasized the continued need for a positive program to assure equality of opportunity in all employment matters with special emphasis on the full utilization and career development of women and minority groups. Particular emphasis will be given to this effort through a special program "Minority Participation in Earth Sciences" committed to advancing the training of minority peoples in earth sciences as a means of increasing employment in its ranks.

There will be continued concentration in the vital area of review and evaluation of personnel management program activities. Analysis, review and study audits are being designed to assess the most efficient and economic utilization of manpower relative to effectiveness of personnel management policies and operations.

There is an increasing need to develop a more specific and direct relationship between career development and training programs. Special concentration and appropriate resources will be devoted to the unique administrative management needs of a scientific research organization. The identification and installation of bureau wide administrative management career development programs is imperative to respond to the growing complexity of all administrative support activities. High calibre candidates at entrance levels are needed and long term career opportunities must be provided to assure continued availability of talented administrative management resources.

Property Control - A new property control system is in the initial phase of implementation. When fully implemented the system will provide additional information with respect to the variety of scientific equipment owned by the Geological Survey. Additional emphasis will be placed on the identification and control of scientific equipment in the hands of contractors and grantees.

Safety Program - Emphasis will be provided to implement the requirements of the Occupational Safety and Health Act of 1970 (OSHA). Specific attention will be directed toward providing uniform direction to safety efforts throughout Survey, and to the development of OSHA standards required to implement the Act. Priority attention must be given to the development and issuance of a policy on noise exposure required under the noise standards of the Act.

Financial Management - The Survey's new accrual accounting and financial management system was implemented on July 1, 1972. Integration of the accounting and budgeting processes in the system, provides direct source data from one set of accounts for budget presentation and evaluation.

During its first two years of operation considerable resources will be devoted to monitoring, maintaining and refining the system.

This system is one of the most complete and sophisticated in Government and provides an excellent basis for expansion. It is anticipated that ultimately, additional resources will be devoted to the design of a centralized billing procedure and incorporation of programming data for the purposes of projecting, as well as measuring accomplishments.

Federal Assistance Review - A reporting and validation system has been developed to monitor and improve all current Federal Domestic Assistance programs in which the Geological Survey is engaged, and those which may be included or will be undertaken in the future. The elements of this system include the type of assistance, the extent of the activity, and the organizational relationships involved within and outside of the Survey. Information derived from this system facilitates the coordinated development and planning, on an intergovernmental basis, of the assistance programs at regional, state and local levels of government. Elements of the Fourth Year FAR program with which the Survey is involved are decentralization of authority to field offices and the newly established Regional Headquarters (under the auspices of the Regional Directors), the Federal regional councils, common Federal regions, the cooperative program, and greater involvement of and reliance upon State and local governments.

The impact on the Administrative Division of the Department's approval of Survey's regional plan involves two levels:

(1) Furnishing administrative/management services in operating the regions and providing the required liaison in the remaining Interior headquarters cities.

(2) Continued shifts of personnel and functions within the Division to support the new Survey field organizational structure. Thus far, unlimited contracting authority and increased personnel authority have been extended to the Regional Management Offices. Procedural and processing changes will be required in other Administrative Division functions on a long-range basis.

Funding of General Administrative Expenses
(Dollars in thousands)

Source of Funds for GAE:	FY 1972	FY 1973	FY 1974	Increase (Associated With Program Increases)
Surveys, Investigations, and Research:				
1. Special resource and environmental projects	54	126	126	--
2. Alaska pipeline related investigations	28	28	18	-10
3. Topographic surveys and mapping	402	417	407	-10
4. Geologic and mineral resource surveys and mapping	336	582	683	+101
5. Minerals discovery loan program	2	2	2	--
6. Water resources investigations	419	539	528	-11
7. Conservation of lands and minerals	258	292	353	+61
8. General administration	2,885	2,831	2,831	--
9. Facilities	2	--	--	--
10. Earth resources observation systems	168	332	277	-55
11. Resource and land information program	--	--	35	+35
Total, SIR	4,554	5,149	5,260	+111
Other Federal agencies and sundry non-Federal sources	1,566	1,695	1,374	-321
Total, general administrative expenses	6,120	6,844	6,634	-210
Relationship to total bureau program:				
SIR:				
General administrative expenses	4,554	5,149	5,260	
Bureau total (budget authority)	130,979	147,450	1/156,000	
Ratio, GAE to total BA	3.5%	3.5%	3.4% 2/	
State and local governments	0%	0%	0%	
Other funds	4.5%	4.5%	4.5%	
All funds:				
GAE	6,120	6,844	6,634	
Total bureau program	188,996	211,863	214,973	
Ratio, GAE to total	3.2%	3.2%	3.1% 2/	

1/ Excludes $3,000 related to Earthquake Hazards Reduction Program in reserve.
2/ Funds for facilities ($8,700) not assessed.

9. Facilities

FY 1973, $0; FY 1974, $5,914,000; increase $5,914,000. The increase consist of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+5,914,000	+15	$5,914,000	15	Relocation of personnel and operations from metropolitan Washington, D.C. to the National Center, Reston, Va.

Cost Factors Included in Increase

As explained in the Need for Increase statement below the FY 1974 funds needed for the relocation will be $8,700,000. The cost factors included are fifteen permanent positions at an average annual rate of $18,000, $275,000; movement of persons and household goods, $1,000,000; lease payments, $3,250,000 contractual services for operations and maintenance $2,975,000 and special equipment $1,200,000.

Need for Increase

Fiscal Year 1974 costs for relocating the Geological Survey's personnel and operations from approximately 23 locations in metropolitan Washington, D.C., to the National Center, Reston, Virginia, is $8,700,000. Of this amount $5,914,000 is being requested as new funds in fiscal year 1974 to cover items such as the lease payment, operation and maintenance costs and certain special equipment needs.

The balance of funds needed for the relocation, $2,786,000, is proposed to be funded from the budget activities listed below and will cover non-recurring costs such as the physical move, movement of household goods, and certain special equipment needs not covered by the new funds. These funds will be made available primarily by delaying the procurement of normal equipment needs and contracting to subsequent years.

Activity	Amount
Topographic surveys and mapping	$ 825,000
Geologic and mineral resource surveys and mapping	1,000,000
Water resources investigations	961,000
TOTAL	2,786,000

Specific items included in the relocation costs are as follows:

(a) Non-recurring Costs ---------- $ 3,700,000

(1) Physical Move ---------- $ 1,500,000

Equipment, furniture, supplies and materials for office, laboratory, computer, map reproduction and storage activities will be moved from 23 different building locations in the Metropolitan Washington area to the National Center. Work stations for approximately 2,300 employees will be relocated. Included

in the move will be disconnects and hook-ups of laboratory, computer and map reproduction equipment, as well as the cost of restoring leased space that has been vacated.

(2) Equipment and Special Purpose Needs ------- $ 539,000

To occupy special purpose areas such as laboratory, telephone switchboard room and the auditorium, it will be necessary to supplement the equipment provided by the contractor and provide equipment before the areas can be made fully operational. In FY 1974, it is estimated that the following will be required:

Telephone Switchboard Equipment ---------- ($225,000)

Auditorium (including visual equipment), duplicating equipment, graphics, special messenger equipment, emergency lights and special purpose fire extinguishers for photographic laboratories ---------- ($314,000)

(3) Moving of Personal Households - (non-recurring after FY 1975) ---------- $ 1,000,000

According to a preliminary survey of employees, approximately 730 employees will be eligible for reimbursement for the movement of household goods and related expenses. This movement of households will be undertaken in a two year period. Allowing an average reimbursement cost of $2,750 and assuming half will be moving each year, it is estimated that one million dollars will be required to cover these costs in FY 1974. Another one million dollars will be required in FY 1975 to cover the remaining costs.

(4) Printing Press and Related Equipment ------ $ 661,000

Purchase new 5-cylinder 60" printing press to replace old and outdated equipment (4 old presses, age 16-24 yrs.). Joint Committee on Printing approval is required.

Procurement of this item is necessary to maintain present plant efficiency. Failure to purchase this item will result in an increase in cost per sheet, in manpower required to operate printing plant, and in the cost of moving the printing plant to the new headquarters.

(b) Recurring Costs ---------- $ 5,000,000

(1) Lease Payments, including taxes and insurance ---------- $ 3,250,000

Approximately $3,250 thousand will be required to cover rental costs for six months for the National Center. Full-year costs will be $6.5 million.

(2) Operation and Maintenance ---------- $ 1,750,000

Funds are required to cover building operations costs for an average of six months total occupancy. Included are costs relating to cleaning, operation and maintenance of electrical, heating, air-conditioning and ventilating, and plumbing and sewage systems, maintenance of escalators and elevators, utilities, protection of building and grounds and the performance of essential support services, such as telephone service, teleticketing and central duplicating, presently performed by the Department, and an enlarged supply operation.

10. Earth Resources Observation Systems (EROS) Program

FY 1973, $10,343,000; FY 1974, $8,443,000; decrease $1,900,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1) -$1,900,000	--	$8,443,000	--	General program reduction.

Program of Work

The proposed program for FY 1974 will include the following components:

1. Research and Development $2,060,000.

Objective: To conduct scientific and engineering studies leading to new remote sensing techniques, data collection instruments, data processing techniques, and resource and environmental applications of the instruments and techniques. The goal is to provide research solutions to problems of land and resource inventory and assessment and to specify systems to collect the needed data.

Description of work to be done:

a. Sensor development will be continued with scientific and engineering studies leading directly to the construction or procurement of new and improved remote-sensing instruments.

b. Applications research provides studies of the use of remote sensing data for the solution of resource and environmental problems. It uses both aircraft and spacecraft data and is primarily oriented toward new applications of existing data or studies leading to an identified need for types of data which are not available. The 1974 level of effort will be slightly lower than in 1973.

2. EROS Data Center $3,700,000

Objective: To provide the major public contact with the EROS Program for the purchase of satellite and aircraft data, routine production of thematic maps derived from satellite data, individual assistance to data users, and training of domestic and foreign resource managers and scientists.

Description of work to be done:

a. Data archiving and distribution function will provide storage, reproduction, and distribution of aircraft and satellite data, including photographic copies and magnetic computer tapes. In 1974 the program continues at about the same level. The flow of data from the satellite requires the full-time operation of the reproduction, processing, archiving, and distribution activities of the Sioux Falls data center.

b. Thematic mapping will continue at a substantially lower level in 1974 and will accomplish the production of maps of resource and environmental characteristics by automated or semi-automated means.

c. Training will be increased in 1974 and will include the conduct of formal classroom, laboratory, and field exercises for organized classes of domestic and foreign resource managers and scientists at Sioux Falls, elsewhere in the United States, and in foreign countries.

d. User assistance also will be increased in order to furnish aid to individual data users in methods of data reduction, feature extraction, and interpretation.

3. Space Experiments Program $1,450,000

Objective: The conduct of research utilizing space data to determine the feasibility of its use in resource and environmental areas. The space experiment program will provide continuing support for ERTS experiments, funding for Skylab experiments, and economic benefit evaluation.

Description of work to be done:

a. ERTS space experiments will provide research into the applications of ERTS data to resource and environmental problems. The level of effort will be reduced in 1974.

b. Skylab experiments will accomplish research into the applications of Skylab data in resource and environmental problems. The Skylab manned spacecraft will be orbited in 1973 and new funds will be used for these experiments.

c. Economic evaluation to determine the economic, environmental, and social value of the use of satellite data for solution of resource problems will be essentially completed in FY 1974.

4. Operational System Study $250,000

Objective: Study of the design of an Earth Resources Satellite System and associated elements designed to provide routine dependable data to resource managers. Continued provision of photography and remote sensing data from high altitude aircraft and from geophysical survey aircraft.

Description of work to be done:

a. Design of an operational satellite system includes study of spacecraft, sensors, launch vehicles, and ground support required to place operating satellites in orbit and in operation. It will be accomplished in coordination with NASA and other agencies continuing at the same funding level.

b. High-altitude photography collection will be continued at a reduced level in 1974. High-altitude photography will be used for the production of cartographic products and as a data base for resource and environmental surveys.

c. Collection and processing of aeromagnetic data for production of the aeromagnetic map of the United States and as a "ground truth" data base for the geophysical interpretation of satellite imagery. The level of effort will be reduced in FY 1974 with emphasis placed on data analysis.

5. Program Management $983,000

Objective: Executive direction and management of the EROS Program including direct staff costs, and travel. It will coordinate the experimental space and aircraft program elements and provide consistent organizational, administrative, and management support to all program elements.

Description of work to be done:

The slight increase will permit more realistic funding for the management capability associated with the EROS Program in FY 1974. A primary requirement is for coordination of activities associated with the ERTS-1 experiment. Other obligations include monitoring contracts and continued planning for experimental application of remote sensing to the activities of 10 Interior Bureaus, and to State and local agencies.

Status of program: The EROS Program goal is to provide cost-effective data on resources and environment from spacecraft and aircraft, develop information analysis and dissemination systems to allow Governmental agencies and the public to make use of the data, to conduct a continuing experiment program to develop new and useful types of data, and to prepare users for eventual routine collection and use of space data.

The program to date has (1) defined the characteristics of the NASA experimental satellite ERTS-1, aided in its development, and initiated over 45 studies to evaluate the satellite data, (2) prepared data users in Interior Bureaus, State and local agencies, and the public to make initial use of the data, (3) placed into operation an interim Data Center in Sioux Falls, South Dakota to make space and aircraft data available on a world wide basis, (4) developed resource information systems using remote sensing data that is now being introduced into the departmental program, and (5) developed automated systems for extracting resources information from space images.

Further steps in the EROS Program include (1) defining future experimental satellite sensors and orbital characteristics for the collection of specific resources data from space, (2) the design and development of operational space systems for the routine and standardized collection of data upon which planners and decision makers can depend, (3) continued application of the space and aircraft data to Interior functions and to the needs of State and local agencies, (4) operation of the Data Center at a level commensurate with the public data needs, and (5) design and conduct of training programs to satisfy the needs of Federal, State and local groups for integrating satellite data into their operations.

EROS PROGRAM

	FY 1972 Amount Available	FY 1973 Amount Available	FY 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973
1. Research and Development	2,069,000	2,693,000	2,060,000	-633,000
a. Sensor Development	0	200,000	160,000	-40,000
b. Applications Research	2,069,000	2,493,000	1,900,000	-593,000
2. EROS Data Center	1,674,000	3,715,229	3,700,000	-15,229
a. Data Archiving & Distribution	950,000	3,115,229	3,200,000	+84,771
b. Thematic Mapping	700,000	450,000	150,000	-300,000
c. Training	24,000	100,000	250,000	+150,000
d. User assistance	0	50,000	100,000	+50,000
3. Space Experiments Program	550,000	2,150,000	1,450,000	-700,000
a. ERTS Space Experiments	550,000	1,150,000	750,000	-400,000
b. Skylab Experiments	0	0	200,000	+200,000
c. Economic Evaluation	0	1,000,000	500,000	-500,000
4. Operational System Study	790,000	830,715	250,000	-580,715
a. Satellite System Design	0	99,070	100,000	+930
b. High Altitude Photography	150,000	147,659	50,000	-97,659
c. Airborne Geophysics	640,000	583,986	100,000	-483,986
5. Program Management	661,110	954,056	983,000	+28,944
TOTAL	5,744,110	10,343,000	8,443,000	-1,900,000

11. Resource and Land Information (RALI) Program

FY 1973, $0; FY 1974, $1,000,000; increase, $1,000,000. Funds redirected for this increase consist of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+1,000,000	+24	$1,000,000	24	Redirected funds to design and develop a Resource and Land Information Program.

Cost Factors Involved in the Increase

Redirected funds for salary and benefits for 24 permanent positions at an annual rate of $25,000, $600,000; travel, transportation, printing, supplies, equipment, $100,000, other services $300,000.

Need for Increase:

In FY 1973, Secretary Morton established by Secretarial Order a Resource and Land Information (RALI) Program designed to improve the Resource and Land Information base available for all those concerned with policy, planning, and decision-making in these subject areas. The ultimate objectives of the RALI Program are to coordinate acquisition and treatment of topographic, geologic, hydrologic, biologic, geographic, and other resource and land data so as to provide comprehensive coverage with emphasis on critical areas; analyze, interpret, and translate basic data and information into terms more understandable and more useful to users; and to make resource and land information more readily available at national, regional, and local levels.

The RALI Program will depend upon existing systems to the maximum practicable extent for collection and dissemination of land and resource data and related analytic services. It will provide a framework for a high degree of interaction between Federal, State and local levels. It will provide a reference service, via a catalog system of available data, starting with Interior data and systematically expanding coverage to other resource and environmental data held by Federal and State agencies, universities, and private companies (for example, utilities). This will cover raw data, interpreted data, and related information systems and analytic support to users.

Increasingly, Federal, State, and local governments, the courts, universities, industry and the public generally are becoming embroiled in controversies involving the interaction between population and economic growth, resource development and depletion, a wide variety of environmental pollution problems, and plans and decisions affecting the use of both public and private lands. Most of these controversies have several things in common. They are highly complex, bitterly disputed, involve large expenditures, have long-term critical impact on the environment and on society, and are characterized by a lack of information readily available and usable to resolve them.

The relevance and importance of these problems is evident from the activity and interest brought about the National Environmental Policy Act and that centering on additional legislative proposals such as the Land Use Policy and Planning Assistance Act and the Coastal Zone Management Act. These Acts would impose various requirements on the several levels of government to regulate, control, manage, or conserve certain lands of their resources--actions which would require the development and application of very large amounts of natural science and resource information. Recognizing the importance of the problems and of the necessity of more and better information in resolving them, the broadest of these Acts, the Land Use Policy and Planning Assistance Act, includes a requirement for the establishment of an organized information system responsive to the needs of those charged with the execution of the Act, specifically the States.

For FY 1974, $1,000,000 is requested for the Resource and Land Information (RALI) Program (1) to survey and identify user requirements for resource and land information; (2) to inventory the data that already exists within Interior and other Federal agencies; (3) to initiate a referral service to the location of other needed resource and natural science data; (4) to continue investigations into new and more rapid techniques for acquiring, analyzing, interpreting displaying and disseminating data; and, (5) to examine the means of achieving better compatibility and interaction of the various Federal, State and local systems which collect, store and dispense resource and land information.

Program of Work:

In FY 1974, a systems planning and design effort will be initiated to define the overall program and develop performance requirements for the initial part. This initial segment will be limited to the natural resource and land information generated or available within the Department of the Interior and will involve a comprehensive survey of the information needs of representative group of users of such information. Extensive use will be made of research results of other users surveys (e.g., the Federal Mapping Study). The problems and methods of coordinating and/or integrating State and Federal information systems will be studied. Work will start on development of a catalog system that will provide users with a centralized referral service for locating existing land and resource data. The problems of establishing standards for analysis, classification, display, and information systems will be explored and defined as needs are identified through the user requirements survey and coordination efforts with State and other users. Continuing review of user demand and economic justification of particular products and services will provide guidance and assist in setting priorities and evaluating tradeoffs in terms of costs and benefits for products or services.

Status of Program:

The Department of Interior has designated the Geological Survey to take the lead in developing a program which is capable of responding not only to the specific requirements of pending legislation, but also to more general problems of cooperatively collecting, organizing, and making available the appropriate information to the broad array of users at all levels of resource and land planning and decision-making.

During FY 1973, a related effort was made within existing programs to:

1. Investigate the requirements and define the tasks for the accomplishment of an improved resource and land information system.

2. Identify resource and land information users and their requirements.

3. Develop a broad inventory of the natural resource information that now exists--what information, on what subjects, over what time period, where stored, etc., --that is available for resolving resource problems.

4. Establish the requirements for and characteristics of a catalog system to refer users to available data.

5. Investigate several promising solutions to problems of data storage, analysis, interpretation, and presentation.

6. Undertake special studies to define or resolve questions or issues which have a significant impact on how a comprehensive land and resource information program would be carried out, most importantly, methods of improving the coordination of and achieving compatibility among Federal and State resource and land information systems.

OTHER FUNDING SOURCES

Mrs. HANSEN. Under "Geologic and mineral resources surveys and mapping" you have listed funding for the Kingdom of Saudi Arabia, Bureau of Reclamation, Department of Defense, Department of Housing and Urban Development, Agency for International Development, et cetera.

Do you want to go through this list and give us very briefly what you are doing for these agencies?

Mr. MCKELVEY. We do work in our general area of responsibility for a great many other agencies. With respect to the Kingdom of Saudi Arabia we are undertaking geologic mapping, mineral resource, and water resource studies there on behalf of the Saudi Arabian Government, also attempting to improve their own capability in these areas, very much as we do in work with AID.

Mrs. HANSEN. What are you doing for AID?

They seem to be the only agency that has a great deal of funds.

Mr. MCKELVEY. Well, I have no knowledge of that.

We are working in Brazil, Colombia, and Indonesia on behalf of AID. We have had projects in many countries over the years with AID in the technical assistance area in which we attempt to develop institutions with capability for work in this area. We attempt to improve the training and capability of their people so that they can help themselves better. We always undertake field demonstration projects of various kinds and sometimes they are directed toward specific problems in the mineral resource or water resource field.

We are also doing work on behalf of the National Science Foundation in Antarctica, both in the form of topographic mapping and geologic studies.

For HUD we have been undertaking some cooperative studies with them. I meant to mention this morning when we were talking about San Francisco and Congressman Veysey's interest in the earthquake problem in California, our work in our San Francisco urban area study is in cooperation with HUD and we have been attempting there to attack some of these problems of acquisition of information that is related to community development and how to use it.

Mr. VEYSEY. Do they then fund part of that?

Mr. MCKELVEY. Part of that is funded directly and part they have undertaken from their own activity.

On the part of DOD, ARPA has funded some of the work that I described on the Rangely Field. For the Atomic Energy Commission much of the work that we have undertaken there has been related to the evaluation of sites proposed for reactors.

Mrs. HANSEN. Does the AEC ask for your evaluation in each instance on the sites proposed for reactors?

Mr. MCKELVEY. Yes. Also we have undertaken work with them in conjunction with their test program involving the evaluations of sites proposed for underground nuclear tests, and the monitoring of the results, and so on.

AMCHITKA TEST

Mrs. HANSEN. Didn't you monitor the Amchitka test?

Mr. MCKELVEY. Yes, and evaluated it in advance of the test.

Mrs. HANSEN. Was there any damage done geologically?

Mr. McKelvey. No substantial damage. Dr. Coulter, I believe, is familiar with that.

Mr. Coulter. There was some fault movement, some ground deformation, and a considerable number of slumps and slides in the coastal area.

Mrs. Hansen. Along the coast or out on the island?

Mr. Coulter. No; on the coastal zone of the island itself. Those were the primary effects.

Mrs. Hansen. Nothing serious?

Mr. Coulter. Nothing serious.

Mr. McKelvey. We have had a very large program sponsored by the National Aeronautics and Space Administration, NASA, and in our astrogeologic research we have been largely responsible for lunar geologic mapping leading to the selection of sits for the Apollo landings and for work involved in working up the results of the lunar——

LUNAR SAMPLES

Mrs. Hansen. I was going to ask you if you were involved in the analysis of the lunar rocks.

Mr. McKelvey. Oh, yes. We are very proud at this time that Jack Schmidt, Harrison Schmidt, is one of the Geological Survey alumni. He was the first geologist, the first scientist, to participate in one of the lunar missions, and we were very proud that it was one of the Geological Survey people who went into the astronaut program.

We have had a very large component of the research in many aspects of the Apollo missions. We are also working with NASA on the exploration of outer space—Mars and other experiments that are planned there.

Our EROS program has also had support from NASA for some of the experimental work that is being done in testing the effectiveness of ERTS.

IMPOUNDMENT OF FUNDS

Mrs. Hansen. Is $3 million of earthquake funds the only item that is impounded?

Mr. McKelvey. Yes, Madam Chairman.

Mrs. Hansen. That is a minor miracle.

VALUE OF RESOURCE MANAGEMENT BY GEOLOGICAL SURVEY

This committee is particularly interested in proper management of our resources. We have often felt a relatively small share of the Federal budget has been spent in this area. Because of the interest of the committee, please insert in the record your total appropriations for the last 5 years and indicate the value of the resources over which you have jurisdiction.

Mr. McKelvey. Yes; and then the value of the resources on public lands?

Mrs. Hansen. Yes; the value of the resources on public lands.

Mr. Radlinski. Over which we have management responsibility?

Mrs. Hansen. Over which you have management responsibility.

Mr. McKelvey. Of course we don't have responsibility for the exploration ourselves.

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Mrs. HANSEN. I understand.
Mr. MCKELVEY. This, of course, would be a very speculative reply.
Mrs. HANSEN. I understand.
Mr. MCKELVEY. But I will.
[The information follows:]

TOTAL GEOLOGICAL SURVEY APPROPRIATION FOR THE PAST 5 YEARS

The total Geological Survey appropriation for the past 5 years was $590 million.

Accurate evaluation of the public land resources for which the Geological Survey has jurisdiction in one way or another is impossible but some estimates are illustrative. Thus, the present value of future Federal income from leased public land resources, including those on the Outer Continental Shelf, shown in the following table published by the House Committee on Government Operations, is $12.8 billion.

Undiscovered and unminable mineral and energy resources have no monetary value until they have been found and are producible economically. Nevertheless, potential resources ultimately will have value. Traditional techniques for their evaluation are based on extrapolations of known and identified resources. More recently the application of geology and statistical theory permit estimation of potential resources of broad regions with fair reliability by modeling the value of an area by comparison with a geologically similar area whose resource potential is known. The Geological Survey has made some gross estimates by this method for the Nation as a whole and this is described in professional paper 820. However, it has not been possible as yet to apply these techniques to more restricted tracts of land, such as the public lands within a given geologic province. An appraisal of the national mineral endowment based on such information is a desirable goal.

Resource values estimated by such techniques are large. Crude calculations extrapolated from national estimates of the fossil fuels alone (petroleum, gas, and coal) indicate a value at current prices for undiscovered resources on public lands of about $5,000 billion, and possibly as much more on the Outer Continental Shelf areas. The method of Griffith and Singer provides an estimate of $250 billion for the total of metals found to date on the public lands; this reasonably may be considered about 10 percent of the total potential metal resource therein.

MINERAL RESOURCE VALUE[1] OF THE PUBLIC DOMAIN[2]

(In thousands of dollars)

STATE	ESTIMATED VALUE[3] (rounded off)	PRINCIPAL SOURCES
Alabama	$ 609	Oil and gas; coal
Alaska	174,962	Oil and gas; coal
Arizona	10,688	Oil and gas; phosphate; potash; sodium; other
Arkansas	948	Oil and gas; other
California	170,747	Oil and gas; coal; potash; sodium; other
Colorado	201,781	Oil and gas; coal; potash; sodium; other
Florida	116	Oil and gas
Idaho	12,625	Oil and gas; phosphate; other
Kansas	9,955	Oil and gas; other
Louisiana	15,287	Oil and gas
Michigan	952	Oil and gas
Minnesota[4]	2,900	Copper and nickel
Mississippi	567	Oil and gas; other
Montana	143,609	Oil and gas; coal; phosphate; sodium; other
Nebraska	99	Oil and gas
Nevada	15,728	Oil and gas; potash; sodium; other
New Mexico	731,633	Oil and gas; coal; potash; sodium; other
North Dakota	12,393	Oil and gas; coal; other
Oklahoma	12,441	Oil and gas; coal; other
Oregon	3,836	Oil and gas; coal; other
South Dakota	4,883	Oil and gas
Utah	215,587	Oil and gas; coal; phosphate; potash; other
Washington	11	Coal
Wyoming	1,135,507	Oil and gas; coal; phosphate; sodium;
Subtotal	$ 2,877,864	
Outer Continental Shelf[5]	9,939,000	Oil and gas; sulfur; salt
TOTAL	$12,816,864	

1/, 2/, 3/, 4/, and 5/ -- See following page

MINERAL RESOURCE VALUE OF THE PUBLIC DOMAIN (Continued)

Footnotes:

1/ For the purpose of establishing a "real estate" value of the public domain, mineral resource values are the capitalized value of income accruing to the Federal Treasury. This income is almost entirely derived from minerals subject to mineral leasing acts. Only negligible income is derived from minerals subject to location under the mining laws because they pass from Federal ownership upon discovery; before discovery, they have only speculative assignable value best reflected in the surface values. Building stone, sand and gravel, and similar materials subject to disposal under the materials act are also reflected in surface values.

2/ Includes lands transferred from the public domain; excludes acquired lands.

3/ Predicated on present receipts from mineral leases, licenses and permits taking into account probable future production and demand factors; capitalized (except where noted) as an annuity for 50 years at 4 percent compound interest and discounted to present value. Estimate as of June 30, 1972.

4/ Minnesota copper and nickel royalty estimates are capitalized as the present value, at 4 percent compound interest, a 25-year annuity deferred 25 years.

5/ The Outer Continental Shelf estimate is preliminary, subject to change with production experience, with litigation, with large bonuses from lease sales, and with technologic developments.

Mrs. HANSEN. It won't be any more speculative than some other items in this budget.

You have listed in your justifications several urban area studies totalling $973,000. You have ongoing projects in San Francisco Bay, Seattle— Puget Sound, Phoenix-Tucson, Denver, Pittsburgh, Connecticut Valley, and Baltimore-Washington.

How much use is being made of these studies?

SAN FRANCISCO BAY STUDIES

Mr. MCKELVEY. I mentioned this morning several examples largely in the San Francisco area of actions that have been taken just during the past year based on this kind of information. It has to do with the location of new facilities such as airports, or areas for waste disposal, the location of subdivisions, zoning, development of codes affecting construction, and so on.

In the San Francisco area, as I mentioned, we are working cooperatively with HUD, and in collaboration with the Association of Area Governments, and I think we are further ahead in these than we are in many others because it has been financed at a higher level.

Therefore, we can certainly see in San Francisco the effects that this work is having.

BALTIMORE-WASHINGTON STUDY

Mrs. HANSEN. What have been the results of the Baltimore-Washington study?

Mr. MCKELVEY. In the Baltimore-Washington area the work is not as far along as it is in some of the other areas. We have recently, however, completed a geologic map of Montgomery County which we think is going to provide a base for information that can be derived from it and translated more directly into problems of interest to planners and users.

But we are far enough into this to see the willingness of the local people to take advantage of information, if it is in a usable and understandable form, as a guide for the decisionmaking and planning that is involved.

DENVER STUDY

In the Denver area, for example, action was taken in one of the suburban developments there. When we showed that there was a high landslide risk they took action, first, to stop development until it could be evaluated, and then to have it proceed in a way that would take account of the risks involved.

SEATTLE-PUGET SOUND

Mrs. HANSEN. Is the study being performed at Seattle-Puget Sound related to the slide study work?

Mr. MCKELVEY. I believe it is, Madam Chairman. In that area also, in the broader region, there is considerable concern about the volcanic hazard also, not just in the form of volcanic eruptions, but in the form of mud flows, ash flows, that might develop as a consequence of volcanic activity.

Mrs. HANSEN. You are requesting no change in funding for special resource and environmental projects.

STATUS OF GEOTHERMAL LEASING PROGRAM

What is the status of the geothermal leasing program?

Mr. MCKELVEY. My understanding, Madam Chairman, is that the environmental impact statement will be completed and issued in final form shortly and that leasing will begin toward the end of the fiscal year or the early part of next fiscal year. This is outside of our immediate area of responsibility—it is handled by BLM—but again I understand that there will be several sales next year and there could be as many as 100 leases as a result during the coming year.

REVENUE FROM GEOTHERMAL LEASING

Mr. MCDADE. May I ask one there?

What about revenue? Is this liable to be a pretty darn good revenue source for the Government?

Mr. MCKELVEY. I don't think it will be at first but as time goes on it may. What usually happens in leasing of this kind is that it has to go far enough to show the value of the activity. This is even true in a new producing area for petroleum. The value of the petroleum leases that may be sold in an area in which there is no production would be very low, but if discoveries are made and production is established, then subsequent leases may go for very high figures.

I would not expect that in the early years this would be a large source of revenue but it is possible that as the geothermal resources are developed, and if they come to be developed successfully, that that amount will increase.

Mr. MCDADE. Thank you.

Thank you, Julia.

Mr. VEYSEY. May I ask a question there.

Mrs. HANSEN. Surely.

POTENTIAL GEOTHERMAL RESERVES

Mr. VEYSEY. Can you do a chart for geothermal energy similar to the one we were looking at earlier for liquid petroleum and then for coal showing the known resources, the known but submarginal, and then the unknown but you believe there. Have you made such a chart? Are you in a position to do such a thing?

Mr. MCKELVEY. I believe it is covered in a circular that we put out during the last year. Yes; circular 650, there is a chart that shows identified recoverable geothermal reserves to be 2.5 times 10^{18} calories.

Then the undiscovered and submarginal resources combined are 10,000 of those units.

KNOWN GEOTHERMAL RESOURCES AREAS

Mr. VEYSEY. You have been for some time preparing for, and I see you have $235,000 in here for supervision of lease activities on the known geothermal resources area. Those are areas that have been identified as having known resources?

Mr. McKELVEY. Yes. I didn't get the first part of that question, Congressman. Excuse me.

Mr. VEYSEY. Well, you have identified some areas of the United States which you have called——

Mr. McKELVEY. KGRA's.

Mr. VEYSEY [continuing]. Known sources.

Mr. McKELVEY. Yes.

Mr. VEYSEY. This isn't it?

Mr. McKELVEY. No, they are not shown on that chart; excuse me. They are shown in circular 647 in a map of——

Mr. VEYSEY. But that presumably is only a very small proportion of the total potential geothermally active area, is that right?

Mr. McKELVEY I am sure that is correct, Congressman, although perhaps I should put it this way: The KGRA's are areas of known geothermal resources, but that says nothing about how much recoverable geothermal energy they may contain, nor does it say anything about hidden and, therefore, presently unrecognized, areas of commercial promise.

Almost certainly there are areas not presently identified as KGRA's that have a potential for geothermal power recovery.

Mr. VEYSEY. Those are the ones you are trying to locate in item 3, page 14, in your program of work for reconnaissance exploration.

Mr. McKELVEY. Yes. I have a chart of the geothermal areas.

[The chart follows:]

Most of the promising areas for generating power from geothermal energy, given present technology, lie west of the Rocky Mountain front, as disclosed by the presence of high temperature hot springs. A clear geographic correlation exists between areas of hot springs and young volcanic rocks, indicating that volcanic geology can be used in exploring for hidden geothermal systems. Geopressured brines along the gulf coast also are potential sources of energy, but require engineering advancement before utilization is realized. The Geological Survey's current geothermal resources program embraces all of the areas of promise shown on this map.

GEOTHERMAL RESOURCES-AREAS OF PROMISE
HOT SPRINGS
MORE THAN 100° F
LESS THAN 100° F
YOUNG VOLCANIC ROCK
GEOPRESSURED BRINES
EASTERN FRONT OF ROCKY MTS.
GULF COAST

Mr. VEYSEY. You are looking for those areas?

Mr. MCKELVEY. Yes. We are trying to develop knowledge of the occurrence of areas that have a geothermal potential. We are also trying to develop an exploration capability. We are trying to find out how to identify geothermal reservoirs that have no obvious surface manifestations.

Mr. VEYSEY. Are you working solely on Federal lands, or on any and all lands?

GEOTHERMAL AREAS ON FEDERAL LANDS

Mrs. HANSEN. What percent of the known geothermal areas are in national parks?

Mr. MCKELVEY. I do not believe that national parks are classified as KGRA's.

Mrs. HANSEN. Your map indicates some of the geothermal areas are in National Parks.

Mr. MCKELVEY. Yellowstone National Park has a potential but it is not classed as a KGRA.

Mrs. HANSEN. So areas in National Parks are not included?

Mr. MCKELVEY. Yes.

GEOTHERMAL AREAS ON FEDERAL LANDS

Mr. VEYSEY. I did not understand the answer to my earlier question, whether you are working solely on Federal lands or on all lands.

Mr. MCKELVEY. No, we are not working solely on Federal lands. In some of the areas in which we have done most detailed work because other work is most advanced, there is substantial private land. The geysers area of California is an example. We are working there partly because there is some Federal land involved but also because much is known about the geology and production capability of the area and we are in the process—trying to learn enough about the origin and characteristics of geothermal reservoirs to be effective in their exploration and evaluation.

GEOTHERMAL DISCOVERY

Mr. VEYSEY. Would you say that work the GS has done has led to the discovery in the geysers area?

Mr. MCKELVEY. Not to the geysers area. The natural geysers there were the primary clue. I will show you a chart on the Jemez Mountain area in New Mexico in which our work did lay the background for a very significant discovery there last summer. Of the three maps that are shown there, the one in the upper left is a simplified topographic map, and even there you can see the broad circular feature that represents the outlines of a fossil caldera. Then geologic mapping, when that is done in an area such as this, leads to the positive identification of such a feature.

[The chart follows:]

Topographic, geologic, and geophysical mapping by the Geological Survey all contributed to the discovery and eventual development of a dry steam geothermal resource in the Jemez Mountains, N. Mex. Union Oil Co. presently is developing the resource to generate electric power.

A DRY STEAM RESOURCE BECOMES POTENTIALLY COMMERCIAL.... JEMEZ MTS., NEW MEXICO



TOPOGRAPHIC MAPPING

Steam well

Hot spring



GEOLOGIC MAPPING



GEOPHYSICAL MAPPING



PRACTICAL RESULTS

Mr. McKelvey. That was the case in this particular area. The work of one of our people, Dr. Robert L. Smith, defined that as a young caldera, a source of recent volcanic activity. Then geophysical mapping shown in the map to the left, shows an anomaly in the center that may reflect magmatic material—molten magma—or else very young and porous volcanic material, either of which would be favorable for the occurrence of a geothermal reservoir. In that area and with that background of information the Union Oil Co. undertook drilling last year, I believe, and they made a dry steam discovery—a very significant discovery. Of the two forms of geothermal energy that are most readily recoverable—steam or hot water—dry steam is the most significant and the most valuable economically. That is the third dry steam field besides the geysers and an area in Yellowstone Park, known thus far in this country and one of the few in the world.

GEOTHERMAL POTENTIAL IN ALASKA

Mrs. Hansen. Is there any geothermal potential in Alaska?

Mr. McKelvey. Yes, there is geothermal potential in Alaska.

GEOLOGIC MAPPING

Mr. Veysey. How do you draw a line as to the appropriateness of the work by a Geological Survey or a private company in developing private land. You mentioned the New Mexico discovery on private land. You apparently did the geological work.

Mr. McKelvey. We did some of the basic geologic work but not any of the drilling. The actual discovery was made by a private company.

Mr. Veysey. Did you make the heat flow measurements?

Mr. McKelvey. I am not sure we made heat flow measurements in the Jemez Mountain area but we did do gravity surveying.

Mr. Veysey. How do you decide where to go?

If some owner has a piece of land and says, I think you ought to come in here and do a pretty thorough job of looking for something valuable for me, do you do that?

Mr. McKelvey. No, we are not permitted to do that.

Mr. Veysey. What led you to concentrate on the Jemez Mountains area?

Mr. McKelvey. This goes back to our Organic Act of 1879. One of our basic commissions is to determine the geologic structure of the United States. The geologic mapping of large areas on a regional scale is a part of our routine fact-finding responsibility. Working at those scales, I might say, is beyond the interest of most private companies.

A mining company may do reconnaissance examination of large regions but it does not publish its information and does not do comprehensive investigation of the geology involved. When it actually zeroes in on a specific property of interest, it works generally in a very small area. So the work in the Jemez Mountains was done as a part of regional geologic studies of a much larger area.

Mr. Veysey. You are doing those in a lot of places?

Mr. McKelvey. Yes.

We have about one-quarter of the United States mapped at a scale of a mile to the inch or larger.

That is the kind of work that really is involved here.

ALASKA PIPELINE STUDIES

Mrs. HANSEN. You are requesting a reduction of $489,000 for Alaska pipeline related investigations. What studies have been completed so far and what studies are scheduled for completion in 1973 and 1974?

Mr. MCKELVEY. We have worked on the Alaska pipeline studies in several areas. Topographic mapping of the pipeline corridor.

Mrs. HANSEN. Have you mapped every segment of the corridor?

Mr. MCKELVEY. Topographically the corridor is all mapped or in progress. From a geologic standpoint I believe it has been nearly all covered in reconnaissance.

Mr. COULTER. On a 1:125,000 scale, the strip maps are completed.

Mr. MCKELVEY. That is 2 miles to the inch. Then we have also done studies in hydrology, such as determining the streamflow and hydrologic factors that need to be taken into account in the evaluation of the pipeline and its design, if in fact it is actually approved.

Your question had another part to it, I believe. What studies are scheduled for 1974.

Mrs. HANSEN. That is correct.

ISSUANCE OF PERMIT

Mr. MCKELVEY. That will be contingent on what happens with respect to the permit.

As you know, the Secretary, after comprehensive evaluation of the environmental impact of the pipeline, decided to grant the request for a permit, but that was contested in the courts and still remains in the court presently. However, it is possible that if the Supreme Court decides favorably, or other action is taken that leads to the issuance of that permit, work on the pipeline could begin within a relatively short time. So we are requesting for fiscal 1974 the full amount.

Mrs. HANSEN. The Supreme Court has not generally acted very quickly.

Mr. MCKELVEY. I read every once in a while some action that was taken just overnight. This is certainly in an area that is unpredictable.

Mrs. HANSEN. Also, you face a further problem, the environmental impact statement has not been reviewed by the courts. Is this not correct?

Mr. MCKELVEY. It was not reviewed by the appeals court, so that certainly does remain an uncertainty at the present time.

ENVIRONMENTAL IMPACT STATEMENT

Mrs. HANSEN. There has been some criticism about the quality of the environmental impact statement on the pipeline. How acceptable was your portion of the report?

Mr. MCKELVEY. Madam Chairman, we did not participate in that as an organization, but as individuals assigned to a departmental task force.

Mrs. HANSEN. You say in your justifications that the Geological Survey had a major role in the preparation of the environmental impact statement?

Mr. MCKELVEY. Yes, I meant in an administrative sense, that the task force was composed of people from a number of bureaus, and

there was not a section of the report that was prepared under our heading.

Mrs. HANSEN. But you had an input.

Mr. MCKELVEY. Yes.

With respect to the environmental impact statement, this was the effort in which Dr. David Brew played such a significant role. I believe that it is one of the most penetrating and comprehensive environmental impact analyses that has ever been made. This statement goes into great depth to analyze what can happen and to show what the effects are and how they are to be coped with.

CHANGES IN PIPELINE PLANNING

Mrs. HANSEN. Have all the alterations in the pipeline plan been the result of the environmental impact statement in which you participated?

Mr. MCKELVEY. I am sure that a number of changes in plans have resulted from that analysis.

Of course, what started it all was the initial identification of permafrost, or the permafrost part of the problem, which was made by the GS and carried as a point of some concern by Dr. Pecora, when he was Director.

GEOLOGIC RISKS IN THE CANADIAN PIPELINE ROUTE

Mrs. HANSEN. Yesterday the statement was made by the Bureau of Land Management that approximately the same geological risks are inherent in the Canadian route that are inherent in the Trans-Alaska route. Is this correct?

Mr. MCKELVEY. I think I will ask Dr. Coulter to elaborate on that. I might just say there is a tradeoff in the two routes that is possibly difficult to add up in quantitative terms. There is some permafrost that will have to be crossed by both routes and perhaps it is more on the Trans-Canadian.

Mrs. HANSEN. Is there some seismic activity along the Canadian route?

Mr. MCKELVEY. Some.

Mrs. HANSEN. Particularly in the Valdez area.

Mr. MCKELVEY. Yes. May I ask Dr. Coulter to comment?

COMPARISON OF CANADIAN AND ALASKAN ROUTE

Mr. COULTER. The distance of permafrost crossed is much longer on the Canadian route than the Alaskan route. The actual distance across high seismic risk areas is much less on the Canadian route than on the Alaskan route. The number of stream crossings which are of a critical nature——

Mrs. HANSEN. There are 12 in Canada?

Mr. COULTER. It depends on what one considers a major stream crossing. In general there are many more stream crossings and more significant stream crossings on the Canadian route than on the Alaskan route.

So you have a greater permafrost problem, a lesser seismic problem, and a greater hydrologic problem on the Canadian route.

It is a trade-off, really.

Mrs. HANSEN. It is also a longer route.

Mr. COULTER. It is a much longer route. It is almost twice as long.

Mrs. HANSEN. You are requesting a reduction of $300,000 for topographic surveys and mapping. This involves the redirection of funds to the RALI program. What are the details of the "large-scale mapping program?" What cities have been selected?

LARGE-SCALE URBAN MAPPING

Mr. MCKELVEY. With respect to the redirection, Madam Chairman, that is part of the source of funds which I discussed earlier.

On the large-scale urban mapping, Fort Wayne is one of the cities in which experimental work is involved.

Charleston and Baltimore are also under consideration. I might ask Mr. Lyddan to comment.

I might say that in these cities we are considering ways by which to make available very large-scale maps, maps on the scale of perhaps as much as 200 feet to the inch, which are needed in urban areas but by and large have been lacking in the past.

Mr. LONG. This is just for the city proper.

Mr. MCKELVEY. May I ask our chief topographic engineer, Mr. Lyddan, to speak about that?

Mr. LONG. I might say that Baltimore City has no county and Baltimore County has no city. The two are completely different. So when they say Baltimore I am never sure whether they are talking about Baltimore City or Baltimore County.

NEED FOR LARGE-SCALE URBAN MAPPING

Mr. LYDDAN. May I point out that we have been told for several years that there is a need for general-purpose maps in metro areas at a scale larger than the 1 to 24,000 which is the scale on which we are doing our routine topographic mapping. There is quite a bit of mapping that is being done and has been done in metropolitan areas, much of it done with money that is provided through various Federal grants. Generally these maps are made for special purposes with virtually no coordination among cities as to scale, content, accuracy, and often very little coordination even within a given city.

So it has appeared that there is a need for some general direction which might be provided by Federal involvement. We are not certain yet as to what extent the Federal Government should be involved in large-scale mapping in metropolitan areas. But there is a large amount of money, estimated between $20 and $40 million going into large-scale mapping in metropolitan areas, much of it coming from Federal sources. Thus, it does appear to us that we needed to experiment with some cities to see what should be done toward bringing some order as to scale, content, and accuracy in all this mapping, not only within each city but among the several cities.

METRIC MAPPING

Mrs. HANSEN. You indicated in one of your press releases that you are converting to all-metric maps for Alaska.

Mr. LYDDAN. We talked that over with a good number of people in Alaska. The basic thought there is that this country surely will go to the metric system fairly soon.

Mrs. HANSEN. Not if American women have to convert everything in their cookbooks to grams.

Mr. MCKELVEY. There will be a lot of new books printed.

Mrs. HANSEN. It is a very difficult problem. If a cake falls, you have had it.

Mr. LYDDAN. The problem that the mapmakers have is that, although we can change the scale without much difficulty at any time, maps showing elevation information by contours, in foot units cannot be converted. The contours will have to be recompiled. We are hoping to avoid spending a lot of money remapping that area 5, 10, or 20 years from now whenever this country does go over to the metric system.

We corresponded with the chairman of the House and the Senate committees concerned most with the problem of this country adopting the metric system. We also talked to the map users in Alaska. They endorsed the position we are taking that it is almost inevitable that this country will adopt the metric system. The largest other country in the world now not on the metric system is Burma. I am not sure this country can compete favorably without adopting the metric system.

Mrs. HANSEN. I am sure there will be a change but there will be great difficulties. Not everybody is mathematically oriented.

Mr. LYDDAN. The plan we will be following is similar to one——

Mrs. HANSEN. I agree with you that the metric system is easier in the ordinary computations, but in some fields it is very difficult.

Mr. LYDDAN. So far as the information published on the maps is concerned, there will probably be a period of several years in which we will publish units in both systems. The elevations will be given in feet and meters.

Mrs. HANSEN. Don't you think it will be necessary to publish both systems in all areas?

Mr. LYDDAN. I am sure there will be a considerable period of time, at least years and maybe decades in which we will use both systems.

Mr. MCKELVEY. Madam Chairman, may I say that I do not think the resistance will come from women. My reading of cookbooks has been such that I believe that anyone who is smart enough to read those, no matter what the units are, is smart enough to learn the metric system.

FISCAL YEAR 1974 INCREASE FOR OCS LEASING

Mrs. HANSEN. You are requesting an increase of $230,000 for acquisition and evaluation of data for the OCS leasing program.

Mr. MCKELVEY. Yes, this is a part of the $2 million that is being requested in support of the accelerated OCS leasing program proposed by the administration. It is for the geologic reconnaissance and evaluation leading to the identification of areas suitable for leasing perhaps later on.

Mrs. HANSEN. You say in your justifications "Some of the data have been collected through our own efforts, utilizing the USGS vessel *Polaris* or using ships working under contract or in cooperative

efforts." Please insert in the record a list of the ships you have had under contract and indicate with whom you are contracting.

Mr. McKelvey. Yes.

[The information follows:]

SHIPS UNDER CONTRACT

During fiscal year 1973 the U.S. Geological Survey has had the use of ships for a total of about 220 days. During that period, we contracted for only one ship, the RV *Hunt*, operated by the Tracor-Mas Corp. of Port Everglades, Fla., for a period of only 45 days. We have been granted the use of the RV *George B. Kelez* for 90 days by NOAA; we are paying only the actual operating cost of the vessel. The U.S. Navy has provided 21 days free ship time on both the U.S.S. *Bartlett* and USNS *Lynch*. The U.S. Coast Guard provided 30 days of ship time at no charge on their ice breaker *Burton Island* and 21 days on the ice breaker *Glacier*. We anticipate about the same level of activity in fiscal year 1974.

MINERAL DISCOVERY LOAN PROGRAM

Mrs. Hansen. Under your mineral discovery loan program, you say: "Financial assistance to explore deposits of 36 eligible minerals is offered on a participating basis to private industry by the Office of Mineral Exploration." Do you want to give us the details on this?

Mr. McKelvey. This program, Madam Chairman, is conducted under the minerals discovery loan program. It provides for loans to private parties that propose to undertake exploration for certain minerals for which provision is made for loans.

The program is weak in that the applicants practically have to take a pauper's oath in order to qualify for a loan. Also, the amount of money available for loan is not very large. Nevertheless, the program over the years has had considerable success. We estimate that with a total investment of about $4.4 million in the form of loans over the years that it has led to the discovery of ore worth about $108 million. So it has had a substantial return. It has not been as successful, by any means, as the DMEA program that preceded it, which had somewhat more liberal terms with respect to the qualifications for a loan, and the amounts involved.

That program with a total Government investment of about $23.3 million was estimated to have led to discovery of about a billion dollars worth of ore.

WATER RESOURCES INVESTIGATIONS

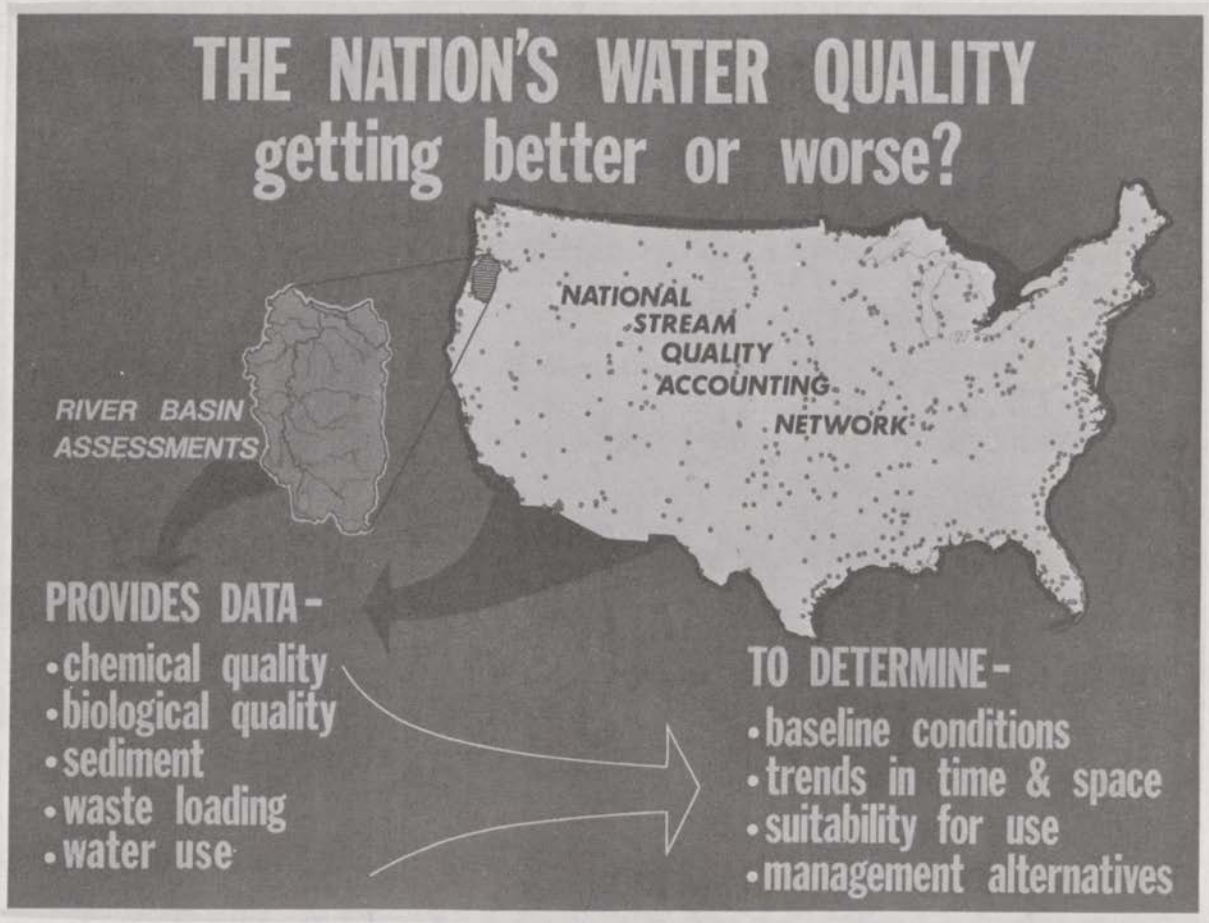
Mrs. Hansen. You are requesting a decrease of $400,000 for water resources investigations. Part of the reduction, $300,000 is for redirection to the RALI program. The other $100,000 is to transfer fund and personnel services to the data program. You also are requesting an increase of $99,600 for base line water quality data. Please explain these requests.

Mr. McKelvey. Yes. The total redirection involved is $400,000—$100,000 of which goes to add more stations to the national water data system, and $300,000 for the RALI program as we have already discussed. We have a chart showing the national stream quality accounting network to which these stations will contribute. The purpose here is to develop the capability to monitor the quality of the water.

[The chart follows:]

Although considerable "spot" water quality information has been obtained, the question, "Is the Nation's water quality getting better or worse?" cannot be answered today because adequate baseline data for river quality does not exist for most river basins. A network of 525 stations, of which 50 are now in operation, is planned to provide a balanced and continuous picture of stream quality in the Nation. Also, pilot river quality appraisals are underway in two river basins to develop methodology for both reconnaissance scale and intensive studies aimed at describing river quality conditions, documenting river quality changes with time, and identifying additional data needs for predicting the effect of water management alternatives.

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THE NATION'S WATER QUALITY
getting better or worse?
NATIONAL
STREAM
QUALITY
ACCOUNTING
NETWORK
RIVER BASIN
ASSESSMENTS
PROVIDES DATA -
• chemical quality
• biological quality
• sediment
• waste loading
• water use
TO DETERMINE -
• baseline conditions
• trends in time & space
• suitability for use
• management alternatives

WATER QUALITY

Mrs. HANSEN. Is the Nation's water quality improving or getting worse?

Mr. MCKELVEY. Yes. Is the Nation's water quality getting better or worse? Our objective is to answer that question and that is why we are developing this program. As we see it, and as I am sure you see it also, in some areas it is getting better and in some worse.

In the overall it has not begun to improve very much. We need this monitoring capability to see how effective our efforts in environmental protection are, and identify problems areas as they arise.

AREAS OF IMPROVEMENT IN WATER QUALITY

Mrs. HANSEN. In what areas is it improving?

Mr. MCKELVEY. Mr. Clarke would like to speak to that.

Mr. CLARKE. That is a difficult question to answer.

The Mississippi River is greatly improved at St Louis over the early 1900's when small animals could walk on the sewage originating in the Chicago Drainage Canal. In other places you will find quality decreased sharply in terms of thermal input where a big powerplant has gone on line, and other cases where wastes are not subjected to tertiary treatment. There are ups and downs and the thing that has not come out clearly in the water quality data monitoring is the overall trend. This effort is aimed at trend analysis—how rivers are changing over time and what is making the changes?

There are sophisticated systems being developed that allow one to extract the effects of fluctuations in flow from the fluctuations in quality and come out with a net that tells if the river is getting better or worse. CEQ has put great emphasis on this and this is what the network is all about—to show the trend and not just point quality of the stream. Some rivers like the Mahoning change markedly depending on activity in the steel mills and it was difficult to sort this out from other effects. We just prepared a report showing how the Potomac is changing with time.

Mrs. HANSEN. I do not think it is changing for the better.

Mr. CLARKE. In some places it is better than the early 1900's. In other places it is worse.

Mrs. HANSEN. It must have been in terrible condition during the early 1900's.

Mr. CLARKE. It is a very interesting report. I think you would like to read it.

Mrs. HANSEN. If I recall correctly you were performing some work on a river in the vicinity of Saltville, Va.

The plant was closed. Have you had an opportunity to monitor that river to see if it is improving?

Mr. MCKELVEY. I am not familiar with it.

Mr. WAYLAND. Synthetic soda ash was the material. I don't know about the condition of the material.

Mrs. HANSEN. I would guess there should be some results of the monitoring available by this time.

Mr. MCKELVEY. This kind of thing has been done. We could provide a short statement for the record, if you would like.

Mrs. HANSEN. Please do.

[The information follows:]

RIVER QUALITY IN VICINITY OF SALTVILLE, VA.

The Olin-Matheson plant, engaged in the manufacture of soda ash, was located at Saltville, Va., on North Fork of the Holston River. Although the Geological Survey has a long record of the flow of the North Fork of the Holston River near Saltville (1921–71) and at Gate City, approximately 75 miles downstream (1931–71), we have not collected records of water quality at these locations since 1960.

The following are representative values collected on the North Fork Holston prior to closing of the Saltville plant and compiled through 1960:

Site	River mile	Total solids [1]	Calcium	(Mg/l) sodium	Sulfate	Chloride
Saltville (above plant)	84.6	140	29	4.2	12	4.7
Holston (below plant)		3,500	686	510.0	50	2,100.0
Mendota		2,300	374	400.0	38	1,300.0
Gate City	8.8	1,400	322	160.0	24	790.0

[1] Bulk of solids is sodium chloride.

The following representative values collected on adjacent streams flowing through the same geologic environment during the period 1930–70 provide an interesting comparison:

Site	Total solids	Calcium	(Mg/l) sodium	Sulfate	Chloride
Levisa Fork near Grundy	160	20	8.3	90.0	4.4
Clinch River at Speers Ferry	150	24	2.8	13.0	2.1
South Fork Holston at Vestal	63	13	2.1	5.6	1.2

The following information on the North Fork of the Holston at mile 79.8 below the plantsite was furnished by TVA:

Date:	*Total solids (mg/l)*
Nov. 29, 1971	1,352
Jan. 28, 1972	145
Mar. 30, 1972	713
July 31, 1972	234
Sept. 28, 1972	1,066

Thus, the evidence indicates that the water at the plantsite had deteriorated in quality due to effluent from the plant.

In July 1971, the manufacture of soda ash ceased, and 400 to 500 employes were discharged. The manufacture of hydrazine ceased in June 1972. At present, it appears, only security personnel remain. Insufficient Geological Survey data are available to make indepth comment or appraisal of water quality changes subsequent to the restriction of plant activities. However, information available from other Federal agencies, TVA and EPA, indicate that the river is now improving in quality.

Mrs. HANSEN. Dr. Long.

CHESAPEAKE BAY WATER QUALITY

Mr. LONG. Since my district is on one of the most important estuaries of the United States, the Chesapeake Bay, naturally I am interested in its water quality. Are you studying Chesapeake water quality? If not, is there any way of getting you to make a study of it? Many people, including myself, feel the bay is deteriorating in its quality. We want to know to what extent and for what run.

Mr. MCKELVEY. May I ask our chief hydrologist, Mr. Hendricks to respond to that.

Mr. HENDRICKS. Mr. Long, we do not have a comprehensive investigation program in the Chesapeake Bay. Such programs are being pursued, as you know, by some of the universities, notably Johns Hopkins.

There is a team of people that are working in the Chesapeake Bay. We have only one man who is doing a research project in the bay, which specializes in the relation of the biota to the quality of water. It is a very specialized study. We ourselves do not have an overall evaluation study going on of the Chesapeake Bay. There is a large Federal interest there. The Corps of Engineers have a large program.

Some work is being done by EPA and some by the universities. The aggregate effort in the Chesapeake is very large but we ourselves do not have a very large part in it.

Mr. LONG. These efforts are fragmented. The Chesapeake Bay is an enormous body of water.

I don't know how it would compare with the Puget Sound but I would guess it would be larger than the Puget Sound as a body of water. Many of the agencies you are talking about are not reliable sources of information. I'm sorry to say I would not trust the Johns Hopkins University Chesapeake Bay Institute as a reliable source of information. Nor would I trust the Corps of Engineers. They are all involved in conflict of interest because they serve as paid advisers and consultants to groups that are, I think, out to pollute the bay for industrial purposes or for estate development.

I would feel much more comfortable if we had some outfit like the Geological Survey, which I felt was more disinterested, more detached, and had the resources to make a really good study. Of course, it is a gigantic undertaking to make a study of the Chesapeake. You don't do it with one man. You don't do it with the resources of even one university. It has to be a great program.

Are any of your water resources programs of the kind that are really going to be very revealing for a large body of water?

Mr. MCKELVEY. Dr. Long, we have undertaken, or have begun in just the last year or so, to place greater emphasis on the very problem you are speaking about, both with respect to estuaries and with respect to river systems taken as a whole and not monitored just in the sense of data collected at specific points.

The examination of the dynamics and the physical and biological qualities of the entire system. That is just beginning. With respect to estuaries not a lot has been done thus far.

Mr. LONG. What I have seen of the sums of money involved that you are dealing with, I do not see how you can find out very much of anything. This is such a small program financially. To determine the quality of water is a fantastic project.

Mr. MCKELVEY. Yes.

FEDERAL AGENCIES INVOLVED IN STUDYING WATER QUALITY

Mrs. HANSEN. The Geological Survey is not the only agency working in this area.

Mr. MCKELVEY. That is true.

Mr. LONG. Should we have a lot of agencies working on it?

Mr. MCKELVEY. They have a lot of different responsibilities, as Dr. Long was implying. There are several kinds of agencies involved,

and some with missions that have to do with public works of one kind or another. The Corps of Engineers is generally involved. EPA also has a rather confined mission. But from the standpoint of the examination of the physical and biologic system for the information itself as it may be applied to whatever kind of problem, the Geological Survey would be one of the two Federal agencies with the clearest and greatest responsibility in the area.

NOAA also would have some responsibility.

Mrs. HANSEN. Doesn't NOAA have the responsibility for coastal areas under the Coastal Zone Act?

Mr. MCKELVEY. The Department of Commerce, under the Coastal Zone Act has responsibility in the area. Actually, just how that program will develop and what its interface will be with the Geological Survey is perhaps yet to be determined.

Mrs. HANSEN. Also isn't the Bureau of Sports Fisheries and Wildlife involved?

Mr. MCKELVEY. Yes.

SUSQUEHANNA RIVER WATER QUALITY STUDY

Mr. LONG. If the chairman will yield once more. What about the Susquehanna which borders on my district and is an important source of water and will be the main source of water, I think, for the whole Baltimore metropolitan area for the future? Are you doing a study of this? It is one of the great rivers of America.

Mr. MCKELVEY. Yes. I would ask that Mr. Hendricks speak to that.

Mr. HENDRICKS. Yes, Dr. Long; but not directed at the Susquehanna alone.

We have collected records of the streamflow and water quality and ground resources for many years in the Susquehanna Basin. The aggregate of this information is very large.

The most recent basinwide effort was in conjunction with the basinwide study conducted under the Susquehanna River Basin Commission. We participated in that study, putting together all the water resource information available for the Susquehanna.

Mr. LONG. Do we get any feeling of which way it is moving as far as it concerns quality? Is the Susquehanna improving or getting worse?

Mr. HENDRICKS. I am sorry, I cannot give you a positive answer. I think overall there are no significant changes.

It has been worse in the past, probably, than it is now. This is generally true for most of the very serious pollution problems. Something has been done about most of them in recent years.

Mr. McKELVEY. I believe in the case of Susquehanna an examination was made of the trend in the suspended load of silt.

Mr. LONG. Certainly you cannot say that silt condition has improved. We have had enormous construction in the last decade. As a result we are pouring silt in enormous amounts into the Chesapeake and Susquehanna. In practically every river in my District—we have many rivers, Black River, Bird River, Bush River, Middle River, the Patapsco, the Gunpowder, the Susquehanna, and so on—are just filling up with silt. The time is coming when none of them will be navigable for even small boats unless they are dredged, and we do not have any place to put the sludge.

Mr. McKELVEY. There are two opposing trends over time, with reference to some of the rivers in the Eastern United States in particular. Years ago the practice with respect to surface mining and the discharge of silt, and so on, as a result was much worse than it has been in recent years. You may recall seeing the effects of that in some of the Pennsylvania streams.

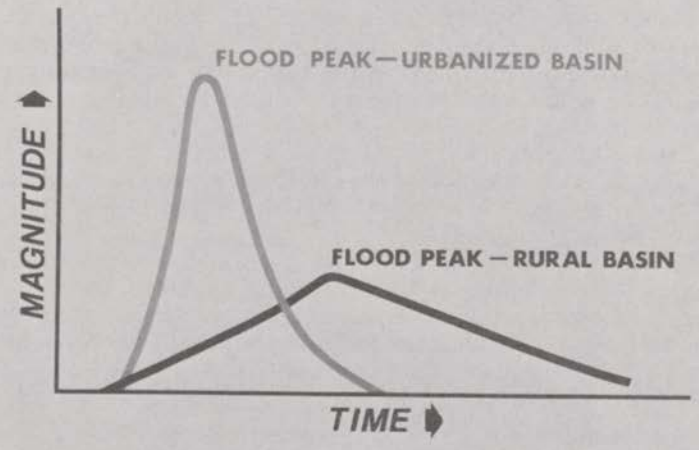
Mr. LONG. That would not be true in the Maryland area because we do not have any mining in that area that I know of. We have tremendous construction going on.

Mr. McKELVEY. That was the trend in the early years and that has diminished in the Pennsylvania area. Now the trend toward urbanization is putting it on the increase again because silt discharge in connection with construction is a major problem. I have a chart on urban development as it relates to watersheds.

[The chart follows:]

Urban development in a watershed causes a redistribution of runoff in volume, magnitude of peak flow, and time of peak flow. The Geological Survey acquires data necessary for the design of structures and facilities to accommodate for these changes and lessen the hazard to life and property.

URBAN DEVELOPMENT INCREASES FLOOD PROBLEMS



BASIN DEVELOPMENT MAY:

1. *Double or triple flood peak magnitudes.*
2. *Drastically reduce flood warning time.*
3. *Increase sediment yield tenfold.*

Mr. LONG. Silt is filling up almost every lake we have. The developers are paving over Baltimore County. I would like to get some feeling, quite aside from these very general statements you are making, as to whether you do have anything quantitative on this.

Is there anything you can send me or show me that would help me on this?

Mr. MCKELVEY. We could supply a statement for the record, Dr. Long, on the status of work in the evaluation of stream systems.

Mr. LONG. I would like some estimates of some of the trends in the quality of the water, let us say, in the Susquehanna, since you do not have it for the Chesapeake and since there is no single standard of pollution.

You have silt pollution, you have industrial pollution of various kinds, you have sewage pollution.

Mr. MCKELVEY. Yes.

Mr. LONG. You now have fresh water pollution. Hurricane Agnes dumped so much fresh water into the Chesapeake that it has imperiled all kinds of sea life.

If you have any quantitative measures of any kind. I would like to be able to have them for the record on the Susquehanna River or any other rivers in the Maryland area.

Mr. MCKELVEY. Dr. Long, suppose we supply a summary statement for the record and send you directly such other publications, and so on, that may possibly be of direct interest.

Mr. LONG. I would appreciate it. You have not done a study in recent years.

Mr. MCKELVEY. It would be an assortment of examples, I am sure.

[The information follows:]

WATER QUALITY TRENDS IN THE CHESAPEAKE BAY AND POTOMAC RIVER AREAS

CHESAPEAKE BAY AREA

In the Maryland part of Chesapeake Bay area, the Geological Survey has made no specific studies to determine trends in quality of water of the Chesapeake Bay. For a task force of the Corps of Engineers, the Environmental Protection Agency compiled a report, "Water Quality Conditions of the Chesapeake Bay System" (August 1972, technical reports Nos. 47 and 55, Annapolis Field Office), giving information on present conditions. Localized areas of the presently troublesome problems were identified, and the overall capacity of the bay system to withstand or recover from such population onslaught was discussed. However, as population and intensive development proceed, further increases in quantities, varieties and places of pollution may be anticipated.

POTOMAC RIVER

As measured by specific conductance the dissolved solids concentration at median flow appears to have increased at the equivalent annual rate shown below between 1950–70:

	Percent
Monocacy River at Bridgeport, Md	2
Conococheague Creek at Fairview, Md	1
Antietam Creek near Waynesboro, Pa	.25

Sediment deposition in the Potomac estuary at Washington, D.C., seems to have been greatest between 1795 and 1838 with relatively minor changes since that time. A downward trend in the rate of sediment carried by the Potomac River at Point of Rocks was noted beginning about 1967. The period from 1967 to 1971 shows a lower rate than the prior 6-year period.

The trend in dissolved solids content of the Potomac River at the Washington water supply intake has been gradually upward for the last 50 years. Although

the dissolved solids range from 85 to 340 ppm, the average dissolved solids have increased from about 100 ppm to about 200 ppm.

SUSQUEHANNA RIVER

Normally, the Susquehanna River which supplies 85 percent of the freshwater to the Chesapeake Bay transports about 3.9 million tons of sediment annually past Harrisburg. Of this amount about 1.8 million tons reaches the head of the Chesapeake Bay. Biggs (1970) indicates that the suspended sediment in the upper bay is 83 percent from the Susquehanna, shore erosion accounts for 13 percent, and skeletal and other organisms account for the remaining 4 percent.

Measurements at Harrisburg during Hurricane Agnes (June 1972) indicate 7.5 million tons of sediment moved past Harrisburg, whereas it is estimated that more than twice that amount may have entered the head of Chesapeake Bay. The unusual amount reaching the bay presumably resulted from a scouring of previously deposited sediments in reservoirs between Harrisburg and the bay.

There is considerable evidence of an overall decrease in sediment yield from about the mid-1950's to the present. This may result from some combination of the effects of decreasing land use for crops (more forest land) and the impact of soil conservation measures. However, based on a study in Pennsylvania, such conservation measures appeared to be only effective during the growing season when much less than half the sediment is transported by the streams.

Urban development causes an important sediment impact on several streams entering the Chesapeake such as the Potomac and the Patuxent. Hopefully, erosion and development controls will have some impact in reducing such effects; but as in the rural areas, the overall effectiveness of such programs have not been evaluated.

FEDERAL-STATE COOPERATION PROGRAM

Mrs. HANSEN. You are requesting the same level of funding as last year for the State-Federal program. The committee has received several letters from various Congressmen urging an increase in this program. The Speaker has written a letter relative to the importance of this program to the State of Oklahoma. Can you explain the rationale for requesting no change in funding for this activity?

Mr. MCKELVEY. Madam Chairman, as you indicate there is a surplus in the offerings from the States for the Federal-State cooperative program beyond what we are able to meet with matching funds. It amounts to more than $5 million in our estimates for fiscal 1974.

The 1974 budget proposal, however, is in the context of the total Federal budget and which the President is trying to bring into balance with expenditures.

Mrs. HANSEN. I do not want to hear any more lectures on that subject.

Mr. MCKELVEY. I was just going to say that our proposal is within the context of the national budget, and we believe that while we are not able to match all of the State offerings nevertheless we have a strong program in this area.

Mrs. HANSEN. You feel the States can use revenue-sharing funds. That is the end of the lecture, I know.

Mr. MCKELVEY. That is hard to say. I would say, Madam Chairman, we are not closed out here from new starts that will be responsive to State needs, because each year some projects are completed and there is some money available to undertake new things.

What this is going to bring both of us to—the States and the Federal survey—is to a close examination of priorities to be sure that the funds that are available go to the most critical needs.

STREAM FLOW

Mrs. HANSEN. Is the total flow of the streams in the United States decreasing or increasing?

Mr. MCKELVEY. I think the total flow would remain about the same, with the exception that in urban areas—Dr. Long mentioned they are paving the whole of Baltimore—there would be less infiltration and locally perhaps some increased stream flow.

Mrs. HANSEN. The reason I ask is that as the population increases you have a greater need for water. Dr. Pecora testified in the past on the exploratory work to find new sources of water.

It is perfectly obvious that there will be a greater need for water and yet I notice the saline water program is being greatly reduced this year.

We are looking at expanding uses of coal. Yet there is an enormous amount of water necessary. You need enormous amounts of water in all these programs.

Mr. MCDADE. Atomic energy.

Mrs. HANSEN. Yes. Yet we have no assurance that there is anymore water available than there was 20 years ago.

Mr. MCKELVEY. There will be more water available, Madam Chairman, in two or three ways. Of course, the total water budget of the country will vary with variations in the climate, the amount of rainfall, and so on. Water is recycled naturally. It is one of the renewable resources, as some people describe it in the sense that it is recycled and never permanently used up or destroyed. But new water supplies come to be available for use through water development and water management efforts.

These include, in the way of new natural resources of water, ground water that is developed by drilling, and so on. It includes management and physical structures that impound surface water—dams and so on. Then there is the recycling of water, treating and reusing sewage and so on. Water that is now disposed of and wasted can be recovered and reused on the spot. Looking as far into the future as we can, we feel that except in local areas, particularly arid areas in this country where water has always been a problem, the prospects of water shortages are not great. But that will only be true if indeed we work at the water management problem.

The chart here is an interesting one in the sense of conservation of water.

[The chart follows:]

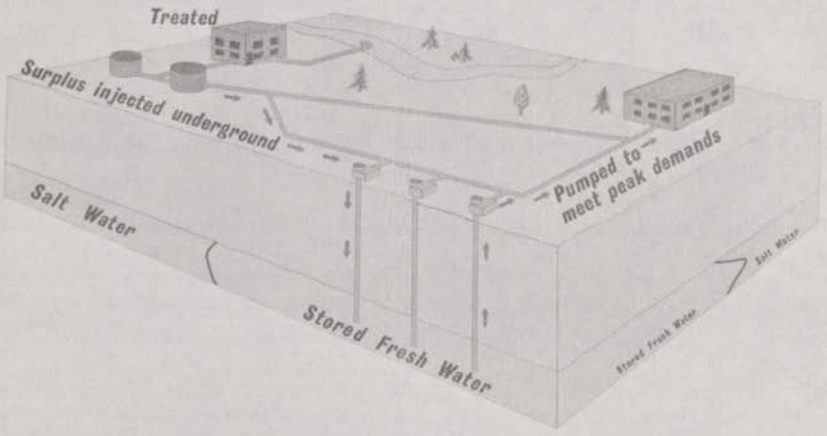
UNDERGROUND SPACE—A USEFUL RESERVOIR

Underground space is increasingly being recognized as a valuable natural asset. For many years underground space has been used for the emplacement of wastes and for the safe and economical storage of water, hydrocarbon fuels, and industrial feed stock. Although fresh water is generally stored in freshwater aquifers, recent investigations show that some saline aquifers may be used to store surplus fresh water, and that half or more of this fresh water may be retrieved for later reuse during deficit periods.

UNDERGROUND SPACE
A
USEFUL RESERVOIR

WINTER SURPLUS

MEETS SUMMER DEFICIT



Dr. McKelvey. This illustrates a project that is actually underway in the Norfolk area, in which an underground salt water reservoir is being used for storage of fresh water which is being pumped into it through wells. It is surplus water that is collected during winter and pumped underground. What is interesting is that fresh water remains as a bubble that expands and pushes aside the salt water that naturally exists in the reservoir, and it can then be redrawn for use in times of summer deficit.

This kind of thing is important, we think, for the future not only in this particular example of the storage of fresh water temporarily underground, but in the form of recharge of natural ground water. In some areas it has been literally mined—taken out and not replaced naturally. Artificial recharge by various devices maintains those underground reservoirs, filling them with surplus water at some seasons and allowing for their continued use.

Mr. McKay. What brings on the phenomenon that the fresh water does not mix with the salt water? Is that what you said?

Mr. McKelvey. Yes; that is correct. There is some mixing, perhaps, at the very margin of the body. This is not unusual. Actually salt water and fresh water will mix under certain conditions, but in coastal areas there is a natural salt water-fresh water interface. The zone of diffusion is very small.

Mrs. Hansen. Again you are requesting a reduction of $300,000 for critical national water problems for redirection to the RALI program. Do you have any further comments other than those which you gave earlier?

Mr. McKelvey. No, Madam Chairman, unless there are questions. I would merely say again that we believe that the redirection from each of these programs, representing an effort toward the improved utilization of the kinds of information that they produce, is going to be beneficial to these programs themselves.

ATOMIC WASTE DISPOSAL

Mrs. Hansen. Last year we discussed with you the salt mine in Kansas where they planned to dispose of atomic wastes. What is the current situation in this regard?

Mr. McKelvey. My recollection, Madam Chairman, is that the plans for the use of that particular mine for the storage of atomic waste have been abandoned.

Mrs. Hansen. What are they doing with the waste?

Mr. McKelvey. I do not think they had gotten to the point where they were doing it in the first place. They are looking now at other areas.

Mrs. Hansen. Aren't they going to have the same problem?

Mr. McKelvey. Very likely there are areas. In the Kansas area it turned out that there were physical problems that would be difficult to cope with. There has been a lot of exploratory drilling for water and gas in the area.

The salt beds were punched full of holes, so to speak.

There may very well be other salt beds suitable for the storage of atomic wastes.

CONSERVATION OF LANDS AND MINERALS

Mrs. HANSEN. You are requesting an increase of $730,000 for OCS lease supervision. You say the Academy report is valuable in its conclusions and recommendations and also for its discussion of safety problems and description of procedures already developed to handle similar problems in other fields.

Mr. McDade has a question in this regard.

OCS LEASE SUPERVISION

Mr. MCDADE. Yes, Madam Chairman.

Doctor, you mentioned this morning you had some uneasiness about the way the Geological Survey's capabilities were able to police the number of platforms you have in the gulf.

Mr. MCKELVEY. I was speaking with reference to the maximum efficient rate of production.

Mr. MCDADE. Exactly. I was asking you whether or not we were sure we were getting it and the companies were not taking the cream and leaving us the balance and you said you were a bit uneasy about it.

I wanted to be sure where we are.

Do you need more people down there?

FISCAL YEAR 1974 PERSONNEL INCREASE FOR OCS SUPERVISION

Mr. MCKELVEY. We are asking for more people for fiscal 1974.

Mr. MCDADE. How many more?

Mr. MCKELVEY. We are asking for a total of 46, or rather 50 positions for the $2 million increase, and 46 of them to be in the conservation division program.

Mr. MCDADE. If you get those 46 people will the uneasiness, whether or not we are getting the proper kind of production no longer exist?

Mr. MCKELVEY. I cannot say that for certain, Congressman McDade. With the 46 new positions, we will be stressing and concerned more with the safety aspects than we will with increased work on the conservation side.

Mr. MCDADE. Will more people solve the problem of this question which we discussed this morning whether or not we are getting the best kind of production out of the shelf?

Mr. MCKELVEY. More people alone I do not think would solve the problem. It may be that there are other approaches to it also.

Madam Chairman just referred to the report recently completed by the National Academy. One of their recommendations involved third party inspection of the offshore operations, with the idea that companies would be required to undertake an inspection of their operations on a periodic basis under prescribed terms and supply the results to the Geological Survey.

That is one of the things we are examining.

Mrs. HANSEN. Is that a fox in the chickencoop plan?

Mr. MCKELVEY. If it were a third-party-type inspection, Madam Chairman, it would perhaps not be of that character.

Mrs. HANSEN. Who will hire the third party?

Mr. McKelvey. The company would hire the third party. It might even supply it in the form of a separate division within its own company.

If it had to undertake inspections in a prescribed way, and with results certified by them as an inspection of each procedure. We would find that the oil companies are not tempted, or that they do not yield very much to temptation, to break prescribed regulations that they know are going to be enforced. It is not good business for them.

There is a problem here. I think there is quite a change here. Our inspection capability in the Gulf of Mexico is still small in terms of the total magnitude of the job; 1,900 or 2,000 platforms and 6,000 wells are a lot.

Mrs. Hansen. Please insert in the record a listing of the total number of field inspection employees, the total cost for these employees, and the total value of the oil being produced.

Mr. McKelvey. We will be glad to do that.

[The information follows:]

	Production value	Field inspection staff		
		Inspector force	Other	Cost
Fiscal year 1973	$2,200,000,000	34 inspectors; 8 engineers	21	$2,218,000.
Fiscal year 1974 budget[1] requested increase		+13 inspectors; +2 engineers	0	+460,000.

[1] In addition to the field inspection staff, our fiscal year 1974 budget request also include $270,000 and 14 positions to commence implementation of other recommendations of the NASA, NAE and internal studies that involve activities in other phases of the OCS lease management program but which also have the objective of safety and pollution control.

Note: Recommendations contained in 3 studies of OCS operations conducted during the last 2 years by a team from the National Aeronautics and Space Administration, by the Systems Laboratory of the USGS Water Resources Division and by a panel of the marine board of the National Academy of Engineering have been evaluated by a safety committee composed of key Geological Survey personnel. This has indicated the need to implement various study recommendations in 15 general categories.

Mr. McKelvey. I was going to say that the mere fact that we are there—our helicopters are visible at many places in the gulf every day. In some cases the operators get a few hours of notice because of the arrangements that have to be made on the platform when one of our inspecting teams visits, but not enough for them to install a blowout preventer in a well if they do not already have one, and make other major changes.

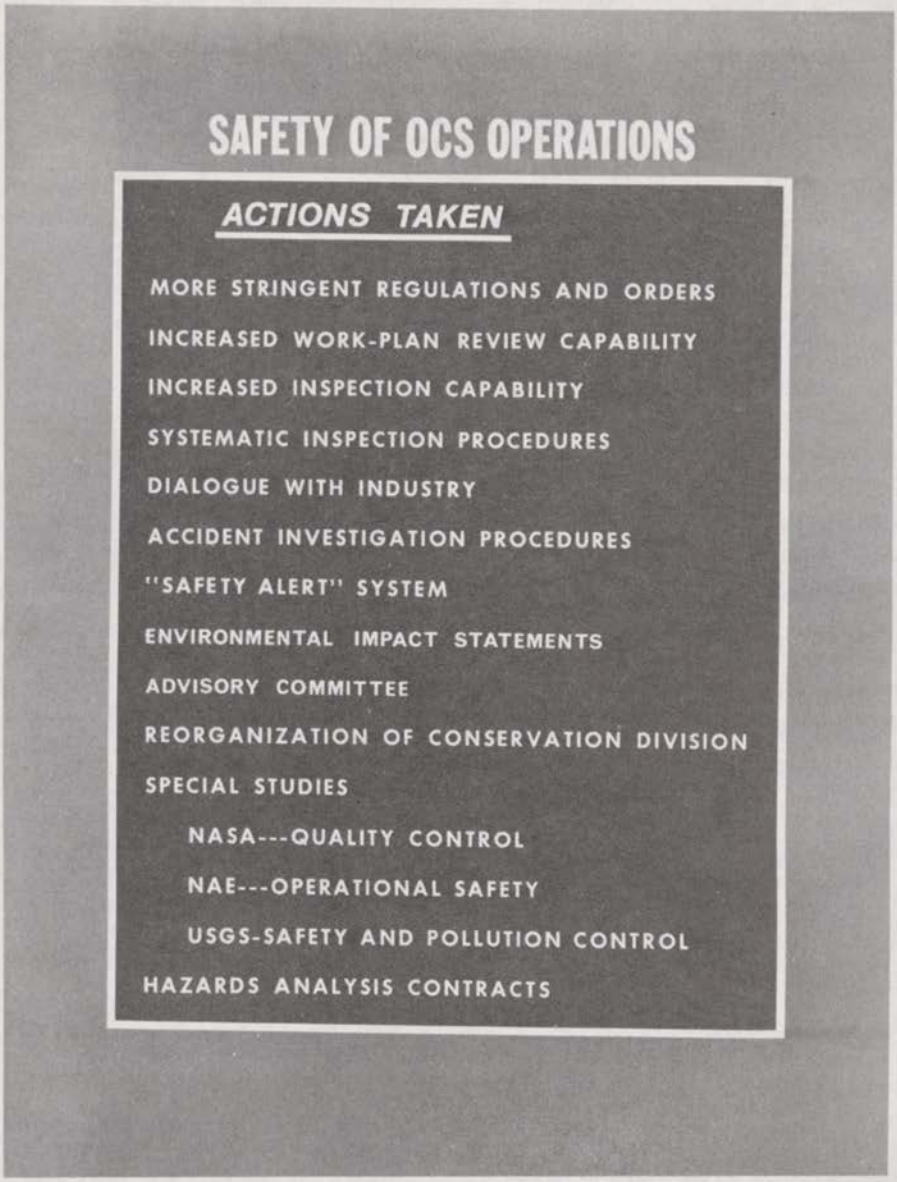
So there is a visible deterrence in our presence.

Mrs. Hansen. That is why the committee is concerned. The committee is not challenging anybody's honesty or integrity. We have had the problem with coal mine safety. The Government's presence has a very salutary effect on operation of all these affairs that affect the American public.

Mr. McKelvey. I am sure that is correct, and I think the net effect of what we have done thus far in the offshore operations has been substantial in the last 2 or 3 years with the support of the Congress. I have additional charts I would like to insert in the record at this point.

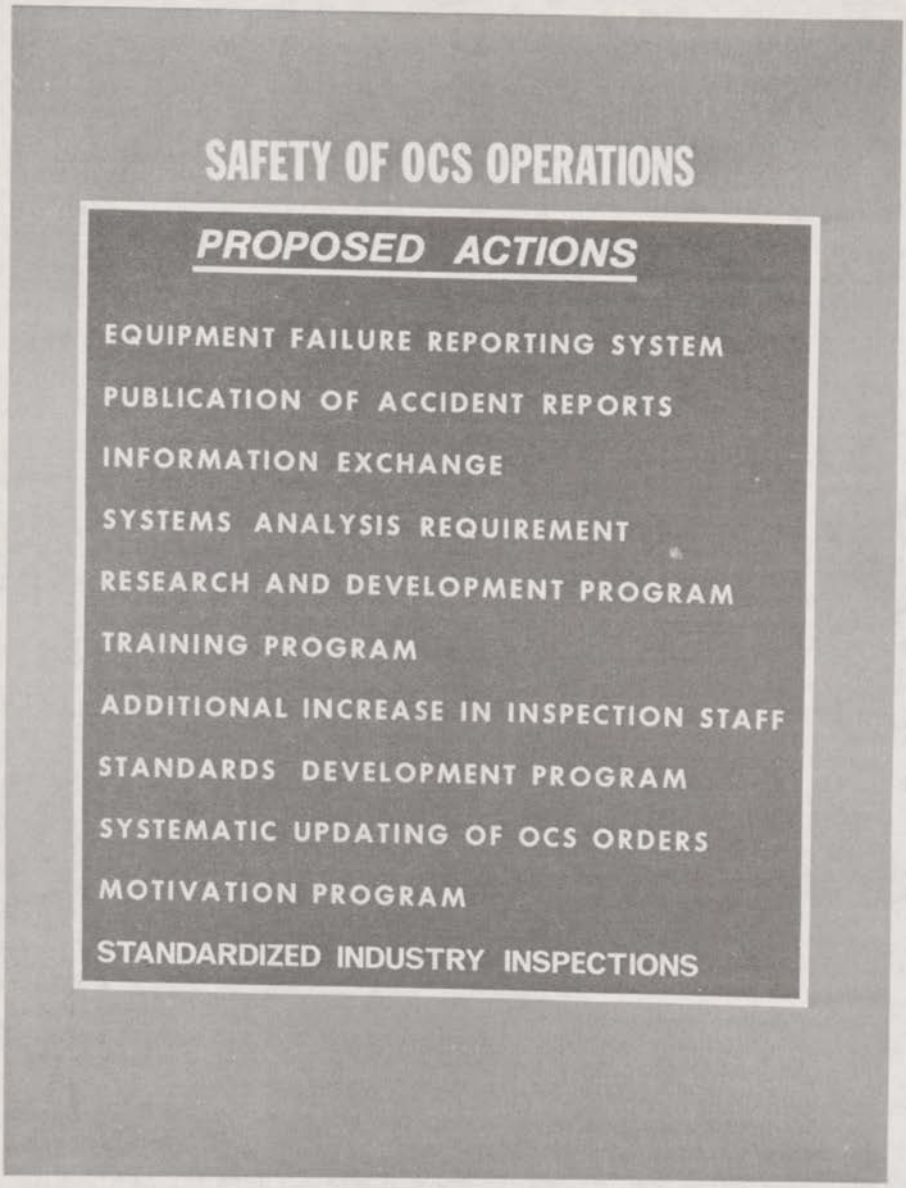
[The charts follow:]

To assure the protection of the marine environment and the safety of those working offshore, it is essential that supervision of these offshore activities maintain the highest standards of safety and environmental protection. This chart lists some of the actions which have been taken.


SAFETY OF OCS OPERATIONS
ACTIONS TAKEN
MORE STRINGENT REGULATIONS AND ORDERS
INCREASED WORK-PLAN REVIEW CAPABILITY
INCREASED INSPECTION CAPABILITY
SYSTEMATIC INSPECTION PROCEDURES
DIALOGUE WITH INDUSTRY
ACCIDENT INVESTIGATION PROCEDURES
"SAFETY ALERT" SYSTEM
ENVIRONMENTAL IMPACT STATEMENTS
ADVISORY COMMITTEE
REORGANIZATION OF CONSERVATION DIVISION
SPECIAL STUDIES
NASA---QUALITY CONTROL
NAE---OPERATIONAL SAFETY
USGS-SAFETY AND POLLUTION CONTROL
HAZARDS ANALYSIS CONTRACTS

As a result of various program studies by NASA, the National Academy of Engineering, and others, the Geological Survey is proposing many new actions to improve the safety of OCS operations. It is proposed to begin the implementation of these actions during fiscal year 1974.

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SAFETY OF OCS OPERATIONS
PROPOSED ACTIONS
EQUIPMENT FAILURE REPORTING SYSTEM
PUBLICATION OF ACCIDENT REPORTS
INFORMATION EXCHANGE
SYSTEMS ANALYSIS REQUIREMENT
RESEARCH AND DEVELOPMENT PROGRAM
TRAINING PROGRAM
ADDITIONAL INCREASE IN INSPECTION STAFF
STANDARDS DEVELOPMENT PROGRAM
SYSTEMATIC UPDATING OF OCS ORDERS
MOTIVATION PROGRAM
STANDARDIZED INDUSTRY INSPECTIONS

Mr. McKelvey. The improved capability that we have developed I think has had a——

Mrs. Hansen. The Congress has had to add funds to provide for this type of inspection. Mr. McDade knows it was this committee that added money in spite of OMB.

Mr. McKelvey. This was the support I was speaking about.

Mr. McDade. Doctor, that goes to safety though. What about husbanding the resource? That is what we were talking about today. Do we have a reasonable basis to be certain that we have the necessary people and expertise in the gulf to make sure the companies are treating that resource which belongs to the people in the best possible way?

Mr. McKelvey. We think we are close to that but we have some studies in progress, I believe. I could perhaps with your permission ask Dr. Wayland to speak on that, the state of our investigation of the MER and the procedure now in operation.

Mr. Wayland. Thank you.

The MER is a difficult type of calculation to make because it requires in the first instance a careful analysis of each reservoir. There are many of them, and it is necessary to identify those reservoirs that are what we call rate sensitive, that will be damaged by an increased rate of production. There are some that are not that way and so their production rate is not important. The needed type of capability has been developed over the last year and a half by the use of the funds allocated to this particular program. We have a cadre of Government employees and three contract specialists at the moment working with us to train our staff in this type of work to where we could get into full-scale operations, but at the moment the program is on a sampling basis and a development basis.

Mr. McKelvey. At the moment I just have to say I am really uneasy about it because I don't think we know enough about how well the present process of regulating MER is working.

Mr. McDade. But that is a problem with the state of the art, is it?

Mr. McKelvey. It is partly a problem of the state of the art but it is partly a problem of the distribution of our effort and our capability. We don't have the capability to make these studies on all of the operating wells in the gulf and, very frankly, in the last 2 or 3 years with our accelerated effort we have focused on the safety problem.

We ask the companies to supply us with the information that supports their determination. We can examine that and get considerable satisfaction that, well, it is probably okay or probably pretty close, but we just haven't had the time and capacity to devote to a full examination of each reservoir.

Mrs. Hansen. Please insert in the record a statement on what it would require to provide the type of inspection that you need.

Mr. McKelvey. Yes, Madam Chairman, be glad to do that.

[The information follows:]

MER Production

In some instances operators may be sacrificing some ultimate recovery in order to produce their petroleum resources at a rate which will allow a greater present worth value of ultimate production. Many reservoirs cannot be produced economically at a rate that will allow the maximum ultimate recovery (MER) and still permit the operator to recover operating costs. Conversely, the need for an assured long-term supply of crude oil to fulfill refinery needs tends to motivate

operators to obtain a maximum ultimate recovery. Additionally, operators' investments in leases, exploration, and development are generally predicted on recovering a predetermined amount of crude oil in a given time frame. The purpose of the MER program is to assure that the factors considered by industry in proposing production rates for each reservoir are valid from an engineering, geologic, and economic standpoint. Without such a program the extent of "creaming" cannot be quantified or controlled.

We received $800,000 and 10 positions for our MER production control program in fiscal year 1972. This has enabled us to take the initial step towards implementing an OCS MER production control program. Until all reservoirs in the Gulf of Mexico are reviewed and inventoried and the relationship between production rates and ultimate recovery established we are unable to determine fully the final scope and magnitude of this activity. For this reason we reserve judgment on what the total program should encompass until our initial inventory is complete which, at the present rate of effort, will be from 12 to 18 months.

[Discussion off the record.]

INCREASE FOR OCS RESOURCE EVALUATION

Mrs. HANSEN. You are requesting an increase of $1.04 million for OCS resource evaluation and classification. How does our evaluation capability now compare with that of industry?

Mr. MCKELVEY. Madam Chairman, I don't think it is as good as many companies possess or as the industry in the aggregate possesses when it comes to actual exploration, but we think we are very strong now in our capability to satisfy the public's purpose in being able to evaluate leases in advance of the sale, and I might say it is not just a matter of getting the geophysical data. We are funded to get proprietary data now, as you know, on a rather comprehensive basis, but we are also continuing to work on the improvement of the actual methods of evaluation.

This is a very difficult thing. You are all familiar with the problem of evaluating a pig in a poke but here is a poke that may or may not contain a pig.

Mrs. HANSEN. We understand.

Mr. MCKELVEY. So it is, you know, one problem further removed. The problem, of course, of evaluating this poke is a difficult one, but we are improving the methods by which that problem is approached and we think we are getting a good capability in this area.

AUDITING ROYALTY PRODUCTION ACCOUNTS

Mrs. HANSEN. How often do you audit your accounts and do you ever have a 100-percent audit?

Mr. MCKELVEY. I don't believe, Madam Chairman, that we have had a 100-percent audit of our royalty accounts.

Mrs. HANSEN. Why not?

Mr. MCKELVEY. I don't know for how long, but it would be simply because of the magnitude of the job.

Mrs. HANSEN. You say in your justifications, "It is expected that total royalty income from OCS oil and gas operations will reach $354 million in fiscal year 1974, nearly $1 million a day."

Yet do you mean to say you can't afford to audit?

Mr. MCKELVEY. We don't have the capacity to audit all of those accounts. We have many additional ones onshore as well.

Mrs. HANSEN. Please insert in the record what percent of your accounts are audited, how often they are audited, and what funding level would be required for a complete audit?

Mr. MCKELVEY. I will be glad to, Madam Chairman.

[The information follows:]

AUDIT OF OIL AND GAS ACCOUNTS

About 20 percent of onshore oil and gas accounts and 70 percent of OCS accounts are being audited annually. We estimate that an additional $400,000 and 35 positions are needed to audit all oil and gas accounts annually and to do the prerequisite accounting work so that auditing occurs at optimum time.

Mr. LONG. Would the Chairman yield?

Mrs. HANSEN. Yes.

INSPECTION OF OCS OIL AND GAS LEASES

Mr. LONG. I see where you do a good deal of inspecting. We have had a very unhappy experience with building inspections in the whole housing program. Recently we found out that a certain builder had built 122 homes and that everyone of those homes had been given a perfect rating by the FHA twice and by the county once. Then the complaints began to come in so fast from the residents I finally got HUD to investigate. It found 1,000 certified signed defects on 122 houses. Yet not a single defect had been found by any of the three inspections.

I have become, therefore, a little bit suspicious of inspections. We can't prove it but I suppose there is bribery.

Now, do you have problems with bribery? Do you have any problems of tampering with the integrity of these inspections and so on? How are they done? Let us check to make sure.

Mr. MCKELVEY. In the history of the Geological Survey there has never been a single instance of malfeasance. Now, we employ people and, of course, people have human failings and I can't guarantee that at sometime there might not be such an event, but we have very high esprit in the Geological Survey and our people appreciate the fact that they work for an organization of extremely high integrity.

We have the respect of the industry. They realize that the Geological Survey is tough but fair, to use words that they themselves have used, and so we have a lot going for us——

Mr. LONG. You never had a complaint?

Mr. MCKELVEY [continuing]. In this regard; we have worked hard at the development of our inspection system. It is really based on an engineering systems approach.

Mr. LONG. Have you ever been accused of having a bad system or defective system of inspection?

Mr. MCKELVEY. Have we ever been accused?

Mr. LONG. Have the environmental groups accused you of bad inspections?

Mr. MCKELVEY. I don't believe in the sense of environmental groups. We have been criticized by individuals, one in particular, who has claimed——

Mrs. HANSEN. Who?

Mr. McKelvey. William Gesner; perhaps he has written to you. He has written to the President and the Secretary of the Interior recommending that I and everyone beneath me be fired.

Mrs. Hansen. What is his reason?

Mr. McKelvey. He says we are not doing a proper job of inspection in the Santa Barbara Channel. He had worked for one of the oil companies and I believe lost his job, but in any case his complaints, as soon as they were received, were turned over to the Interior Department Office of Survey and Review. They made a thorough field inspection of his complaints and were unable to find any substance to them.

However, there certainly have not been very many complaints of that kind and none that I know of has ever been substantiated.

FEDERAL AND INDIAN LANDS

Mrs. Hansen. What is the situation on Indian lands? How many leases are involved and what are the total revenues? What is the status of mapping? Insert the information in the record.

Mr. McKelvey. We will supply it for the record.

[The information follows:]

INDIAN LANDS

As of December 31, 1972, Indian oil and gas leases under Geological Survey supervision totaled 9,655 and involved 3,476,279 acres. Mining leases totaled 947 and involved 4,972,672 acres.

Oil and gas royalties from Indian land leases totaled $16,556,192 in calendar year 1972. Mining royalties from Indian land leases totaled $5,123,086 in fiscal year 1972.

Indian lands, like any other, are mapped topographically, geologically, and hydrologically, by the Geological Survey on a quadrangle basis, but not specifically for land classification purposes.

Mrs. Hansen. You say, Colorado, Montana, New Mexico, North Dakota, Utah, Washington, and Wyoming will receive priority attention in the programing of 1.4 million acres per year for coal land classification. Is that in the Cascade Mountain area of Washington?

Mr. McKelvey. Yes, you can see the location on this chart.

[The chart follows:]

Classification of Leasable Minerals (Except Oil and Gas)

About 300 million acres of potential mineral lands still require classification. Priority areas for classification are indicated on the exhibit. These include about 30 million acres of high priority coal lands and about 6 million acres of high priority oil shale lands.

CLASSIFICATION OF LEASABLE MINERALS (EXCEPT OIL AND GAS) for Public Land Management



Classified as mineral land prior to 1960: 50 Million acres
Classification progress since 1960: 12 Million acres
Potential mineral land requiring classification
Priority area

FACILITIES—NEED FOR ADDITIONAL POSITIONS

Mrs. HANSEN. You are requesting an increase of $5,914,000 for the relocation of personnel and operation from Washington, D.C. to Reston, Va. What is the need for 15 additional positions?

Mr. MCKELVEY. I believe, Madam Chairman, that those positions are such people as telephone operators, and people to run a central service store, and so on, but may I ask Mr. Grant to confirm that?

Mr. GRANT. That is correct, Madam Chairman.

These are 15 support positions to augment the minimum service that we will receive from the General Services Administration because the building is so far from the normal source of such service. These people will perform such work as duplicating and telephone operating, space assignments, operation of the GSA store, and things of that nature.

Mrs. HANSEN. But aren't you also reducing your space someplace else?

Mr. GRANT. We are, and in many of the buildings which we will vacate, we now receive these kinds of services from GSA.

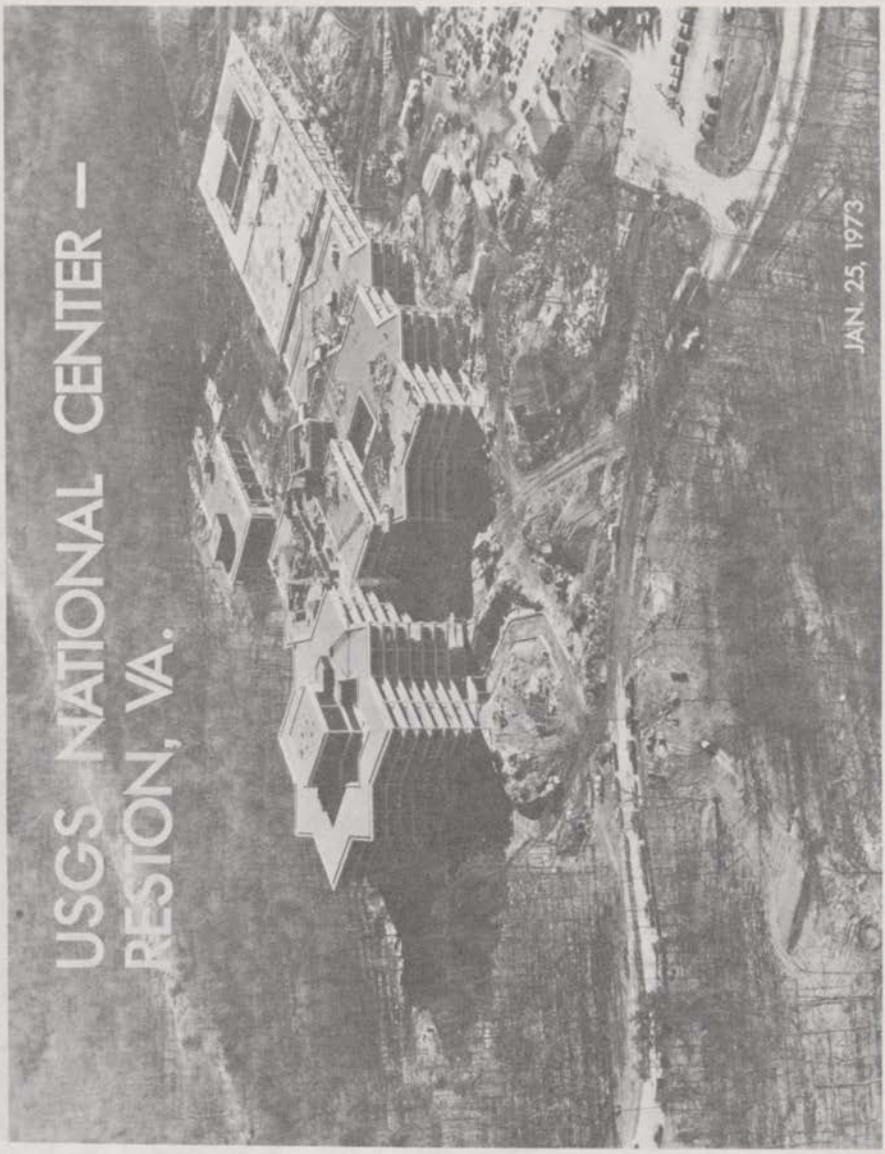
Mrs. HANSEN. I see.

Mr. GRANT. But here we will be 25 miles outside of downtown Washington and GSA is not able to provide this service.

This picture was taken in January and it shows the state of completion of the building at that time, which was about 75 percent complete. It is now about 82 percent complete.

[The picture follows:]

The USGS National Center is being constructed by Gulf-Reston, Inc., under a 20-year lease-purchase agreement on a Government-owned site of 105 acres in the new town of Reston, Va., about 25 miles from Washington, D.C. The Center is being finished in phases with initial occupancy scheduled for summer of 1973. Completion and full occupancy will occur in the first half of 1974.


USGS NATIONAL CENTER –
RESTON, VA.
JAN. 25, 1973

PHYSICAL MOVING COSTS

Mrs. HANSEN. Why is it going to cost $1.5 million to move furniture, supplies, materials, et cetera?

Mr. GRANT. The $1.5 million we have quoted, Madam Chairman, is for a composite of these kinds of things. First, the actual contract to move us from 26 or 27 locations, all of our furniture, our laboratory equipment, map cases, and all of our bulky materials. In addition to that, it is the cost of the disconnects and hookups for various special kinds of utilities that we have, plus the restitution of the leased buildings. As you know, when you move out of a leased building, and we are moving out of a number of them, we are required to restore those buildings.

Mrs. HANSEN. What damage has occurred?

Mr. GRANT. We haven't damaged them except through fair wear and tear, but we have done minor modifications.

Mrs. HANSEN. Didn't your lease call for fair wear and tear?

Mr. GRANT. They call for the restoration to the original condition.

Mr. MCKAY. There is a clause that usually says, "except for fair wear and tear."

Mr. LONG. In other words, you have to make it "brandnew"?

Mr. GRANT. No, but if we put a wall up or put in a major alteration, or if we punched a hole in the wall, and so forth, we have to restore it.

Mr. LONG. After what it cost me to move one room of furniture from Baltimore to Washington I wonder how you got it done for $1.5 million.

Mr. MCKELVEY. I was just going to say about 10 years ago I moved from one house to another, a block apart in Washington, and as I recall the bill for the move, and I did a lot of it in my own car and so on, was about $75. I suppose 10 years later it would be a couple of times that; there are 2,300 people whose effects and working equipment and so on are being relocated.

EQUIPMENT AND SPECIAL-PURPOSE NEEDS

Mrs. HANSEN. You are requesting $539,000 for "Equipment and special-purpose needs." This is to occupy special-purpose areas such as laboratory, telephone switchboard room, and the auditorium, et cetera. Of the total $225,000 is for telephone switchboard equipment. Are you buying a completely new system?

Mr. MCKELVEY. Well, I have that feeling, Madam Chairman, but those are present-day costs and they are hard costs over which we have no control.

Mrs. HANSEN. The telephone company determines the costs?

Mr. MCKELVEY. Yes.

MOVING OF PERSONAL HOUSEHOLDS

Mrs. HANSEN. $1 million is requested for the moving of personal households. I hope you realize Members of Congress have to pay their own moving expenses.

Mr. MCKELVEY. Well, the OMB regulations provide circumstances under which employees may be reimbursed for moving expenses, in moves of this sort, and the General Accounting Office, to whom we have

taken this problem, has prescribed specific circumstances under which employees will be reimbursed.

Mrs. HANSEN. What are those circumstances?

Mr. MCKELVEY. There are three primarily. One is that the distance of travel has been increased by 10 miles or more, and 20 minutes time or more has been added to the time of travel, and that they move within 5 miles closer to Reston, and they have to meet all of those conditions.

In other words, they must travel 10 miles more at least and take 20 minutes longer.

Mr. GRANT. The determination of the cost is based, first of all, upon what the Civil Service Commission defines as the commuting area and the Civil Service Commission made a formal decision in our case that the commuting area did not include the community of Reston. The commuting area is defined in various ways for various cities but it is generally the area in which employees commute by definition.

There is a formal definition under existing law that if an employee's worksite is moved out of the commuting area, then he is eligible to have his household goods moved at Government expense to the new worksite. It is based upon this law that the projection of a million dollars for the approximate number of people who will take advantage of that is based.

We really have no option in making that determination for meeting the expense if an employee wishes to move his residence.

Mr. MCKELVEY. Our average grade is GS–9, or a little bit more. For many of our people this move will actually create a hardship. As far as the decision is concerned it is not a decision that the Geological Survey has made.

In the regulations of the Civil Service Commission and the determination of the General Accounting Office is an instruction to us to reimburse employees that meet the circumstances I described. I am sure that this is not a decision created on our behalf for our special circumstance. This is part of the general Government regulations that apply in this area.

PRINTING PRESS

Mrs. HANSEN. You are requesting $661,000 for a printing press and related equipment. Has the Joint Committee on Printing approved your new printing press?

Mr. MCKELVEY. It has been requested, Madam Chairman, but not yet acted on.

Mrs. HANSEN. If you are contracting your printing work why do you need such a press?

Mr. MCKELVEY. Madam Chairman, much of our print equipment is outdated and we think that substantial efficiencies can be achieved in the proposed purchase described here.

With respect to our contracting, I might say that we have found difficulty in finding contractors that can print topographic maps and other maps that we produce to satisfy standards. It isn't that there aren't companies that print maps. I won't name it, but you would be surprised that one of the larger of the mapmaking companies took one of our contracts, had great difficulty in actually getting the paper through their presses, and meeting the contract, and when the next one came up for bid they didn't apply. So we are not yet ready to go all out in private contracting of map printing.

Mr. McKAY. Aren't there other Government agencies who do interagency contracting for their press needs?

Mr. McKELVEY. I think that we are probably one of the largest, Congressman, in the map printing.

Mr. McKAY. The military does, don't they?

Mr. RADLINSKI. The military do and we do some subcontracting, too. We are also working with NOAA at the present time to see what additional capacity they might have that we could use for our printing.

LEASE-PURCHASE AGREEMENT

Mrs. HANSEN. You are requesting $5 million for recurring costs. Why isn't GSA paying the rental cost?

Mr. McKELVEY. May I ask Mr. Grant to respond.

Mr. GRANT. Madam Chairman, the rental costs on the building are included in a lease-purchase agreement. Lease payments, based upon the construction cost of the building will be paid over a period of 20 years, at which time the Federal Government will own the building. However, GSA does not have any money in its base to pay the rental costs.

Mr. McDADE. What is the effective cost per square foot in this building?

Mr. GRANT. It is approximately $9.75 a square foot on the basis of the lease payments.

Mr. McDADE. That seems awfully expensive to me.

Mr. GRANT. It is difficult to compare, Congressman.

Mr. McDADE. Tell me why.

Mr. GRANT. Because of the fact that this building is unique in that it is a composite of both office space and laboratory space, special-purpose space, print plant space, and so forth.

Most buildings are based on what is called a single-purpose occupancy and this is multipurpose occupancy so there isn't a building in Metropolitan Washington that can be directly compared to it nor have we found another fair comparison. So on that basis it might seem a little high.

Mr. McDADE. What kind of rental are you paying now per square foot?

Mr. GRANT. It varies all the way from $3 or $4, depending on where it is, up to $7 or $8. Much of our space is not charged to us because it is in the GSA base, such as our headquarters building.

Mr. RADLINSKI. But I don't think it is fair to compare it on a rental basis because it is on a lease-purchase basis and after 20 years the Government will own the building. So you might say it is a good deal for the Government.

Mrs. HANSEN. Hopefully.

Mr. McDADE. I think the record had better darn well reflect that. If $9.75 a square foot should be an honest cost, and that is a more accurate description of what you are talking about, and if the element of ownership is worth paying that much, let us know why.

[The information follows:]

U.S. GEOLOGICAL SURVEY NATIONAL CENTER
COMPARISON OF RENT COSTS AND LEASE-PURCHASE CONTRACT COSTS
(50 YEAR PERIOD - CONSTANT 1973 DOLLARS)

	50 YEAR COST COMPARISON		
	RENT BASIS	LEASE-PURCHASE BASIS	DIFFERENCE RENT vs LEASE-PURCHASE
ANNUAL PAYMENTS:			
a. First 20 years	$111,800,000 (a)	$132,000,000	$ -20,200,000
b. 21st through 50th year ---	167,700,000 (a)	-0- (b)	+167,700,000
REPAIR AND UPKEEP	-0- (c)	(25,155,000) (d)	(-25,155,000)
a. First 20 years	-0-	5,590,000	-5,590,000
b. 21st through 50th year ---	-0-	19,565,000	-19,565,000
Total 50 Year Cost----------	$279,500,000	$157,155,000	$ +122,345,000
Average Annual Cost----------	$ 5,590,000	$ 3,143,100	+2,446,900
Average Annual Cost/sq.ft.---	$6.55	$3.68	$+2.87

CONCLUSIONS

1. For the first 20 years, the lease-purchase contract costs are $25,790,000 higher than renting, as follows:

a. Difference of 20 years annual payments --	$20,200,000
b. Difference of 20 years repairs and upkeep	5,590,000
Total ----------	25,790,000

2. The 50 years costs on a rental basis are $122,345,000 higher than on a lease purchase basis.
3. The average annual cost on a rental basis, over a 50 year period, is $2,446,900 higher than on a lease-purchase basis.
4. Under the lease-purchase contract at the end of 50 years the Government has the residual value of the land and improvements. The Federal Government owns 105 acres of land on which the Center is being built. The estimated present value is $65,000 an acre. Of the 105 acres 50 were donated to the Government. The other 55 acres were purchased by the Government earlier for approximately $7,000 an acre.

FOOTNOTES:

(a) Based on GSA's estimated total project construction cost of this special purpose facility constructed to the Government's plans and specifications and allowing for a net return of 10% on the owner's investment.

(b) At the end of the 20 year lease-purchase contract term the Government will own the facility.

(c) Repair and upkeep owner's responsibility under the lease.

(d) Based on 1/2 of 1% of the facility construction cost ($55.9 million) for the first 20 years; 1% of the second 20 years; and 1-1/2% for the last 10 years of the 50 year period.

Note: The above costs are exclusive of operation, maintenance, and protection costs which will be the same whether the facility is leased or acquired by lease-purchase contract.

TELEPHONE SWITCHBOARD EQUIPMENT

Mr. McDade. What about this telephone switchboard equipment, $225,000. What is that about?

Mr. Grant. In order to provide service the telephone company has discussed with us their needs for switchboard equipment in the building and the $225,000 is for the master switchboard which will service the telephone network for the entire building that has to be bought either by the General Services Administration, which it is in buildings which are owned or serviced by GSA, or in this case it is going to be a single occupancy, the Geological Survey, so somebody has to meet the cost.

The telephone company simply installs it but we have to purchase the switchboard equipment and that is the cost of it, $225,000.

Mr. McDade. And who will furnish that cost? Is that your own individual cost that the phone company bills to you?

Mr. Grant. The phone company will bill us for $225,000 for the switchboard equipment; yes, sir.

Mr. McDade. How do we know that that is a reasonable cost? That is $225,000. Can you give me some comparison to educate me about that one?

Mr. Grant. Well, we have telephone personnel in the Department of the Interior who have consulted with their equivalent in the General Services Administration who do this all the time and who assure us that that is a fair estimate from the telephone company.

OTHER SPECIAL EQUIPMENT NEEDS

Mr. McDade. Tell me about this $314,000 listed under auditorium will you.

Mr. McKelvey. It is auditorium and additional duplicating equipment, graphics, special messenger equipment.

Mr. McDade. Will you give an explanation for the record. Put in the record a breakdown as to what that is.

Mr. McKelvey. Yes, we will.

[The information follows:]

OTHER SPECIAL EQUIPMENT COSTS

The $314,000 requested will permit us to beneficially use special areas and permit us to provide certain common services in the national center.

$125,000 will be required for a motion picture and sound system including a projection room in the auditorium, which will house approximately 500 people. These improvements have not been included in the construction contract.

$85,000 will be required to equip a duplicating section with multiliths, collators, diazo printer, electrostatic copiers and photo makers to provide reproductive services now provided by the Department.

$34,000 will be required to provide special equipment to move mail in the national center. This will cover automatic mail carts and sort racks for the submail rooms that will be located on all of the seven floors of the building.

$25,000 will be required for the fixtures of a self-service store to hold administrative and laboratory supplies to be used by various survey offices. Special safety lights for photo laboratories and special fire extinguishers for photo laboratories and chemical laboratories will require $15,000.

$30,000 will be required for interior signs, door cards, and locator boards.

Mr. McDade. Thank you.

Mr. Long. Will the chairman yield?

Mrs. Hansen. Yes.

LEASE-PURCHASE AGREEMENT

Mr. LONG. You referred to an arrangement whereby you buy on a lease-purchase basis. At the end of 20 years the Government owns it. Are you free to break the lease before 20 years?

Mr. RADLINSKI. Yes. If we are able to purchase the building before 20 years. Is that what you mean?

Mr. LONG. Yes. Are you free to move out?

Mr. RADLINSKI. Only if there is a violation of the lease conditions.

Mr. GRANT. That is right. We are free to purchase it on 60 days' notice at any time within the 20 years.

Mrs. HANSEN. I doubt that Congress would appropriate funds within 60 days.

Mr. GRANT. We would request funds through the appropriation process, and then give 60-day notice.

Mr. LONG. Tell me why is this done? Is this done to keep the national debt down, so you do not have to float bonds to buy it.

It strikes me that any time you go into a deal like this, it will cost you more money.

I do not see how you can rent a car and buy it later on without costing extra. Why not buy it to begin with? You are paying for it on an installment basis. I am just wondering what implicit interest you are paying and what it is costing the Federal Government to acquire building in this way, in order to keep down the national debt.

Mrs. HANSEN. It is to keep down the size of the yearly appropriation. This procedure has been used in the purchase of post offices. I have been convinced for years that we are purchasing post offices at twice the cost that we should be. Isn't that correct?

Mr. RADLINSKI. Yes.

Mr. LONG. This is another way of saying we are avoiding running into debt if we can keep down our annual appropriation. But you are adding to the longrun cost.

That even allows for interest charges.

[Discussion off the record.]

Mr. LONG. We do not have anything to say whether you buy a building or rent it?

Mr. RADLINSKI. That decision was made many years ago and discussed with this committee and the Senate committee.

Mr. LONG. I meant if a new building went up.

[Discussion off the record.]

EARTH RESOURCES OBSERVATION SYSTEMS

Mrs. HANSEN. You are requesting a reduction of $1,900,000 for EROS. Why are you requesting a decrease when the experiment has apparently been so successful?

Mr. MCKELVEY. Madam Chairman, this has to do with the administration's overall decision with respect to the budget.

Mrs. HANSEN. Stop right there.

I thought EROS was created to eventually save the Government money because of the input of information. You were supposed to be able to develop additional resource knowledge.

Mr. MCKELVEY. That is correct. We are still optimistic that will be the outcome. However, what is being done is to actually stretch out the

time of the experiment and the launch of ERTS–B has been postponed until 1976.

Mrs. HANSEN. This is an effective, useful satellite. We have been able to afford our other space programs.

Mr. MCKELVEY. I cannot speak with reference to a comparison between them.

I think, Madam Chairman, that we should keep in mind that ERTS is an experimental satellite. There are some 300 experiments all told that are part of the overall experiment. Of course, there will be an evaluation of the benefits of the overall experiment.

LAUNCHING OF ERTS–B AND SKYLAB

Mrs. HANSEN. What is the schedule of the launch of ERTS–B and Skylab?

Mr. MCKELVEY. Skylab is to be launched in May and ERTS–B launch is now planned for 1976.

Mrs. HANSEN. Everything is planned for 1976.

Mr. MCKELVEY. This may be one of our bigger firecrackers in 1976.

Mrs. HANSEN. You might be right.

Mr. MCKAY. We certainly will have a lot of fizzles.

Mr. MCKELVEY. I did not mean it in that sense. I think the increased time for an evaluation of the results of these experiments is not bad. We do not think that in the overall this program is going to suffer.

Mrs. HANSEN. You feel you are able to decrease this program by $2 million without any disaster?

Mr. MCKELVEY. No, Madam Chairman. We believe that the budget we are proposing represents a strong program and a good advance.

OIL SPILL INFORMATION

Mrs. HANSEN. The other day I sat in a Coast Guard hearing in the Transportation Subcommittee. They said they do not receive their oil spill information from the Geological Survey. I was surprised at that statement.

Mr. MCKELVEY. At this stage I do not think the capability for the identification of the kinds of spills that are of concern to the Coast Guard, many of which are very small, has developed. Maybe I could ask Dr. DeNoyer to speak to that.

Mr. DENOYER. We have been involved in developing the technology for detecting oil spills primarily from aircraft. The Coast Guard is using this.

NASA is also involved.

Mrs. HANSEN. Eventually you could be involved in this detection program?

Mr. MCKELVEY. Yes, or this technology certainly would be involved.

STATUS OF ECONOMIC EVALUATION PROGRAM

Mrs. HANSEN. What is the status of your economic evaluation program?

Mr. MCKELVEY. May I ask Dr. DeNoyer to comment?

Mr. DENOYER. Madam Chairman, we have a contract with Earth Satellite Corp. and Booz-Allen, to conduct this study. This contract

was signed in February. They are off to a running start. There was a review of the ERTS program in the second week in March and this was their first big input in starting to evaluate the benefits of this program.

UTILIZATION OF ADDITIONAL FUNDING

Mr. McKay. If you had more money, could you increase some of your uses of that program much sooner for the needs you have here, such as topographic mapping, et cetera?

Mr. McKelvey. Do you mean as a part of this program?

Mr. McKay. You have great needs for technology to expand your program of evaluating technological resources and mapping. Suppose out of this program you have a technology that you are evaluating which could in fact accelerate the ends you are after. Is that true?

Mr. McKelvey. EROS and the ERTS we believe will contribute to those two objectives in several of those areas.

That is one of the reasons for the program. We feel it will increase our capability for acquiring information of value in a great many land and resource fields, including agriculture, land use, and so on.

That is the justification.

Mr. McKay. If you received more money, would you have the expertise to expedite and speed up that program before the target date you are setting here?

Mr. McKelvey. The funds that are being cut back here are largely funds relating to a program on an accelerated schedule which has now been cut back.

Mr. Radlinski. An increase in funds would not allow us to speed up any applications of data because ERTS would be delayed. NASA's program would also have to be speeded up. If I may, Congressman, ERTS is not a tool for preparing topographic maps such as we propose in the Geological Survey in the standard program. You can prepare small scale maps but you cannot prepare a topographic map from ERTS data.

Mr. McKay. Isn't that a potential?

Mr. Radlinski. That potential is far into the future. It is not designed for that. It would have to be a follow-on system with a far greater capability and resolution before it would ever be able to be used for the preparation of topo maps.

SIOUX FALLS DATA CENTER

Mrs. Hansen. You are requesting $3,700,000 for the EROS Data Center.

What is the status of the Center?

Mr. McKelvey. The Data Center is under construction but the capability is housed in temporary quarters in Sioux Falls. The Data Center will be completed shortly for occupancy in early June. But in the meantime we are housed in temporary quarters in Sioux Falls and are receiving and distributing and reproducing ERTS data.

Mr. Hansen. What would be the result if this activity were cut?

Mr. McKelvey. That would reduce our operating capability, Madam Chairman. As I said, we are receiving and meeting customer demands for ERTS imagery and for other remote sensing data.

Mrs. HANSEN. How many requests do you receive per year?

Mr. MCKELVEY. May I ask Dr. DeNoyer to speak to that?

Mr. DENOYER. Madam Chairman, the rate of demand has been increasing from initially about 200 orders a month to about 800 a month now. An average order is for 15 frames of imagery.

Mrs. HANSEN. From who do you receive your requests?

Mr. DENOYER. Initially they were largely the Department of Interior. However, at the present time they are about 30 percent Department of Interior, 7 percent other Federal agencies and the rest States, universities, industry, and foreign governments.

Mrs. HANSEN. How much do States, universities, industry and foreign governments pay for the information?

Mr. DENOYER. They pay the costs of reproduction.

Mrs. HANSEN. What are the costs of reproduction?

Mr. DENOYER. There is a standard rate depending on the size of the product.

Mrs. HANSEN. Please insert in the record the rate for each product.

Mr. DENOYER. Yes.

[The information follows:]

Photographic Products Price List

Contact prints, enlargements and transformed prints are unmounted and untrimmed. The reproduction will be printed on standard paper stock unless the order specifies other materials.

PRODUCT	PRICE	
	1 to 25	Over 25*
Black and white paper prints		
Contact prints:		
70mm	$ 1.25	$ 1.00
5 in x 5 in	1.50	1.00
9 in x 9 in	1.75	1.25
10 in x 12 in*	2.50	2.50
20 in x 24 in*	3.00	3.00
Enlargements:***		
20 in x 20 in	3.50	3.00
30 in x 30 in	4.50	3.50
40 in x 40 in	9.00	8.00
Black and white film transparency		
Contact prints:		
16 mm (100 ft. roll)	15.00	15.00
35 mm (100 ft. roll)	20.00	20.00
70 mm	2.50	2.50
5 in x 5 in	2.75	2.75
10 in x 10 in	3.00	3.00
Color paper print		
Contact prints:		
70 mm	4.00	2.50
10 in x 10 in	7.00	3.00
Enlargements:***		
20 in x 20 in	12.00	9.00
30 in x 30 in	17.00	13.00
40 in x 40 in	25.00	20.00
Color film transparency		
Contact prints:		
16 mm (100 ft. roll)	20.00	20.00
35 mm (100ft. roll)	25.00	25.00
70 mm	4.00	2.50
10 in x 10 in	7.00	4.00
Enlargements:***		
20 in x 20 in	15.00	8.00
30 in x 30 in	19.00	15.00
40 in x 40 in	27.00	22.00
Transformed prints from either convergent or transverse low-oblique photographs	3.50	3.00

*Quantity prices apply only to those prints ordered in excess of 25 of the same size, i.e., 26 contact prints cost: 25 at $1.75 each — $43.75 plus 1 at $1.25 - $45.00

**Photo indexes

***For an intermediate-size enlargement, use the price listed for the next larger size.

ADDITIONAL FUNCTIONS OF DATA CENTER

Mr. RADLINSKI. Madam Chairman, may I add something on the data center? It is not only a place for the dissemination of ERTS data, we also at the data center will be disseminating aircraft data from the mapping program of the GS and from the aircraft program of NASA. That is going to be the central place in the United States for the public to acquire not only ERTS data but also aircraft.

Mrs. HANSEN. How much is NASA providing for this program?

Mr. RADLINSKI. They are not putting anything into the program. They are providing the film.

Mr. MCKELVEY. Of course, they are a major supporter of the ERTS experiment itself.

BALTIMORE CANYON STUDY

Mr. LONG. Are you conducting surveys of the Baltimore Canyon as a possible future site for selling oil leases? Have you conducted exploratory drilling as part of these surveys? If so, what have you found? How certain are you that large deposits of oil will be found in the Baltimore Canyon? When will your surveys be completed? Tell us what types of surveys you have conducted and some of your findings. Are these types of surveys also being conducted off the coasts of California and Alaska?

Mr. MCKELVEY. The U.S. Geological Survey is not currently conducting any geologic or geophysical surveys in the Baltimore Canyon portion of the Atlantic OCS. The Geological Survey has an established program, the Atlantic OCS study group, currently investigating the resource potential of the Baltimore Canyon area. The preliminary Atlantic OCS studies will be completed this fiscal year. The study indicates the presence of geologic structures and stratigraphic traps with potential for hydrocarbon entrapment. However, only exploratory drilling will determine the presence or absence of oil and/or gas. The Geological Survey has not to date conducted any exploratory drilling on the Atlantic OCS. Similar studies are underway for southern California and portions of the Alaska OCS areas.

LARGE SCALE MAPPING

Mr. LONG. When will your large scale mapping in Baltimore be completed? What does your preliminary study involve? Is this just for the city of Baltimore or for the city and surrounding suburbs?

Mr. MCKELVEY. The large scale mapping proposed in the Baltimore area, and other metropolitan areas, is part of a study to determine the types of maps or related cartographic data that will better serve the functions performed by the agencies of cities. We plan to conduct this research in cooperation with local governments selected on the basis of their potential value to the study. The city of Baltimore presently has large scale coverage at 1:1,200 scale (1 inch on the map equals 100 feet on the ground). A pilot project is tentatively scheduled in a suburban area of Baltimore (Howard County) and, depending upon the results of this project, the entire Baltimore suburban area would be considered for large scale mapping at some later date.

TRANS-ALASKA PIPELINE

Mr. LONG. In light of the fact that the permit for a Trans-Alaska pipeline is currently tied up in the courts, are you conducting any studies of an alternate route?

Mr. MCKELVEY. Studies by the U.S. Geological Survey of alternate routes were prepared in support of the Department of Interior's analysis of alternatives to the Trans-Alaska pipeline. We are also completing engineering geologic strip maps, at a scale of 1:125,000, of prospective routes for pipelines between Prudhoe Bay and the Canadian border in the event that an application for a gasline to connect with the proposed Mackenzie Valley pipeline system should be received.

Mr. LONG. I note that you are requesting $850,000 for fiscal year 1974 for Alaska pipeline related investigations. Do you plan to carry out these investigations even if the court of appeals decision against the permit for the Trans-Alaska pipeline is allowed to stand?

Mr. MCKELVEY. In fiscal year 1974, studies by the Geological Survey will be restricted to matters concerning already identified and unresolved problems related to the delineation of potentially active faults, the continued collection of baseline hydrologic data, and to data analysis and final map completion which would be lost if abruptly terminated. No new investigations will be initiated unless, or until, the matter clears the courts, if the permit is not issued during fiscal year 1974, only about $470,000 would be expended and the remainder would be returned to the Treasury.

BALTIMORE-WASHINGTON URBAN AREA STUDY

Mr. LONG. Exactly what area will your Baltimore-Washington urban area study cover? What is the status of the study? What types of work are you doing in the study and what will it be used for?

Mr. MCKELVEY. The area covered by the Baltimore-Washington study includes over 5,000 square miles and comprises the standard statistical metropolitan areas of Baltimore and Washington; that is, in addition to the District of Columbia, it includes the counties of Carroll, Baltimore, Harford, Anne Arundel, Howard, Montgomery, Prince Georges, Loudoun, Prince William, and Fairfax. Initially, Calvert, Charles, and Frederick Counties were included in the plan but with the present level of activity this additional work can not be done for many years.

As for the present status of work, geologic studies of Montgomery County, begun in the fall of 1971, are in the final stages of preparation. Hydrologic studies in that county have just begun. A new topographic map is nearly ready for publication. In Baltimore County geologic studies, performed under a grant to the Maryland Geological Survey, are about two-thirds completed and hydrologic studies have been started in that county. Geologic studies have recently been started in Prince Georges and Fairfax Counties. The planned program is less than 10 percent completed.

The type of work being done is to prepare and publish maps and reports at scales suitable for planning purposes showing, particularly,

geologic features of each county that represent valuable resources, features that may be construction hazards, or features that may influence planning decisions for other reasons. Also to be shown are hydrologic conditions related to planning such as flood-prone areas, potential contamination of groundwater and unsewered areas, and the potential for increasing groundwater supplies in bedrock areas. The work involves mainly compilation of existing data but also includes obtaining new field data where existing information is inadequate.

The published products of the study will be prepared for use by planning officials and the general public to aid in the understanding of the natural environment and to assess the possible effects of man-made changes in the environment. The scales are chosen so as to provide an overview of each county and to suggest possible problems rather than to guide the actual development at specific sites where it is assumed that more detailed information will commonly be needed. The publication should provide a valuable reference to such topics as the location of natural construction materials, unstable rock formations, pollution hazards, and many other natural conditions that affect economic land use and development as well as safety and the quality of life.

EROS PROGRAM

Mr. EVANS. What have been the effects of NASA cutbacks on ERTS experiments and on the plans for ERTS–2?

Dr. MCKELVEY. The deferral of the launch of ERTS–B until 1976 has delayed review of proposed ERTS–B experiments. This delay will defer some important experiments and will slow implementation of an operational system and resultant benefits.

ERTS–B was configured as a backup for ERTS–1 and was scheduled for launch in November 1973. It had been hoped that if ERTS–1 were successful, ERTS–B could be modified to include a fifth data channel (thermal infrared) in the multispectral scanner. Technological difficulties have delayed this proposed modification. The present schedule calls for providing this capability on the ERTS–B spacecraft to be launched in 1976.

Mr. EVANS. Why is the budget request for EROS almost $2 million less for fiscal year 1974 when it would appear that additional funds would be necessary to permit the full range of ERTS experiments to take place, to equip the next ERTS satellite with the sensors that are needed to perform more sophisticated investigations, and to reduce the time that will elapse between the demise of ERTS–1 and the launch of ERTS–2?

Mr. MCKELVEY. General fiscal constraints have forced a reduction in the EROS budget for fiscal year 1974. NASA is funding the development of the sensors needed to perform more sophisticated investigations and will continue to do so in the experimental program. However, the EROS budget reduction will stretch out our experimentation with ERTS and Skylab data but there are advantages as well as disadvantages in that.

A prolonged data hiatus between the demise of ERTS–1 and the launch of ERTS–B—if that should occur—would limit our ability to demonstrate the value of ERTS data to time varying phenomenon such as changes in vegetation characteristics, surface water distribution, and changes in snow cover distribution.

Mr. EVANS. What additional benefits could be expected from increased funding?

Mr. MCKELVEY. Additional funding would permit (1) improvement in service to the user community in providing data products and training at the EROS Data Center; (2) continuance of ERTS experiments already underway; (3) initiation of a few new experiments of high merit; (4) implementation of experiments designed to test the value of the highly sophisticated data to be derived from Skylab; and (5) acceleration of the benefits analysis of a follow-on ERTS-type system being conducted by the EROS program on behalf of the Federal community.

MINERAL RESOURCE SURVEYS

Mr. EVANS. In light of projected shortages in our gas and oil supplies, can the same level of funding for mineral resource surveys in fiscal year 1974 as we have in fiscal year 1973 be adequate to do the job?

Mr. MCKELVEY. In consideration of the national need to make optimum but conservative use of available funds, the level of funding available for mineral resources surveys in fiscal year 1974 will permit significant progress to be made toward long-range improvements in easing the shortage of domestic oil and gas supplies.

Mr. EVANS. What specific efforts does U.S. Geological Survey have underway to increase energy supplies?

Mr. MCKELVEY. The U.S. Geological Survey has underway the following specific efforts aimed at increasing energy supplies: regional geophysical and geological resource investigations of the Outer Continental Shelves, particularly portions of the Gulf of Mexico, the Bering, Chukchi, and Beaufort Seas off Alaska, parts of the Gulf of Alaska, the southern California borderland, and the undeveloped northern Atlantic continental margin; intensive efforts to identify minable resources of low-sulfur coal, both in central and southern Appalachia and in the northern Rocky Mountain coal fields, together with ongoing mapping and evaluation of Federal coal lands in the Rocky Mountain States; systematic investigations of rocks favorable for the occurrence of uranium and/or thorium, especially in the Rocky Mountain region and Texas; studies of the resources of oil shale, with emphasis on those in the northern Rocky Mountain region beneath Federal lands, and on geologic factors that may be of environmental concern in any future extraction process; and basic and regional investigations to identify new prospective geothermal areas of the Western States and to evaluate the known prospective areas, particularly in California.

Mr. EVANS. How is the Survey effort to find new energy sources being coordinated with other Federal agencies?

Mr. MCKELVEY. The Survey is the lead agency of the Government responsible for investigations of the geological and mineral resources of the Nation. Our efforts to identify new resources of energy minerals are coordinated with related efforts of other Federal agencies at both the working and the policy levels through formal liaison relationships, informal contacts, and through the normal channels of communication by publication of results.

Mr. EVANS. How is the data collected?

Mr. McKelvey. Energy resource data are collected in many ways during the course of scientific field investigations and evaluation surveys, through literature research, and by study of proprietary and publicly available data from industrial and other private sources. Under the OCS regulations industry is required to submit all geologic, geophysical, and engineering data collected or developed under lease operations to the Federal Government. Under geologic and geophysical permits issued for exploration of unleased OCS lands, industry is required to submit to the Government the results of their geologic work, samples, core drilling, and so on. The Government does not require industry to submit copy of the records developed under geophysical permits on the OCS. Geological Survey collects OCS data through in-house programs and by contract purchase.

OIL SHALE

Mr. Evans. What research has the USGS conducted on oil shale development?

Mr. McKelvey. Research on oil shale by the USGS has been directed primarily toward the stimulation of its commercial development. Recent outgrowths of this research have been a 1972 resource appraisal of the 30-gallon per ton oil shale (presumed to be the minimum to be considered in an initial commercial venture) in the Green River Formation and the delineation of the areal extent of the minerals nahcolite (sodium bicarbonate) and dawsonite (sodium aluminum carbonate) associated with zones of rich oil shale in the Piceance Creek basin of Colorado. These minerals not only provide an economic incentive by doubling the value of the mined rock, but may prove to be extremely valuable environmentally in air and water pollution control.

Mr. Evans. How is the USGS program specifically tied into the development of our oil shale resources?

Mr. McKelvey. The USGS has participated in the Department of the Interior's prototype oil shale leasing program from its inception, including the monitoring of exploratory core drilling prior to and following the selection of the lease tract, and in contributing to the draft in final environmental impact statements. A 2-year water study is underway in the Piceance Creek basin, Colo., which involves the determination of the quantity and quality of the surface and ground water of the basin, stream gaging, packer testing of core holes in wells drilled for oil and gas, and water quality sampling and analysis. The study indicates that there may be as much as 25 million acre-feet of ground water of varying quality available for use for a large-scale oil shale industry. Related studies suggest that the first underground mine near the oil shale area may have to pump as much as 40 cubic feet per second to maintain a dry mine and that the quality of this pumped water might have a significant effect in increasing the salt loading of the Colorado River system. Other areas appear to be potentially short of ground water and, thus, alternative sources of supply will need to be developed. In addition, the USGS is making a mineral resource appraisal of both Federal and fee land by surface and subsurface mapping to determine the equitability of a land exchange.

The USGS has supervised the oil shale test drilling, made inspections to enforce reclamation requirements, participated in developed environmental stipulations for preparing the environmental impact statement, and will exercise full authority for supervising operations under lease.

Mr. EVANS. What exploration efforts have been directed toward finding previously unknown deposits of oil shale?

Mr. MCKELVEY. During long term nationwide studies of other mineral or energy sources, geologists of the Geological Survey have sampled likely or suspected deposits of oil shale. These studies have shown that there are many large deposits of low-grade oil shale in the United States but the only deposit of immediate commercial interest is the thick, high-grade oil shale in the three-State area of Colorado, Utah, and Wyoming. The greatest benefits to an oil shale industry would come from a concentrated evaluation of these high-grade deposits. A detailed delineation of these Green River deposits is being made in these States. New techniques have been developed for determining the location of the richest and thickest buried deposits. Studies of the thickness, depth, and lateral extent of deeply buried and therefore less-known oil shale deposits have been planned. Potentially valuable minerals associated with the oil shale have been discovered and the quantity and extent of these minerals is partially evaluated.

OFFSHORE OIL DRILLING

Mr. EVANS. Will your monitoring effort be adequately staffed and funded to deal with the increased offshore drilling planned and underway?

Mr. MCKELVEY. Yes. The proposed accelerated leasing program will be supported by the requested increase which includes $700,000 for the contract purchase of deep and shallow focus seismic data in the Gulf of Mexico; $340,000 and 17 positions for interpretation and analysis of the basic data; and $730,000 and 29 positions for lease management which will be used for expanded OCS safety and pollution control work and for increasing our inspection and review capability on the OCS. This will enable us to maintain and improve our current level of OCS inspection and review capability while handling an increased offshore drilling program.

Mr. EVANS. Are proper measures being taken to safeguard against a reoccurrence of a Santa Barbara type of blowout or a Gulf of Mexico type of fire?

Mr. MCKELVEY. The Outer Continental Shelf Lands Act of 1953 is the basis for the Federal regulatory authority over the offshore oil industry. In 1969, after the Santa Barbara incident, the existing regulations of the Secretary of the Interior governing operations by lessees were revised and strengthened. Of equal importance, the OCS Orders, which have the force of regional regulations, have been expanded and made more stringent. These orders are under continuous review and changes are made when necessary.

By increasing the Geological Survey's inspection force, by providing helicopters and radio communication facilities, and by devising a systematized inspection procedure, the enforcement of regulations and OCS orders has significantly improved since 1969. This has re-

duced incidents of noncompliance with regulations and orders to low levels.

RALI PROGRAM

Mr. EVANS. Many of your traditional programs have been cut to provide redirected funds for the RALI program. What will this new program accomplish that the old ones did not?

Mr. MCKINNEY. Our objective in the RALI program is to explore and develop means permitting more effective use of resource and land information including, and especially at this stage, topographic, hydrologic, and geologic information of the kinds being collected in the programs from which the RALI funds are being directed. We are finding the need not only to make such information more readily available, but to put it into more understandable terms, and into systems in which multidisciplinary data can be used in an interactive manner to solve complex problems. In short, RALI should provide a far more usable and effective information base for policymaking, planning, and decisionmaking than component programs do now.

Mr. EVANS. Will this new effort be more effective in dealing with land use problems?

Mr. MCKELVEY. Yes. The solution to many land use problems requires effective analysis of complex data on the character of the land, its subsurface, and physical and biologic resources. Resources and urban development, for example, often involve complex interactions of land, water, vegetation, and wildlife which can best be analyzed, interpreted, and predicted by the multidisciplinary computer modeling and other improved products and services under study in the RALI program. The central purpose of the RALI program, in fact, is to provide better means than are now available to analyze and solve land use, resources development, and environmental conservation problems.

GEOTHERMAL LEASING

Mr. EVANS. With geothermal leasing about to begin and extensive surveys of geothermal areas being planned, how can USGS meet its responsibilities in this area without additional funds?

Mr. MCKELVEY. When the budget request for fiscal year 1973 was drawn up, it was fully anticipated that leasing would begin sometime during that fiscal year. For this reason, funding in an amount adequate to meet the needs for prelease evaluations was requested. This year's funding in this area has been used specifically in evaluating applications for grandfather clause areas, in verifying development claims, in helping draft the environmental impact statement, aiding in finalizing both the leasing and operations regulations, and in making field studies with BLM of KGRA's and prospectively valuable areas.

Mr. EVANS. Please discuss your budget request in light of your program and the schedule for geothermal leasing.

Mr. MCKELVEY. It is my understanding that geothermal leasing is to begin early in fiscal year 1974.

In part, however, our geothermal resources program proceeds independently of the issuance of leases since it relates to preleasing activities such as developing evaluation data and exploration techniques through geologic, geochemical, hydrologic, and geophysical studies.

The program still continues as four basic elements which are as follows:

1. Supervision of operations on geothermal leases, the continuation of the classification of mineral retention areas for geothermal resources, and the establishment of prospectively valuable and known geothermal resource areas. Continuation with the preleasing activities leading to the issuance of leases.

2. Development and testing of geophysical, geochemical, hydrologic, and geologic techniques for identifying and evaluating geothermal areas and prelease evaluation of prospectively valuable areas.

3. Reconnaissance exploration of the United States for geothermal resources.

4. Monitoring and evaluating the environmental effects of geothermal developments.

TRANS-ALASKA PIPELINE

Mr. EVANS. Have you or are you developing any data that would be useful in evaluating alternatives to the Trans-Alaska Pipeline proposal?

Mr. MCKELVEY. In support of the Department of Interior's analysis of alternatives to the Trans-Alaska Pipeline, the U.S. Geological Survey prepared a report entitled "Existing Environment of Natural Corridors from Prudhoe Bay, Alaska to Edmonton, Canada." (104 pp. one map at a scale of 1:5 million). This report describes the topography, drainage, vegetation, surficial geology, bedrock geology, permafrost, seismicity, and climate along five prospective alternative pipeline routes.

Mr. EVANS. Are you developing data in anticipation of other right-of-way applications, such as a gasline?

Mr. MCKELVEY. Published engineering geologic strip maps, at a scale of 1:125,000, of the Trans-Alaska pipeline route would be suitable for the evaluation of a prospective parallel gasline route occupying the same transportation corridor. We are completing engineering geologic strip maps, at a scale of 1:125,000, of prospective routes for pipelines between Prudhoe Bay and the Canadian border in the event that an application for a gasline to connect with the proposed Mackenzie Valley pipeline system should be received.

STRIP MINING

Mr. EVANS. How are you carrying out your responsibilities in areas where there is strip mining?

Mr. MCKELVEY. Before any operations commence on leased or permit land, the operator must submit and receive approval of his plan from the mining supervisor. The mining plan shows how the operations will be performed in order to comply with lease terms, stipulations, and operating regulations and how the land will be reclaimed. The mining supervisor consults with land management agencies and other Federal, State, and local agencies who have expertise in protecting the non-mineral resources prior to approving mining plans to assure that the operations will have the least physical impact on the environment. During operations, the mining supervisor makes compliance inspections and issues any orders necessary to require compliance. The

Survey keeps abreast of reclamation techniques and continually refines its mine plan requirements and improves its standards for reclamation.

Mr. EVANS. What are your requirements for land reclamation, for restoring the land?

Mr. MCKELVEY. The Geological Survey participates with the surface managing agencies in making technical examinations prior to permit or lease issuance to determine the effects exploration or mining will have on the lands and the environment. Based on the technical examination, stipulations are developed jointly which are included in the lease or permit. The stipulations are designed to protect nonmineral resources; to prevent or minimize air and water pollution and soil erosion during exploration and mining operations; and to assure proper reclamation of the lands affected by such operations. These stipulations can be of a general nature or very specific in certain cases depending on the environmental values involved.

After a lease or permit has been issued, operations are not approved by the mining supervisor unless they meet the requirements of applicable Federal and State laws, regulations or guidelines and best conservational practices.

SUNDRY ACCOUNTS

Mrs. HANSEN. We will insert justification pages 71 through 75 in the record at this point.

PERSONNEL SUM[illegible]

	Actual 1972	Estimate 1973	Estimate 1974
Total number of permanent positions	5,759	5,799	5,849
Full-time equivalent of other positions	618	707	724
Average number of all employees	6,410	6,506	6,573
Average GS grade	9.6	9.6	9.6
Average GS salary	$ 15,016	$ 15,106	$ 15,082
Average salary of ungraded positions	$ 11,580	$ 11,580	$ 11,580

ITEMIZATION OF ESTIMATE

Department of the Interior
Appropriation Title: Surveys, Investigations, and Research

	Actual 1972	Estimate 1973	Estimate 1974	Increase (+) or Decrease (-)
Program and Financing				
Total obligations	130,951,616	148,334,776	156,005,000	+7,670,224
Recovery of prior year obligations	-169,270	-5,000	-5,000	--
Unobligated balance available, start of year	-1,203,271	-1,279,776	-400,000	+879,776
Unobligated balance available, end of year	1,279,776	400,000	400,000	--
Unobligated balance lapsing	120,349	3,000,000	--	-3,000,000
Budget authority	130,979,200	150,450,000	156,000,000	+5,550,000
Budget authority:				
Appropriation	131,050,000	150,450,000	156,000,000	+5,550,000
Transferred to other accounts	-70,800	--	--	--

	Actual 1972	Estimate 1973	Estimate 1974	Increase (+) or Decrease (-)
Obligations by Objects				
11 Personnel compensation	$ 90,303,306	$ 95,266,000	$ 97,532,000	$ +2,266,000
12 Personnel benefits	8,418,666	8,914,000	9,860,000	+946,000
13 Benefits for former personnel	2,404	--	--	--
21 Travel and transportation of persons	4,305,643	4,427,000	5,209,000	+782,000
22 Transportation of things	1,504,994	1,761,000	2,038,000	+277,000
23 Rent, communications, and utilities	5,631,368	6,676,000	9,860,000	+3,184,000
24 Printing and reproduction	1,718,774	2,181,000	2,200,000	+19,000
25 Other services	9,785,373	19,047,235	19,255,000	+207,765
26 Supplies and materials	5,200,778	5,369,000	5,049,000	-320,000
31 Equipment	3,582,280	3,359,000	4,634,000	+1,275,000
33 Investments and loans	137,000	248,541	84,000	-164,541
41 Grants, subsidies and contributions	348,944	378,000	279,000	-99,000
42 Insurance claims and indemnities	14,666	7,000	7,000	--
Allocation to General Services Administration Facilities	-	702,000	--	-702,000
Subtotal	130,954,196	148,335,776	156,007,000	+7,671,224
Quarters and subsistence charges	-2,580	-1,000	-2,000	-1,000
Total obligations	130,951,616	148,334,776	156,005,000	+7,670,224

Authorization for Purchase of 25 Passenger Motor Vehicles, for Replacement Only

The vehicles requested are used to transfer men and equipment over all types of roads and terrain and in all kinds of weather, in the conduct of the field work of the Geological Survey. These vehicles must provide dependable service at all times, since a great deal of the transportation required is in areas where repair services are not available. Field use tends to shorten the efficient life of a vehicle.

The 25 vehicles to be replaced, as shown below, will meet or exceed the age or mileage replacement standards prescribed by the General Services Administration, and can no longer give dependable and economical service. The vehicles will be used in areas not serviced by vehicle pools maintained by the General Services Administration.

	Sedans	Station Wagons	Total
Replacements based on:			
Mileage			
60,000 - 80,000	3	6	9
80,000 or over	5	7	12
Age	1	3	4
Total	9	16	25
Total passenger vehicles owned by Geological Survey	55	103	158

Miscellaneous Services to Other Accounts

Miscellaneous services performed for other Federal agencies and the public, on a reimbursable basis, by central services units of the Geological Survey are summarized below:

	Actual 1972	Estimate 1973	Estimate 1974
Electronic data processing and related services	$1,511,033	$1,894,000	$2,467,000
Map reproduction services for other agencies	96,127	98,000	103,000
Sale of maps to other agencies	251,523	244,000	252,000
Sale to the public of photographs and copies of records (43 U.S.C.45)	21,773	22,000	22,000
Property maintenance services and sale of material from stock to other Federal agencies	147,008	84,000	86,000
Total central services reimbursable program	2,027,464	2,342,000	2,930,000

Central Services and Consolidated Accounts

Services to Geological Survey programs, similar to those rendered to other agencies, as well as motor vehicle fleet operations and other common-use services, are financed for reasons of economy through central service and consolidated accounts. Charges initially made to these accounts are ultimately charged to the activity benefited.

The actual costs of these services for 1972 and the estimates for 1973 and 1974 and their distribution by activity, are summarized below:

Central Services	Actual 1972	Estimate 1973	Estimate 1974
Electronic data processing and related services	$4,862,078	$5,766,000	$6,445,000
Map reproduction	3,603,828	3,866,000	3,867,000
Editing and illustration of publications	3,350,793	3,405,000	3,405,000
Distributing of maps and reports, response to public inquiries and related functions	3,711,951	3,995,000	4,065,000
Property maintenance and instrument development	664,857	662,000	693,000
Payroll services for other bureaus	75,977	31,000	31,000
Total central services	16,269,484	17,725,000	18,506,000

	Actual 1972	Estimate 1973	Estimate 1974
Consolidated Accounts			
Motor vehicle fleet operation	$ 906,309	$ 900,000	$ 880,000
Rental and maintenance of certain facilities at headquarters and field centers	1,624,028	1,742,000	1,880,000
Warehouse stock of common-use supplies and materials	695,672	766,000	839,000
Survey's proportionate share of departmental charges, Safety Committee, and contingencies arising from operation of field centers	463,491	571,000	689,000
Total consolidated accounts	3,689,500	3,979,000	4,288,000
Grand Total	19,958,984	21,704,000	22,794,000
Distribution by activity:			
Topographic surveys and mapping	6,073,736	6,794,000	6,805,000
Geologic and mineral resource surveys and mapping	6,022,296	6,334,000	6,701,000
Water resources investigations	4,210,036	4,289,000	4,354,000
Conservation of lands and minerals	543,731	922,000	943,000
Earth resources observation systems	235,043	339,000	371,000
General administration	846,678	684,000	690,000
Miscellaneous services to other accounts	2,027,464	2,342,000	2,930,000
Total	19,958,984	21,704,000	22,794,000

Mr. McKelvey. Madam Chairman, we have some additional charts. We do not need to take your time now but I wonder if you would like to have them incorporated in the record with captions.

Mrs. Hansen. Yes, we will look at them now.

USES AND IMPACT OF ORTHOPHOTOQUADS

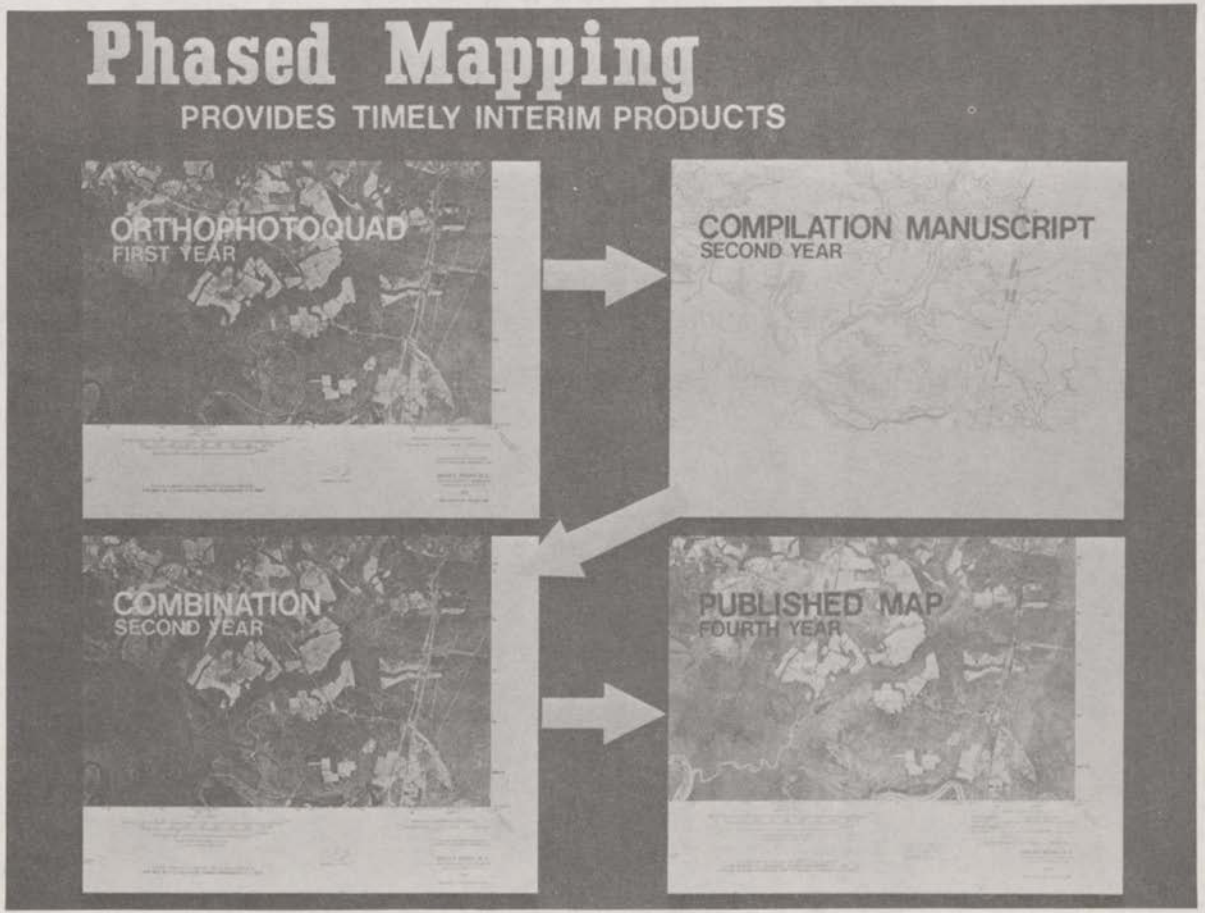
Mr. McKelvey. We have a number we can show you.

Shown on the left here is the Orthophotoquad, which was developed by the Geological Survey in recent years.

[The chart follows:]

PHASED MAPPING

This exhibit shows a three-phase mapping procedure which can provide the map user with a useful interim product in a short period of time. The first phase is an orthophotoquad which can be available in the first year. In the second phase, a contour compilation is prepared and combined with the orthophotoquad to provide the next product. The final phase is the published multicolor topographic map or orthophotomap which is available during the fourth year.


Phased Mapping
PROVIDES TIMELY INTERIM PRODUCTS
ORTHOPHOTOQUAD
FIRST YEAR
COMPILATION MANUSCRIPT
SECOND YEAR
COMBINATION
SECOND YEAR
PUBLISHED MAP
FOURTH YEAR

Beginning with this product we are considering a system of phased mapping to make available maps at earlier stages in the map-making process than they would be made available otherwise. We can make the orthophotoquad in about a year, whereas it takes about 4 years to make the complete standard topographic map that is shown on the bottom right hand corner.

So by making available the photoquad in the first year, we have made available what is essentially a map picture of the Earth's surface that is useful in land use planning and many other activities. Then in the normal process of the making of the standard map, we develop the topographic information itself, in the form of contours and other data on the configuration of the Earth's surface. We can make that available in manuscript form so that it can be superimposed onto the orthophotoquad, so that the combination of those two is available in the second year, and then go on to the completion of the final topographic map. But in the meantime, we have provided 3 and 2 years earlier, respectively, map products for the public's use in advance of when we could do them otherwise.

LAND USE MAPPING

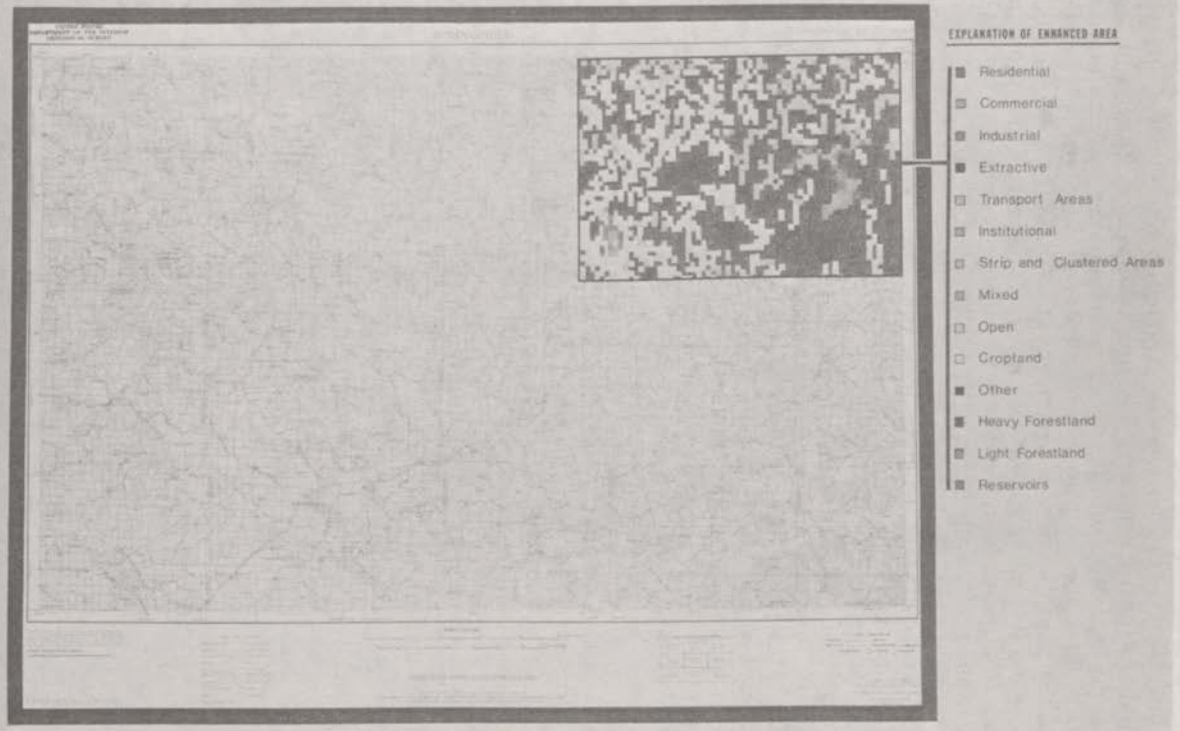
We are developing a capability in land use mapping that is illustrated on this chart.

[The chart follows:]

COMPUTERIZED MAP OF LAND USE IN SPRINGFIELD, MO.

This map is based on land use information compiled from remote sensor sources and digitized for computer handling to facilitate comprehensive planning in the Ozarks area.

COMPUTERIZED MAP OF LAND USE IN SPRINGFIELD, MISSOURI



COOPERATIVE EFFORT WITH THE OZARK REGIONAL COMMISSION (ARKANSAS, MISSOURI, LOUISIANA, OKLAHOMA AND KANSAS)

Dr. McKelvey. Dr. James Anderson, our Chief Geographer, in collaboration with others, has developed a system of land use classification that we are attempting to have serve as a standard for the entire land use mapping community. It involves several levels of classification, the first of which could be done from satellite imagery; the second from high-altitude aircraft imagery. The more detailed levels, three and four, would be done at much larger scales by the local community. This particular map is at a scale 4 miles to the inch in the Springfield, Mo., area.

All of this information has been put into a computer and the map itself printed by a computer. The detail of it is difficult to read at this distance.

Mr. Radlinski. It is just the overlay information that is computer printed, map information, not the base.

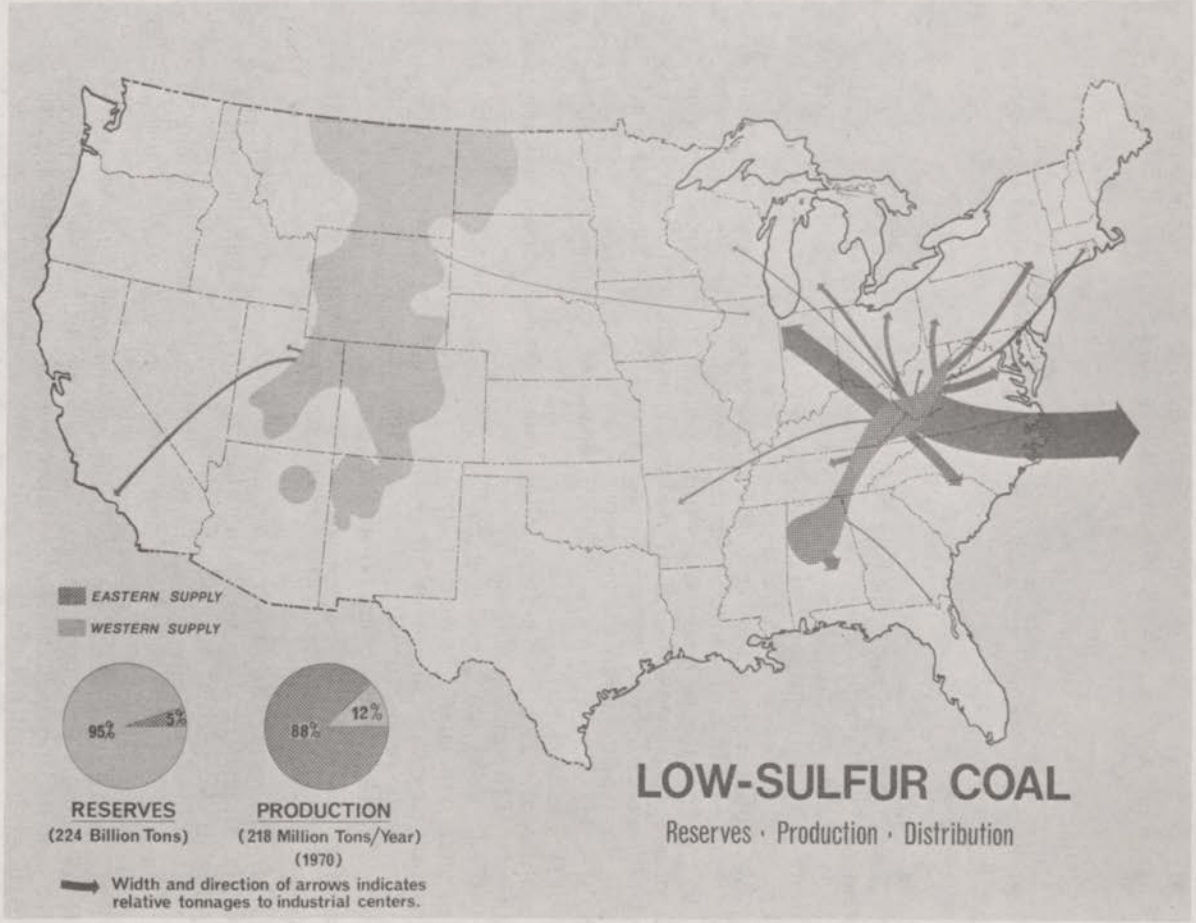
Mr. McKelvey. Yes. We have enhanced the patterns in the upper quadrant so you can see it more readily. This capability makes possible very rapid and complex analyses of the form in which the land is presently used, which is the beginning of land-use planning and land-use analysis.

LOW-SULFUR COAL

We talked about the coal problem earlier. This chart shows the distribution of low-sulfur coal in the United States.

(The chart follows:)

The majority of the low-sulfur coal reserves in the United States are located far from the present major points of consumption. Reserves of low-sulfur coal are inadequate in the highly industrialized Eastern States. The large deposits in the Western States, many of which are publicly owned, are presently being explored and developed.


EASTERN SUPPLY
WESTERN SUPPLY
95%
5%
88%
12%
RESERVES
(224 Billion Tons)
PRODUCTION
(218 Million Tons/Year)
(1970)
Width and direction of arrows indicates relative tonnages to industrial centers.
LOW-SULFUR COAL
Reserves · Production · Distribution

Mr. McKELVEY. The coal in the Western United States is shown in blue (solid color in exhibit 17) and in the Eastern United States in red (cross hatch on exhibit).

Mrs. HANSEN. Is the coal in Montana, Colorado, Wyoming, and Utah mined by deep mining or strip mining?

Mr. McKELVEY. It is both. Shown on the chart are low-sulfur coal both near surface and available for mining underground. As shown in the pie diagram below——

STRIP MINING

Mrs. HANSEN. Which type of mining is predominant? I am sure you realize that there are many perplexing questions being asked. Shall all strip mining cease in the United States? Will the cessation of strip mining force all mining to be done by deep mining? These questions are being discussed every day.

Mr. McKELVEY. In the Western United States there are large quantities of coal that are suitable for strip mining, providing mining can meet environmental standards. With respect to the total resource, I suspect that the bulk of it, if we are considering coal regardless of depth, would have to be mined underground. But the amounts available close to the surface are enormous.

Mrs. HANSEN. Do you have any problems of earthquakes throughout this entire area?

Mr. McKELVEY. Every State in the Union has had earthquakes, but in most of this area seismic activity is low.

Western Wyoming and eastern Utah would be a notable exception to that. The chart shows that the bulk, or about 95 percent of the country's reserves, of low-sulfur coal are in the Western United States, whereas the production diagram shows that 85 percent of the production of low-sulfur coal comes from the East.

COAL RESERVES IN THE EAST

Mrs. HANSEN. How much of our coal reserves are in the East?

Mr. McKELVEY. I do not have at the tip of my tongue the total reserve. It is 5 percent of 390 billion tons.

Mrs. HANSEN. Actually, when we are talking about coal problems in West Virginia, you are talking about 5 percent of the Nation's reserves?

Mr. McKELVEY. That is correct. the eastern coal is 5 percent. We think there is some potential for the discovery of low sulfur coal in the eastern United States and we have some of our program directed to the exploration of that.

The country's coal problem is rather neatly summarized on his chart. Most of the coal resources is in the part of the area where the least of it is used.

Mrs. HANSEN. It is largely in public lands.

Mr. McKELVEY. A great part is in public lands.

Mr. SHELDON. In the eastern coal field, there are 22 billion short tons of recoverable identified resource. That compares with about 390 billion for the whole United States.

The eastern coal reserve would be somewhere around 5 percent.

Mrs. HANSEN. What part of the Nation's energy supply is based upon present use of coal and what is the estimate if OCR's research is successful?

Mr. MCKELVEY. Presently coal supplies about 22 percent of the total energy consumed in the United States. As we showed with one of the other charts earlier, it has an enormous potential.

The problem is to produce that coal and consume it in ways that are environmentally acceptable.

If the research on the development of technology——

COAL RESERVES

Mrs. HANSEN. Based on current use, how long will that coal last?

Mr. MCKELVEY. We are using about 600 million tons a year. It would be 500 years, at least, for what is shown here, and there is a coal potential in addition to what is shown. When we think of our total resources of coal—high-sulfur, low-sulfur, rich, lean, shallow, deep—it is of the order of 3 trillion tons.

Mrs. HANSEN. How long would our coal reserves last if it were 50 percent of the total energy consumed?

Mr. MCKELVEY. We can supply that arithmetic.

[The information follows:]

COAL RESERVES

If coal reserves are used as 20 percent of total energy consumed at the present level, 377 years' supply remained as of 1971 (making no allowance for possible future restrictions that might result from changes in strip mining regulations or sulfur emission standards). If coal were to comprise 50 percent of total energy consumed at the present level, 1971 reserves would suffice for 150 years.

Following World War II, coal consumption decreased as markets were lost to fuel oil and natural gas. Since 1960, coal consumption has increased as oil and gas supplies tightened and the anticipated rapid growth in nuclear power generation did not materialize. Coal consumption is now stabilized at about 18 percnet of total energy requirements and is anticipated to remain at about this level until about year 2000. Such forecasts do not reflect the fact that patterns of coal consumption will undoubtedly shift rapidly due to rapid depletion of known oil and gas reserves, restrictions on oil and gas imports for security reasons, and probable rapid increase in coal use for direct energy use and indirectly, for gasification and liquefaction. Neither do the forecasts reflect future shifts in environmental protection regulations.

Mr. MCKELVEY. In looking at the future, when we say the life of reserves or life of resources at present rates of consumption, what has happened in the past is that the present rate of consumption has been doubled every 10 or 15 years, depending on the resource.

ERTS IMAGERY

Mr. MCKELVEY. This is one of the ERTS images.

[The chart follows:]

NATION'S CAPITAL AREA

A color composite of an ERTS–1 image of the Nation's Capital area has been enlarged to a scale of 1:250,000 or 1 inch equals 4 miles. A standard line map regularly produced by the U.S. Geological Survey, showing highways and political boundaries, has been overlain upon the image. The two fit precisely, and the satellite image provides much needed information on current land use and population distribution.

EXHIBIT NO. 18



Mr. McKelvey. I think you will be interested in looking at this up close. This is of the Nation's Capital area, Chesapeake Bay, and Washington. On this map we have overprinted—you will have to look at this in detail—the black line plates from the regular topographic map series. So this has roads, the place names, all of that sort of information added to it from the 4-mile to the inch maps. This is a false color, composite image made by combining the images from several spectral bands.

When they are combined this false color image shows vigorous vegetation, shown in red, and essentially silt-free water is shown as a very dark blue or black.

The water with a high silt content turns out to be blue, and here you can see in the Potomac and the Rappahannock the effect of a very heavy rainstorm about a day or two before.

Mrs. Hansen. Isn't silting heavier in the Atlantic States than it is in other areas of the country?

Mr. McKelvey. The results of, you might say, artificially-produced siltation, I think would be greater in the East, but some of the other parts of the country, the arid West, for example, in periods of heavy——

Mrs. Hansen. I very seldom see a muddy river in the Northwest.

Mr. Radlinski. You have a lot of vegetation up there and it makes a lot of difference.

Mr. McKay. In the Colorado River you see a lot. You come up with about 25 percent or greater silt in suspension.

Mr. McKelvey. Pretty thick.

Mr. McKay. It is just about that thick, isn't it?

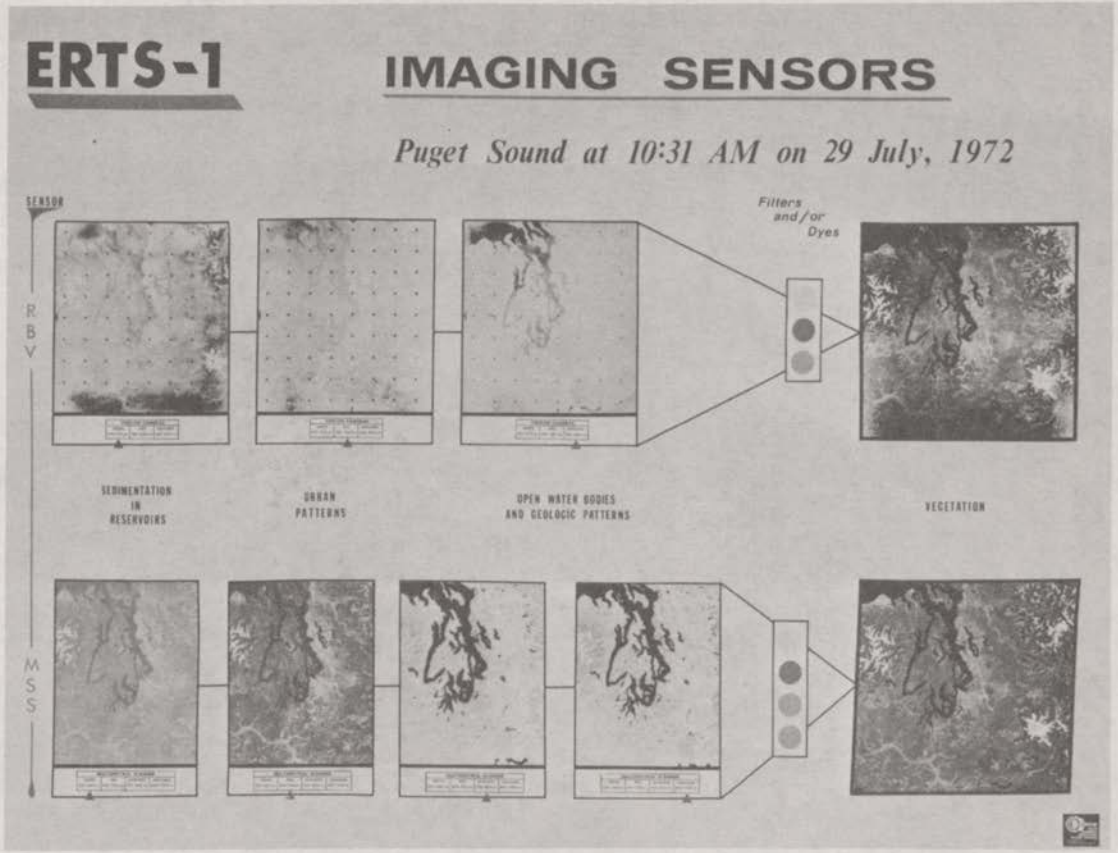
Mr. McKelvey. Very high at times.

This next chart shows the spectral images that are actually involved in both of the two systems that are on the satellite.

[The chart follows:]

ERTS—1 IMAGING SENSORS

Two imaging systems are operated from the Earth Resources Technology Satellite (ERTS–1): A three-carema Return Beam Vidicon (RBV) system providing green, red, and near-infrared spectral information, and a four-band Multispectral Scanner System (MSS) providing green, red, and two near-infrared band information. The bands can be printed individually as black and white images for specific tsudies such as mapping urban patterns (red band) or water bodies (near-infrared band), or as false color composites for vegetation mapping by processing the images with special filters or dyes. This scene of Seattle-Tacoma, Wash., demonstrates the procedure.


ERTS-1
IMAGING SENSORS
Puget Sound at 10:31 AM on 29 July, 1972
SENSOR
R B V
M S S
Filters and/or Dyes
SEDIMENTATION IN RESERVOIRS
URBAN PATTERNS
OPEN WATER BODIES AND GEOLOGIC PATTERNS
VEGETATION

Mr. McKELVEY. One is a return beam vidicon camera that takes pictures in three parts of the spectrum, and when those are combined as shown at the right, they produce this false color image in which, as I say, vegetation and vigorous growth turns out to be bright red.

Mr. RADLINSKI. Do you recognize that area?

Mrs. HANSEN. It is Puget Sound.

Mr. McKELVEY. Yes, and on a sunny day. How about that.

Mrs. HANSEN. That isn't so surprising.

Mr. McKELVEY. It surprises a lot of people to have an area of 10,000 square nautical miles in that area absolutely cloud free.

Mrs. HANSEN. I saw many days like that. Was this picture taken last summer?

Mr. McKELVEY. Yes.

Mrs. HANSEN. That was a very unusual summer.

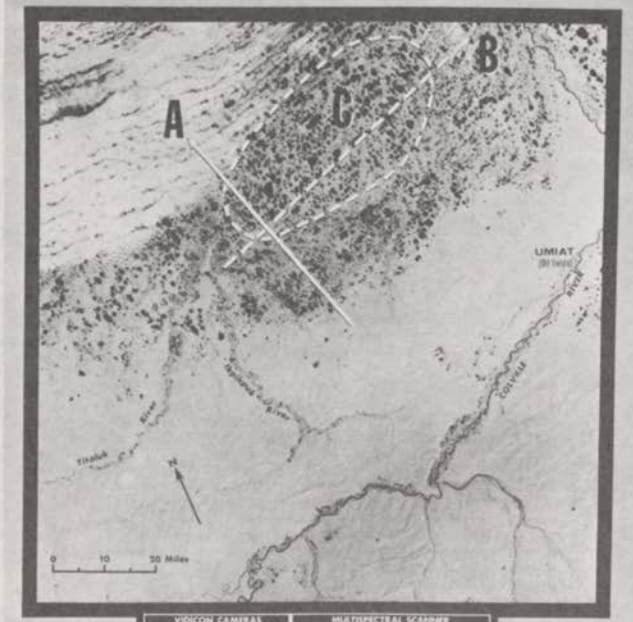
PARTIAL APPLICATIONS OF ERTS IMAGERY

Mr. McKELVEY. This next chart shows one of the potential applications of the imagery.

[The chart follows:]

This ERTS–1 image shows a possible petroleum bearing structure north of Umiat, Alaska. The north-northwest linear trend of lake elongation (A) was previously known and is believed to be due to erosion by prevailing winds and wave action. The east-northeast lineation (B) marked by the edges of clusters of lakes has not been previously recognized and suggests subsurface structure. The curvilinear clustering of many small lakes (C) suggests a domal uplift whose axes coincide with the linear trend (B). Thus, this image indicates an area where more detailed aircraft and ground exploration may be warranted.

ERTS-1 DEFINES OIL EXPLORATION TARGETS in Northern Alaska...



...27 July, 1972

A *Elongation of lakes confirms known linear trend*

B *Linear alignment of lakes suggests newly defined trend*

C *Curvilinear clustering of lakes suggests subsurface structure*

EROS EARTH RESOURCES OBSERVATION SYSTEMS PROGRAM

Dr. McKelvey. This is part of the Naval Petroleum Reserve No. 4 in Alaska, and those dark spots are lakes, and I think you can see the sort of elliptical pattern to the distribution of those lakes.

This hasn't been checked out yet, but the nature of that pattern may reflect the presence of a large dome, which is the kind of structure that is favorable for the occurrence of petroleum.

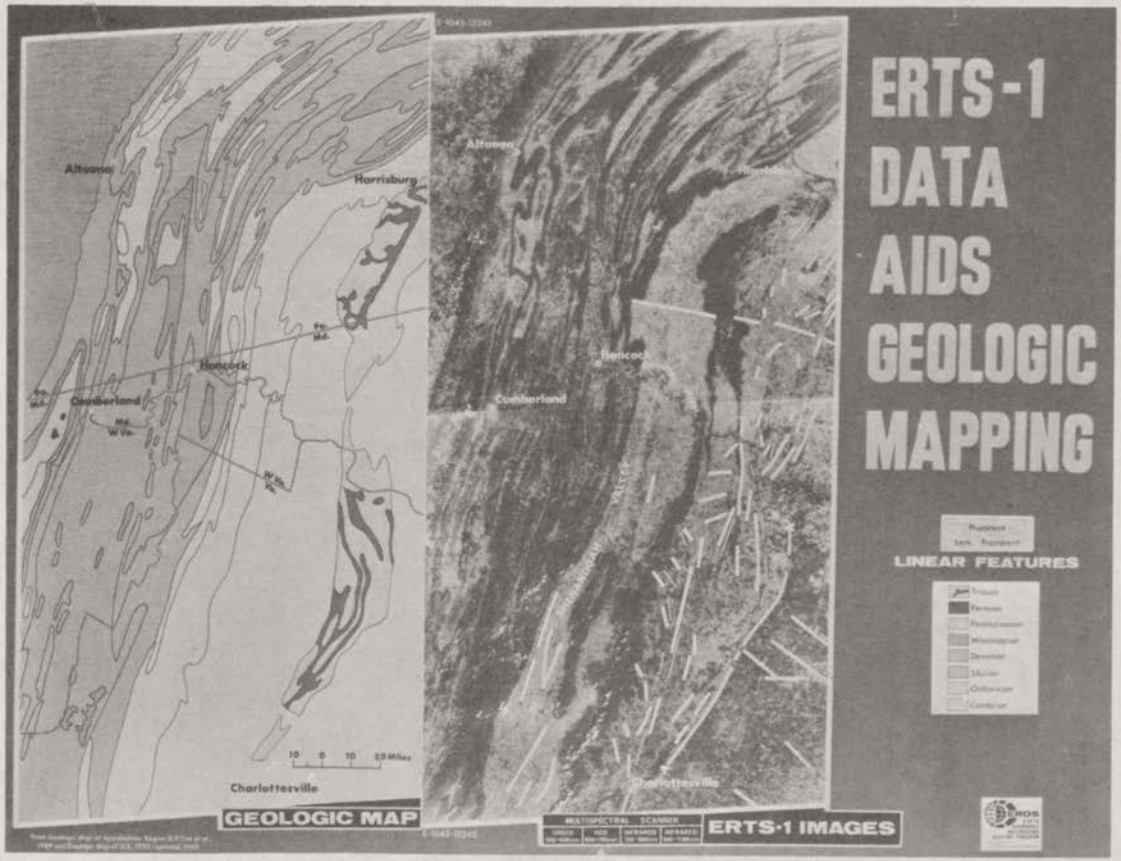
This, of course, is petroleum country. This image hasn't found an oilfield, as the newspaper said in describing it, but it has identified an area that certainly deserves further investigation and may be, in fact, promising for the occurrence of petroleum.

And similar large structures have shown up on ERTS images that have not been identified from previous studies.

Another chart.

[The chart follows:]

Two ERTS—1 images are compared with a geologic map that extends from central Pennsylvania to central Virginia and that span the Piedmont Valley and Ridge and the Allegheny Plateau geological provinces of the Eastern United States. The synoptic view provided by the images graphically portrays the intricate folding of the Appalachian Mountains that comprise the Valley and Ridge Province. The readily seen linear features that may be faults, fractures, or rock contacts can be used to assist in geologic investigations.


ERTS-1
DATA
AIDS
GEOLOGIC
MAPPING
Altoona
Harrisburg
Hancock
Cumberland
Charlottesville
GEOLOGIC MAP
ERTS-1 IMAGES
LINEAR FEATURES
10 0 10 20 Miles

Mr. McKelvey. Among these features that show up on the ERTS images are linear features such as faults and folds that may extend for great distances and yet be difficult to see on the ground. But with that tremendous continuity when you can see it all at once in a synoptic view, if reveals itself.

On this chart, which is a segment of the Appalachians, the ERTS images are shown on the right and the geologic map that had already been prepared, on the left. There are a number of structures that are shown by the yellow and red lines on the ERTS imagery that had not been identified on the geologic map.

Some of them may have been reported in other ways, and the significance of them remains to be checked out. The point is that a feature has been identified in many places from the ERTS imagery by reason of the synoptic view that had not been identified by other means.

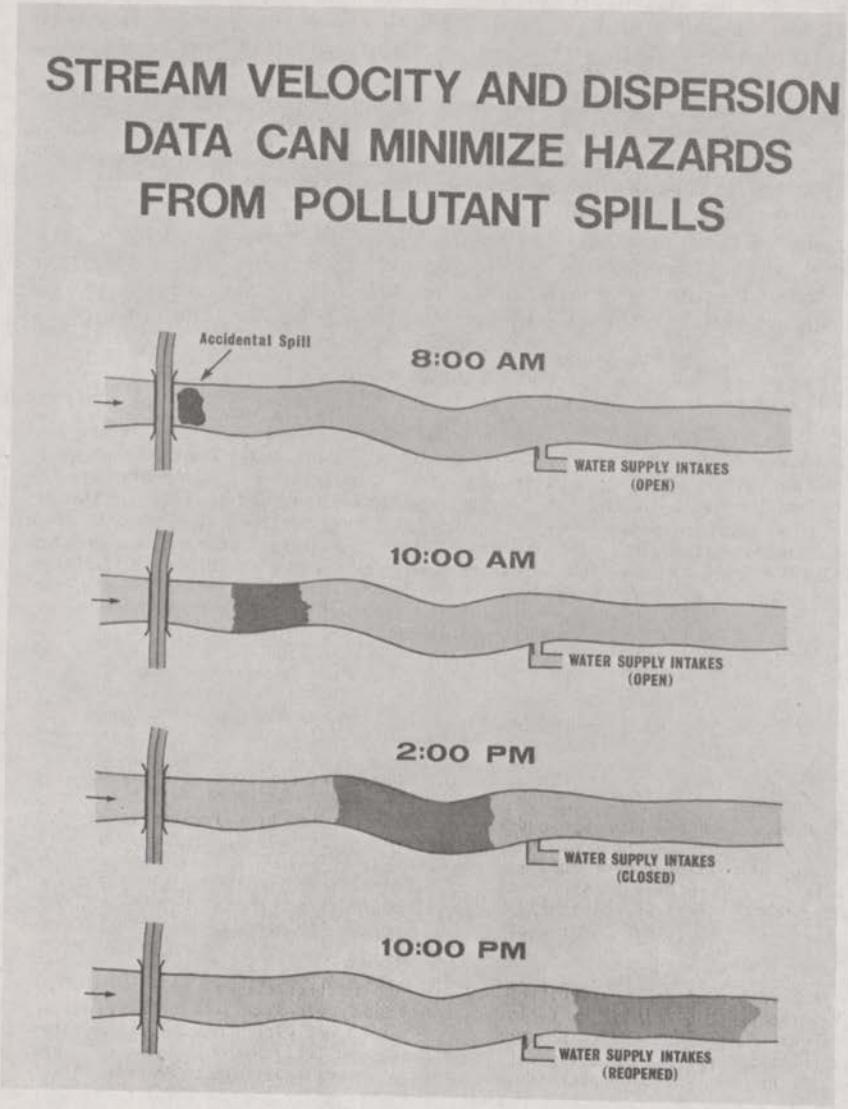
STREAM DISCHARGE

[The chart follows:]

If a harmful contaminant or hazardous material is accidentally introduced into a river, it often becomes necessary to stop diverting water for public supplies until the contamination passes or drops to a harmless level. Time of travel of water studies made by the U.S. Geological Survey are used to estimate the arrival time at downstream points of accidental discharges from upstream sources. The time available (in hours or days) before the contaminated water reaches the intake source, can be used to store emergency water supplies or to arrange for an alternative source of supply.

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EXHIBIT NO. 22



Dr. McKelvey. This chart shows the use of some of our stream discharge information. For about 15,000 miles of rivers in the United States, we have information to determine the time of travel from one point on a river to another, so in case there is a spill of oil or chemical at one place, we know how long it will take to travel down the river. This allows advanced preparation, notice to water supply systems downstream so that they, if they are drawing water from the stream, can turn it off until the spill goes by.

FLOOD-PRONE AREA MAPPING

Another chart.

[The chart follows:]

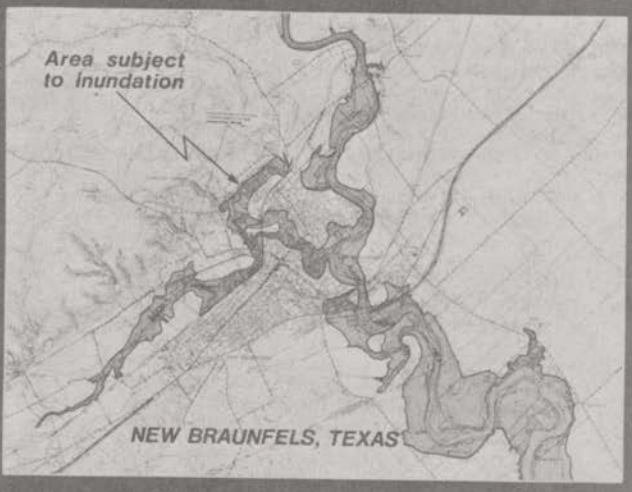
FLOOD-PRONE AREA MAPPING

Identification of areas subject to flood inundation is needed for effective land-use planning, regulation, and management. It provides information for public alert to flood potential, warning and evacuation, design of control structures, flood insurance programs, and evaluation of flood hazards at Federal facilities.

EXHIBIT NO. 23

FLOOD-PRONE AREA MAPPING....

(H.D. 465)



BASIS FOR —

- Public alert to flood potential
- Land use management & regulation
- Warnings and evacuations
- Design of flood control structures
- Flood insurance programs (P.L. 90-488)
- Evaluation of flood hazards at federal facilities (E.O. 11296)

Dr. McKelvey. Flood-prone area mapping is one of the activities that we are carrying on in the general area of attempting to identify natural hazards and reduce their consequences.

Another chart.

[The chart follows:]

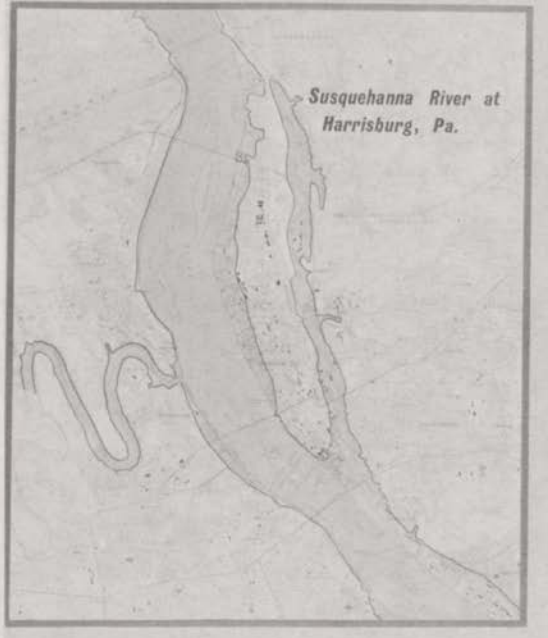
DOCUMENTATION OF EXTREME FLOODS

Floods caused by Hurricane Agnes resulted in 50 deaths, more than $2 billion damage, and 67,000 dwellings damaged or destroyed in Pennsylvania alone. The Governor's mansion (upper photo) and much of the downtown commercial and residential area (lower photo) were inundated. Delineation of the urban areas covered by floodwater, along with the stage and other information, is essential to intelligent flood protection and flood-plain management.

EXHIBIT NO. 24

DOCUMENTATION OF EXTREME FLOODS
PROVIDES DATA FOR FLOOD-PLAIN MANAGEMENT

FLOOD OF JUNE 1972
HURRICANE "AGNES"







Dr. McKelvey. Documentation of floods is an important activity. This represents some of the documentary work that was done in the vicinity of Harrisburg during the Agnes flood there last June. It is important to know what areas have been flooded in times of great floods of this sort, and to do that requires actual firsthand observation at or very shortly after the time of the flood.

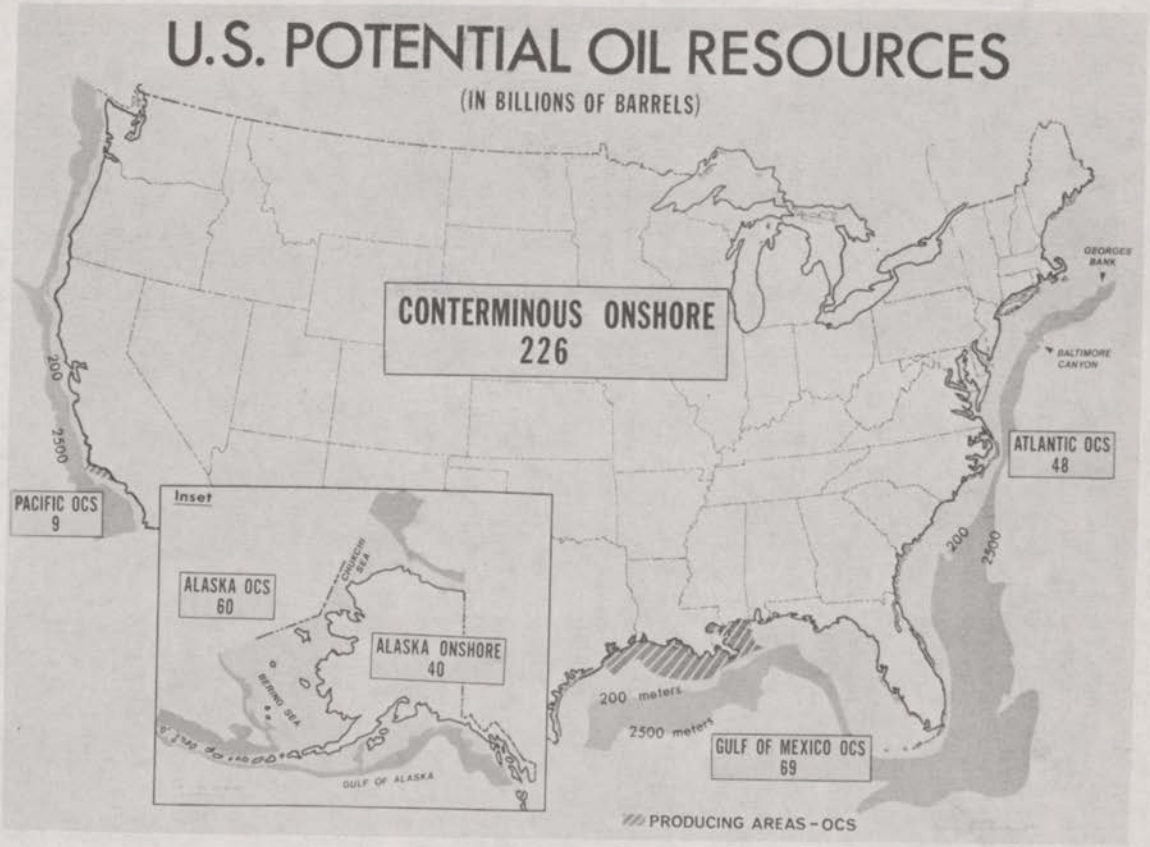
Mr. Radlinski. That is the Governor's mansion.

POTENTIAL OIL RESERVES

Mr. McKelvey. Another chart.

[The chart follows:]

The unexplored areas of the Nation's Outer Continental Shelf (OCS) lands may contribute significantly to solving the Nation's energy shortage. The potential oil resources of the OCS are estimated to be approximately 186 billion barrels. Present production is confined to the California, Texas, and Louisiana coasts.


U.S. POTENTIAL OIL RESOURCES
(IN BILLIONS OF BARRELS)
CONTERMINOUS ONSHORE
226
PACIFIC OCS
9
ATLANTIC OCS
48
GULF OF MEXICO OCS
69
ALASKA OCS
60
ALASKA ONSHORE
40
Inset
BEAUFORT SEA
CHUKCHI SEA
BERING SEA
GULF OF ALASKA
GEORGES BANK
BALTIMORE CANYON
200
2500
200 meters
2500 meters
PRODUCING AREAS - OCS

Mr. McKelvey. This shows the distribution of potential oil resources onshore and offshore by each of the major Outer Continental Shelf areas. What the net of the chart adds up to is that the potential offshore is just about as large as it is onshore. Even though it represents a smaller area, the portion of it that is favorable for the occurrence of petroleum is larger so there is a substantial offshore potential.

Mr. McKay. Do the darker areas indicate heavier potential or less?

Mr. McKelvey. The darker areas are those beyond the 200-meter isobath.

PETROLEUM EXPLORATION OFF THE WASHINGTON COAST

Mrs. Hansen. There was a great deal of exploration off the Washington coast, and all of a sudden it was terminated. Did they find any significant amounts of petroleum?

Mr. McKelvey. To my knowledge, Madam Chairman, none of the drilling there was successful.

Now, this doesn't mean that petroleum does not remain to be found. It takes a long time very often to open up a new petroleum province.

They very nearly turned off exploration in the North Sea out of discouragement until a big discovery was made, and now the drilling is much extended and discovery continues. But in areas in which there has been no petroleum production, it sometimes takes a lot of courage actually to——

OIL PRODUCTION IN COOK INLET, ALASKA

Mrs. Hansen. How much production is there at Cook Inlet?

Mr. McKelvey. I can't give you that offhand.

Mrs. Hansen. Do you want to insert the information in the record?

Mr. McKelvey. We will put it in the record.

[The information follows:]

Oil Production—Cook Inlet

In Cook Inlet, about one-third of the 15,000 square miles of Federal and State onshore and submerged lands potentially valuable for oil and gas have been partly explored by drilling. Recoverable reserves found in 15 fields total about 800 million barrels of oil and 4,250 billion cubic feet of gas.

Current (December 1972) oil production is about 196,000 barrels per day. Peak oil production in Cook Inlet occurred in October 1970 and amounted to 239,000 barrels per day.

Mr. SHELDON. It is not very large compared to Prudhoe Bay.

Mrs. HANSEN. I know, but at one time wasn't this area considered a major source of oil?

Mr. MCKELVEY. Cook Inlet is a promising province.

OFFSHORE OIL POTENTIAL IN ALASKA

As to the total offshore in Alaska, we estimate the potential there to be about 60 billion barrels. Those figures have to be regarded as very speculative, both offshore and onshore.

Mrs. HANSEN. I understand. Won't there be a lot of problems offshore in Alaska in exploration and development?

Mr. MCKELVEY. There certainly will be difficult problems in the exploration and development of petroleum.

Mrs. HANSEN. The problem with the ocean itself will be terrific.

Mr. MCKELVEY. It is the ice. When undersea completions reach an advanced stage, the outlook there may change.

In other words, if the operation can proceed and be almost totally independent on the sea floor and not have surface structures, then it may be possible to——

Mrs. HANSEN. Also there are very heavy storms.

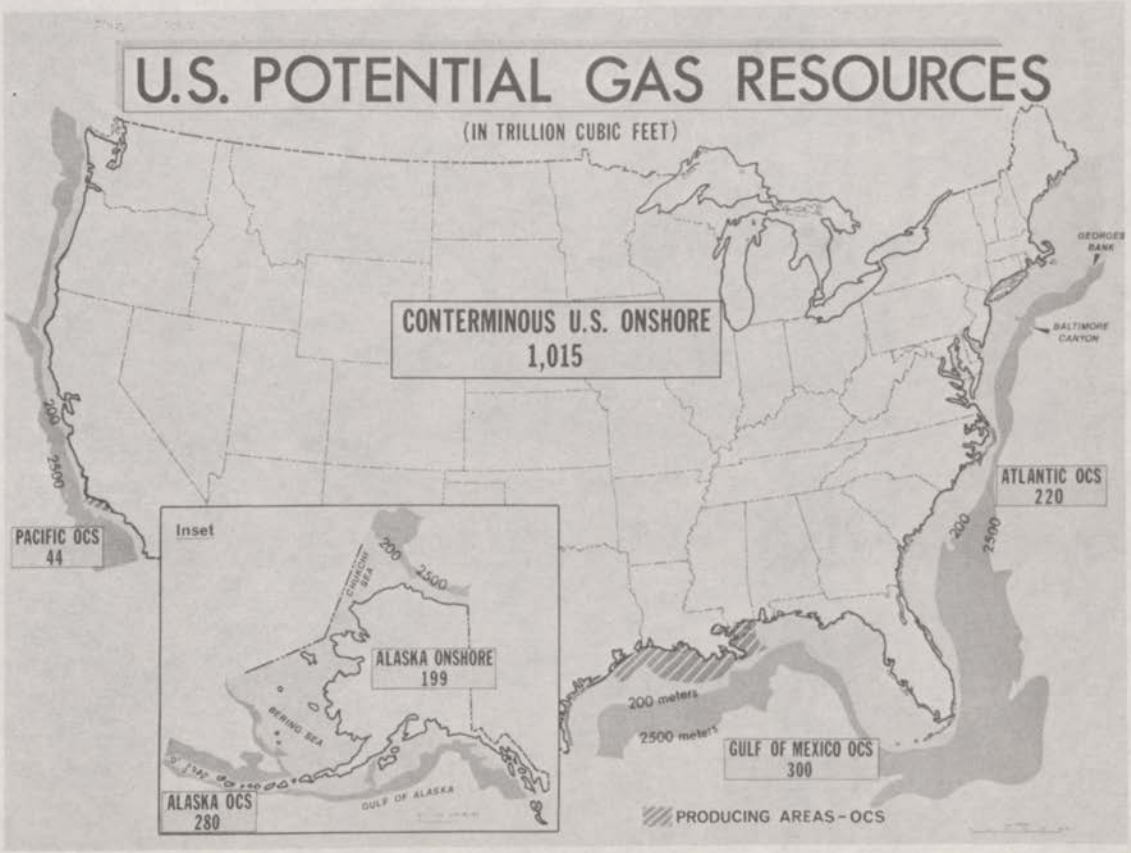
Mr. MCKELVEY. Very heavy storms.

OFFSHORE POTENTIAL FOR GAS

Another chart.

[The chart follows:]

The unexplored areas of the Nation's Outer Continental Shelf (OCS) lands may contribute significantly to solving the Nation's energy shortage. It is estimated that the potential gas resources on the OCS are approximately 844 trillion cubic feet. At present, production is limited to the crosshatched areas off Texas and Louisiana.


U.S. POTENTIAL GAS RESOURCES
(IN TRILLION CUBIC FEET)
CONTERMINOUS U.S. ONSHORE
1,015
PACIFIC OCS
44
ATLANTIC OCS
220
GULF OF MEXICO OCS
300
Inset
ALASKA ONSHORE
199
ALASKA OCS
280
BERING SEA
GULF OF ALASKA
CHUKCHI SEA
200 meters
2500 meters
GEORGES BANK
BALTIMORE CANYON
PRODUCING AREAS-OCS

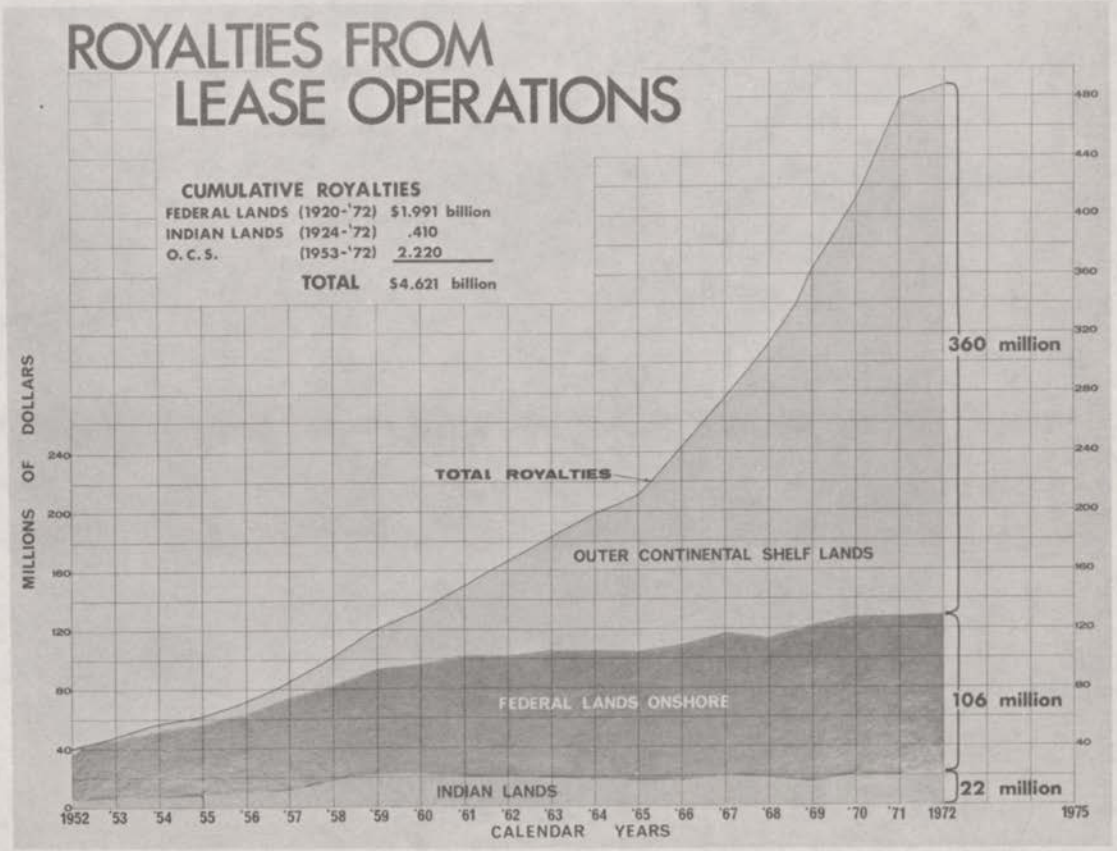
Mr. McKelvey. This chart shows the potential for gas and again about the same picture with the offshore potential very nearly as large as that onshore.

ROYALTIES RECEIVED FROM LEASE OPERATIONS

Another chart.
[The chart follows:]

Royalties From Lease Operations

Outer Continental Shelf (OCS) royalty income has had a very rapid growth rate which may now be leveling off. Significantly, total cumulative royalty through 1972 from the OCS, onshore public lands, and Indian lands is nearly $5 billion. Daily income now exceeds $1 million.


ROYALTIES FROM
LEASE OPERATIONS
CUMULATIVE ROYALTIES
FEDERAL LANDS (1920-'72) $1.991 billion
INDIAN LANDS (1924-'72) .410
O.C.S. (1953-'72) 2.220
TOTAL $4.621 billion
MILLIONS OF DOLLARS
TOTAL ROYALTIES
OUTER CONTINENTAL SHELF LANDS
FEDERAL LANDS ONSHORE
INDIAN LANDS
360 million
106 million
22 million
CALENDAR YEARS
1952 '53 '54 55 '56 '57 '58 '59 '60 '61 '62 '63 '64 '65 '66 '67 '68 '69 '70 '71 1972 1975

Mr. McKelvey. You have seen this chart before, Madam Chairman, but it is updated to show the total royalties received from lease operations, both onshore and offshore. The decline in rate of increase of royalties is mainly because of the delay in the offshore lease sales during the last couple of years.

Mrs. Hansen. And these were delayed because of environmental impact statements?

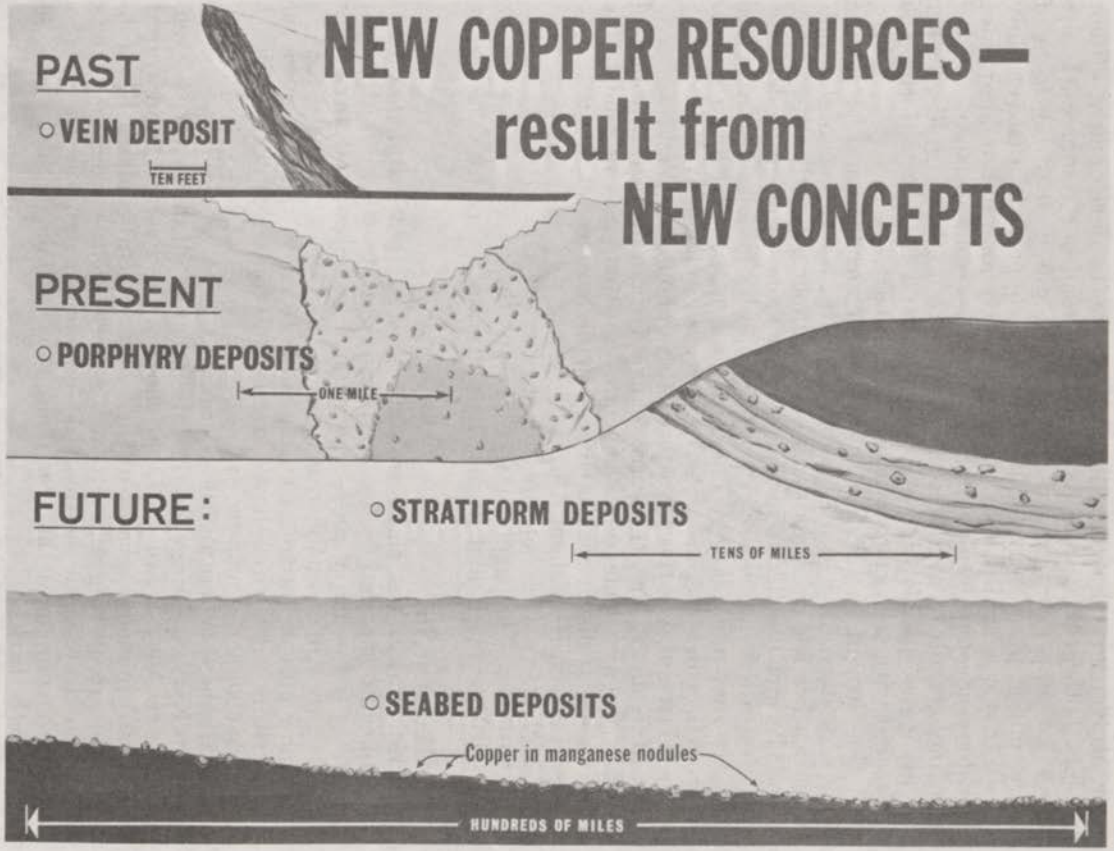
Mr. McKelvey. Yes.

NEW CONCEPTS TO EXTEND RESOURCES—COPPER

New chart.

[The chart follows:]

Improved scientific understanding and changing technology enable formerly unthought of and uneconomic copper resources to become recoverable reserves. In the past only relatively small, high-grade, easily identified vein deposits were usable. Recent technological developments now permit the use of larger lower grade deposits. Improved geologic understanding and breakthroughs in mining technology will permit future discovery and use of even larger stratiform and seabed deposits, thereby increasing reserves.


NEW COPPER RESOURCES—
result from
NEW CONCEPTS
PAST
○ VEIN DEPOSIT
TEN FEET
PRESENT
○ PORPHYRY DEPOSITS
ONE MILE
FUTURE:
○ STRATIFORM DEPOSITS
TENS OF MILES
○ SEABED DEPOSITS
Copper in manganese nodules
HUNDREDS OF MILES

Dr. McKelvey. This chart illustrates how the development of new concepts, both geologic and technologic, extend our resources. I suppose when copper was first used by man it was used in the form of native copper, practically 100-percent pure copper, and that certainly was all that was available to bronze-age early man but as knowledge of geology develops, other kinds of resources come to be known and as technology advances it becomes possible to use lower grade, deeper and more inaccessible kinds of resources, and that sort of thing is illustrated with respect to copper on this chart.

At the turn of the century most copper production was coming from vein deposits which are characteristically rather high grade but only a few feet thick and with limited dimensions otherwise. Then, when it became possible to produce copper from lower grade deposits, what are called the porphyry copper deposits became available and these are very much larger. They are rock masses that are a mile or so across in which there is a vastly increased tonnage available.

Mrs. Hansen. Are these scattered throughout the West?

Mr. McKelvey. Yes, there are many of these deposits throughout the West and also some indications now that there may be some in the East; no actual discoveries have been made here as yet.

Mrs. Hansen. How about Alaska?

Mr. McKelvey. I am not sure that any have been in Alaska.

Mr. Sheldon. The porphyries, yes, I think there are.

Mr. McKelvey. I dont' think there are any being produced there now

Mrs. Hansen. No.

Mr McKelvey. Yes, there are some there, I recall. But now what is coming into the picture are stratiform deposits, the kind of copper deposits in sedimentary rocks that extend for miles, and are of low grade, but are still a minable resource.

But now on the horizon, for those able to see in the ocean, are the manganese nodules which have a rather substantial content of nickel, cobalt, and copper in many areas.

Mrs. Hansen. Where are these located?

Mr. McKelvey. Manganese nodules occur in all of the oceans, generally on the deep ocean floor, but those in the Pacific Ocean appear to be most promising because of their higher metal content. The technology for recovering and producing these metals from manganese nodules at deep ocean depths is coming into hand, and there are a number of companies that feel that they will have this capability within 2 or 3 years.

I guess that covers them, Madam Chairman.

Mrs. Hansen. We appreciate having your charts.

CADASTRAL SURVEYS

Mr. McKay. Madam Chairman, you talked earlier about giving these States time so they can get their school sections determined in your mapping.

Mr. McKelvey. I didn't understand that, sir.

Mrs. Hansen. I think BLM is the agency that is behind in that type of mapping.

Mr. McKelvey. The cadastral surveys. That is by the Bureau of Land Management.

Mr. McKay. You fellows don't have anything to do with that?

Mr. McKelvey. No.

RESTRICTED FUNDS FOR NATURAL RESOURCE EXPLORATION

Mrs. Hansen. The thing that disturbs me about the Office of Management and Budget is that I do not think they want to spend the money for the management or exploration of our natural resources in direct relationship to our national wealth.

They will approve an increased foreign aid budget. They will approve a budget to do something here, there, and yonder. There are two sources of wealth in the United States. It is people and land. In neither instance does OMB appear particularly interested in providing adequate funding. We should be becoming more knowledgeable on what our earth holds and what potential it has, but this is not recognized by the Budget officials.

I will give you an example. The OMB has known for years that if you want trees in the year 2000, they have to be in the ground now. But yet the budget has been constantly cut in the area of reforestation.

Now, all of a sudden lumber prices escalate. We are importing from Canada. We are depleting and diminishing at a time when we should be managing and replenishing where replenishment is in order. I think that we have to have a good national inventory of everything we possess.

Mr. McKelvey. As I indicated in my opening statement, we are really very much concerned about the gravity and the urgency of the problems ahead. As I indicated in my little hyperbole, we are going to really have to build a second America between now and the end of the century in having to duplicate nearly everything we have done before, and I say that not because I want to see it happen but because I don't think you can escape that prospect. So we have a massive job before us, and we think that we have an important contribution to make in supplying information.

Mrs. Hansen. It has to be done. I have been on this committee for 10 years, and there has always been some restraints someplace. We have had national restraints ever since I have been here, and never in those 10 years have we put into the management of our natural resources what was needed.

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Mr. McKelvey. I think that the total problem is extremely complex. It is beyond our competence, of course, to analyze it in the detail and scope that faces the administration, but certainly with problems of inflation and increased consumption, balance-of-payments problems, and so on, it is an extremely complex thing in its total. There is no question about it.

Mrs. Hansen. America has had a genius for waiting until a crisis is upon her. I think that we have wasted a lot of effort and energy in not being ready.

Mr. McKelvey. Yes, we need to look ahead.

Mrs. Hansen. That is what disturbs me. I wish to express my appreciation and the committee's appreciation to you, Dr. McKelvey, for a very interesting and excellent presentation. I would also like to express my appreciation to the staff who have participated.

Dr. McKelvey. Thank you very much.

Wednesday, March 28, 1973.

BUREAU OF MINES

WITNESSES

DR. ELBURT F. OSBORN, DIRECTOR
DR. THOMAS A. HENNIE, DEPUTY DIRECTOR, MINERAL RESOURCES AND ENVIRONMENTAL DEVELOPMENT
DONALD P. SCHLICK, DEPUTY DIRECTOR, HEALTH AND SAFETY
PAUL ZINNER, ASSISTANT DIRECTOR, PLANNING
JOSEPH A. CORGAN, CHIEF, DIVISION OF ENVIRONMENT
HAROLD LIPPER, CHIEF, DIVISION OF HELIUM
ELWOOD THOMSON, CHIEF, DIVISION OF BUDGET
ROBERT LONG, ASSOCIATE SOLICITOR
FRANCIS M. WILES, DIRECTOR OF BUDGET, OFFICE OF THE SECRETARY

Mrs. Hansen. The committee will come to order. This morning we have the Bureau of Mines. We have as our principal witness, Dr. Elburt F. Osborn, the Director.

We are very pleased to welcome you back to the committee, Dr. Osborn. You had the great misfortune of appearing last year under difficult circumstances. Shortly after you appeared, a great many RIF notices were issued.

Mr. Osborn. We do have some troubles, but the program is important and it is worth the trouble.

GENERAL STATEMENT OF THE DIRECTOR

Mrs. Hansen. I am sure you have a general statement. Please insert it in the record and summarize it for us.

Mr. Osborn. Yes, Mrs. Hansen and members of the committee. There is this written statement that you have.

[The statement follows:]

Madam Chairman, it is again a pleasure to appear before this committee to discuss Bureau of Mines budget estimates for a new fiscal year. You already

have our written budget proposal, along with justification materials in summary as well as in detail. I will not, therefore, dwell on the particulars of our proposal. What I will do, with your permission, is list what I consider some of the highlights of the Bureau's program, and try to show how Bureau efforts influence the Nation's welfare in general—by insuring adequate mineral supplies, by preserving and enhancing environmental quality, by establishing better working conditions for members of the minerals industries, and by adhering to the congressional declaration on minerals policy as expressed through the Mining and Minerals Policy Act of 1970 (Public Law 91-631).

ENERGY RESEARCH

Startling increases in energy consumption and dwindling domestic supplies of gaseous and liquid fuels have focused national attention on what is commonly termed our energy crisis. Yet, we know that the critical problem is not the adequacy of resources, but rather how to produce, distribute, and use these resources in a manner that is both environmentally acceptable and economically sound.

Toward these ends, the Bureau of Mines conducts the largest in-house Federal research effort devoted to fossil fuels. This program is carried out by about 900 people at 6 research facilities.

Technology is the key that will enable our abundant domestic energy resources to be provided and consumed at acceptable costs. You have provided the means to initiate the Bureau's Synthane process to convert coal into pipeline-quality gas. In February, Under Secretary Whitaker broke ground for our $10 million pilot plant to be onstream by 1975. The information developed will be used to evaluate commercial operability and cost, to identify the potential environmental problems that might be created by commercial plants, and to provide effective means for environmental controls within the limits set by Federal and State standards.

The Bureau is also converting coal to a low-B.t.u. gas for use in generating electric power. We have advanced earlier European technology in this field to enable the process to operate with the strongly caking coals found in the United States. We are also able to operate this process with coal-as-mined, thus reducing the costs and inefficiencies of carefully sizing the coal as required in current practice.

Parallel research is also underway to clean up the hot gases produced. Hot clean combustion gases will also be available from a combustor that we are now building at our Pittsburgh facility in cooperation with the Office of Coal Research. The objective of this effort is to provide a hot gas suitable for direct use in an MHD unit or in other advanced power cycles.

During the past year, we have also redirected our efforts on underground coal gasification. This new effort has been made possible by impressive advances made in related technology in recent years. The Bureau is pioneering a new understanding of how to use subsurface fracture systems in coal gasification. In addition, our efforts to calculate the movement of fluids in petroleum reservoirs and to prepare underground formations by chemical explosives fracturing, when combined with industrial advances in directional drilling, indicate that we can demonstrate the feasibility of underground coal gasification.

If successful, we could replace, and therefore eliminate or greatly reduce, the problems associated with current mining practices. Specifically, underground coal gasification would eliminate the health and safety hazards of deep-mine development, eliminate the cost of mining and preparation, reduce the waste disposal problem, and decrease the volume of acid mine drainage. Initial testing of this method was started at a site near Hanna, Wyo., late last fall.

Research, also, is underway to develop the Nation's heavy oils and tar sand resources and to improve the recovery of petroleum and natural gas from known reservoirs. We believe that through these efforts in the energy field, we can assist in providing the technological breakthroughs that will assure the Nation a dependable supply of clean energy.

The research programs on oil shale are looking toward the future when oil from the Nation's vast deposits will become a reality. Underground retorting of oil shale to obtain the oil through a system of wells, instead of mining the rock and retorting at the surface, is being studied at a Wyoming field site.

MINERALS RESEARCH

The importance of minerals to this country and its industrial economy cannot be overstated. Energy and processed materials of mineral origin are valued at

more than $150 billion annually. Without them, our present national levels of strength, prosperity, and high standard of living could not have been attained. We will continue to need them to further our economic growth. By the year 2000, our demand for primary minerals is projected to be four times that of today.

Contrary to what is frequently heard, we are not running out of mineral raw materials. The mineral resources exist. However, we are running out of the rich, high-grade ores we mined in the past. It is the technology of mineral extraction and processing that is not advancing fast enough to keep U.S. mineral production and our mineral industries at the forefront. Advancements in technology will permit the economic extraction and recovery of metals and minerals from resources formerly considered too low in mineral content to extract economically. There is good precedent for this attitude, and I shall cite some examples of success in this area later on.

In overview, the Bureau's mineral research activity incorporates the collection and appraisal of salient minerals information, research to advance mining, metallurgical and fuels technology, research to improve the safety and health conditions in the Nation's mines, and activities to minimize or eliminate the environmental disruption attributable to the domestic minerals industry.

One of the Bureau's most vital activities is the maintenance and application of a minerals and fuels intelligence capability. The Mining and Minerals Policy Act of 1970 (Public Law 91-631) recognizes the essential need for reliable knowledge to guide commercial and governmental decisions. Our data collection and analysis functions are meeting the reporting requirements of this act.

Concurrently, the Bureau is collecting better knowledge of land utilization and reclamation in mining; computerizing its mineral and energy supply demand data for immediate and reliable retrieval; improving and extending our information network with State and local governments and universities, and developing additional information on world mineral use and trade. Our mining, metallurgy, and fuels research activities have common objectives in that they seek to expand our domestic resources, to reduce production costs, to prevent waste of our resources, and to provide for the protection of both the workers and the environment.

Mining research emphasizes the improvement of the total mining process through better ground control, new and better methods of fragmentation, improvement of the environment in which men must work, and efficient materials handling systems.

One of their more challenging assignment to date—indeed, one of the largest repair jobs of manmade environmental degradation ever attempted by a Federal agency—involved controlling a fire in an abandoned coal mine beneath the streets of Scranton, Pa. Excavation crews dug a trench 190 feet deep and three-fourths of a mile long to get at the fire. Once it was extinguished, the trench was filled and the surface smoothed and seeded to permit reuse of the land.

The demand for new energy sources has a direct bearing on the extractive minerals industries. To decrease the competition with the United States for the energy that is available, the Bureau is advancing technology which will allow the metallurgical industry to use more abundant, less utilized sources of energy, such as lignite, high-sulfur coal, and petroleum residues in its processes, and to devise processing methods that use less energy, especially electric power.

In addition to being a period of emergence of energy supply as a problem, the 1970's will be remembered as the decade when the new dimension of environmental quality had to be added to conventional minerals processing practices and at very substantial costs. The cost to the nonferrous smelting industry alone is estimated at nearly $750 million to comply with the new Federal air quality standards. In this connection, Bureau metallurgists have developed a new process for removing sulfur oxides from smelter stack gas. This year we will test the process in a pilot plant being constructed at a lead smelter in Idaho. This new technique, known as the citrate process, promises to be a commercially feasible means of sulfur dioxide pollution control for smelters and possibly also for powerplants fired with high-sulfur fuel. Equally important, the citrate process converts sulfur oxides to high-quality sulfur, a product that can probably be marketed, or, at the least, it can be stored with a minimum risk to the environment. The practicability of using the citrate process at coal burning powerplants will be tested soon at a small steam generating plant in Indiana, under a cooperative agreement between three private firms. The Bureau will provide technical advice and assistance.

We have not neglected the important work of developing our low-grade mineral deposits, although much more needs to be done. As a direct result of a Bureau developed process for recovering a useful product from a low-grade iron-bearing formation formerly considered to have no commercial significance, a $165 million plant is now under construction at Tilden, Mich. This plant will employ 550 persons and add 3 million tons of iron a year to our domestic production.

Likewise, gold reserves and resources have been expanded by the Bureau developed technique for extracting gold from the Nevada carbonaceous gold ores, heretofore not responsive to known methods of extraction. Modifications of this technology have been extended and are now being examined for treating domestic mercury and molybdenum ores.

Coinciding with our research on sulfur recovery from waste gases is the work we are conducting in cooperation with industry on sulfur utilization. Sulfur has a long record of usefulness, but surpluses appear inevitable as a result of efforts to exclude it from industrial smoke and gases. Possibly it can be made to serve as a substitute for some of the more costly and less abundant minerals.

Another important program currently underway has to do with the safe and adequate storage and disposal of the watery clay wastes generated by the phosplate industry in mining and processing of ore for the production of fertilizers. The Florida phosphate industry is cooperating with the Bureau on a cost-sharing basis to solve this serious environmental problem.

In our concern for meeting the continuously expanding needs for primary materials, we are not overlooking the importance of secondary substances as a means of accommodating total demands for minerals and metals. In urban refuse alone 12 million tons of iron, 1 million tons of nonferrous metals, and 13 million tons of glass are buried and wasted each year. The Bureau of Mines developed a recycling process to recover these substances. We built, and during the past several years successfully operated, a pilot plant to prove the technical and commercial feasibiilty of the process. This pilot plant is the model for a full-scale urban waste reclamation plant to be built soon at Lowell, Mass. The plant will recover glass and metal from the residue of an urban incinerator, designed to serve as many as half a million people. Bureau personnel will serve as consultants during construction and initial testing and operation of the plant.

HEALTH AND SAFETY

The main overall objective of the Bureau's current health and safety enforcement program is to reduce the frequency and severity of accidents and to minimize health hazards in mines and the minerals industry. We believe progress is being made toward attaining that objective.

The most impressive facts are that coal mine fatalities have decreased from 260 in 1970 to 181 in 1971 to 157 in 1972, a drop of 39.6 percent in 2 years. The frequency fatality rate reached an unprecedented low in 1972 of 0.56 million man-hours of worktime. Equally as significant is the notable improvement in mine health conditions to the extent that most coal mines are in compliance with the respirable dust and noise standards. For example, at the close of 1972, 95 percent of the coal mine sections were in compliance with the previously required 3 milligram or less level of respirable dust concentrations.

Nonfatal injury statistics are not so encouraging. The number of reported nonfatal coal mine injuries has increased. Some increase was expected because a new reporting system was instituted in April 1972. Under the new system, the Bureau issued a mandatory reporting system that included nondisabling injuries that heretofore were not reported. However, we are not satisfied with the record and intend to see that this unfavorable situation is corrected. Among other things, we are now requiring the pretraining of miner recruits, the regular retraining of employed miners, and special training for miners prior to assuming unfamiliar or new duties.

Since the passage of the Metal and Nonmetallic Mine Safety Act of 1966, nonfatal injury-frequency rates at underground and surface mines and mills have been steadily increasing, thereby pointing up a real need for broader coverage and more frequent inspections in surface mines and mills in addition to more frequent visits to underground mines.

The Secretary of the Interior recognized this need and expressed a desire to increase the health and safety inspection frequency of underground metal and nonmetal mines. The estimate before you provides funds to increase the inspection force by 75, and to increase safety research in the metal and nonmetal mines.

The Bureau believes that miner education is equally as important as regulations of mining conditions as a means of preserving high safety standards. In this connection, the Bureau's education and training program was significantly improved by the establishment of a Federal Health and Safety Academy at Beckley, W.Va. The first class of inspector trainees numbered 52. Of these, 26 were graduated last summer, while the remaining trainees are scheduled to graduate in 1973. Also, the Academy to date has provided refresher training for 775 experienced inspectors and 56 industry personnel. The classes have been conducted in temporary quarters at Beckley, W.Va., but construction is now underway at a permanent facility with completion scheduled for early 1976.

In addition to the Beckley Academy, miners are taught Bureau-sponsored courses in first aid, accident prevention, and mine rescue at nine health and safety training centers throughout the country. Last year 60,000 coal miners and 10,000 noncoal miners took these courses. In addition, Bureau trained and certified industry instructors presented courses to over 70,000 coal miners and 12,000 noncoal miners.

Research likewise is an important element in the Bureau's health and safety program. Among recent innovations developed by the Bureau is a large portable shield that protects miners from roof falls—the number one cause of fatalities. Safety instrumentation has also been markedly improved and refined in recent years, so that miners can be more readily warned of dangerous concentrations of gas, dust, and other hazards. Remote control is being studied as a means of operating mining machines and shuttle cars, and as a means of probing dangerous mine areas during rescue operations. Research to develop the technology to reduce respirable dust to a minimum while mining coal and eliminate dust-related industrial diseases such as "black lung" is also an important part of the Bureau's health and safety research program.

In 1974, research effort pertaining to safety in metal and nonmetallic mines will include: fire and explosion prevention with emphasis on the identification and characterization of combustible mine materials; evaluation of the effect of fuel loading on flame propagation in mines; mine timber treatment to reduce fire potential; and the development of automatic extinguishment systems for fires in stationary or mobile electrically powered equipment.

In conclusion, as we stated earlier, the country is not running out of mineral resources but out of the mineral technology needed for their profitable production and processing in world competition. We seek to prevent an impending serious loss in the country's competitive position in mineral technology. The Bureau of Mines pledges its full resources and best efforts to this endeavor.

Mr. OSBORN. I would like to make a few remarks which do not follow the statement exactly but which I think are important to make.

1974 BUDGET REDUCTION

First in regard to the budget, the budget does show this cut of $20 million, but about three-fourths of that is one-shot money which was only for this year. $13 million was for the Academy at Beckley.

Similary the $1 million which your committee so wisely put in our budget last year for the mine waste dumps, that again was for one year and we are spending that and I can report on that later, too, as you wish.

In addition the first part of the Rock Springs, Wyo., backfilling project will be completed this year. So, that money is not in. Finally, $300,000 was in our budget specifically for the mineral data analysis work in support of the work of the National Materials Policy Commission. That Commission terminates at the end of this year.

Those add up to about $15 million. So the net cut is about $5 million. I would like to say that in the coming year in this budget which we will be justifying, we will continue in general with some programs that are really of tremendous importance in this country. Those that I want to mention—and I will do it very briefly—are in the critical areas of energy, environment, and mineral production.

ENERGY SITUATION IN THE NORTHEAST

Let me just tick off a few things. In the case of energy the key to part of the problem is coal. I have a figure here which is rather interesting. For the Northeastern United States, which is New England and Pennsylvania, New York, and New Jersey, for generation of power during the 5-year period, 1966 to 1971, the consumption of coal use at utility plants decreased from 53 million tons a year to 46 million.

Mrs. HANSEN. To what do you attribute that?

Mr. OSBORN. Let me insert one more phrase. The oil used in this same area increased from 77 million barrels to 199 million barrels. In other words, the amount of oil used for power in the Northeast nearly tripled whereas the use of coal went down about 13 percent.

I will get to your question in just a moment, if you don't mind.

PLANNED ADDITIONAL POWERPLANT CAPACITY

For the period 1972 to 1978, for which I have figures for the Northeast area, there is planned additional fossil-fuel powerplant capacity totaling more than 21,000 megawatts for this area. A 1,000-megawatt plant used to be considered a very large one.

Mrs. HANSEN. How many people will it serve?

Mr. OSBORN. It would serve a city of 500,000, or so.

New York would have maybe 15 of that size. I can get the exact figure, if that is important.

Mrs. HANSEN. Yes, it is important.

[The information follows:]

There are 17 plants in the New York City area with a total generating capacity of 10,275 megawatts.

Mr. OSBORN. The equivalent of 21 plants of 1,000-megawatt capacity each will be put into commission between 1972 and 1978.

Mr. WYATT. In what geographical area?

Mr. OSBORN. What we call the Northeast. New England, Pennsylvania, New York, and New Jersey; 21,000 additional megawatts, or 21 big stations if they were all 1,000 megawatts. Of this new capacity, 16,000 megawatts will be oil and gas fired, and only 5,000 will be coal; and all of those new coal plants will be in Pennsylvania. In other words, all of the new capacity in New England, New York, and New Jersey, totaling 16,000 out of the 21,000 will be oil and gas.

NUCLEAR PLANT CONSTRUCTION IN NORTHEAST

Mr. WYATT. At this point, is there any nuclear plant construction there?

Mr. OSBORN. Yes.

Mr. WYATT. Can you give us that figure?

Mr. OSBORN. We will put that in the record.

[The information follows:]

Operable and Planned Nuclear Plants for Northeastern States as of December 31, 1972

State	In operation		Planned or under construction		Total	
	No. of plants	Capacity (megawatts)	No. of plants	Capacity (megawatts)	No. of plants	Capacity (megawatts)
Connecticut	2	1,262	1	828	3	2,090
Maine	1	790	-	-	1	790
Massachusetts	1	175	2	1/1,835	3	2,010
New Hampshire	-	-	2	2,200	2	2,200
New Jersey	1	640	7	7,709	8	8,349
New York	3	1,310	5	4,558	8	5,868
Pennsylvania	2	130	12	12,202	14	12,332
Vermont	-	-	1	514	1	514
Total	10	4,307	30	29,846	40	34,153

1/ 655 megawatts of this scheduled for summer 1973 operation.

Source: AEC

COAL VERSUS OIL IN POWERPLANTS

Mr. OSBORN. The importation of oil which is getting us into more and more international trouble, and other problems, can be partly compensated for if we can reverse this trend, and burn coal in those powerplants instead of oil and gas. We have in the Appalachians a tremendous reservoir of coal, as you know. The reasons for not increasing our use of coal in powerplants in the East are, that oil is convenient to use and it has a relatively lower sulfur content than coal. Oil is also more expensive. For example on the cost—and this is what the utility plant pays for fuel—in this same area for a million Btu, in 1966, coal was 27.7 cents, and it increased in 1971 to 41.3 cents per million Btu.

Oil in 1966 was 32.2 cents and increased up to 53.6 cents per million Btu in 1971. Since oil was 53.6 cents and coal was 41.3 cents. It is obviously not the price that determines the movement towards oil.

However, if the price is passed right on to the consumers, this is not noticed.

Mrs. HANSEN. The consumer is paying an ever-increasing price for oil.

Mr. OSBORN. Yes, and for its lower sulfur content.

Oil is going up faster than coal. Coal increased in price 49 percent and oil increased 66.5 percent in this 5-year period.

Mrs. HANSEN. Is the reason oil prices have increased so rapidly the result of environmental concerns or the cost of transportation systems?

Mr. OSBORN. I would say it is mostly, and particularly right now, largely the environmental problem. In other words, the sulfur content of imported oil is lower generally than that of domestic coal.

Mrs. HANSEN. Coal in the east has a high-sulfur content.

Mr. OSBORN. Yes. The coals in the East are mostly high in sulfur. Therefore, we must overcome the sulfur problem. We must find ways to get coal into the powerplants and save this more precious oil which is more and more coming from abroad, for uses for which it is most appropriate; in other words, for transportation and home heating. Even in the home heating, if we go to electric heating, and that power is generated from coal, we are in effect replacing some of the oil.

Let me explain what the Bureau of Mines is doing about this.

ENERGY TRENDS IN OTHER PARTS OF THE COUNTRY

Mrs. HANSEN. What has been the price trend in the Midwest, the west coast, and the Rocky Mountain regions?

Mr. OSBORN. May we put this in the record for you?

[The information follows:]

Fuel Consumption and Costs in Selected Regions for Steam-Electric Generating Plants

FUELS CONSUMED

Region	1966 Coal (1,000 tons)	1966 Oil (1,000 barrels)	1966 Gas (Million Cu.Ft.)	1971 Coal (1,000 tons)	1971 Oil (1,000 barrels)	1971 Gas (Million Cu.ft.)	Percent Change, 1971 Over 1966 Coal	Oil	Gas
1/ East North Central	98,625	631	76,205	119,444	15,894	219,973	21.1	2,418.9	188.7
2/ Mountain	8,586	1,571	147,048	15,885	3,208	214,833	85.0	104.2	46.1
3/ Pacific	-	20,216	554,015	-	33,348	561,052	-	65.0	1.3
Total U.S.	264,347	130,931	2,465,977	327,358	350,660	3,832,550	23.8	167.8	55.4

"AS BURNED" COST PER MILLION BTU (CENTS)

	1966 Coal	1966 Oil	1966 Gas	1971 Coal	1971 Oil	1971 Gas			
East North Central	24.4	59.8	25.9	35.5	63.2	42.9	45.5	5.7	65.6
Mountain	20.4	25.4	26.7	20.9	40.4	32.4	2.5	59.1	21.3
Pacific	-	31.5	31.5	-	55.4	34.6	-	75.9	9.8
Total U.S.	24.7	32.4	25.0	36.0	51.5	28.8	45.7	59.0	15.2

1/ Illinois, Indiana, Michigan, Ohio and Wisconsin.
2/ Arizona, Colorado, Montana, Nevada, New Mexico, Utah, and Wyoming.
3/ California, Oregon, Washington.

ENVIRONMENTAL PROBLEMS OF HIGH SULFUR COAL

Mr. VEYSEY. If I may ask a question at this point, Madam Chairman, you indicated the cost factors on the fuel alone and have spoken about the environmental problem of the sulfur content of coal. Do we have the technology available to burn the coal without emitting sulfur dioxide, or whatever? That is one question. Second, what is the overall cost after you have put on additional equipment to make it possible to burn coal cleanly? That is really the comparison we need.

Mr. OSBORN. I am glad you asked that because that is what I would like to lead into. I have been giving just the highlights of the problem. In order to make the coal acceptable, we have to get the sulfur way down. Most of our coal is fairly high sulfur, at least 2 or 3 percent. Indiana coal is excellent but it is around 5-percent sulfur.

Mrs. HANSEN. You also have to reduce the level of particulates.

Mr. OSBORN. That is right. There are three approaches to this. The Bureau of Mines is working on all three. One is to remove the sulfur from the coal. The Bureau of Mines in the past has done extensive work in this area. In general we can get the sulfur down to about half by mechanical cleaning. Only about half is inorganic sulfur. The rest is organic and you cannot separate it out by mechanical means.

We are not working on that. We have this technology on the shelf. Second, we could remove part or most of the sulfur during the combustion. In other words, we could throw alkalis or limestone into the furnace. Some of the sulfur combines with the calcium and sodium to form sulfates. We have worked on this rather extensively.

This method is not showing great promise. The third technique is removing the sulfur dioxide from the stack gases. This approach, combined with the cleaning of the coal before firing, which would remove a third or a half of it, looks like a solution. This we should be pushing as hard as we can, seeking a practical technique for removing the sulfur dioxide from the stack gases. There are about as many different ways suggested of doing this as there are people thinking about it. One after the other when they are tried they are not practical. We say a method is practical only if it has been tried and has operated successfully for a year in at least a 250,000 kW plant, not that it was tried and worked 1 day.

CITRATE PROCESS FOR SULFUR DIOXIDE REMOVAL

Our information is that there is not now a practical means of removing SO_2 from the powerplant gases using my definition of what is practical. But we have been working on a process that looks very heartening, and that is what we call the citrate process. It is called that because we use citric acid and sodium citrate in a solution which is reacted with the gases and removes the SO_2 almost completely, about 90 percent of it. Then we recirculate this citrate solution and precipitate the sulfur out in its elemental form. So we get solid sulfur which can be stored or sold. We do not create a big waste disposal problem.

USES AND DISPOSITION OF SULFUR

Mrs. HANSEN. Is there a good market for sulfur?

Mr. OSBORN. It is good if you want to buy it.

Mrs. HANSEN. The disposition of sulfur is a serious problem.

Mr. OSBORN. It is a serious disposal problem if you convert the sulfur to sulfuric acid and you are out someplace where you cannot possibly use the stuff. Few States will let you pump it underground because it will cause trouble there.

You cannot put it on the surface. What can you do with sulfuric acid? This process converts the sulfur oxides to elemental sulfur, and we can store that.

Mrs. HANSEN. How much sulfur is in a ton of coal?

Mr. OSBORN. If it contained around 5 percent sulfur, perhaps 50 or 60 pounds, based upon expected efficiencies of conversion and recovery.

Mrs. HANSEN. For each ton of coal, you are going to have 50 or 60 pounds of sulfur bricks?

Mr. OSBORN. It would vary. In Iowa, they are averaging 7 or 8 percent sulfur.

Mr. VEYSEY. Didn't you indicate that half of this would be removed before?

Mr OSBORN. I said it could be.

Mr. VEYSEY. With the citrate process, you would not bother to do that?

Mr. OSBORN. I would not say that. I would think we would probably want to remove as much of the sulfur as possible before combustion.

Mr. VEYSEY. How do you get it out first?

Mr. OSBORN. About half of the sulfur is in the form of iron sulfide, this fool's gold. When it is ground finely enough, it separates and it can be floated off or removed by several conventional mechanical processes. We got into this citrate process in connection with our research on sulfur emissions from smelters. Smelters are in real trouble, as you are aware, Madam Chairman.

Mrs. HANSEN. I am well aware of the problems.

PILOT PLANT FOR SULFUR DIOXIDE REMOVAL

Mr. OSBORN. We first had a small pilot plant at a copper smelter in Arizona. This was based upon research done at our Salt Lake City laboratory with the funds you provided. The problem at smelters is that if there is a high SO_2 effluent gas, like more than 5 percent, it can be readily converted into sulfuric acid. In the copper regions such acid might be used to leach more copper out of the waste rock. If it is less than 4 or 5 percent sulfur, the sulfuric acid technique does not work.

So we are working on the lower sulfur oxide gases, and it works pretty well. I reported on this last year, and your committee provided $1 million to build a larger pilot plant. That is now being constructed at the Bunker Hill lead smelter in the Coeur d'Alene district. We have an arrangement where we can vary the SO_2 content of gases. We can try the system with different concentrations of SO_2, including simulating those in powerplants.

In powerplants, the SO_2, instead of being 2 or 3 percent, is about 0.2 percent. In other words a 10th as much. So we have to handle a lot more gas. It is hot gas. In this process, the gas has to be cooled down and the particulates removed. That answers part of your question. In the citrate process, we get rid of the particulates as well as the SO_2.

You might say this is a dream on the part of those crazy engineers, but three companies have now joined and are putting up their own money, about a million dollars, to build a pilot plant at Terre Haute, Ind. This is being constructed from the Bureau of Mines design. It will remove the SO_2 from coal-fired steam boilers. A chemical company which makes citric acid combined with two other companies, and the three are putting up their own money to build a pilot plant along this line.

In my opinion, this is the immediate way to go to get coal back into the powerplant picture. We can say let's extend the air pollution requirements another year, but sooner or later we have to face up to it and get the sulfur out. This is the sulfur problem. There are other ways of getting at this. You also provided funds for construction of our synthane plant, at Bruceton, Pa., which is on Government property.

CONSTRUCTION OF BUREAU SYNTHANE PILOT PLANT

The contracts were let, and the ground was broken on February 6, 1973. That pilot plant will be in operation in August 1974. It will produce from coal a high B.t.u. gas, free of sulfur, which is another way of making use of coal.

This does not helped the powerplant situation because this is a high-energy gas which will not be used for powerplants. It is too expensive.

Mrs. HANSEN. What will it be used for?

UNDERGROUND COAL GASIFICATION EXPERIMENT

Mr. OSBORN. Pipeline gas, to supplement the natural gas supply. So we are going to a third type of experiment, and that is direct underground gasification of coal. In this experiment, the fire is to be lighted today in honor of this occasion. The work is being done near Hanna, in a coal seam 400 feet underground, 20 to 30 feet thick, which is, we think, about ideal for us to run this experiment. We have drilled five experimental holes, and we have taken cores and we have run permeability tests on the cores. We have been doing that sort of thing for months. The fire will be started today and will start our experiments in bringing up a low B.t.u. gas. This system has the great advantage of not having to mine the coal, or disturb the surface. In mining the coal, we also would be bringing up waste. In this system, we don't have the waste. We don't have the health and safety problem, either. There are these obvious advantages at least.

Mrs. HANSEN. What would be the number of people employed in this type of mining compared to the number in traditional methods, either strip or deep mining?

Mr. OSBORN. This might require as many as stripping but nothing like the underground mining. This would be more like a chemical operation rather than mining; more like petroleum or natural gas production. This would be ideal for local power plants, especially those using turbines developed in recent years, which use low B.t.u. gas and be built there. The energy would then be transmitted as electricity.

We are very hopeful about this process, but we do not think it is moving fast enough. We hope to extend the experiment to the Appalachians where the coal is different and the geologic conditions are

quite different. We hope to try a different type of experiment in the East. We want to try an experiment based upon directional drilling. We will drill holes down, intersect the coal seam and go horizontally in the coal. Then we will gasify the coal between these horizontal holes. In the West we are trying it by vertical holes and fracturing between the holes before burning. This gasification is very similar to the gasification we would do on the surface, except we will stop at a low Btu stage. We will not try to upgrade it to a high Btu gas.

This is another way we are working on this problem of making coal available for power. If you will bear with me, I would like to mention two others.

Mrs. HANSEN. Please do, because the committee is intensely interested.

TURBULENT REACTOR EXPERIMENT AT PITTSBURGH

Mr. OSBORN. Another pilot scale experiment at our Pittsburgh laboratory that is in an early stage and that we think is extremely promising is coal conversion in what we call a turbulent reactor. We are now up to 1-inch size reactor diameter pipes. We react the powdered coal with hydrogen, and water, and oxygen and produce oil. This is a low-sulfur fuel we produce. We do not have money for a larger plant for that and we did not ask for any in this budget. We can continue experimenting at least for another year very fruitfully, I am sure, with this 1-inch size tube.

CONTROL OF BLACK LUNG

Then let me mention lastly—I am trying to hit some highlights here—that one of the problems in mining of coal has been the health of the miners. Disasters are spectacular and get the public's attention, but really the most serious problem in recent years has been black lung. There are about 140,000 miners disabled because of black lung. This is as many as we have working. For every one that is working, we have another one that is on the sideline because of black lung. In the recent past, as the rate of production increased, and the productivity increased with these tremendous machines—machines that grind the coal off the face instead of the old techniques—the rate of black lung went up.

When we got around to finding out how many there were, we found this tremendous number of exworkers suffering from black lung. This is caused by respirable dust getting into the lungs of miners. This dust is very tiny particles, less than 5 microns in size. I am very happy to say that the Bureau of Mines people, working with industry—we have to give industry the credit for this—have gotten this respirable dust down in a remarkable way. So what I would consider one of the most serious roadblocks to the production and use of coal is getting under control.

OIL FROM ORGANIC WASTE

Finally, in this matter of coal utilization, in working on oil from coal our people transferred this same technique to producing oil from organic wastes, cow manure, and so on.

Although this is principally an environmental problem, if this accessible cow manure were converted to oil it would be a significant amount, like half a million barrels a day, or something like that, of low-sulfur fuel oil. This would not be low-cost oil, but if you take a credit for getting rid of the manure then it becomes practical.

Mrs. HANSEN. Otherwise, what is going to happen to this manure?

Mr. OSBORN. I don't know.

Mr. MCKAY. It decays.

Mrs. HANSEN. I know, but not very fast.

Mr. OSBORN. It will blow around after a while. If you take $4 or $5 a ton credit for getting rid of that, which it could cost to haul it away someplace, then making it into oil is competitive.

Mrs. HANSEN. Are you performing these comparative economic studies on the production of oil, so that you can look at the total energy picture and have your options open on the selection of the type of energy to be used?

Mr. OSBORN. Yes, we can give you some numbers on that. The only thing is this, Mrs. Hansen: This is still in the small pilot plant stage. We do not have an adequate demonstration of the cost factors. On the basis of a small one, we have a plus or minus situation.

TRANSPORTATION PROBLEMS OF COAL UTILIZATION

Mrs. HANSEN. Are you preparing reports on the full utilization of coal in given areas of the United States so that you have firm figures on the cost of coal development? Are you also considering the transportation problems that exist in the East?

Mr. HENRIE. We have a report that is in final draft form. It will be an information circular and will discuss the sulfur, the geography, and transportation problems of coal utilization. This report is promised to be in the Director's office next week.

Mrs. HANSEN. Supposing your eastern rail system disappears under various pressures?

Mr. OSBORN. Mrs. Hansen, if the rail system disappears then we could, I suppose, put in coal pipelines. We do not have coal pipelines in the East because the railroads won't allow competing coal pipelines to go across State boundaries. You probably know about this.

Mrs. HANSEN. I do and that is why I want you to discuss this matter.

Mr. OSBORN. If we should loose the rail lines we would have some coal pipelines.

Mrs. HANSEN. Don't the rail and coal industries have many joint ventures?

Mr. OSBORN. I do not know how many of those there are anymore. I think they have both been in so much trouble financially, both the coal mines and the railroads, they decided to stay by themselves.

The railroads are still being pretty largely funded in the East by coal haulage. Hauling coal is what kept the railroads in business over the years. Some are still in good shape. Pennsylvania, West Virginia, Kentucky, and New York City, so I do not think there is any immediate problem on transportation.

RECYLING URBAN WASTE

Let me say just a little about environment now. We have been experimenting with secondary recovery of mineral substances by recycling urban waste from incinerator residue and you know about that because we reported on it earlier. I am happy to say that this system that the Bureau of Mines developed and demonstrated for a couple of years at College Park, Md., has now been adopted in a contract between EPA and the city of Lowell, Mass. EPA is putting up about three-fourths of the money and Lowell, Mass., about one-fourth. The city has a contract with Raytheon to build a plant after our specifications.

They have sent two of their people down here who are working with us at our laboratory to be able to handle the project.

COST FACTORS OF A RECYCLING PLANT

Mrs. HANSEN. Do you have the cost factors on building a plant, the cost of operation, and how much energy is used in these plants.

Mr. OSBORN. Yes. We have that in some reports.

Mrs. HANSEN. Please insert that information in the record.

Mr. OSBORN. I would be glad to.

[The information follows:]

RECYCLING DEMONSTRATION PLANTS—COST FACTORS

A cost evaluation, based on the Bureau of Mines 1,000 lb-per-hour pilot plant, indicates that a demonstration plant designed to handle 250 tons of incinerator residue per 8-hour day would have a capital cost of about $1.5 million and an operating cost of about $4 per ton of residue processed. Since it is estimated that the products from the process could be sold for about $15 per ton of residue processed, the plant could operate at a profit. Operating costs for a larger plant treating 1,000 tons per day of residues would only be about $2 per ton. Electrical requirements for the residue plant would only be that necessary to operate the machinery. We estimate that to be about 7 KWH per ton of residues treated. No energy is expended in burning of the refuse since it is a self sustaining operation. As a matter of fact the waste heat can be utilized to make steam or electricity.

OTHER COST FACTORS IN SOLID WASTE DISPOSAL

Mr. EVANS. Madam Chairman, if I may ask a question at this point? In the process of your economic studies of reclaiming resources, do you consider factors such as freight rates, tax incentives and so forth?

Mr. OSBORN. We have not in this particular case gone into that, no.

What we have are figures on the operating cost plus the capitalization amortized over a certain period of time, and the sale locally of the iron, the aluminum, the colorless glass, the colored glass, and so on that comes out of his. Where the big urban waste problems are, there are also ordinarily glass plants or steel foundries and so on.

Mr. EVANS. To get a true picture of comparing the final product and its value to a product that may come virgin from the ground and be produced as a brand new raw material, wouldn't you have to take into consideration things like freight rates, the depletion allowance, tax investment credits and so forth?

Mr. OSBORN. Are you talking about the incinerator residue recycling?

Mr. EVANS. I am talking about the reclaiming of resources through the solid waste disposal.

Mr. OSBORN. What we are talking about in our report is the value of this scrap material in the vicinity. In other words, glass has to be ground up finally to separate the colorless from the colored. The colorless glass brings $14 a ton delivered. The colored glass, $4 a ton, as an example.

OTHER RESOURCES RECOVERED

Mr. EVANS. What other resources are you recovering?

Mr. OSBORN. Iron, aluminum, zinc, copper alloys are the main ones.

Mr. EVANS. But you make no attempt to compare the value of those recovered resources with resources newly and freshly mined and developed and smelted?

Mr. OSBORN. Yes; in this respect: The recovered iron is compared directly with the price of scrap.

Mr. EVANS. In this comparison do you give any weight to the depletion allowances and tax investment credits and freight rates that may be advantageous to the mining if virgin material?

Mr. OSBORN. I think I understand your question, but I do not think it is applicable.

We are talking here about the scrap materials which are on the market now. In other words, a steel foundry or an iron foundry or an aluminum plant uses scrap. We are simply saying this is the market place of scrap.

GOVERNMENT INCENTIVES FOR RECOVERY OF RESOURCES

Mr. EVANS. You attempt to make no judgment with respect to recommending governmental incentives in the recovery of resources?

Mr. OSBORN. I am not, no.

Mr. EVANS. The reason I ask is because Mr. Ruckelshaus of EPA was before our House Agricultural Subcommittee the other day and they raised in the report the question of Government incentives for this, but never made a recommendation. Of course, it is a matter of public policy whether you do build in the incentives for recovering resources or whether you do not. Nevertheless, you are comparing the value of what you recovered against that which is developed from virgin sources, which do have advantages arising out of Government policies.

Mr. OSBORN. No; it is not that. We are comparing the value of what is recovered with comparable scrap that is on the market. In making steel about a third is scrap that is put into the steel making furnaces. In the case of aluminum, the aluminum companies buy scrap aluminum for about $200 a ton, I think it is—and we are saying this is going into the scrap market.

The incentive is this: The amortization and operating costs run about $4 a ton of this incinerator residue material. The recovered material is worth about $15 a ton. There is about a $11 differential there. You get a credit also because this does not have to be hauled off, which is a cost, and then buried someplace in space which costs so many dollars an acre. So the incentive is quite clearly that this should be a profitable operation. I think Lowell, Mass., will find that is true.

Mrs. HANSEN. Mr. Long.

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Mr. LONG. I am very interested in this.

I suppose, as in most cities, this is one of the hottest problems around Baltimore. We just do not have any landfill places any more. Anytime one comes up, the people complain vociferously that their whole area is being degraded, as it usually is, from the burning dump and the smells and everything.

You say this was developed at the University of Maryland.

Mr. OSBORN. No, this is the Bureau of Mines. We have a research laboratory in College Park, and near it we have a pilot plant on this recycling.

LOCATION OF PILOT PLANT AT LOWELL, MASS.

Mr. LONG. I am a little interested why you have to go all the way to Lowell, Mass., to get a pilot plant set up when we have Baltimore right here.

Mr. OSBORN. I would love to have it in Baltimore instead of having to transport our people with our short travel budget all the way up to Lowell, Mass.

Mr. LONG. Were any efforts made to get Baltimore, either the county or city, interested in this?

Mr. OSBORN. This was EPA. The Resources Recovery Act of 1970 authorized something like $20 million a year for Interior to work on this, but we have never gotten a nickel. Instead of that, EPA has the funds, and they finally let out requests for proposals for construction of a recycling plant according to Bureau of Mines plans. They took over all this. The proposals came in from three cities. I do not know whether Baltimore submitted one or not. One was Chicago and one was Lowell.

Mr. LONG. It works, according to you, at Lowell, Mass.

Mr. OSBORN. No, it works in our pilot plant. Lowell is just constructing one. If it works at Lowell at that scale, 250 tons a day, we are in.

Mr. LONG. I would like to get something going in the Baltimore metropolitan area.

Mr. OSBORN. It should.

Mrs. HANSEN. Why don't you contact your city and county fathers?

Mr. LONG. Baltimore City and County are completely separate entities. Anne Arundel County is also separate. I just wondered what you have undertaken to do already to get those authorities interested.

Mr. OSBORN. In the Balitmore area, the foundries and glass plants and industrial operations will take the scrap without any haulage cost to amount to anything.

Mr. LONG. There is simply no place to dump solid waste.

Mr. OSBORN. It should not be dumped. It is valuable.

Mr. LONG. I don't know any place in Baltimore County, which has 650,000 population, where you can dump this stuff without getting a scream that will reach to high heaven. The county authorities claim they are helpless. They do not know what to do. The stuff has to be dumped. So we have smoking junkyards, which are cluttering up some of the finest areas around. I am disappointed the programs or experiments in recycling have not been carried on in the Baltimore area only 20 to 30 miles from College Park.

Mrs. HANSEN. Dr. Long, in its report to the House last year, the committee discussed this problem. The committee also devoted several pages of hearings to the discussion of this problem.

Mr. LONG. I know, as everybody knows, there are vague plans underway to do recycling.

Mrs. HANSEN. Dr. Osborn gave some excellent statistics on the amount of recycling work that was being accomplished. If I recall, Dr. Osborn brought along some exhibits.

It was fully covered in the record.

Mr. LONG. I want to get all the information you have because I plan to hold some meetings among the political people and the technical people in the Baltimore area to see what I can get going.

Mr. OSBORN. We will be very glad not only to give you the information, but we will get one of our people to discuss it if you will call my office.

Mr. LONG. This is not just a matter of more economics; it is a matter of the life of the community.

PROGRESS ON PILOT PLANT TO HANDLE ALL URBAN REFUSE

Mr. OSBORN. I would like to add this: What I have been talking about now is the incinerator residue where there are incinerators. Washington has four, and so on. There are 200 or 300 incinerators in the country. More important, in the long run, is development of a system to handle the whole urban waste, the raw refuse as it comes out. As I am sure some of the committee recall, we have been building a pilot plant to handle all the urban refuse in another building in College Park and I am glad to say this is in operation.

Mrs. HANSEN. What is your experience to date?

Mr. OSBORN. It is good. It has only been operating a couple of months. This separates the paper and plastic one way and separates the paper and the plastic and chops it up and so on. In this way we will have the organic material on one side, and we will have the inorganic material, which we now process from the incinerator residue. The fraction which is organic can then be made into low-sulfur fuel oil—that is this manure conversion business I was talking about—or it can ultimately be burned for steam or it can be used for scrap.

This is beginning to operate now. I would say that within a year we will have some good data on this.

The municipalities are very slow to pick up anything new. If a city councilman or the mayor does not do anything—

Mr. LONG. They are not slow to pick up new money.

Mr. OSBORN. If they do not do anything but go out and buy more land to dump more fill, there is nothing against them. If they go into something new, they might be criticized. I think this is the problem.

PROBLEMS IN FINDING NEW LAND FILL

Mr. LONG. They are sure criticized when they go out and pick up the land. You have community associations that make it worth your life to go into. The people gather for miles around whenever they see a land fill coming into their areas.

The authorities pick a couple of hundred acres of the most beautiful open rural land, with $30,000, $40,000, $50,000, $60,000 $70,000 homes

in the general area, and there they dump the stuff. They do not mind criticism from that apparently. I think it is partly because once the land is filled up, there is a real estate deal involved.

Mr. OSBORN. The Bureau of Mines is in this because we do not want to see this material wasted.

BUREAU EXPERIMENTAL PROGRAMS ON SOLID WASTE DISPOSAL

Mrs. HANSEN. Dr. Osborn, how long has the Bureau of Mines been performing these experimental programs?

Mr. OSBORN. Each year we make a little progress. This contract alone in Massachusetts represents a real step increase.

Mrs. HANSEN. I have been on this committee for 10 years and the Bureau of Mines has been working on these various problems long before environmental concerns were in vogue. I want to compliment the Bureau of Mines for their imagination. Sometimes it has been a little difficult to get funds out of the Office of Management and Budget. Experimentation and these kinds of programs take a long time to develop.

Mr. LONG. I want to compliment you, too, and I want to deplore the fact that with a research program at College Park, Md., you had to go all the way to Lowell, Mass., when we have probably the greatest area for experiment just a few miles away.

Mr. OSBORN. It is incredible, I agree.

ROLE OF THE BUREAU AND EPA IN SOLID WASTE RECYCLING

Mr. VEYSEY. On that point, Madam Chairman, may I ask this question? Are our programs in solid waste recycling fractioned among several agencies? Does the Bureau of Mines have something, and EPA have something else and so on?

Mr. OSBORN. Yes, they would seem to be. The difference is this: The Bureau of Mines does this all in-house. EPA does not operate such laboratories and does it under contract. EPA is contracting some research. This particular program was developed in-house in the Bureau of Mines.

The apparent conflict developed with respect to a demonstration plant. We wanted to see a demonstration plant built just as soon as possible at a municipality and 2 years ago we were arguing for it and 1 year ago we were still arguing and we finally gave up because we could not get any money.

EPA had some funding and this arrangement with Lowell went through. This is where the apparent conflict arose. This year I think EPA's money in solid waste has been cut way back.

Mr. VEYSEY. Is there any other agency that has any solid waste work going?

Mr. OSBORN. No, this is all.

Mr. VEYSEY. Out in California, which I have not heard mentioned here—you have been talking about Baltimore and Lowell—I am aware that there are some projects that seem to parallel. For example, UCLA has some on recycling manure.

DEPARTMENT OF AGRICULTURE SOLID WASTE WORK IN CALIFORNIA

Mr. HENRIE. The Department of Agriculture has this particular problem.

Mr. VEYSEY. Agriculture is working on agriculture waste?

Mr. OSBORN. Yes, and there is some industrial work on pyrolysis. We are not working on pyrolysis anymore. If you do not know the term, that is the process where you make charcoal or coke. Urban refuse can be treated this way and you end up with a char which hopefully you can burn someplace, and you get a little gas and oil from it. This has real hope, I think, for certain areas, and this is being tried in the Los Angeles area. It is not still a means of getting back into circulation the mineral materials, the metals and glass and so on, that we are interested in.

Mr. VEYSEY. There is a process that I am aware of in California that takes feed lot manure and combines it with broken up bottles to make a building material plus oil. I do not know if this is one of your projects.

Mr. OSBORN. Don't associate us with that.

Mr. VEYSEY. You wish to be disassociated with that?

PHOSPHATE SLIME PROBLEM IN FLORIDA

Mr. OSBORN. Yes, if you are associating it. I would like to go on to a couple of other things in the environment. One of the real serious problems in mining—and we have to have mining someplace in the world—is the surface problem. One of the worst problems is in Florida with the phosphate slimes. That waste material hangs on to about 95 percent water. Even though they might mine a 20-foot bed of phosphate and take out a third, the remaining two-thirds has a larger volume than the original because you have this colloidal mess which they call slimes. Twice in the last 4 years the large enclosed areas that hold many acres of these slimes have broken loose. The dams have broken and the slimes have gone into the river and completely ruined the river for many months. We have to do something about it. The Bureau of Mines has been working on this problem of how to dewater this type of waste, trying to get the water out so we can handle the drier material.

I want to report—I think it is very important—that during this past year I was able to accompany some of our people down to Florida for the signing of a contract with the Florida Phosphate Council. The council is made up of the 14 companies which are mining and processing phosphates down there. The Bureau of Mines is putting in people and knowledge and the phosphate industry about $600,000. We are now going into a real field testing program on dewatering these slimes. This is a very important industry. They produce about three-fourths of all the phosphate we use, which is largely fertilizer and produce about a third of the world's supply in Florida. This has got to be gotten under control. We think working with industry we can.

Mrs. HANSEN. What will they do with the dry residue?

Mr. OSBORN. The dry residue would have a lower volume so we can put it back in the hole and reclaim the land.

SURFACE SUBSIDENCE FROM UNDERGROUND MINES

Now we just have this mess down there which is terrible. I would like to mention a third and final item in this little review of the environmental matter. That has to do with the back-filling. There are state-

ments made about how we should stop strip mining and do underground mining of coal. Actually, the underground mining turns out to be a worse hazard than strip mining for this reason. With reasonable control and regulation we can handle the strip mining. We know what to do at the surface. It is a matter of enforcing it and doing it. But in underground mining we do not really know what to do. So we just go ahead and mine and we leave about half of the coal underground as pillars. The pillars, of course, hold up the roof. I have some pictures here which I am trying to describe.

Here is one of the mines under Scranton. These pillars comprise about 50 percent of the coal in the mined bed. Hence from the standpoint of mineral conservation this is much worse than strip mining. In strip mining you get most of the coal out. Here you leave half of it. Second, in time the coal begins to spall off the pillars and finally the pillar will give way a little bit and the roof comes down. Let us say the coal seam is 10 feet thick and some in the Scranton area are much thicker than that, 20 feet, and then the roof will cave in and the rock comes down and pretty soon the surface begins to subside. The reason that Scranton is so important is that this is the oldest coal mining region. It might take 100 or 150 years to have this happen. But it is inevitable. All of underground coal mining is going to cause trouble at the surface. If it is out in the woods, a little slump here and there, might not be noticed. But as we build out the cities we will be noticing more and more of this land that is undermined.

Mr. McKay. There is a classic example in England where they have dug for years and some cities are sinking.

Mr. Osborn. Yes.

SURFACE EFFECTS OF UNDERGROUND GASIFICATION

Mr. Veysey. What is the effect in your underground gasification? You are going to intentionally burn coal underground?

Mr. Osborn. Yes, but we will do that instead of mining. In other words, we have to mine but we need to figure out some way to take care of it so that we don't cause troubles that we don't want.

Mr. Veysey. What are you going to do about gasification? Nobody down there?

Mr. Osborn. We are not doing anything about the mining either. In other words, this is a substitute for mining but if through gasification we take practically all the coal out, at least we have a conservation measure and, furthermore, it will start subsiding pretty soon, which might be a blessing——

Mrs. Hansen. The subsidence will occur many years in advance of other types of subsidence.

Mr. Osborn. Yes, and we ought to be able to predict it I think. You are touching a very important point, but the main thing is we have a tremendous area of ignorance of what to do about this. But in the case of Scranton, now, this old, old region, it is my feeling, my philosophic attitude toward this, that we should not object at all to very large expenditures of public funds to take care of this because in the past we have produced something like 5 billion tons of anthracite and at the current price of $15 a ton that is about $75 billion worth

of energy we have produced out of there which has made possible the tremendous industrial development in this country.

So it is something like floating bonds for schools; you pay for it in the future. Well, it seems to me that we are now having to go back and pay some of the costs that we didn't pay when we were mining this coal.

Mrs. HANSEN. The same is true with burning culm banks.

PROGRESS ON BACKFILLING PROGRAM IN SCRANTON AREA

Mr. OSBORN. Exactly. So up in the Scranton area we are making, some I think tremendous progress—Congressman McDade knows a great deal about this and has supported it, of course—where we are developing a new scheme, contractors of ours are, and of course we are monitoring the whole thing, of a backfilling with a slurry.

We tried that first at Rock Springs, Wyo., a year ago. Now at Scranton we are using one of these huge culm banks, 300,000 cubic yards, crushing it down to a quarter inch, mixing it with about six parts of water in a tremendous tank, flowing it underground under high pressure so it spreads out into these tunnels underground.

At the present time we are about two-thirds through with that job. It should be finished in May. We are up now to 40,000 cubic yards a day underground injection. Furthermore, we are now experimenting, and it is successful, with using one-half inch material, which is a lot lower cost to grind. In other words grinding this culm bank material to one-quarter inch is more expensive than grinding it one-half inch. So right in the heart of Scranton, below which there are two thick coal seams that have been mined out, but where it hasn't started to cave yet but we know it is gong to cave, we are carrying on this backfilling experiment.

Now, we don't have the authority to go into large-scale public works program but we have the authority to go into sufficiently large demonstration projects so we can show whether it will work or not.

Mrs. HANSEN. What is the cost per acre?

Mr. OSBORN. This present job is $1.7 million and it is 22 acres but two coal seams. So it must be something like $40,000 an acre. But the real estate on that is worth many millions of dollars. It will be ruined if it sinks.

It is very expensive property in downtown Scranton. Now, as to the coal that came out of that 20 acres, well, it must be like $1 billion worth of coal and we just didn't pay the cost. We should have backfilled right then, just pushed the waste rock back. But we didn't so now we have to pay for it.

Mr. MCKAY. What is it you are filling it back with? A gravel pit or something?

Mr. OSBORN. No; there are tremendous piles of waste rock that were taken out of the mines and now remain as an eyesore. They catch on fire now and then because they still contain a fair amount of coal. So by removing those big culms banks, as they are called, we eliminate a health problem and at the same time bring new real estate into being.

Mr. MCKAY. I am with you now.

Mr. OSBORN. We also carried on an experiment at Rock Springs with the $800,000 which you folks provided and Rock Springs is a similar situation to Scranton.

Let me move on then to the third point that I wanted to emphasize and that is mineral production. With all of this noise about the energy problem—and it is not because we don't have energy sources; it is just that we haven't really administered this very well—but with all of this noise we sometimes tend to forget that mineral production is also extremely important.

I just happen to have, for example, one of these charts—as a matter of fact, I have a couple of them here—which is one way of showing the situation. You notice on the left there we show imports. Crude oil and refined petroleum imports are $4.3 billion, but, look, iron and steel are $3 billion, aluminum metal $0.3 billion, alumina $0.2 billion, bauxite $0.2 billion, copper metal, nickel metal, and so on.

Mrs. HANSEN. Yesterday we asked the Department to be sure that you provide a list for the record of the countries we are importing minerals from, the amount by country, and the value of the minerals. They told us that the Bureau of Mines was the agency to ask to provide this type of information. Will you please insert the information in the record at this point?

Mr. OSBORN. Yes.

[The information follows:]

Table - 1

Value of U.S. Mineral Supply and Demand Components (current)

Drawing on current balances, the essential components of U.S. Supply and the distribution of U.S. Supply of individual commodities may be converted to apparent value and tabulated.

"Values" are the product of multiplying quantitative units by the average price for the primary material during the year for which the balance is drawn and thus do not always represent the commercial value of the crude materials as actually marketed. This practice is used in all of the other tables too.

Commodities are grouped to permit separate summation of metals and mineral-forming elements, nonmetallic minerals, mineral fuels and certain industrial gases. This grouping is retained in all related tabulations.

This tabulation permits an initial concept of prevailing value relationships between the essential components of the total U.S. supply like primary production, secondary production, and imports. Similarly, it permits an understanding of how the supply is distributed, accounting for incremental changes in industry stocks, National stockpile balances and exports in the balance between supply and demand.

Complementing the tabulations, the data are shown graphically in Figure 2. The latter presentation also relates U.S. primary mineral production to that in the rest of the world and identifies the source, by continent, of U.S. primary mineral imports.

TABLE 1

JANUARY 17, 1973

VALUE OF U.S. MINERAL SUPPLY AND DEMAND COMPONENTS IN 1971
(MILLION DOLLARS)

(THE VALUES ARE BASED ON U.S. 1971 PRICES FOR MATERIALS IN PRIMARY FORM AND IN SOME CASES DO NOT REPRESENT COMMERCIAL VALUE OF THE CRUDE MATERIALS).

	COMPONENTS OF U.S. SUPPLY						DISTRIBUTION OF U.S. SUPPLY					
	PRIMARY PRODUCTION FROM DOMESTIC SOURCES	SECONDARY PRODUCTION	IMPORTS	STOCK-PILE RELEASE	STOCKS 1/1/71	TOTAL SUPPLY	STOCKS 12/31/71	STOCK-PILE ACQUISITION	EXPORTS	TOTAL DEMAND	PRIMARY DEMAND	TOTAL DISTRIBUTION
ALUMINUM	297.0	125.3	2,919.6	118.9	3,205.7	5,666.5	2,445.3	.0	491.3	2,730.0	2,604.7	5,666.6
ANTIMONY	2.6	25.0	10.2	.0	12.6	59.4	12.3	.0	1.7	45.4	20.5	59.4
ARSENIC	*	.0	3.4	.0	*	5.5	*	.0	.0	*	*	5.5
BARIUM	12.5	.0	7.3	.0	1.6	21.4	.6	.0	.4	20.5	20.5	21.5
BERYLLIUM	*	*	19.3	1.1	*	82.6	*	.0	2.5	*	*	82.5
BISMUTH	*	*	5.7	(89)	*	15.2	*	.0	.2	*	*	15.3
BORON	91.8	.0	.5	.0	1.0	93.3	1.0	.0	46.8	45.5	45.5	93.3
BROMINE	60.5	.0	(02)	.0	5.6	66.1	5.4	.0	3.4	57.3	57.3	66.1
CADMIUM	6.8	.0	15.1	(02)	9.2	31.1	10.2	.0	.1	20.8	20.8	31.1
CALCIUM	378.0	.0	3.0	.0	38.7	419.7	38.7	.0	3.0	378.0	378.0	419.7
CESIUM	.0	.0	(02)	.0	*	*	*	.0	.0	*	*	*
CHLORINE	701.2	.0	2.6	.0	15.0	718.8	15.0	.0	.8	703.0	703.0	718.8
CHROMIUM	.0	7.3	76.9	7.0	45.5	136.7	63.2	.0	10.5	62.9	55.6	136.6
COBALT	1.3	.3	24.0	9.7	12.6	42.1	11.5	.0	.8	29.8	29.5	42.1
COLUMBIUM	.0	.0	.0	(61)	10.3	14.5	7.7	.0	(31)	6.8	6.8	14.5
COPPER	1,582.9	462.8	358.8	.0	470.8 1/	2,959.8	609.4	.0	195.5	2,154.9	1,462.1	7,959.8
FLUORINE	17.1	.0	67.6	7.1	20.7	118.5	27.6	.0	.7	90.3	90.3	118.6
GALLIUM	*	.0	1.9	.0	*	2.8	*	.0	.6	*	*	2.6
GERMANIUM	3.6	.0	2.9	.0	12.0	17.6	12.2	.0	.0	5.3	5.3	17.5
GOLD	61.7	90.8	256.4	.0	164.3 1/	570.9	180.5	.0	28.9	361.5	370.7	570.9
HAFNIUM	.0	.0	5.4	.0	1.9	7.3	1.7	.0	.0	5.6	5.6	7.3
INDIUM	*	.0	1.1	.0	*	4.1	*	.0	.0	*	*	4.1
IODINE	*	.0	11.0	.0	2.2	*	*	.0	.7	8.7	8.7	*
IRON	3,733.2	2,294.6	1,620.8	.0	3,386.9	11,335.5	3,764.8	.0	144.3	7,426.5	5,131.9	11,335.6
LEAD	161.8	137.2	76.7	3.6	91.3 2/	472.7	69.2	.0	1.7	401.8	364.6	472.7
LITHIUM	*	*	.2	.0	*	*	*	.0	.9	*	*	*
MAGNESIUM-METAL	88.9	2.0	2.6	.5	9.1	103.1	10.6	.0	17.5	75.0	73.1	103.1
MAGNESIUM-NONMETALLIC	84.4	.0	9.1	.0	.0	93.5	.0	.0	3.5	90.0	90.0	93.5
MANGANESE	2.0	.0	61.6	6.3	63.0	132.9	68.7	.0	1.6	62.7	62.7	133.0
MERCURY	5.1	3.8	8.7	1.7	4.8	23.5	6.1	.8	2.1	15.3	12.1	23.5
MOLYBDENUM	189.5	.0	1.1	1.5	71.1	261.6	110.3	.0	81.4	69.9	69.8	261.6
NICKEL	41.6	193.8	375.5	39.5	149.0	799.4	218.0	.0	12.4	569.1	569.1	799.5
NITROGEN-COMPOUNDS	639.4	.0	23.5	.0	76.7	739.6	89.7	.0	22.8	633.1	633.1	799.6
NITROGEN-GAS & LIQUIDS	148.9	.0	.0	.0	.0	148.9	.0	.0	.0	148.9	148.9	148.9
PALLADIUM	.4	5.7	25.8	.0	12.3 2/	44.2	11.3	.2	4.9	28.1	22.5	44.5
PHOSPHOROUS	205.2	.0	.5	.0	75.6	281.3	68.7	.0	70.2	142.3	142.3	281.2
PLATINUM	1.0	12.1	63.7	.0	32.1 2/	108.6	23.5	.4	31.7	53.0	41.0	108.6
POTASSIUM	100.9	.0	107.9	.0	17.7	226.5	17.5	.0	22.0	187.0	187.0	226.5
RARE EARTHS	*	.0	1.8	1.0	*	13.2	*	.0	1.8	7.1	7.1	13.2
RHENIUM	6.9	.0	.4	.0	7.6	14.9	7.6	.0	.0	7.2	7.2	14.8
RHODIUM	.8	1.8	7.6	.0	9.6	18.4	10.0	.0	1.6	6.8	5.0	18.4
RUBIDIUM	.0	.0	.0	.0	*	*	*	.0	.0	.0	.0	*
SCANDIUM	.0	.0	.1	.0	(21)	.1	(84)	.0	.0	(58)	(58)	.0
SELENIUM	5.6	.3	3.6	.0	1.7	11.2	1.6	.0	1.4	8.2	7.9	11.2
SILICON	137.0	.0	3.9	.0	20.3	161.2	10.3	.0	3.8	138.0	138.0	161.1
SILVER	84.0	46.3	84.9	3.9	323.7 1/	516.2	294.7	.0	18.8	202.7	156.3	516.2
SODIUM	378.0	.0	32.9	.0	19.7	428.6	19.7	.0	9.4	399.6	399.6	428.7
STRONTIUM	.0	.0	1.1	.0	.3	1.4	.3	.0	.0	1.1	1.1	1.4
SULFUR	167.5	.0	25.0	.0	70.7	263.2	75.6	.0	26.9	160.7	160.7	263.2
TANTALUM	.0	1.2	8.4	(50)	32.9	42.4	30.4	.0	1.3	10.8	9.6	42.5
TELLURIUM	1.0	.0	1.2	.0	.8	2.0	.7	.0	.0	1.3	1.3	2.0
THALLIUM	*	.0	(34)	*	*	*	*	.0	.0	*	*	*
THORIUM	*	.0	2.8	.0	8.3	12.1	*	.0	.0	*	*	12.1
TIN	*	42.2	187.0	6.5	85.3	321.0	83.9	.0	8.5	228.7	186.5	321.1
TITANIUM-METAL	.0	.0	44.9	.0	50.2 3/	95.1	46.9	.0	4.3	44.0	44.0	95.1
TITANIUM-NONMETALLIC	200.7	.0	186.3	.0	458.1	845.1	406.8	.0	14.4	423.9	423.9	845.1
TUNGSTEN	20.4	1.5	1.7	4.1	46.0	73.7	32.8	.0	6.4	34.4	32.9	73.7
VANADIUM	31.7	.0	14.9	(96)	24.1	70.3	26.9	.0	3.8	40.3	40.3	70.4
YTTRIUM	*	.0	1.2	.0	*	3.1	*	.0	(18)	*	*	*
ZINC	161.0	25.6	257.9	1.0	65.6	511.1	48.3	.0	1.6	461.1	435.5	511.0
ZIRCONIUM-METAL	.0	.0	101.1	.0	12.0 3/	113.1	5.3	.0	11.7	*	*	113.0
ZIRCONIUM-NONMETALLIC	*	.0	4.2	.0	*	12.1	*	.0	*	*	*	12.0
TOTAL	9,842.6	3,479.1	7,496.0	206.5	8,517.4	29,379.9	9,073.0	.7	1,321.6	18,483.9	15,405.2	29,379.4
ASBESTOS	15.4	.0	80.4	.0	2.6	99.3	3.5	.0	4.3	89.5	89.5	99.3
CLAYS	273.6	.0	.3	.0	.0	273.9	.0	.0	9.5	264.5	264.5	274.0
COLUMBIUM	.0	.0	(03)	.1	(98)	.1	(99)	.0	.0	.1	.1	.1
DIATOMITE	34.3	.0	.0	.0	2.4	36.7	2.6	.0	9.1	25.0	25.0	36.7
FELDSPAR	9.4	.0	(30)	.0	2.0	11.0	3.9	.0	(60)	8.1	8.1	12.0
GARNET	1.9	.0	.0	.0	.6	2.5	.6	.0	.3	1.6	1.6	2.5
GRAPHITE	*	.0	2.7	.2	*	*	*	.0	.3	*	*	*
GYPSUM	39.1	.0	22.9	.0	15.6	77.6	14.0	.0	.2	63.4	63.4	77.6
KYANITE	*	.0	(74)	.0	.0	*	.0	.0	2.4	*	*	*
MICA-SCRAP & FLAKE	2.9	.0	184.7	.0	(58)	2.9	.1	.0	(81)	2.9	2.9	3.0
MICA-SHEET	(12)	.0	4.1	1.2	1.9	7.2	1.5	.0	1.7	4.0	4.0	7.2
PEMLITE	4.9	.0	.0	.0	.5	5.4	.5	.0	.1	4.8	4.8	5.3
PUMICE	3.5	.0	.4	.0	.3	4.2	.3	.0	.0	4.0	4.0	.3
SAND & GRAVEL	1,150.0	.0	1.3	.0	250.0	1,401.3	250.0	.0	2.5	1,148.8	1,148.8	1,401.3
STONE-CRUSHED	1,146.3	.0	1.8	.0	350.0	1,498.1	350.0	.0	1.8	1,146.3	1,146.3	1,498.1
STONE-DIMENSION	93.4	.0	14.2	.0	113.4	221.0	113.4	.0	1.8	105.8	105.8	221.0
TALC	7.6	.0	.1	.0	1.5	9.2	1.1	.0	1.0	7.2	7.2	9.3
VERMICULITE	7.2	.0	.2	.0	.2	7.6	.2	.0	1.0	6.5	6.5	7.7
TOTAL	2,801.1	.0	128.4	2.4	741.7	3,673.6	742.4	.0	43.3	2,888.7	2,888.7	3,674.5
ANTHRACITE	103.9	.0	.0	.0	17.0	120.9	16.9	.0	18.5	87.3	87.35/	120.7
BITUMINOUS COAL & LIGNITE	3,904.0	.0	.8	.0	662.8	4,567.6	644.7	.0	400.4	3,498.7	3,498.75/	4,543.8
NATURAL GAS	3,889.8	.0	168.4	.0	574.4	4,632.5	634.1	.0	14.4	3,983.9	3,983.9	4,632.4
PEAT	7.1	.0	3.3	.0	.0	10.4	.0	.0	.0	10.5	10.5	10.5
PETROLEUM 4/	13,111.1	.0	4,606.6	.0	3,277.5 7/	21,497.0	3,361.5	.0	263.0	17,872.5	17,872.5	21,497.0
SHALE OIL	.3	.0	.0	.0	.0	.3	.0	.0	.0	.3	.3	.3
URANIUM	159.6	.0	11.7	.0	117.4	288.9	123.4	.0	.6	165.0	165.0	289.0
TOTAL	21,176.0	.0	4,780.9	.0	4,649.1	31,117.8	4,780.6	.0	694.9	25,618.2	25,618.2	31,093.7
ARGON	42.1	.0	.0	.0	.0	42.1	.0	.0	.0	42.1	42.1	42.1
HELIUM	14.5	.0	.0	.0	.0	14.5	.0	.0	3.3	11.3	11.3	14.6
HYDROGEN	670.8	.0	.0	.0	.0	670.8	.0	.0	.0	670.8	670.8	670.8
OXYGEN	156.0	.0	.0	.0	.0	156.0	.0	.0	.0	156.0	156.0	156.0
TOTAL	883.4	.0	.0	.0	.0	883.4	.0	.0	3.3	880.2	880.2	883.5
GRAND TOTAL	34,703.1	3,479.1	12,375.3	208.9	13,908.2	65,054.7	14,596.0	.7	2,063.1	48,371.0	44,892.3	65,031.1

1/ EXCLUDES VALUE OF PRIMARY MATERIALS PRODUCED IN 1971 BUT NOT REFINED, AS FOLLOWS:
COPPER, $115.5 MILLION; AND GOLD, $2.3 MILLION; AND SILVER, $6.6 MILLION.
2/ INCLUDES VALUE OF PRIMARY MATERIALS PRODUCED IN PREVIOUS YEAR AND REFINED IN 1971 AS FOLLOWS:
LEAD, $2.1 MILLION; PLATINUM, $9.2 MILLION; AND PALLADIUM, $0.3 MILLION.
3/ INCLUDES $44.9 MILLION SPONGE PRODUCED FROM IMPORTED RUTILE.
4/ VALUE OF ZIRCONIUM SPONGE PRODUCED FROM IMPORTED ZIRCON.
5/ INCLUDES VALUE FOR LOSSES AS FOLLOWS:
ANTHRACITE, $48 THOUSAND; AND BITUMINOUS COAL AND LIGNITE, $23.8 MILLION.
6/ INCLUDES NATURAL GAS LIQUIDS.
7/ INCLUDES $502.0 MILLION FOR MISCELLANEOUS PRODUCTION.
NA NOT AVAILABLE. ( ) ACTUAL DATA. THOUSANDS DOLLARS. SOME DATA MAY NOT ADD TO TOTAL DUE TO ROUNDING.
* CERTAIN DATA ARE WITHHELD BECAUSE THE MANNER IN WHICH THE INFORMATION BECAME AVAILABLE TO THE BUREAU OF MINES DOES NOT PERMIT GENERAL DISCLOSURE.

Figure 2. - U.S. Mineral Supply-Demand Relationships in 1971
(Million Dollars)

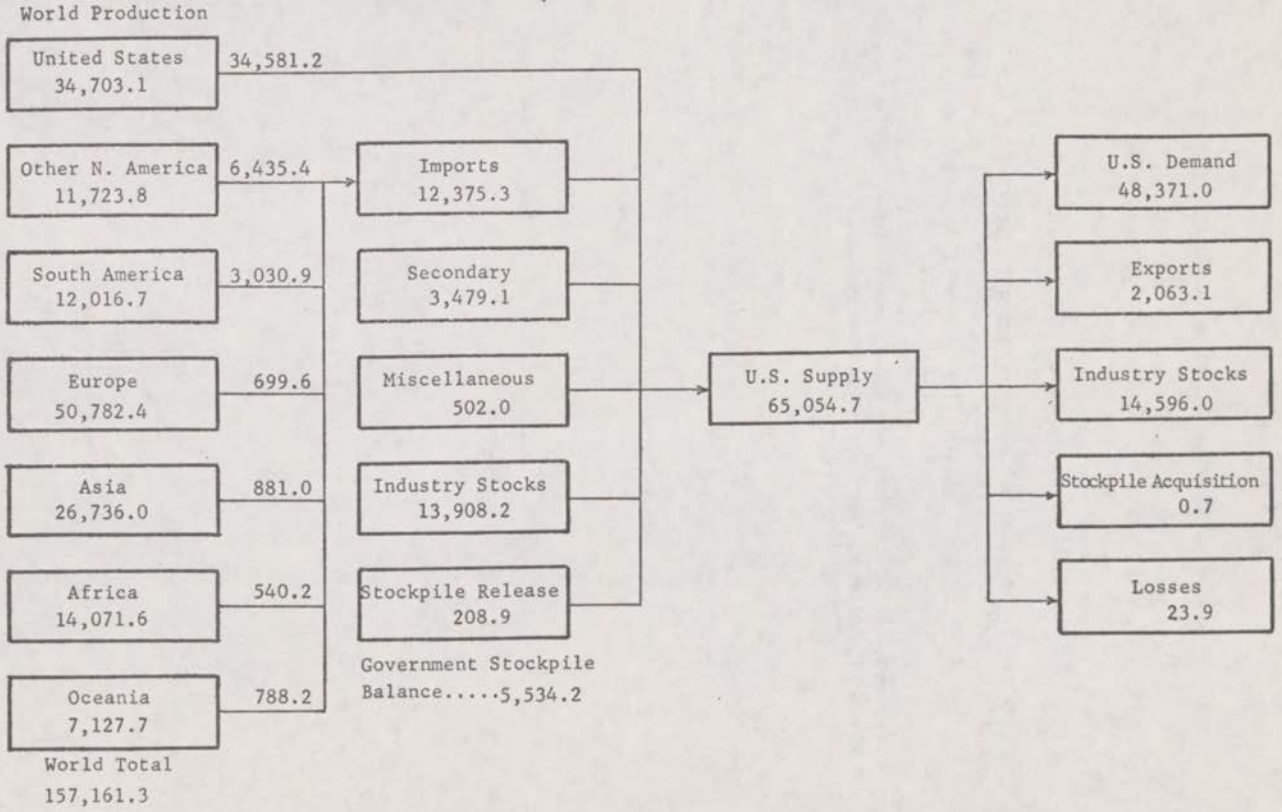


Table - 2

Value of Mineral Imports (Current)

The import component of U.S. Supply, described in Table 1, is explained in terms of continental source. Further, the value of mineral imports by the principal countries of origin is summarized in Table 2A.

Through the process of annual or more frequent revision of these tabulations, and the individual commodity balances from which they are drawn, impressions may be gained of the significant changes in world source patterns. Similarly, changes in the forms in which materials move to U.S. markets (e.g. bauxite vs. alumina vs. aluminum) are detectable in the process of revising the supply-demand balances.

TABLE 2 JANUARY 17, 1973

VALUE OF U.S. MINERAL IMPORTS IN 1971
(THOUSAND DOLLARS)

(THE VALUES ARE BASED ON U.S. 1971 PRICES FOR MATERIALS IN PRIMARY FORM AND IN SOME CASES DO NOT REPRESENT THE COMMERCIAL VALUE OF THE CRUDE MATERIALS)

	NORTH AMERICA	SOUTH AMERICA	EUROPE	ASIA	AFRICA	OCEANIA	GRAND TOTAL
ALUMINUM	1,591,513	712,934	135,097	29,134	22,165	428,785	2,919,628
ANTIMONY	4,628	2,740	3,962	1,734	6,088	90	19,202
ARSENIC	1,144	428	1,097	672	25	-	3,366
BARIUM	2,565	1,674	2,727	-	351	-	7,317
BERYLLIUM	82	12,768	72	-	5,999	403	19,324
BISMUTH	3,020	1,010	317	1,352	-	-	5,699
BORON	-	-	-	520	-	-	520
BROMINE	-	-	2	-	-	-	2
CADMIUM	8,639	1,089	2,064	1,803	286	1,240	15,121
CALCIUM	3,010	-	-	-	-	-	3,010
CESIUM	-	-	2	-	-	-	2
CHLORINE	2,550	75	-	-	-	-	2,625
CHROMIUM	-	166	23,240	28,552	24,900	-	76,858
COBALT	2,000	-	12,860	-	9,145	-	24,005
COLUMBIUM	246	2,361	324	667	560	18	4,176
COPPER	141,273	154,693	19,261	13,667	28,309	1,596	358,799
FLUORINE	53,620	-	13,160	-	840	-	67,620
GALLIUM	186	-	1,691	1	-	-	1,878
GERMANIUM	798	133	665	399	4	-	1,995
GOLD	120,780	990	111,582	3,630	18,356	1,073	256,411
HAFNIUM	-	-	-	-	-	5,440	5,440
INDIUM	586	86	373	95	3	3	1,146
IODINE	-	5,369	-	7,872	-	-	13,241
IRON	992,165	783,662	8,450	-	86,906	49,601	1,920,784
LEAD	38,920	15,680	3,640	-	3,640	14,840	76,720
LITHIUM	-	187	-	-	39	-	226
MAGNESIUM-METAL	1,403	-	1,115	-	120	6	2,644
MAGNESIUM-NONMETALLIC	149	-	7,990	915	-	41	9,095
MANGANESE	1,286	17,956	5,843	1,715	32,000	2,841	61,641
MERCURY	6,741	292	1,236	419	-	-	8,688
MOLYBDENUM	7	1,438	-	24	-	-	1,469
NICKEL	310,039	-	38,656	5	6,544	20,216	375,460
NITROGEN-COMPOUNDS	18,928	2,744	1,848	-	-	-	23,520
PALLADIUM	1,258	74	22,681	74	1,554	111	25,752
PHOSPHOROUS	468	-	-	-	-	-	468
PLATINUM	2,214	3,075	40,221	2,583	14,760	369	63,222
POTASSIUM	103,964	376	1,034	2,538	-	-	107,912
RARE EARTHS	-	37	-	1,118	-	694	1,849
RHENIUM	-	-	359	-	-	-	359
RHODIUM	-	600	6,200	-	200	-	7,000
SCANDIUM	81	-	-	-	-	39	120
SELENIUM	3,231	27	126	171	-	-	3,555
SILICON	502	-	2,746	534	79	-	3,881
SILVER	57,879	22,156	1,701	1,044	705	1,451	84,936
SODIUM	27,816	2,305	1,991	-	827	-	32,939
STRONTIUM	844	-	244	-	-	-	1,088
SULFUR	24,973	-	-	-	-	-	24,973
TANTALUM	1,776	430	942	2,957	1,975	182	8,262
TELLURIUM	42	132	6	-	-	-	180
THALLIUM	16	2	17	-	-	-	35
THORIUM	-	-	-	1,323	-	1,514	2,837
TIN	935	17,076	2,477	161,232	1,145	4,175	187,040
TITANIUM-METAL	-	-	2,640	5,280	-	36,960	44,880
TITANIUM-NONMETALLIC	61,200	-	10,800	9,900	9,000	95,400	186,300
TUNGSTEN	876	660	-	-	-	172	1,708
VANADIUM	-	5,760	1,038	-	7,716	-	14,514
YTTRIUM	450	-	-	342	-	396	1,188
ZINC	183,040	23,360	28,160	2,880	7,680	12,800	257,920
ZIRCONIUM-METAL	2,724	-	4,104	1,224	-	93,000	101,052
ZIRCONIUM-NONMETALLIC	-	-	-	-	73	4,387	4,460
ASBESTOS	76,547	-	814	-	3,039	-	80,400
CLAYS	10	-	297	-	-	-	307
CORUNDUM	-	-	-	-	3	-	3
FELDSPAR	30	-	-	-	-	-	30
GRAPHITE	2,147	-	207	111	204	-	2,669
GYPSUM	22,853	-	-	-	-	-	22,853
KYANITE	-	-	-	74	-	-	74
MICA-SCRAP & FLAKE	-	17	-	62	3	-	82
MICA-SHEET	2	583	21	3,369	161	-	4,136
PUMICE	2	-	426	-	-	-	428
SAND & GRAVEL	1,250	-	-	-	-	-	1,250
STONE-CRUSHED	1,750	-	-	-	-	-	1,750
STONE-DIMENSION	1,531	-	12,304	-	340	-	14,175
TALC	59	-	58	7	-	-	124
VERMICULITE	-	-	-	-	240	-	240
BITUMINOUS COAL & LIGNITE	615	-	-	-	170	-	785
NATURAL GAS	168,120	-	-	-	180	-	168,300
PEAT	3,311	-	152	-	-	-	3,463
PETROLEUM 1/	2,373,604	1,235,797	158,519	591,060	237,227	10,391	4,606,598
URANIUM	2,993	-	2,001	-	6,672	-	11,666
TOTAL	6,435,391	3,030,942	699,580	881,059	540,229	788,194	12,375,395

1/ INCLUDES NATURAL GAS LIQUIDS.

TABLE 2A JANUARY 17, 1973

VALUE OF U.S. MINERAL IMPORTS, BY COUNTRIES, IN 1971
(THOUSAND DOLLARS)

(THE VALUES ARE BASED ON U.S. 1971 PRICES FOR MATERIALS IN PRIMARY FORM AND IN SOME CASES DO NOT REPRESENT THE COMMERCIAL VALUE OF THE CRUDE MATERIALS)

COUNTRY	VALUE
*** NORTH AMERICA ***	
BAHAMAS	183,069
CANADA	3,561,118
DOMINICAN REPUBLIC	118,924
GUATEMALA	1,113
HAITI	64,961
HONDURAS	14,990
JAMAICA	1,125,452
MEXICO	192,065
NETHERLAND ANTILLES	507,984
NICARAGUA	1,453
PANAMA	7,160
PUERTO RICO	112,008
TRINIDAD + TOBAGO	223,113
VIRGIN ISLANDS	320,300
>UNDISTRIBUTED	2
TOTAL	6,463,391
*** SOUTH AMERICA ***	
ARGENTINA	1,460
BOLIVIA	21,070
BRAZIL	131,316
CHILE	116,152
COLOMBIA	36,963
GUYANA	107,880
PERU	216,112
SURINAM	605,054
VENEZUELA	1,795,235
TOTAL	3,030,962
*** EUROPE ***	
AUSTRIA	1,848
BELGIUM - LUXEMBOURG	39,504
FINLAND	19,106
FRANCE	57,311
GREECE	30,129
IRELAND	4,276
ITALY	107,915
LATVIA	1,282
NETHERLANDS	36,469
NORWAY	69,486
POLAND	2,203
PORTUGAL	1,812
RUMANIA	5,970
SPAIN	27,752
SWEDEN	13,917
SWITZERLAND	110,090
U.S.S.R.	46,288
UNITED KINGDOM	89,538
WEST GERMANY	24,615
YUGOSLAVIA	10,625
>UNDISTRIBUTED	451
TOTAL	699,580
*** ASIA ***	
ABU DHABI	93,464
BAHRAIN	14,767
INDIA	9,710
INDONESIA	135,993
IRAN	131,932
IRAQ	14,509
ISRAEL	2,563
JAPAN	67,309
KUWAIT	42,414
MALAYSIA	118,614
PAKISTAN	1,992
PHILIPPINES	26,240
SAUDI ARABIA	149,917
THAILAND	53,625
TURKEY	18,568
>UNDISTRIBUTED	1,373
TOTAL	881,050
*** AFRICA ***	
ALGERIA	18,067
EGYPT	22,295
GABON	17,152
GHANA	22,467
GUINEA	1,740
LIBERIA	86,219
LIBYA	71,964
MOROCCO	4,140
MOZAMBIQUE	1,562
NIGERIA	127,589
REPUBLIC OF SOUTH AFRICA	125,992
RHODESIA	1,504
SIERRA LEONE	9,002
SOUTH WEST AFRICA	3,643
UGANDA	1,083
ZAIRE	18,627
ZAMBIA	6,937
>UNDISTRIBUTED	2,751
TOTAL	540,229
*** OCEANIA ***	
AUSTRALIA	744,057
CHRISTMAS ISLAND	22,040
NEW CALEDONIA	18,088
>UNDISTRIBUTED	9
TOTAL	788,194
GRAND TOTAL	12,375,395

>UNDISTRIBUTED = LESS THAN ONE MILLION DOLLARS

Table - 3

Value of Imports Compared to Exports (Current)

The total value of the import component of U.S. supply shown in Table 1, and in geographic detail in Table 2, is compared with the export component of the distribution of supply.

Initial impressions may be gained of the national material trade position as well as the individual commodity instances where import-export relationships might merit particular attention. The degree to which foreign supplies accommodate U.S. demands is illustrated.

Notably, high values of imports compared to exports, are assignable to a relatively small number of commodities.

Again the process of annual revision provides the means for detecting significant changes from a position at any given time or from long-term trends.

TABLE 3 JANUARY 17, 1973

VALUE OF U.S. MINERAL IMPORTS AND EXPORTS IN 1971
(THOUSAND DOLLARS)

(THE VALUES ARE BASED ON U.S. 1971 PRICES FOR MATERIALS IN PRIMARY FORM AND IN SOME CASES DO NOT REPRESENT THE COMMERCIAL VALUE OF THE CRUDE MATERIALS)

COMMODITY	IMPORTS	EXPORTS	NET IMPORTS + NET EXPORTS -
ALUMINUM	2,919,628	491,260	+ 2,428,368
ANTIMONY	19,202	1,654	+ 17,548
ARSENIC	3,366	-	+ 3,366
BARIUM	7,317	351	+ 6,966
BERYLLIUM	19,324	2,520	+ 16,804
BISMUTH	5,699	195	+ 5,504
BORON	520	46,800	- 46,280
BROMINE	2	3,400	- 3,398
CADMIUM	15,121	127	+ 14,994
CALCIUM	3,010	3,010	-
CESIUM	2	-	+ 2
CHLORINE	2,425	825	+ 1,600
CHROMIUM	76,858	10,458	+ 66,400
COBALT	24,005	803	+ 23,202
COLUMBIUM	4,176	31	+ 4,145
COPPER	358,798	195,520	+ 163,279
FLUORINE	67,620	700	+ 66,920
GALLIUM	1,878	622	+ 1,256
GERMANIUM	1,995	-	+ 1,995
GOLD	256,411	28,875	+ 227,536
HAFNIUM	5,440	-	+ 5,440
INDIUM	1,146	-	+ 1,146
IODINE	13,241	688	+ 12,553
IRON	1,920,784	144,270	+ 1,776,514
LEAD	76,720	1,680	+ 75,040
LITHIUM	226	680	- 454
MAGNESIUM-METAL	2,644	17,504	- 14,860
MAGNESIUM-NONMETALLIC	9,095	3,502	+ 5,593
MANGANESE	61,641	1,608	+ 60,033
MERCURY	8,888	2,112	+ 6,776
MOLYBDENUM	1,469	81,370	- 79,901
NICKEL	375,460	12,236	+ 363,224
NITROGEN-COMPOUNDS	23,520	22,792	+ 728
NITROGEN-GAS & LIQUIDS	-	-	-
PALLADIUM	25,752	4,921	+ 20,831
PHOSPHORUS	468	70,239	- 69,771
PLATINUM	63,222	31,734	+ 31,488
POTASSIUM	107,912	21,998	+ 85,914
RARE EARTHS	1,844	1,763	+ 81
RHENIUM	359	-	+ 359
RHODIUM	7,000	1,600	+ 5,400
RUBIDIUM	-	-	-
SCANDIUM	120	-	+ 120
SELENIUM	3,595	1,390	+ 2,205
SILICON	3,981	3,910	+ 71
SILVER	84,936	18,825	+ 66,111
SODIUM	32,939	9,397	+ 23,542
STRONTIUM	1,088	-	+ 1,088
SULFUR	24,973	26,880	- 1,907
TANTALUM	8,262	1,272	+ 6,990
TELLURIUM	180	-	+ 180
THALLIUM	35	-	+ 35
THORIUM	2,837	-	+ 2,837
TIN	187,040	8,462	+ 178,578
TITANIUM-METAL	44,680	5,280	+ 39,400
TITANIUM-NONMETALLIC	186,300	14,400	+ 171,900
TUNGSTEN	1,708	6,394	- 4,686
VANADIUM	14,514	3,588	+ 10,926
YTTRIUM	1,188	18	+ 1,170
ZINC	257,920	1,600	+ 256,320
ZIRCONIUM-METAL	101,952	11,748	+ 89,204
ZIRCONIUM-NONMETALLIC	4,460	514	+ 3,946
TOTAL	7,456,062	1,321,589	+ 6,134,473
ASBESTOS	80,400	6,334	+ 74,066
CLAYS	307	9,470	- 9,163
COLUMBITE	3	-	+ 3
DIATOMITE	-	9,114	- 9,114
FELDSPAR	30	60	- 30
GARNET	-	306	- 306
GRAPHITE	2,469	267	+ 2,402
GYPSUM	22,853	154	+ 22,699
KYANITE	74	2,368	- 2,294
MICA-SCRAP & FLAKE	82	81	+ 1
MICA-SHEET	4,336	1,701	+ 2,635
PERLITE	-	160	- 160
PUMICE	428	-	+ 428
SAND & GRAVEL	1,250	2,500	- 1,250
STONE-CRUSHED	1,750	1,750	-
STONE-DIMENSION	14,179	7,088	+ 7,087
TALC	124	1,001	- 877
VERMICULITE	240	960	- 720
TOTAL	128,521	43,314	+ 85,205
ANTHRACITE	-	18,529	- 18,529
BITUMINOUS COAL & LIGNITE	785	420,395	- 389,610
NATURAL GAS	168,300	14,400	+ 153,900
PEAT	3,463	-	+ 3,463
PETROLEUM 1/	4,608,598	263,026	+ 4,345,572
SHALE OIL	-	-	-
URANIUM	11,666	555	+ 11,111
TOTAL	4,790,812	694,905	+ 4,095,907
ARGON	-	-	-
HELIUM	-	3,276	- 3,276
HYDROGEN	-	-	-
OXYGEN	-	-	-
TOTAL		3,276	- 3,276
GRAND TOTAL	12,375,395	2,063,084	+10,312,309

1/ INCLUDES NATURAL GAS LIQUIDS.

Table - 5

Value of World Primary Mineral Production (Current)

The primary production component of U.S. supply, described in Table 1, is compared here to continental and world primary mineral production value totals.

The tabulation provides initial insight to the current value of total world primary mineral production, the continental and individual commodity increments of that value, and the relationship of the U.S. increment to the rest of the world.

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TABLE 5 JANUARY 17, 1973

VALUE OF WORLD PRIMARY MINERAL PRODUCTION IN 1971
(MILLION DOLLARS)

(THE VALUES ARE BASED ON U.S. 1971 PRICES FOR MATERIALS IN PRIMARY FORM AND IN SOME CASES DO NOT REPRESENT COMMERCIAL VALUE OF THE CRUDE MATERIALS)

	UNITED STATES	OTHER NORTH AMERICA	SOUTH AMERICA	EUROPE	ASIA	AFRICA	OCEANIA	TOTAL
ALUMINUM	297.0	1,887.7	1,546.3	1,615.9	194.6	337.6	1,604.7	7,478.1
ANTIMONY	2.6	5.8	19.2	18.8	27.0	29.3	1.8	100.6
ARSENIC	(1)	1.7	.5	5.3	1.1	.5	.0	(1)
BARIUM	17.5	6.7	2.2	25.9	4.3	1.4	.0	53.0
BERYLLIUM	(1)	.0	13.3	6.6	.0	8.4	.1	(1)
BISMUTH	(1)	11.8	15.1	4.4	7.5	.0	7.6	(1)
BORON	91.8	.8	3.6	12.5	39.6	.0	.0	147.5
BROMINE	60.5	.0	.0	13.6	8.7	.0	.0	82.3
CADMIUM	6.8	20.1	6.2	13.4	6.1	2.9	4.7	58.2
CALCIUM	378.0	.0	.0	1,105.1	245.1	.0	17.2	1,745.4
CESIUM	.0	.0	.0	.0	.0	.0	.0	.0
CHLORINE	701.2	64.8	.0	572.3	245.6	.0	4.9	1,588.8
CHROMIUM	.0	.0	1.7	129.0	85.9	122.5	.0	334.5
COBALT	1.5	13.5	.0	13.9	.0	80.0	1.5	115.4
COLUMBIUM	.0	2.7	9.0	2.5	1.4	2.0	.0	17.6
COPPER	1,562.9	815.5	1,055.6	784.2	366.6	1,388.0	184.8	6,177.9
FLUORINE	17.1	87.1	.0	133.8	47.4	16.7	.0	302.0
GALLIUM	(1)	.1	.3	.8	.4	.1	.8	(1)
GERMANIUM	3.6	2.0	.8	6.9	2.7	4.0	.0	20.0
GOLD	61.7	97.5	.0	276.4	.0	1,323.6	27.6	1,786.8
HAFNIUM	.0	.0	.0	4.3	.0	.0	10.5	14.8
INDIUM	(1)	1.4	.4	1.1	.4	.1	.4	(1)
IODINE	(1)	.0	10.5	.0	27.0	.0	.0	(1)
IRON	3,733.2	7,279.2	4,076.2	13,279.0	4,102.9	2,298.6	3,031.7	37,801.8
LEAD	161.8	169.0	54.9	255.1	74.8	43.4	127.9	885.9
LITHIUM	(1)	.0	.2	1.3	.5	3.9	.0	(1)
MAGNESIUM-METAL	88.9	5.2	.0	80.1	7.7	.0	.0	181.9
MAGNESIUM-NON-METALLIC	84.4	1.8	6.1	283.7	134.1	2.4	.6	513.3
MANGANESE	2.0	5.7	70.9	189.6	71.0	164.8	24.1	530.1
MERCURY	5.1	15.6	.5	53.4	11.7	.0	.0	86.3
MOLYBDENUM	188.5	48.7	27.0	30.3	5.8	.0	.0	300.3
NICKEL	61.6	888.4	9.3	396.6	79.7	72.5	390.4	1,878.0
NITROGEN-COMPOUNDS	639.4	75.6	14.0	935.2	319.2	.0	28.0	2,011.4
NITROGEN-GAS & LIQUID	148.9	.0	13.8	212.5	66.1	.0	5.0	446.5
PALLADIUM	.4	7.4	.0	51.1	.3	11.6	.0	70.8
PHOSPHOROUS	205.2	.7	.0	115.6	15.7	123.9	23.6	483.2
PLATINUM	1.0	25.0	3.0	85.0	.5	109.5	.0	224.0
POTASSIUM	100.9	151.1	1.1	578.2	26.1	.0	.0	857.4
RARE EARTHS	(1)	.0	.5	1.5	2.3	.4	1.9	(1)
RHENIUM	6.9	.0	.6	1.9	.0	.2	.0	9.6
RHODIUM	.0	2.8	.2	9.2	.0	6.0	.0	18.2
RUBIDIUM	.0	.0	.0	.0	.0	.0	.0	.0
SCANDIUM	.0	.1	.0	.0	.0	.0	.0	.1
SELENIUM	5.6	7.2	.1	7.2	4.7	2.6	.0	27.4
SILICON	137.0	23.0	5.2	308.2	44.7	7.7	2.4	528.2
SILVER	64.0	132.8	69.6	60.1	.0	5.2	34.3	365.0
SODIUM	376.0	90.4	.0	414.7	180.3	.0	26.8	1,088.2
STRONTIUM	.0	1.8	.0	1.0	.0	.0	.0	2.8
SULFUR	167.5	118.4	.0	318.5	71.4	.0	4.9	680.7
TANTALUM	.0	2.9	1.5	3.3	6.2	4.3	.2	18.4
TELLURIUM	(1)	.1	.3	.7	.5	.0	.0	(1)
THALLIUM	.0	.1	.0	.1	.0	.0	.0	.2
THORIUM	(1)	.0	2.2	1.4	5.2	.2	4.7	(1)
TIN	(1)	.0	102.7	111.4	505.0	50.1	34.0	(1)
TITANIUM-METAL	.0	.0	.0	.0	.0	.0	37.0	37.0
TITANIUM-NONMETALLIC	200.7	323.1	2.7	347.4	108.9	6.3	456.3	1,445.4
TUNGSTEN	20.4	14.4	27.1	60.3	103.8	2.7	10.1	238.8
VANADIUM	31.7	.0	4.0	57.8	.0	54.0	.0	147.5
YTTRIUM	(1)	.8	.3	.8	1.3	.1	1.0	(1)
ZINC	161.0	548.8	133.8	466.2	186.4	46.7	158.7	1,702.1
ZIRCONIUM-METAL	.0	.0	.0	.0	.0	.0	.0	.0
ZIRCONIUM-NONMETALLIC	(1)	.0	.3	3.3	.7	.1	24.4	(1)
ASBESTOS	15.4	192.9	2.6	172.0	24.9	56.5	.0	464.3
CLAYS	273.6	240.0	.0	1,027.2	158.4	.0	144.0	1,843.2
COLEMANITE	.0	.0	.0	.4	.0	.2	.0	.6
DIATOMITE	34.3	3.0	.0	60.5	.0	.3	.0	98.1
FELDSPAR	9.9	1.4	.8	18.6	1.6	.0	.0	32.3
GARNET	1.9	.0	.0	.1	.1	.0	.0	2.1
GRAPHITE	(1)	2.6	.0	6.7	9.5	1.0	.0	(1)
GYPSUM	39.1	30.6	.0	110.3	10.6	.0	4.4	194.0
KYANITE	(1)	.0	.0	1.5	7.1	5.0	.1	(1)
MICA-SCRAP & FLAKE	2.9	.0	.0	.0	.6	.2	.0	3.7
MICA-SHEET	.0	.0	2.3	.0	12.7	.8	.0	15.8
PERLITE	4.9	.1	.0	4.2	.0	.0	.0	9.2
PUMICE	3.5	.1	.0	18.2	.0	.0	.0	22.0
SAND & GRAVEL	1,150.0	245.0	.0	3,205.0	.0	601.3	.0	5,201.3
STONE-CRUSHED	1,146.3	117.3	.0	2,212.0	84.0	.0	304.0	3,867.6
STONE-DIMENSION	93.4	14.3	.0	727.9	.0	19.1	.0	854.7
TALC	7.6	.5	.0	9.8	20.8	.0	.4	39.1
VERMICULITE	7.2	.0	.2	.0	.0	3.4	.0	10.8
ANTHRACITE	103.9	.0	.0	1,433.5	.0	30.4	.0	1,567.8
BITUMINOUS COAL & LIGNITE	3,904.0	.0	.0	12,745.3	.0	481.6	.0	17,130.9
NATURAL GAS	3,889.8	504.7	.0	2,160.5	.0	196.7	.0	6,841.7
PEAT	7.1	3.6	.0	2,508.3	1.3	.0	.0	2,520.3
PETROLEUM 2/	13,111.1	2,257.7	4,672.6	456.3	18,419.2	9,287.6	364.2	45,565.7
SHALE OIL	.3	.0	.0	74.6	84.8	.0	.0	159.7
URANIUM	159.8	58.3	.7	103.3	71.9	59.3	4.1	406.9
ARGON	42.1	2.1	.0	40.6	8.9	.0	.3	94.0
HELIUM	14.5	.5	.0	1.9	.0	.0	.0	17.3
HYDROGEN	670.8	.0	25.8	.0	274.0	.0	8.1	977.9
OXYGEN	156.0	7.9	.0	219.6	144.0	.0	4.0	531.4
TOTAL	34,703.1	11,727.4	12,016.7	50,782.4	26,736.0	14,071.6	7,127.7	167,161.3

1/ CERTAIN DATA ARE WITHHELD BECAUSE THE MANNER IN WHICH THE INFORMATION BECAME AVAILABLE TO THE BUREAU OF MINES DOES NOT PERMIT GENERAL DISCLOSURE.
2/ INCLUDES NATURAL GAS LIQUIDS.

Table - 7

U.S. Primary Mineral Supply-Demand Relationships

The two tabulations compare the U.S. primary mineral supply-demand relationships that existed in 1971 with those that are anticipated for 2000.

Specifically, the tabulations show the quantity and value of primary minerals that would have to be derived from domestic sources in 2000, if (1) the present (1971) production to demand ratio is maintained, and (2) if production trends of the past 20 years prevail. Differences between the constant ratio projections and those based on historical production trends indicate potential changes in the percentage of the U.S. demand for minerals that may be met from domestic sources.

In 1971, the U.S. demand for primary minerals totaled about $45 billion. On the basis of 1971 constant dollars, the demand is expected to increase about 4 times to $189 billion in 2000.

It is apparent from the tabulations that, by 2000, domestic production will supply substantially less of the demand for primary minerals than it does at present. For example, to maintain the present production to demand ratio in 2000 a domestic primary mineral production of $145 billion would be required. However, based on historical production trends of the past 20 years the value of domestic primary production in 2000 would be about $88 billion. On this basis of comparison, the value of primary mineral net imports would be $57 billion in 2000, or almost 6 times larger than in 1971.

TABLE 7

JANUARY 17, 1973

BUREAU OF MINES

COMPARISON OF PREVAILING U.S. PRIMARY MINERAL SUPPLY-DEMAND RATIOS WITH PROJECTED HISTORICAL TRENDS IN DOMESTIC MINERAL PRODUCTION

COMMODITY	UNITS	1971			2000			
		A U.S. PRIMARY PRODUCTION FROM DOMESTIC SOURCES	B U.S. PRIMARY DEMAND	CONSTANT RATIO A/B	C PROJECTED U.S. PRIMARY DEMAND	D U.S. PRIMARY PRODUCTION IF 1971 CONSTANT RATIO PREVAILS	E U.S. PRIMARY PRODUCTION IF PAST 20-YEAR TRENDS PREVAIL	F DEPARTURE FROM CONSTANT RATIO (DIFFERENCE BETWEEN D&E)
ALUMINUM	THOUSAND S.T.	512	4,491	.114	26,400	3,010	535	- 2,475
ANTIMONY	S.T.	1,853	14,419	.129	48,000	6,192	731	- 5,461
ARSENIC	S.T.	(1)	(1)	.032	38,000	1,216	600	- 616
BARIUM	THOUSAND S.T.	462	759	.609	1,380	840	363	- 477
BERYLLIUM	S.T.	(1)	(1)	.494	1,770	874	187	- 687
BISMUTH	THOUSAND LB	(1)	1,769	.617	4,000	2,468	1,016	- 1,452
BORON	THOUSAND S.T.	177	88	2.011	303	609	361	- 248
BROMINE	MILLION LB	356	337	1.056	500	528	623	- 95
CADMIUM	THOUSAND LB	3,553	10,832	.328	30,800	10,102	4,263	- 5,839
CALCIUM	MILLION S.T.	88	88	1.000	241	241	124	- 117
CESIUM	LB	0	(1)	0	20,000	0	0	0
CHLORINE	THOUSAND S.T.	9,349	9,373	.997	42,200	42,073	20,492	- 21,581
CHROMIUM	THOUSAND S.T.	0	335	0	1,090	0	0	0
COBALT	THOUSAND LB	690	13,418	.051	24,700	1,260	0	- 1,260
COLUMBIUM	THOUSAND LB	0	4,104	0	19,200	0	0	0
COPPER	THOUSAND S.T.	1,522	1,627	.935	5,400	5,049	2,463	- 2,586
FLUORINE	THOUSAND S.T.	122	645	.189	2,400	454	56	- 398
GALLIUM	KG	(1)	(1)	.365	25,000	9,125	1,020	- 8,105
GERMANIUM	THOUSAND LB	27	40	.675	75	51	0	- 51
GOLD	THOUSAND T.OZ	1,495	6,562	.228	14,300	3,260	1,040	- 2,220
HAFNIUM	S.T.	0	(1)	0	58	0	0	0
INDIUM	THOUSAND T.OZ	(1)	(1)	.082	800	66	302	236
IODINE	THOUSAND LB	(2)	4,892	.147	15,500	2,279	522	- 1,757
IRON	MILLION S.T.	54	75	.720	153	110	57	- 53
LEAD	THOUSAND S.T.	578	945	.612	1,430	875	643	- 232
LITHIUM	S.T.	(1)	(1)	1.117	10,800	12,064	6,322	- 5,742
MAGNESIUM-METAL	THOUSAND S.T.	123	102	1.206	580	699	153	- 546
MAGNESIUM-NONMETALLIC	THOUSAND S.T.	879	938	.937	2,160	2,024	1,507	- 517
MANGANESE	THOUSAND S.T.	38	1,170	.032	2,380	76	0	- 76
MERCURY	THOUSAND FL	18	42	.429	90	34	31	- 3
MOLYBDENUM	THOUSAND LB	109,592	40,694	2.696	188,000	506,848	190,000	- 316,848
NITROGEN-COMPOUNDS	THOUSAND S.T.	31,300	282,700	.111	770,000	85,470	80,400	- 5,070
NITROGEN-GAS & LIQUIDS	THOUSAND S.T.	11,417	11,305	1.010	39,700	40,097	27,100	- 12,997
PALLADIUM	THOUSAND T.OZ	9,957	9,957	1.000	20,900	20,900	14,200	- 6,700
PHOSPHOROUS	THOUSAND S.T.	18	607	.016	1,060	17	34	17
PLATINUM	THOUSAND T.OZ	8,261	5,648	1.462	12,000	17,304	11,680	- 5,624
POTASSIUM	THOUSAND S.T.	8	333	.024	820	20	0	- 20
RARE EARTHS	S.T.	2,147	3,976	.540	12,000	6,480	4,136	- 2,344
RHENIUM	LB	(1)	10,700	1.142	22,000	25,124	32,800	7,676
RHODIUM	THOUSAND T.OZ	7,250	7,600	.954	18,400	17,554	15,400	- 2,154
RUBIDIUM	LB	0	25	0	85	0	1	1
SCANDIUM	KG	0	(1)	0	2,200	0	1	1
SELENIUM	THOUSAND LB	0	14	0	25	0	4	4
SILICON	THOUSAND S.T.	627	879	.713	1,620	1,155	688	- 467
SILVER	THOUSAND T.OZ	448	451	.993	1,000	993	901	- 92
SODIUM	THOUSAND S.T.	41,564	101,525	.409	210,000	85,890	44,100	- 41,790
STRONTIUM	S.T.	19,088	20,283	.941	67,200	63,235	37,953	- 25,282
SULFUR	THOUSAND L.T.	0	(1)	0	34,200	0	0	0
TANTALUM	THOUSAND LB	9,572	9,180	1.043	30,000	31,290	14,848	- 16,442
TELLURIUM	THOUSAND LB	0	1,157	0	4,010	0	0	0
THALLIUM	LB	164	212	.774	386	283	202	- 81
THORIUM	S.T.	(1)	(1)	.369	9,000	3,321	4,561	1,240
TIN	L.T.	(1)	(1)	.469	1,500	704	53	- 651
TITANIUM-METAL	THOUSAND S.T.	0	49,854	0	90,000	0	67	67
TITANIUM-NONMETALLIC	THOUSAND S.T.	223	17	0	168	0	0	0
TUNGSTEN	THOUSAND LB	6,900	471	.473	1,810	856	522	- 334
VANADIUM	S.T.	5,288	11,122	.620	74,000	45,880	2,648	- 43,232
YTTRIUM	S.T.	(1)	6,716	.787	31,000	24,397	11,900	- 12,497
ZINC	THOUSAND S.T.	503	(1)	.298	420	125	28	- 97
ZIRCONIUM-METAL	THOUSAND S.T.	0	1,361	.370	3,100	1,147	551	- 596
ZIRCONIUM-NONMETALLIC	THOUSAND S.T.	(1)	(1)	0	20	0	0	0
				.500	187	84	91	7
ASBESTOS	THOUSAND S.T.	131	759	.173	2,430	420	290	- 130
CLAYS	MILLION S.T.	57	55	1.036	174	180	82	- 98
CORUNDUM	S.T.	0	2,000	0	1,100	0	0	0
DIATOMITE	THOUSAND S.T.	535	390	1.372	2,000	2,744	1,160	- 1,584
FELDSPAR	THOUSAND L.T.	643	537	1.235	2,500	3,088	996	- 2,092
GARNET	THOUSAND S.T.	19	16	1.188	53	63	39	- 24
GRAPHITE	THOUSAND S.T.	(1)	(1)	.035	95	3	0	3
GYPSUM	THOUSAND S.T.	18,418	16,914	.614	35,000	21,560	11,520	- 10,040
KYANITE	THOUSAND S.T.	(1)	(1)	1.241	630	794	322	- 472
MICA-SCRAP & FLAKE	THOUSAND S.T.	127	125	1.016	448	455	221	- 234
MICA-SHEET	THOUSAND LB	17	9,478	.003	600	2	0	2
PERLITE	THOUSAND S.T.	432	414	1.033	1,350	1,395	855	- 540
PUMICE	THOUSAND S.T.	3,316	3,716	.892	12,000	10,704	7,640	- 3,064
SAND & GRAVEL	MILLION S.T.	920	919	1.001	3,200	3,203	1,800	- 1,403
STONE-CRUSHED	MILLION S.T.	655	651	1.006	2,520	2,520	1,490	- 1,030
STONE-DIMENSION	THOUSAND S.T.	1,648	1,773	.929	3,820	3,549	1,285	- 2,264
TALC	THOUSAND S.T.	1,037	979	1.059	2,920	3,092	1,670	- 1,422
VERMICULITE	THOUSAND S.T.	301	271	1.111	725	805	465	- 340
ANTHRACITE	THOUSAND S.T.	8,727	7,338	1.189	2,300	2,735	0	- 2,735
BITUMINOUS COAL & LIGNITE	MILLION S.T.	562	495	1.135	1,000	1,115	767	- 348
NATURAL GAS	BILLION C.F.	21,610	22,133	.976	49,000	47,824	43,752	- 4,072
PEAT	THOUSAND S.T.	605	991	.671	2,200	1,476	1,589	87
PETROLEUM (2)	MILLION BBL	4,092	5,550	.734	14,500	10,643	6,409	- 4,234
SHALE OIL	MILLION BBL	0	0	1.000	1,500	1,500	0	- 1,500
URANIUM	S.T.	10,945	11,300	.969	62,000	60,078	24,500	- 35,578
ARGON	THOUSAND S.T.	156	156	1.000	772	772	355	- 417
HELIUM	MILLION C.F.	577	447	1.291	2,500	3,228	2,009	- 1,219
HYDROGEN	BILLION C.F.	2,580	2,580	1.000	10,500	10,500	5,743	- 4,757
OXYGEN	THOUSAND S.T.	13,000	13,000	1.000	64,500	64,500	36,400	- 28,100

1/ CERTAIN DATA ARE WITHHELD BECAUSE THE MANNER IN WHICH THE INFORMATION BECAME AVAILABLE TO THE BUREAU OF MINES DOES NOT PERMIT GENERAL DISCLOSURE.

2/ INCLUDES NATURAL GAS LIQUIDS.

TABLE 7A — JANUARY 18, 1973

BUREAU OF MINES

COMPARISON OF VALUE OF U.S. PRIMARY MINERAL PRODUCTION AND DEMAND IN 1971 WITH PROJECTED VALUE IN 2000

COMMODITY	PRICE UNITS	AVERAGE UNIT PRICE 1971 DOLLARS		VALUE - MILLION 1971 DOLLARS					DEPARTURE FROM 1971 CONSTANT RATIO
				PRIMARY DEMAND		PRIMARY PRODUCTION FROM DOMESTIC SOURCES			
		1971	2000	1971	2000	1971	2000 A IF 1971 CONSTANT RATIO PREVAILS	2000 B IF PAST TREND PREVAILS	DIFFERENCE A & B
ALUMINUM	LB	.29	.37	2,604.7	19,536.0	297.0	2,227.1	395.9	- 1,831.2
ANTIMONY	LB	.71	.70	20.5	67.2	2.6	8.7	1.0	- 7.7
ARSENIC	S.T.	168.00	180.00	(1)	6.8	(1)	.2	.1	- .1
BARIUM	S.T.	27.00	29.00	20.5	40.0	12.5	24.4	10.5	- 13.9
BERYLLIUM	LB	60.00	50.00	(1)	177.0	(1)	87.4	18.7	- 68.7
BISMUTH	Lb	5.26	5.00	9.3	20.0	(1)	12.3	5.1	- 7.2
BORON	S.T.	520.00	510.00	45.5	154.5	91.8	311.7	184.1	- 127.6
BROMINE	LB	.17	.17	57.3	85.0	60.5	89.8	105.9	16.1
CADMIUM	LB	1.92	3.50	20.8	107.8	6.8	35.4	14.9	- 20.5
CALCIUM	S.T.	4.30	4.30	378.0	1,036.3	378.0	1,036.3	534.6	- 501.7
CESIUM	LB	.60	.60	(1)	.01	.0	.0	.0	.0
CHLORINE	S.T.	75.00	75.00	703.0	3,169.0	701.2	3,159.5	1,538.9	- 1,618.6
CHROMIUM	S.T.	169.00	185.00	55.6	201.7	.0	.0	.0	.0
COBALT	LB	2.20	2.45	24.5	60.5	1.5	3.1	.0	- 3.1
COLUMBIUM	LB	1.65	1.57	6.8	30.1	.0	.0	.0	.0
COPPER	LB	.52	.75	1,694.1	8,100.0	1,582.9	7,573.5	3,694.5	- 3,879.0
FLUORINE	S.T.	140.00	300.00	90.3	720.0	17.1	136.1	16.8	119.3
GALLIUM	G	.70	.55	(1)	9.8	(1)	3.2	.4	- 2.8
GERMANIUM	LB	133.00	200.00	5.3	15.0	3.6	10.1	.0	- 10.1
GOLD	T.OZ	41.25	80.00	270.7	1,144.0	61.7	260.8	83.2	- 177.6
HAFNIUM	LB	85.00	85.00	(1)	9.9	.0	.0	.0	.0
INDIUM	T.OZ	2.50	3.00	(1)	2.4	(1)	.2	.4	.7
IODINE	Lb	1.82	2.60	.7	40.3	(1)	5.9	1.4	- 4.5
IRON	S.T.	68.70	73.00	5,131.9	11,169.0	3,733.2	8,119.9	4,161.0	- 3,958.9
LEAD	LB	.14	.16	264.6	457.6	161.8	280.1	205.8	- 74.3
LITHIUM	LB	.88	.90	(1)	19.4	(1)	21.7	11.4	- 10.3
MAGNESIUM-METAL	LB	.36	.36	73.1	417.6	88.9	508.2	110.2	- 398.0
MAGNESIUM-SUBMETALLIC	S.T.	96.00	96.00	90.0	207.4	84.4	194.5	144.7	- 49.8
MANGANESE	S.T.	53.60	49.00	62.7	115.6	2.0	3.7	.0	- 3.7
MERCURY	FLASK	292.00	700.00	12.1	56.0	5.1	23.7	21.7	- 2.0
MOLYBDENUM	LB	1.72	1.80	69.9	338.4	188.5	912.3	342.0	- 570.3
NICKEL	LB	1.13	1.33	375.3	1,026.1	41.6	113.7	106.9	- 6.8
NITROGEN-COMPOUNDS	S.T.	56.00	60.00	833.1	2,382.0	639.4	2,405.8	1,626.0	- 779.8
NITROGEN-GAS & LIQUIDS	S.T.	25.00	30.00	148.9	627.0	148.9	627.0	426.0	- 201.0
PALLADIUM	T.OZ	37.00	75.00	20.5	79.5	.4	1.3	2.6	1.3
PHOSPHOROUS	S.T.	39.00	50.00	142.3	600.0	205.2	865.2	594.0	- 271.2
PLATINUM	T.OZ	123.00	165.00	41.0	135.3	1.0	3.2	.0	- 3.2
POTASSIUM	S.T.	47.00	55.00	187.0	680.0	100.9	356.4	227.5	- 128.9
RARE EARTHS	LB	.35	.35	7.1	15.4	(1)	17.6	23.0	5.4
RHENIUM	LB	950.00	1200.00	7.2	22.1	6.9	21.1	18.5	- 2.6
RHODIUM	T.OZ	250.00	300.00	5.0	25.5	.0	.0	.3	.3
RUBIDIUM	LB	.37	.60	.0	.00	.0	.0	.0	.0
SCANDIUM	G	4.29	4.50	.0	.1	.0	.0	.02	.02
SELENIUM	LB	9.00	6.00	7.9	9.7	5.6	6.9	4.1	- 2.8
SILICON	S.T.	306.00	380.00	138.0	380.0	137.0	377.0	342.4	- 34.6
SILVER	T.OZ	1.54	2.70	156.3	567.0	64.0	231.9	119.1	- 112.8
SODIUM	S.T.	19.70	19.70	309.6	1,323.8	376.0	1,245.7	733.9	- 511.8
STRONTIUM	S.T.	54.00	58.00	1.1	2.0	.0	.0	.0	.0
SULFUR	L.T.	17.50	17.50	160.7	525.0	167.5	547.6	259.8	- 287.8
TANTALUM	LB	8.26	15.70	9.6	63.0	.0	.0	.0	.0
TELLURIUM	Lb	6.00	6.00	1.3	2.2	1.0	1.7	1.2	- .5
THALLIUM	LB	7.50	7.50	(1)	.0	(1)	.02	.03	.01
THORIUM	LB	7.97	8.50	(1)	25.5	(1)	12.0	.9	- 11.1
TIN	LB	1.67	3.00	186.5	604.8	(1)	.0	.5	.5
TITANIUM-METAL	LB	1.32	1.20	44.9	405.2	.0	.0	.0	.0
TITANIUM-NONMETALLIC	Lb	.45	.58	423.9	2,099.6	200.7	993.1	605.5	- 387.6
TUNGSTEN	LB	2.96	4.00	32.9	296.0	20.4	183.5	10.6	- 172.9
VANADIUM	LB	3.00	3.15	40.3	195.3	31.7	153.7	75.0	- 78.7
YTTRIUM	LB	9.00	14.00	(1)	11.8	(1)	3.5	.8	2.7
ZINC	LB	.16	.25	435.5	1,550.0	181.0	573.5	275.5	- 298.0
ZIRCONIUM-METAL	LB	6.00	6.00	(1)	240.0	.0	.0	.0	.0
ZIRCONIUM-NONMETALLIC	S.T.	109.00	116.00	(1)	19.4	(1)	9.7	10.5	.8
TOTAL				15,905.2	61,398.6	9,842.6	33,798.9	17,086.3	-16,730.6
ASBESTOS	S.T.	118.00	130.00	89.5	315.9	15.4	54.7	37.7	- 17.0
CLAYS	S.T.	4.80	10.00	264.5	1,740.0	273.6	1,800.9	823.0	- 977.9
CORUNDUM	S.T.	55.00	65.00	.1	.0	.0	.0	.0	.0
DIATOMITE	S.T.	64.20	65.00	25.0	130.0	34.3	178.4	75.4	- 103.0
FELDSPAR	S.T.	15.00	15.00	8.1	37.5	9.9	46.3	14.9	- 31.4
GARNET	S.T.	102.00	102.00	1.6	5.4	1.9	6.4	4.0	- 2.4
GRAPHITE	S.T.	46.50	50.00	(1)	4.8	(1)	.1	.0	- .1
GYPSUM	S.T.	3.75	4.00	63.4	140.0	39.1	86.2	46.1	- 40.1
KYANITE	S.T.	74.00	103.00	(1)	64.9	(1)	81.8	33.6	- 48.2
MICA-SCRAP & FLAKE	S.T.	23.00	25.00	2.9	11.2	2.9	11.4	5.5	- 5.9
MICA-SHEET	LB	.73	.75	4.0	.5	.01	.00	.0	.0
PERLITE	S.T.	11.40	11.00	4.8	14.9	4.9	15.3	9.4	- 5.9
PUMICE	S.T.	1.07	1.20	4.0	14.4	3.5	12.8	9.2	- 3.6
SAND & GRAVEL	S.T.	1.25	1.35	1,146.8	4,320.0	1,150.0	4,324.3	2,430.0	- 1,894.3
STONE-CRUSHED	S.T.	1.75	1.70	1,146.3	4,284.0	1,146.3	4,284.0	2,533.0	- 1,751.0
STONE-DIMENSION	S.T.	56.70	49.00	100.5	187.2	93.4	173.9	63.0	- 110.9
TALC	S.T.	7.36	8.50	7.2	24.8	7.6	26.3	14.2	- 12.1
VERMICULITE	S.T.	24.00	28.00	6.5	20.3	7.2	22.6	13.0	- 9.6
TOTAL				2,888.7	11,315.8	2,801.1	11,125.4	6,111.6	- 5,013.8
ANTHRACITE	S.T.	11.90	15.00	87.3	34.5	103.9	41.0	.0	- 41.0
BITUMINOUS COAL & LIGNITE	S.T.	7.07	11.00	3,498.7	11,000.0	3,904.0	12,278.0	8,441.5	- 3,836.5
NATURAL GAS	MCF	.18	.26	4,923.9	28,420.0	3,889.8	27,737.9	25,376.2	- 2,361.7
PEAT	S.T.	11.70	12.50	10.5	27.5	7.1	18.5	17.4	- 1.1
PETROLEUM 1/	BBL	3.22	4.30	17,872.5	62,350.0	13,111.1	45,764.9	27,558.7	-18,206.2
SHALE OIL	BBL	3.39	4.50	.3	6,750.0	.3	6,750.0	.0	- 6,750.0
URANIUM	LB	7.30	20.00	165.0	2,480.0	159.8	2,403.1	980.0	- 1,423.1
TOTAL				25,618.7	111,062.0	21,175.0	94,991.4	62,373.8	-32,617.6
AMGON	S.T.	270.00	300.00	42.1	231.5	42.1	231.5	106.4	- 125.1
HELIUM	MCF	25.20	60.00	11.3	150.0	14.5	193.7	120.5	- 73.2
HYDROGEN	MCF	.26	.39	670.8	4,095.0	670.8	4,095.0	2,239.8	- 1,855.2
OXYGEN	S.T.	12.00	13.00	156.0	838.5	156.0	838.5	473.2	- 365.3
TOTAL				880.2	5,315.0	883.4	5,358.7	2,939.9	- 2,418.8
GRAND TOTAL				44,892.3	189,091.4	34,703.1	145,272.4	88,491.6	-56,780.8

1/ CERTAIN DATA ARE WITHHELD BECAUSE THE MANNER IN WHICH THE INFORMATION BECAME AVAILABLE TO THE BUREAU OF MINES DOES NOT PERMIT GENERAL DISCLOSURE.

2/ INCLUDES NATURAL GAS LIQUIDS.

Table - 8

Historical U.S. Primary Production and Demand compared with current and Projected Relationships

U.S. primary mineral production and demand during the past two decades is compared to current and projected relationships. Past and projected unit prices are adjusted to current dollar values.

Specifically, the tabulations show the quantity (Table - 8), and value (Table 8A) of primary minerals that would have to be derived from domestic sources in 2000, if (1) the present production to demand ratio is maintained, and (2) if production trends of the past 20 years prevail. Differences between the constant ratio projections and those based on historical production trends indicate potential changes in the percentage of the U.S. demand for minerals that may be met from domestic sources.

The accompanying Figure illustrates graphically the totals drawn from Table 8A.

January 17, 1973

Table 8

U.S. Primary Mineral Production and Demand in 1950, 1960, 1971, and Projections for 2000

Commodity	Units	Primary Production					Primary Demand			
		1950	1960	1971	2000		1950	1960	1971	2000
					If 1971 Constant Ratio Prevails	If Past 20-Year Trends Prevail				
Aluminum	Thousand S.T.	374	559	512	3,010	535	914	1,585	4,491	26,400
Antimony	S.T.	4,750	1,091	1,853	6,192	731	15,494	11,884	14,419	48,000
Arsenic	S.T.	3,100	(1)	(1)	1,216	600	24,300	(1)	(1)	38,000
Barium	Thousand S.T.	388	432	462	840	363	440	666	759	1,380
Beryllium	S.T.	22	14	(1)	874	187	120	388	(1)	1,770
Bismuth	Thousand lb	(1)	(1)	(1)	2,468	1,016	1,853	1,817	1,769	4,000
Boron	Thousand S.T.	59	101	177	609	361	38	56	88	303
Bromine	Million lb	99	175	356	528	823	75	168	337	500
Cadmium	Thousand lb	4,700	4,100	3,553	10,102	4,263	9,502	9,770	10,832	30,800
Calcium	Million S.T.	68	70	88	241	124	68	70	88	241
Cesium	lb	-	-	-	-	-	-	(1)	(1)	20,000
Chlorine	Thousand S.T.	2,084	4,837	9,349	42,073	20,492	2,000	4,537	9,373	42,200
Chromium	Thousand S.T.	-	28	-	-	-	228	353	335	1,090
Cobalt	Thousand lb	800	2,200	690	1,260	-	5,000	10,700	13,418	24,700
Columbium	Thousand lb	-	-	-	-	-	100	2,458	4,104	19,200
Copper	Thousand S.T.	909	1,080	1,522	5,049	2,463	1,272	1,107	1,627	5,400
Fluorine	Thousand S.T.	130	103	122	454	56	189	294	645	2,400
Gallium	Kg	(1)	(1)	(1)	9,125	1,020	(1)	(1)	(1)	25,000
Germanium	Thousand lb	NA	52	27	51	-	NA	52	40	75
Gold	Thousand T.oz	2,390	1,670	1,495	3,260	1,040	2,800	3,085	6,562	14,300
Hafnium	S.T.	-	-	-	-	-	-	20	(1)	38
Indium	Thousand T.oz	(1)	(1)	(1)	66	302	(1)	(1)	(1)	800
Iodine	Thousand lb	(1)	(1)	(1)	2,279	522	1,392	3,944	4,802	15,500
Iron	Million S.T.	54	53	54	110	57	62	65	75	153
Lead	Thousand S.T.	431	247	578	875	643	698	539	945	1,430
Lithium	S.T.	(1)	(1)	(1)	12,064	6,322	(1)	(1)	(1)	10,800
Magnesium-Metal	Thousand S.T.	16	40	123	699	153	18	51	102	580
Magnesium-Nonmetallic	Thousand S.T.	727	962	879	2,024	1,507	735	977	938	2,160
Manganese	Thousand S.T.	239	117	38	76	-	1,034	1,077	1,170	2,360
Mercury	Thousand Fl	5	33	18	34	31	47	46	42	80
Molybdenum	Million lb	28	68	110	507	190	20	37	41	188
Nickel	Million lb	2	25	31	85	80	200	243	282	770
Nitrogen-Compounds	Thousand S.T.	1,477	4,118	11,417	40,097	27,100	1,157	4,914	11,305	39,700
Nitrogen-Gas & Liquids	Thousand S.T.	28	673	5,957	20,900	14,200	28	673	5,957	20,900
Palladium	Thousand T.oz	16	10	10	17	34	129	380	607	1,060
Phosphorus	Thousand S.T.	1,743	2,660	5,261	17,304	11,880	1,300	2,006	3,648	12,000
Platinum	Thousand T.oz	19	12	8	20	-	275	288	333	820
Potassium	Thousand S.T.	1,069	2,190	2,147	6,480	4,136	1,172	1,940	3,979	12,000
Rare Earths	S.T.	(1)	(1)	(1)	25,124	32,800	800	2,250	10,200	22,000
Rhenium	lb	-	750	7,250	17,554	15,400	-	500	7,600	18,400
Rhodium	Thousand T.oz	-	1	-	-	1	14	24	25	85
Rubidium	lb	-	-	-	-	-	-	(1)	(1)	2,200
Scandium	Kg	-	-	-	-	4	-	-	14	25
Selenium	Thousand lb	500	540	627	1,155	688	1,084	758	879	1,620
Silicon	Thousand S.T.	256	280	448	993	901	278	256	451	1,000
Silver	Million T.oz	43	31	42	86	44	135	148	102	210
Sodium	Thousand S.T.	6,863	10,684	19,088	63,235	37,253	6,744	10,913	20,283	67,200
Strontium	S.T.	-	-	-	-	-	4,000	3,300	(1)	34,200
Sulfur	Thousand L.T.	6,000	6,700	9,572	31,290	14,848	5,000	5,862	9,180	30,000
Tantalum	Thousand lb	(1)	-	-	-	-	150	508	1,157	4,010
Tellurium	Thousand lb	105	271	164	283	202	100	218	212	364
Thallium	lb	(1)	(1)	(1)	3,321	4,361	(1)	(1)	(1)	9,000
Thorium	S.T.	(1)	-	(1)	704	53	(1)	(1)	(1)	1,500
Tin	Thousand L.T.	-	-	(1)	-	-	73	59	50	90
Titanium-Metal	Thousand S.T.	-	-	-	-	-	1	8	17	168
Titanium-Nonmetallic	Thousand S.T.	150	255	223	856	522	216	330	471	1,810
Tungsten	Thousand lb	3,963	6,669	6,900	45,880	2,648	6,597	11,405	11,122	74,000
Vanadium	S.T.	1,800	5,500	5,288	24,397	11,900	1,100	2,223	4,716	31,000
Yttrium	S.T.	(1)	-	(1)	125	28	(1)	(1)	(1)	420
Zinc	Thousand S.T.	623	435	503	1,147	551	1,147	956	1,361	3,100
Zirconium-Metal	Thousand S.T.	-	-	-	-	-	(1)	(1)	(1)	20
Zirconium-Nonmetallic	Thousand S.T.	(1)	(1)	(1)	84	91	(1)	(1)	(1)	167
Asbestos	Thousand S.T.	41	45	131	420	290	727	709	759	2,430
Clays	Million S.T.	39	49	57	180	82	39	46	55	174
Corundum	S.T.	-	-	-	-	-	3,500	2,630	2,000	1,100
Diatomite	Thousand S.T.	274	481	535	2,744	1,160	220	389	390	2,000
Feldspar	Thousand L.T.	408	502	663	3,088	996	411	671	537	2,500
Garnet	Thousand S.T.	9	11	19	63	39	9	9	16	53
Graphite	Thousand S.T.	(1)	(1)	(1)	3	-	(1)	(1)	(1)	95
Gypsum	Thousand S.T.	8,192	9,825	10,618	21,560	11,520	11,082	14,008	16,914	35,000
Kyanite	Thousand S.T.	(1)	(1)	(1)	794	322	(1)	(1)	(1)	630
Mica-Scrap & Flake	Thousand S.T.	69	97	127	455	221	74	99	125	448
Mica-Sheet	Thousand lb	579	587	17	2	-	12,500	7,722	3,478	600
Perlite	Thousand S.T.	102	312	432	1,395	855	100	297	418	1,350
Pumice	Thousand S.T.	719	2,210	3,316	10,704	7,640	739	2,268	3,716	12,000
Sand & Gravel	Million S.T.	370	710	920	3,203	1,800	368	710	919	3,200
Stone-Crushed	Million S.T.	80	441	655	2,520	1,490	80	441	655	2,520
Stone-Dimension	Thousand S.T.	1,859	2,257	1,648	3,549	1,285	1,859	2,257	1,773	3,820
Talc	Thousand S.T.	617	734	1,037	3,092	1,670	621	716	979	2,920
Vermiculite	Thousand S.T.	208	199	301	805	465	207	197	271	725
Anthracite	Million S.T.	44	19	9	3	-	40	18	7	2
Bituminous Coal & Lignite	Million S.T.	516	416	552	1,115	767	454	378	495	1,900
Natural Gas	Billion C.F.	6,500	12,771	21,610	47,824	43,752	5,900	12,269	22,133	49,000
Peat	Thousand S.T.	131	471	605	1,476	1,389	255	735	901	2,200
Petroleum 2/	Million bbl	2,156	2,915	4,072	10,643	6,409	2,375	3,586	5,550	14,500
Shale Oil	Million bbl	-	-	-	1,500	-	-	-	-	1,500
Uranium	S.T.	687	15,980	10,945	60,078	24,500	120	280	11,300	62,000
Argon	Thousand S.T.	3	30	156	772	355	3	30	156	772
Helium	Million C.F.	81	475	577	3,228	2,009	81	470	447	2,500
Hydrogen	Billion C.F.	165	644	2,580	10,500	5,743	165	644	2,580	10,500
Oxygen	Thousand S.T.	1,031	3,890	13,000	64,500	36,400	1,031	3,890	13,000	64,500

NA Not available.

1/ Certain data are withheld because the manner in which the information became available to the Bureau of Mines does not permit general disclosure.

2/ Includes natural gas liquids.

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Table 8A
Value of U.S. Primary Mineral Production in 1950, 1960, 1970, and 1971, With Projected Value in 2000

Commodity	Price Units	Average Unit Price - 1971 Dollars					Value - Million 1971 Dollars					
											2000	
		1950	1960	1970	1971	2000	1950	1960	1970	1971	If 1971 Constant Ratio Prevails	If Past 20-Year Trends Prevail
Aluminum	lb	0.31	0.36	0.30	0.29	0.37	234.5	397.2	353.3	297.0	2,227.1	395.9
Antimony	lb	.52	.43	1.51	.71	.70	5.0	.9	6.4	2.6	8.7	1.0
Arsenic	ST	176.00	159.00	176.00	168.00	180.00	.8	(1)	(1)	(1)	.2	.1
Barium	ST	28.00	29.40	26.30	27.00	29.00	10.9	12.6	12.5	12.5	24.4	10.5
Beryllium	lb	149.00	85.00	63.00	60.00	50.00	6.6	2.4	(1)	(1)	87.4	18.7
Bismuth	lb	3.65	3.10	6.30	5.26	5.00	(1)	(1)	(1)	(1)	12.3	5.1
Boron	ST	1,097.00	764.00	534.00	520.00	510.00	64.8	77.0	93.3	91.8	311.7	184.1
Bromine	lb	.34	.27	.18	.17	.17	34.2	60.4	98.8	60.5	89.8	105.9
Cadmium	lb	3.75	2.10	3.74	1.92	3.50	17.7	8.6	13.3	6.8	35.4	14.9
Calcium	ST	5.30	5.15	4.20	4.30	4.30	362.4	358.4	377.6	378.0	1,036.3	534.6
Cesium	lb	1.05	.82	.63	.60	.60	-	-	-	-	-	-
Chlorine	ST	90.00	88.00	78.50	75.00	75.00	187.3	406.5	764.5	701.2	3,155.5	1,536.9
Chromium	ST	220.00	165.00	161.00	166.00	185.00	-	4.6	-	-	-	-
Cobalt	lb	3.15	2.10	2.30	2.20	2.45	2.5	4.6	1.6	1.5	3.1	-
Columbium	lb	2.90	2.36	1.73	1.65	1.57	-	-	-	-	-	-
Copper	lb	.37	.44	.61	.52	.75	664.9	948.0	2,085.0	1,582.9	7,573.5	3,694.5
Fluorine	ST	144.00	138.00	119.00	140.00	300.00	18.7	16.2	14.5	17.1	136.1	16.8
Gallium	g	7.95	3.57	.73	.70	.35	(1)	(1)	(1)	(1)	3.2	.4
Germanium	lb	NA	186.00	133.00	131.00	200.00	NA	9.7	3.8	3.6	10.1	-
Gold	T.oz	61.75	48.00	38.13	41.25	80.00	147.6	80.2	66.4	61.7	260.8	83.2
Hafnium	lb	-	55.00	89.00	85.00	85.00	-	-	-	-	-	-
Indium	T.oz	3.95	3.10	2.60	2.50	3.00	(1)	(1)	(1)	(1)	.2	.9
Iodine	lb	3.00	1.30	1.50	1.82	2.40	(1)	(1)	(1)	(1)	5.9	1.4
Iron	ST	74.00	80.80	65.20	68.70	73.00	3,995.2	4,275.7	3,834.9	3,733.2	8,119.9	4,161.0
Lead	lb	.23	.16	.16	.14	.16	198.1	82.6	191.2	161.8	280.1	205.8
Lithium	lb	1.25	1.50	.82	.88	.90	(1)	(1)	(1)	(1)	21.7	11.4
Magnesium-Metal	lb	.39	.48	.37	.36	.36	12.3	38.5	81.9	88.9	508.2	110.2
Magnesium-Nonmetallic	ST	82.00	88.00	88.50	96.00	96.00	59.7	84.3	90.9	84.4	194.5	144.7
Manganese	ST	136.00	116.00	50.40	53.60	49.00	32.0	13.6	3.3	2.0	3.7	-
Mercury	Fl	143.00	289.00	427.00	292.00	700.00	.7	9.5	11.5	5.1	23.7	21.7
Molybdenum	lb	1.80	1.70	1.80	1.72	1.80	49.7	117.2	200.1	188.5	912.3	342.0
Nickel	lb	.90	1.02	1.34	1.33	1.33	1.8	26.1	41.0	41.6	113.7	106.9
Nitrogen-Compounds	ST	172.00	123.00	57.00	56.00	60.00	254.7	507.8	621.9	639.4	2,405.8	1,626.0
Nitrogen-Gas & Liquid	ST	NA	33.00	27.40	25.00	30.00	NA	22.5	145.4	148.9	627.0	426.0
Palladium	T.oz	41.80	34.00	40.00	37.00	75.00	.6	.3	.4	.4	1.3	2.6
Phosphorus	ST	69.00	60.40	40.60	39.00	50.00	120.4	160.4	212.3	205.2	865.2	594.0
Platinum	T.oz	133.00	114.00	139.00	123.00	165.00	2.5	1.4	.9	1.0	3.2	-
Potassium	ST	74.80	56.20	45.40	47.00	55.00	79.9	122.9	102.5	100.9	356.4	227.5
Rare Earths	lb	.63	.31	.37	.35	.35	(1)	(1)	(1)	(1)	17.6	23.0
Rhenium	lb	-	940.00	915.00	950.00	1,200.00	-	.7	5.4	6.9	21.1	18.5
Rhodium	T.oz	220.00	187.00	225.00	200.00	300.00	.08	.2	-	-	-	.3
Rubidium	lb	1.05	.51	.39	.37	.60	-	-	-	-	-	-
Scandium	g	-	-	4.30	4.29	4.50	-	-	-	-	-	.02
Selenium	lb	5.25	7.15	9.40	9.00	6.00	2.6	3.9	9.2	5.6	6.9	4.1
Silicon	ST	418.00	398.00	320.00	306.00	380.00	107.0	111.2	238.2	137.0	377.0	342.4
Silver	T.oz	1.60	1.23	1.85	1.54	2.70	67.4	38.9	83.3	64.0	231.9	119.1
Sodium	ST	17.90	24.50	20.00	19.70	19.70	122.7	261.3	387.4	376.0	1,245.7	733.9
Strontium	ST	64.00	72.00	51.30	54.00	58.00	-	-	-	-	-	-
Sulfur	LT	40.30	31.70	24.20	17.50	17.50	243.3	212.1	231.0	167.5	547.6	259.8
Tantalum	lb	6.95	10.00	9.60	8.26	15.70	-	-	-	-	-	-
Tellurium	lb	3.10	4.10	6.30	6.00	6.00	.3	1.1	.9	1.0	1.7	1.2
Thallium	lb	22.00	10.30	7.85	7.50	7.50	(1)	(1)	(1)	(1)	.02	.03
Thorium	lb	10.80	8.60	8.35	7.97	8.50	(1)	-	(1)	(1)	12.0	.9
Tin	lb	1.70	1.39	1.82	1.67	3.00	.3	.03	(1)	(1)	-	.5
Titanium-Metal	lb	8.80	2.20	1.38	1.32	1.20	-	-	-	-	-	-
Titanium-Nonmetallic	lb	.63	.63	.47	.45	.58	188.1	319.8	259.6	200.7	993.1	605.5
Tungsten	lb	1.25	1.90	2.70	2.96	4.00	5.0	12.5	23.8	20.4	183.5	10.6
Vanadium	lb	3.30	3.40	4.60	3.00	3.15	12.0	36.8	51.1	31.7	153.7	75.0
Yttrium	lb	32.00	11.00	9.40	9.00	14.00	(1)	-	(1)	(1)	3.5	.8
Zinc	lb	.24	.18	.16	.16	.25	299.5	154.6	167.4	161.0	573.5	275.5
Zirconium-Metal	lb	18.00	9.00	6.00	6.00	6.00	-	-	-	-	-	-
Zirconium-Nonmetallic	ST	162.00	133.00	121.00	109.00	116.00	(1)	(1)	(1)	(1)	9.7	10.5
Total							7,625.2	9,012.0	10,936.3	9,842.6	33,796.9	17,066.3
Asbestos	ST	121.00	133.00	121.00	118.00	130.00	5.0	5.9	14.5	15.4	54.7	37.7
Clays	ST	4.20	4.50	5.10	4.80	10.00	163.0	220.2	281.6	273.6	1,800.9	823.0
Corundum	ST	96.60	39.90	23.20	55.00	65.00	-	-	-	-	-	-
Diatomite	ST	45.00	67.90	57.20	64.20	65.00	12.3	32.6	34.2	34.3	178.4	75.4
Feldspar	LT	11.00	13.00	15.60	15.00	15.00	4.5	6.6	10.0	9.9	46.3	14.9
Garnet	ST	130.00	129.00	108.00	102.00	102.00	1.4	1.4	1.8	1.9	6.4	4.0
Graphite	ST	83.80	48.40	47.40	46.50	50.00	(1)	(1)	(1)	(1)	.1	-
Gypsum	ST	4.90	4.98	3.90	3.75	4.00	40.3	48.8	36.7	39.1	86.2	46.1
Kyanite	ST	104.50	94.00	102.00	74.00	103.00	(1)	(1)	(1)	(1)	81.8	33.2
Mica-Scrap & Flake	ST	44.20	38.80	22.20	23.00	23.00	3.0	3.7	2.6	2.9	11.4	5.5
Mica-Sheet	lb	1.40	.84	.75	.73	.75	.8	.5	-	.01	-	-
Perlite	ST	7.80	11.70	11.30	11.40	11.00	.8	3.7	5.1	4.2	15.3	9.4
Pumice	ST	6.50	2.90	1.24	1.07	1.20	4.7	6.5	3.8	3.5	12.8	9.2
Sand & Gravel	ST	1.40	1.40	1.24	1.25	1.35	522.0	964.5	1,164.0	1,150.0	4,324.3	2,430.0
Stone-Crushed	ST	2.35	1.95	1.65	1.75	1.70	188.1	852.6	1,069.9	1,146.3	4,284.0	2,533.0
Stone-Dimension	ST	55.00	52.30	63.70	56.70	49.00	102.9	117.7	99.5	93.4	173.9	63.0
Talc	ST	16.00	10.00	7.90	7.36	8.50	9.7	7.3	8.2	7.6	26.3	14.2
Vermiculite	ST	18.00	21.40	23.90	24.00	28.00	3.8	4.3	6.8	7.2	22.6	13.0
Total							1,066.6	2,282.4	2,754.0	2,801.1	11,125.4	6,111.6
Anthracite	ST	16.00	10.73	11.53	11.90	15.00	689.7	204.5	109.8	103.9	41.0	-
Bituminous Coal & Lignite	ST	8.60	6.40	6.55	7.07	11.00	4,421.6	2,763.5	3,944.7	3,904.0	12,276.0	8,441.5
Natural Gas	MCF	.11	.19	.18	.18	.58	724.2	2,402.2	3,733.4	3,889.8	27,737.9	25,376.2
Peat	ST	15.50	15.00	12.00	11.70	12.50	2.0	7.0	6.2	7.1	18.5	17.4
Petroleum 2/	bbl	4.40	3.85	3.16	3.22	4.30	9,486.4	11,222.8	13,031.8	13,111.1	45,784.9	27,558.7
Shale Oil	bbl	-	-	3.32	3.39	4.50	-	-	.3	.3	6,750.0	-
Uranium	lb	19.00	14.20	7.75	7.30	20.00	26.2	450.9	167.4	159.8	2,403.1	980.0
Total							15,350.1	17,050.9	20,993.6	21,176.0	94,991.4	62,373.8
Argon	ST	NA	671.00	289.00	270.00	300.00	NA	20.1	43.5	42.1	231.5	106.4
Helium	MCF	22.00	24.00	27.20	25.30	60.00	1.8	11.2	17.5	14.5	193.7	120.5
Hydrogen	MCF	.63	.35	.25	.26	.39	103.4	235.5	611.3	670.8	4,095.0	2,239.8
Oxygen	ST	NA	29.50	13.70	12.00	13.00	NA	114.6	150.5	156.0	838.5	473.2
Total							105.2	381.4	822.8	883.4	5,358.7	2,939.9
Grand Total							24,147.1	28,726.7	35,506.7	34,703.1	145,272.4	88,491.6

NA Not available.
1/ Certain data are withheld because the manner in which the information became available to the Bureau of Mines does not permit general disclosure.
2/ Includes natural gas liquids.

Comparison of Value of U.S. Demand for Primary Minerals and Value of Domestic Production, 1950 and 1971 with projected Values in 2000

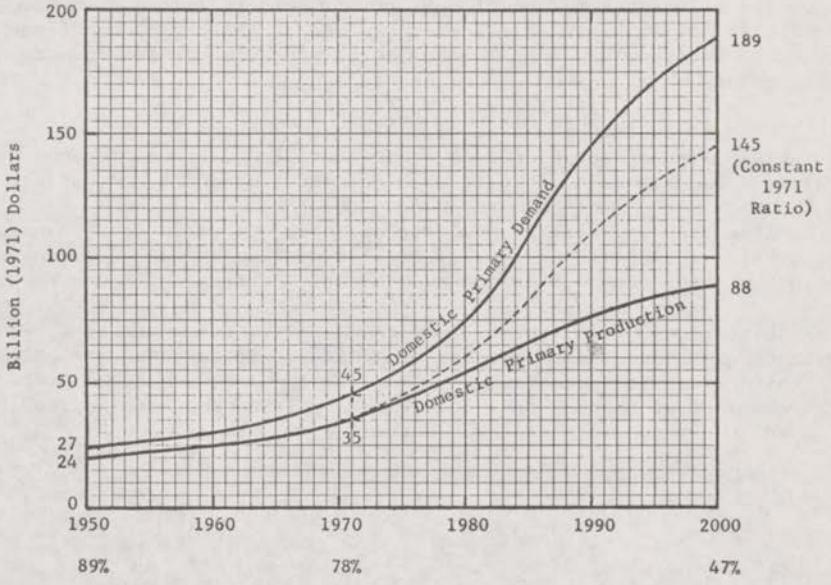


Table - 9

Ratio of U.S. Primary Mineral Production
to Domestic Demand for Primary Minerals

The calculated ratios of U.S. primary mineral production to demand for primary minerals, currently and at the beginning of the two past decades, are compared to ratios projected to the end of the century.

Changes in the U.S. capability to meet demands for primary materials from domestic sources are summarized in terms of such ratios from data maintained in the individual commodity summaries.

These data provide information necessary to verify any changes or trends in the U.S. primary mineral production and demand relationship that have occurred in the past or are anticipated in the future.

Historical or forecasted reductions in the U.S. primary mineral production-demand ratios for any commodity indicate that production is neither keeping pace nor expected to keep pace with demand for that commodity. Hence, this serves as an alert that some action is needed to reverse any undesirable trends.

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Table 9

Ratio of U.S. Primary Mineral Production to Primary Mineral Demand in 1950, 1960, 1970, and 1971 With Projected Ratio in 2000

(Percent)

Commodity	Ratio of Primary Production to Primary Demand				
	1950	1960	1970	1971	2000
Aluminum	40.9	35.3	14.8	11.4	2.0
Antimony	30.7	9.2	14.3	12.9	1.5
Arsenic	12.8	16.7	11.3	3.2	1.6
Barium	88.2	64.9	60.7	60.9	26.3
Beryllium	18.3	3.6	43.7	49.4	10.6
Bismuth	62.5	30.9	48.4	61.7	25.4
Boron	155.3	180.4	198.9	201.1	119.1
Bromine	132.0	104.2	102.3	105.6	124.6
Cadmium	49.5	42.0	39.0	32.8	13.8
Calcium	100.0	100.0	100.0	100.0	51.5
Cesium	-	-	-	-	-
Chlorine	104.2	102.2	100.0	99.7	48.6
Chromium	-	7.9	-	-	-
Cobalt	16.0	20.6	4.3	5.1	-
Columbium	-	-	-	-	-
Copper	71.5	97.6	109.4	93.5	45.6
Fluorine	68.8	35.0	20.1	18.9	2.3
Gallium	8.3	116.1	105.9	36.5	4.1
Germanium	NA	100.0	70.0	67.5	-
Gold	85.4	54.1	28.4	22.8	7.3
Hafnium	-	-	-	-	-
Indium	49.2	64.1	36.7	8.2	37.8
Iodine	56.8	25.2	14.7	14.7	3.4
Iron	87.1	81.5	70.2	72.0	37.3
Lead	61.7	45.8	69.0	61.2	45.0
Lithium	161.7	47.8	111.6	111.7	58.5
Magnesium-Metal	88.9	78.4	116.7	120.6	26.4
Magnesium-Nonmetallic	98.9	98.5	97.4	93.7	69.8
Manganese	23.1	10.9	5.0	3.2	-
Mercury	10.6	71.7	50.0	42.9	38.8
Molybdenum	140.0	183.8	226.8	269.6	101.1
Nickel	1.0	10.3	9.8	11.1	10.4
Nitrogen-Compounds	127.7	83.8	105.4	101.0	68.3
Nitrogen-Gas & Liquid	100.0	100.0	100.0	100.0	67.9
Palladium	12.4	2.6	1.9	1.6	3.2
Phosphorus	134.1	132.6	144.2	144.2	99.0
Platinum	6.9	4.2	1.7	2.4	-
Potassium	91.2	112.9	58.0	54.0	34.5
Rare Earths	66.3	12.0	96.3	114.2	149.1
Rhenium	-	150.0	187.3	95.4	83.7
Rhodium	-	4.2	-	-	1.2
Rubidium	-	-	-	-	-
Scandium	-	-	-	-	16.0
Selenium	46.1	71.2	88.2	71.3	42.5
Silicon	92.1	109.4	99.8	99.3	90.1
Silver	31.9	20.9	61.6	40.9	21.0
Sodium	101.8	97.9	96.7	94.1	55.4
Strontium	-	-	-	-	-
Sulfur	120.0	114.3	104.6	104.3	49.5
Tantalum	-	-	-	-	-
Tellurium	105.0	124.3	55.4	77.4	55.2
Thallium	65.7	73.2	41.1	36.9	50.7
Thorium	143.5	-	74.1	46.9	3.5
Tin	0.1	-	0.1	-	-
Titanium-Metal	-	-	-	-	-
Titanium-Nonmetallic	69.4	77.3	59.2	47.3	28.8
Tungsten	60.1	58.5	50.0	62.0	3.6
Vanadium	163.6	247.4	79.0	78.7	38.4
Yttrium	1,100.0	-	34.1	29.8	6.7
Zinc	54.3	45.5	41.0	37.0	17.8
Zirconium-Metal	-	-	-	-	-
Zirconium-Nonmetallic	77.8	74.3	45.7	50.0	54.5
Asbestos	5.6	6.3	17.0	17.3	11.9
Clays	100.0	100.0	103.8	103.6	47.1
Corundum	-	-	-	-	-
Diatomite	124.5	123.7	134.7	137.2	58.0
Feldspar	99.3	106.6	112.1	123.5	39.8
Garnet	105.7	116.6	118.8	118.8	73.6
Graphite	11.7	4.3	3.9	3.5	-
Gypsum	73.9	70.1	65.8	61.6	32.9
Kyanite	88.1	95.7	118.3	126.1	51.1
Mica-Scrap & Flake	93.2	98.0	100.0	101.6	49.3
Mica-Sheet	4.6	7.6	-	0.3	-
Perlite	102.0	105.1	103.6	103.3	63.3
Pumice	97.3	97.4	89.6	89.2	63.7
Sand & Gravel	100.5	100.0	100.0	100.1	56.3
Stone-Crushed	100.0	100.0	100.0	100.0	59.1
Stone-Dimension	100.0	100.0	89.9	92.9	33.6
Talc	99.4	102.8	108.4	105.9	57.2
Vermiculite	100.5	101.0	129.0	111.1	64.1
Anthracite	110.0	105.6	118.0	118.9	-
Bituminous Coal & Lignite	113.7	110.1	116.6	111.5	76.7
Natural Gas	106.8	104.1	98.4	97.6	89.3
Peat	51.4	64.1	64.6	67.1	63.1
Petroleum 1/	90.8	81.3	76.9	73.4	44.2
Shale Oil	-	-	-	-	-
Uranium	572.5	5,707.1	130.1	96.9	39.5
Argon	100.0	100.0	100.0	100.0	46.0
Helium	100.0	101.1	110.2	129.1	80.4
Hydrogen	100.0	100.0	100.0	100.0	54.7
Oxygen	100.0	100.0	100.0	100.0	56.4

NA Not available.

1/ Includes natural gas liquids.

Table - 10

Average Annual Growth Rate in U.S.
Demand for Primary Minerals

The average annual percentage growth rates in U.S. demand for primary minerals during the past two decades is compared to anticipated average growth rates to the end of the century.

These data permit a rapid determination of all average annual growth rates in primary mineral demand for the individual commodities. This information when related to that on per capita demand and end-use demand is helpful in analyzing past trends and in forecasting future demands.

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Table 10

Average Annual Growth in U.S. Primary Mineral Demand During 1950-1960, 1960-1970, 1950-1970, and 1950-1971, With Projected Growth During 1971-2000
(Percent)

Commodity	1950-1960	1960-1970	1950-1970	1950-1971	1971-2000
Aluminum	5.7	9.6	7.6	7.9	6.3
Antimony	-2.7	2.1	-0.3	-0.3	4.2
Arsenic	-2.7	0.9	-0.9	-1.2	2.4
Barium	4.2	1.7	2.9	2.6	2.1
Beryllium	12.5	-0.3	5.9	6.1	5.1
Bismuth	-0.2	2.1	0.9	-0.2	2.9
Boron	4.0	4.6	4.3	4.1	4.3
Bromine	8.4	7.4	7.9	7.4	1.4
Cadmium	0.3	-0.7	-0.2	0.6	3.7
Calcium	0.3	2.5	1.4	1.2	3.5
Cesium	-	7.6	-	-	4.0
Chlorine	8.5	8.0	8.2	7.6	5.3
Chromium	4.5	2.7	3.6	1.8	4.2
Cobalt	7.9	4.2	6.1	4.8	2.1
Columbium	37.0	7.5	22.0	19.3	5.4
Copper	-1.4	3.6	1.0	1.2	4.2
Fluorine	4.5	7.6	6.1	5.9	4.6
Gallium	32.0	4.2	17.3	28.0	8.7
Germanium	-	-2.7	-	-	2.2
Gold	1.0	7.1	4.0	4.1	2.7
Hafnium	-	3.8	-	-	1.9
Indium	9.0	6.3	7.6	6.8	1.6
Iodine	3.4	10.0	6.7	6.1	4.1
Iron	0.4	2.6	1.5	0.9	2.5
Lead	-2.6	4.4	0.9	1.5	1.4
Lithium	18.0	7.6	12.6	12.0	4.1
Magnesium-Metal	11.0	6.5	8.7	8.6	6.2
Magnesium-Nonmetallic	2.9	0.8	1.8	1.2	2.9
Manganese	0.4	2.1	1.3	0.6	2.5
Mercury	-0.2	1.6	0.7	-0.5	2.3
Molybdenum	6.3	2.8	4.6	3.5	5.4
Nickel	2.0	2.5	2.2	1.7	3.5
Nitrogen-Compounds	15.6	7.7	11.6	11.5	4.4
Nitrogen-Gas & Liquid	37.0	23.0	30.0	29.0	4.4
Palladium	11.4	3.5	7.4	7.7	1.9
Phosphorus	4.4	6.1	5.3	5.0	4.2
Platinum	0.5	3.5	2.0	0.9	3.2
Potassium	5.2	7.3	6.2	6.0	3.9
Rare Earths	10.9	17.7	14.3	12.9	2.7
Rhenium	-	20.0	-	-	3.1
Rhodium	5.5	4.2	4.8	2.8	4.3
Rubidium	-	-0.8	-	-	3.5
Scandium	-	-	-	-	2.0
Selenium	-3.7	3.8	0.1	-1.0	2.1
Silicon	-0.8	7.6	3.3	2.3	2.8
Silver	0.9	-7.3	-3.1	-1.3	2.5
Sodium	4.9	6.4	5.7	5.4	4.2
Strontium	-1.9	19.3	8.2	8.0	1.9
Sulfur	1.6	4.5	3.1	2.9	4.1
Tantalum	13.0	8.2	10.6	10.2	4.4
Tellurium	8.1	2.7	5.4	3.6	1.9
Thallium	-4.8	8.1	1.6	1.5	1.1
Thorium	16.9	0.2	8.2	8.6	8.8
Tin	-2.2	-1.1	-1.6	-1.8	2.1
Titanium-Metal	23.0	11.6	17.2	14.4	8.2
Titanium-Nonmetallic	4.3	3.5	3.9	3.8	4.8
Tungsten	5.6	3.6	4.6	2.5	6.8
Vanadium	7.3	12.2	9.7	9.0	5.4
Yttrium	7.2	46.0	25.0	23.0	5.7
Zinc	-1.8	3.1	0.6	0.8	2.9
Zirconium-Metal	17.5	-	8.4	10.4	3.2
Zirconium-Nonmetallic	14.5	7.2	10.8	10.3	3.0
Asbestos	-0.3	0.3	(1)	0.2	4.1
Clays	2.3	0.8	1.5	1.7	4.0
Corundum	-2.8	-2.9	-2.8	-2.7	-2.1
Diatomite	5.9	1.4	3.6	2.8	5.7
Feldspar	1.4	2.1	1.7	1.3	5.4
Garnet	0.2	5.8	3.0	2.8	4.2
Graphite	0.2	0.4	0.3	0.8	1.8
Gypsum	2.4	0.2	1.3	2.0	2.5
Kyanite	5.1	6.2	5.6	5.1	5.8
Mica-Scrap & Flake	2.9	1.9	2.4	2.5	4.5
Mica-Sheet	-4.9	-1.7	-3.3	-4.0	-7.3
Perlite	11.5	4.0	7.7	7.0	4.1
Pumice	11.9	4.4	8.1	8.0	4.1
Sand & Gravel	6.8	2.9	4.8	4.4	4.4
Stone-Crushed	18.6	3.9	11.0	10.5	4.7
Stone-Dimension	2.0	-2.6	-0.3	-0.2	2.7
Talc	1.4	2.9	2.1	2.2	3.8
Vermiculite	-0.5	1.2	0.3	1.3	3.4
Anthracite	-8.3	-8.4	-8.4	-8.7	-3.9
Bituminous Coal & Lignite	-1.9	3.2	0.6	0.4	2.5
Natural Gas	7.6	5.7	6.6	6.5	2.8
Peat	11.2	0.9	5.9	6.2	3.1
Petroleum	4.2	4.1	4.2	4.1	3.4
Shale Oil	-	-	-	-	-
Uranium	8.8	40.0	24.0	24.0	6.0
Argon	26.0	17.8	22.0	21.0	5.6
Helium	19.2	2.2	10.4	8.5	6.1
Hydrogen	14.6	13.8	14.2	14.0	4.9
Oxygen	14.2	12.9	13.5	12.8	5.7

1/ Less than one-tenth unit.

Table - 11

U.S. Per Capita Mineral Demand

Using Population Reference Bureau data and projections; historical, current, and projected U.S. per capita primary demand for each commodity is expressed in quantitative and dollar value terms.

These data are extremely helpful in analyzing and interpreting changes and trends in primary mineral demand as well as in forecasting mineral demands.

Despite an increase in annual primary demand for some commodities, at the same time there has been a marked decrease in per capita primary demand for those commodities. Relating this type of information to end-use demands and average annual growth rates in demand permits resolution of apparent discrepancies and promotes improved demand forecasting.

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Table 11
U.S. Per Capita Primary Mineral Demand in 1950, 1960, 1970, and 1971, With Projected Demand in 2000

Commodity	Units	Per Capita Primary Demand					Units	Per Capita Primary Demand				
		1950	1960	1970	1971	2000		1950	1960	1970	1971	2000
Aluminum	Pounds	12.0	17.5	38.6	43.4	176.0	Dollars	3.76	6.23	11.69	12.58	65.12
Antimony	Pounds	.2	.1	.1	.1	.1	Dollars	.10	.05	.02	.10	.02
Arsenic	Pounds	.3	.2	.2	.2	.2	Dollars	.04	.02	.02	.02	.02
Barium	Pounds	5.8	7.4	7.7	7.4	9.2	Dollars	.08	.10	.10	.10	.13
Beryllium	Pounds	(1)	(1)	(1)	(1)	(1)	Dollars	.24	.37	.23	.24	.59
Bismuth	Pounds	(1)	(1)	(1)	(1)	(1)	Dollars	.04	.04	.07	.04	.07
Boron	Pounds	.5	.6	.8	.9	2.0	Dollars	.27	.24	.23	.22	.52
Bromine	Pounds	.5	.9	1.7	1.6	1.7	Dollars	.17	.32	.47	.28	.28
Cadmium	Pounds	.1	.1	(1)	.1	.1	Dollars	.23	.11	.17	.10	.30
Calcium	Pounds	893.0	774.8	878.9	850.2	1,606.7	Dollars	2.38	1.99	1.84	1.83	3.46
Cesium	Pounds	-	(1)	(1)	(1)	(1)	Dollars	-	-	-	-	(1)
Chlorine	Pounds	26.3	50.2	95.2	90.6	281.3	Dollars	1.18	2.20	3.71	3.40	10.55
Chromium	Pounds	3.0	3.9	4.5	3.2	7.3	Dollars	.33	.32	.37	.27	.67
Cobalt	Pounds	(1)	.1	.1	.1	.1	Dollars	.10	.13	.18	.14	.20
Columbium	Pounds	(1)	(1)	(1)	(1)	.1	Dollars	(1)	.03	.04	.03	.10
Copper	Pounds	16.7	12.2	15.3	15.7	36.0	Dollars	4.11	5.36	9.30	8.17	27.00
Fluorine	Pounds	2.5	3.2	6.0	6.2	16.0	Dollars	.18	.23	.36	.44	2.40
Gallium	g	(1)	(1)	(1)	(1)	(1)	Dollars	(1)	(1)	(1)	(1)	.03
Germanium	Pounds	NA	(1)	(1)	(1)	(1)	Dollars	NA	.05	.02	.03	.05
Gold	Troy ounces	(1)	(1)	(1)	(1)	(1)	Dollars	1.14	.82	1.14	1.31	3.81
Hafnium	Pounds	-	(1)	(1)	(1)	(1)	Dollars	-	.01	.02	.03	.03
Iodine	Troy ounces	(1)	(1)	(1)	(1)	(1)	Dollars	(1)	.01	.01	.01	.01
Iodine	Pounds	(1)	(1)	(1)	(1)	.1	Dollars	.03	.01	.04	.04	.13
Iron	Pounds	814.2	719.4	820.3	724.6	1,020.0	Dollars	30.12	29.02	26.66	24.79	37.33
Lead	Pounds	9.2	6.0	8.1	9.1	9.5	Dollars	2.11	.95	1.38	1.28	1.53
Lithium	Pounds	(1)	(1)	(1)	(1)	.1	Dollars	.01	.02	.01	.03	.06
Magnesium-Metal	Pounds	.2	.6	.9	1.0	3.9	Dollars	.09	.27	.34	.35	1.39
Magnesium-Nonmetallic	Pounds	9.6	10.8	10.3	9.1	16.4	Dollars	.40	.47	.46	.43	.69
Manganese	Pounds	13.8	11.9	12.9	11.3	15.7	Dollars	.91	.69	.32	.30	.39
Mercury	Pounds	(1)	(1)	(1)	(1)	(1)	Dollars	.04	.07	.11	.06	.19
Molybdenum	Pounds	.1	.2	.2	.2	.6	Dollars	.23	.36	.43	.34	1.13
Nickel	Pounds	1.3	1.3	1.5	1.4	2.6	Dollars	1.17	1.41	2.04	1.81	3.41
Nitrogen-Compounds	Pounds	15.2	34.4	101.2	109.2	264.7	Dollars	1.31	3.35	2.88	3.06	7.94
Nitrogen-Gas & Liquid	Pounds	.4	7.4	51.8	57.6	139.3	Dollars	NA	.13	.71	.72	2.09
Palladium	Troy ounces	(1)	(1)	(1)	(1)	(1)	Dollars	.03	.07	.10	.11	.27
Phosphorus	Pounds	17.1	22.2	33.4	35.2	80.0	Dollars	.59	.67	.72	.69	2.00
Platinum	Troy ounces	(1)	(1)	(1)	(1)	(1)	Dollars	.24	.18	.27	.20	.45
Potassium	Pounds	15.4	21.5	38.2	38.4	80.0	Dollars	.57	.81	.87	.90	2.20
Rare Earths	Pounds	(1)	(1)	.1	.1	.1	Dollars	.01	.01	.04	.03	.03
Rhenium	Pounds	-	(1)	(1)	(1)	(1)	Dollars	-	(1)	.01	.03	.07
Rhodium	Troy ounces	(1)	(1)	(1)	(1)	(1)	Dollars	.02	.02	.04	.02	.08
Rubidium	Pounds	-	(1)	(1)	(1)	(1)	Dollars	-	-	-	-	-
Scandium	Pounds	-	-	(1)	(1)	(1)	Dollars	-	-	(1)	-	(1)
Selenium	Pounds	(1)	(1)	(1)	(1)	(1)	Dollars	.04	.03	.05	.04	.03
Silicon	Pounds	3.6	2.8	5.2	4.4	6.7	Dollars	.76	.56	1.16	.44	1.23
Silver	Troy ounces	.9	.8	.4	.5	.7	Dollars	1.39	1.02	.44	.76	1.89
Sodium	Pounds	88.6	120.8	198.6	196.0	448.0	Dollars	.79	1.47	1.93	1.93	4.41
Strontium	Pounds	.1	(1)	.2	.1	.2	Dollars	(1)	(1)	(1)	(1)	.01
Sulfur	Pounds	73.3	72.7	99.9	88.7	224.0	Dollars	1.33	1.02	1.08	.78	1.75
Tantalum	Pounds	(1)	(1)	(1)	(1)	(1)	Dollars	.01	.03	.05	.05	.21
Tellurium	Pounds	(1)	(1)	(1)	(1)	(1)	Dollars	(1)	.01	.01	.01	.01
Thallium	Pounds	(1)	(1)	(1)	(1)	(1)	Dollars	(1)	(1)	(1)	(1)	(1)
Thorium	Pounds	(1)	(1)	(1)	(1)	(1)	Dollars	(1)	.01	.01	.01	.09
Tin	Pounds	1.1	.7	.6	.5	.7	Dollars	1.80	.99	1.06	.90	2.02
Titanium-Metal	Pounds	(1)	.1	.2	.2	1.1	Dollars	.11	.20	.32	.22	1.34
Titanium-Nonmetallic	Pounds	2.8	3.6	4.5	4.6	12.1	Dollars	1.78	2.29	2.14	2.05	7.00
Tungsten	Pounds	(1)	.1	.1	.1	.2	Dollars	.05	.11	.23	.16	.99
Vanadium	Pounds	(1)	(1)	.1	.1	.2	Dollars	.05	.08	.31	.19	.65
Yttrium	Pounds	(1)	(1)	(1)	(1)	(1)	Dollars	(1)	(1)	.01	.01	.04
Zinc	Pounds	15.1	10.6	12.7	13.1	20.7	Dollars	3.62	1.88	2.00	2.10	5.17
Zirconium-Metal	Pounds	(1)	(1)	(1)	(1)	.1	Dollars	.23	.47	.30	.46	.80
Zirconium-Nonmetallic	Pounds	.1	.4	.7	.7	1.1	Dollars	.01	.02	.04	.04	.06
								66.23	67.24	79.05	74.90	204.66
Asbestos	Pounds	9.5	7.8	7.2	7.3	16.2	Dollars	0.58	0.51	0.42	0.43	1.05
Clays	Pounds	512.1	542.3	517.6	531.4	1,160.0	Dollars	1.08	1.23	1.33	1.28	3.80
Corundum	Pounds	(1)	(1)	(1)	(1)	(1)	Dollars	(1)	(1)	(1)	(1)	(1)
Diatomite	Pounds	2.9	4.3	4.3	3.8	13.3	Dollars	.06	.15	.13	.12	.43
Feldspar	Pounds	6.0	5.8	6.3	5.8	18.7	Dollars	.03	.03	.04	.04	.13
Garnet	Pounds	.1	.1	.1	.2	.3	Dollars	.01	.01	.01	.01	.02
Graphite	Pounds	.6	.5	.5	.6	.6	Dollars	.03	.01	.01	.01	.02
Gypsum	Pounds	145.5	155.0	140.0	183.4	233.3	Dollars	.36	.39	.27	.31	.47
Kyanite	Pounds	.5	.8	1.2	1.1	4.2	Dollars	.03	.03	.04	.04	.12
Mica-Scrap & Flake	Pounds	1.0	1.1	1.2	1.2	3.0	Dollars	.02	.02	.01	.01	.04
Mica-Sheet	Pounds	.1	(1)	(1)	(1)	(1)	Dollars	.13	.03	.02	.02	(1)
Perlite	Pounds	1.3	3.3	4.3	4.0	9.0	Dollars	.01	.02	.02	.02	.03
Pumice	Pounds	9.7	25.1	34.1	35.9	80.0	Dollars	.03	.04	.02	.02	.05
Sand & Gravel	Tons	2.4	3.9	4.6	4.4	10.7	Dollars	3.43	5.34	5.68	5.55	14.40
Stone-Crushed	Tons	.5	2.4	3.2	3.2	8.4	Dollars	1.23	4.71	5.23	5.54	14.28
Stone-Dimension	Pounds	24.4	25.0	17.0	17.1	25.5	Dollars	.68	.65	.54	.59	.63
Talc	Pounds	8.1	7.9	9.2	9.5	19.5	Dollars	.06	.04	.04	.04	.08
Vermiculite	Pounds	2.7	2.2	2.1	2.6	4.8	Dollars	.02	.02	.02	.03	.08
								7.75	13.23	13.85	13.96	37.72
Anthracite	Pounds	525.3	199.2	78.1	70.9	13.3	Dollars	4.12	1.08	0.46	0.42	0.12
Bituminous Coal & Lignite	Tons	3.0	2.1	2.5	2.4	3.3	Dollars	25.54	13.44	16.51	16.90	36.67
Natural Gas	Thousand C.F.	38.7	67.9	104.3	106.9	163.3	Dollars	4.45	12.77	18.54	19.25	94.73
Peat	Pounds	3.3	8.1	7.8	8.7	14.7	Dollars	.03	.06	.04	.05	.09
Petroleum 1/	bbl	15.6	19.8	26.2	26.8	48.3	Dollars	68.61	76.41	82.76	86.34	207.83
Shale Oil	bbl	-	-	-	-	5.0	Dollars	-	-	(1)	(1)	22.50
Uranium	Pounds	(1)	(1)	.1	.1	.4	Dollars	.03	.04	.63	.80	8.26
								102.78	103.80	118.94	123.76	370.20
Argon	Pounds	(1)	.3	1.5	1.5	5.1	Dollars	NA	0.11	0.21	0.20	0.77
Helium	C.F.	.5	2.6	2.9	2.2	8.3	Dollars	0.01	.06	.07	.06	.30
Hydrogen	Thousand C.F.	1.1	3.6	11.4	12.5	35.0	Dollars	.68	1.30	2.99	3.24	13.65
Oxygen	Pounds	13.5	43.0	127.8	125.6	430.0	Dollars	NA	.64	.74	.75	2.80
								.69	2.11	4.01	4.25	17.72
								177.45	186.38	215.85	216.87	630.30

NA Not available.
1/ Less than one-tenth unit.
2/ Includes natural gas liquids.

Table - 12

Value of Primary Demand

The historical, current, and projected value of U.S. demands for primary minerals using average annual unit prices and constant current dollar values are tabulated and summarized in Table 12.

The current quantitative U.S. and rest-of-the-world demands for primary minerals are compared with the projected U.S. and world demands. The cumulative U.S. and world demands for individual primary minerals through the remainder of the century are presented in Table 12A.

The current value of U.S. and world demand for primary minerals is compared to projected values and the value of the cumulative U.S. and world demand through the end of the century is calculated and summarized in Table 12B.

These tabulations clearly exhibit the historical and forecasted demand for primary minerals in the United States and in the rest of the world. Thus, it is possible to relate U.S. primary demand, for individual or all the commodities to corresponding world primary mineral demands.

Information such as this on the magnitude and significance of annual and cumulative primary mineral demands in both the U.S. and rest of the world identifies the need for productive actions to assure that the minerals demands will be met.

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Table 12

Value of U.S. Primary Mineral Demand in 1950, 1960, 1970, and 1971, With Projected Value in 2000

Commodity	Price Units	Average Unit Price - 1971 Dollars					Value - Million 1971 Dollars				
		1950	1960	1970	1971	2000	1950	1960	1970	1971	2000
Aluminum	lb	0.31	0.36	0.30	0.29	0.37	573.1	1,126.3	2,994.7	2,604.7	19,536.0
Antimony	lb	.52	.43	1.51	.71	.70	15.7	10.0	44.3	20.5	87.2
Arsenic	ST	276.00	159.00	176.00	168.00	180.00	6.7	(1)	(1)	(1)	6.8
Barium	ST	28.00	29.40	26.30	27.00	29.00	12.3	19.5	20.7	20.5	40.0
Beryllium	lb	149.00	85.00	63.00	60.00	50.00	35.8	65.8	(1)	(1)	177.0
Bismuth	lb	3.65	3.10	6.30	5.26	5.00	(1)	(1)	(1)	9.3	25.0
Boron	ST	1,087.00	764.00	534.00	520.00	510.00	41.7	42.7	46.9	45.5	134.5
Bromine	lb	.34	.27	.18	.17	.17	25.9	57.9	96.5	57.3	85.0
Cadmium	lb	3.75	2.10	3.74	1.92	3.95	35.7	20.4	34.0	20.8	107.8
Calcium	ST	3.30	3.13	4.20	4.30	4.30	362.4	358.4	377.5	378.0	1,036.3
Cesium	lb	1.05	.82	.63	.60	.60	-	-	(1)	(1)	.01
Chlorine	ST	90.00	88.00	78.50	73.00	73.00	179.7	397.8	784.5	703.0	3,165.0
Chromium	ST	220.00	165.00	161.00	166.00	185.00	50.3	58.3	74.3	35.6	201.7
Cobalt	lb	3.15	2.10	2.30	2.20	2.45	15.7	22.4	37.7	29.5	80.5
Columbium	lb	2.90	2.36	1.73	1.65	1.57	.3	5.7	8.7	6.0	30.1
Copper	lb	.37	.44	.61	.52	.75	930.5	971.7	1,905.6	1,492.1	8,100.0
Fluorine	ST	144.00	138.00	119.00	140.00	300.00	27.3	40.5	72.4	90.3	720.6
Gallium	g	7.95	3.57	.73	.70	.35	(1)	(1)	(1)	(1)	8.8
Germanium	lb	NA	186.00	133.00	133.00	200.00	NA	9.7	5.3	5.3	15.0
Gold	T.oz	61.75	48.00	38.13	41.25	90.00	172.9	148.0	215.9	270.7	1,144.0
Hafnium	lb	-	55.00	89.00	85.00	85.00	-	(1)	(1)	(1)	9.9
Iodine	T.oz	3.93	3.10	2.60	2.30	3.00	(1)	(1)	(1)	(1)	2.4
Iodine	lb	3.00	1.30	1.50	1.62	2.60	4.2	2.3	7.6	8.7	40.3
Iron	ST	74.00	80.80	65.20	68.70	73.00	4,587.1	5,243.8	5,459.9	5,131.9	11,169.0
Lead	lb	.23	.16	.16	.14	.16	320.9	180.3	277.2	264.6	457.6
Lithium	lb	1.25	1.50	.82	.88	.90	(1)	(1)	(1)	(1)	19.4
Magnesium-Metal	lb	.39	.68	.37	.36	.36	13.9	49.0	70.2	73.1	417.6
Magnesium-Nonmetallic	ST	82.00	88.00	88.50	94.00	96.00	60.3	85.7	93.3	90.0	207.6
Manganese	ST	136.00	116.00	50.40	53.60	49.00	138.4	124.9	66.9	62.7	115.4
Mercury	Fl	143.00	289.00	427.00	292.00	700.00	6.7	13.3	23.0	12.1	56.0
Molybdenum	lb	1.80	1.70	1.80	1.72	1.80	35.5	63.8	88.3	69.9	358.4
Nickel	lb	.90	1.02	1.34	1.33	1.13	177.7	233.9	416.5	375.3	1,024.1
Nitrogen-Compounds	ST	172.00	123.00	57.00	56.00	60.00	199.5	606.0	590.2	633.1	2,382.0
Nitrogen-Gas & Liquid	ST	NA	33.00	27.40	25.00	30.00	NA	22.5	145.4	148.9	627.0
Palladium	T.oz	41.80	34.00	40.00	37.00	75.00	5.4	13.1	21.4	22.5	79.5
Phosphorus	ST	68.00	60.40	40.60	39.00	50.00	89.8	120.9	147.1	142.3	680.0
Platinum	T.oz	133.00	114.00	139.00	123.00	165.00	36.7	32.8	56.5	41.0	135.3
Potassium	ST	74.80	56.20	45.40	47.00	55.00	87.7	104.9	176.8	187.0	660.0
Rare Earths	lb	.63	.31	.37	.35	.35	1.0	1.5	8.5	7.1	15.4
Rhenium	lb	-	940.00	915.00	930.00	1,200.00	-	.4	2.9	7.3	22.1
Rhodium	T.oz	220.00	187.00	225.00	200.00	300.00	1.1	4.5	8.0	5.0	25.5
Rubidium	lb	1.05	.51	.39	.37	.60	-	-	-	-	-
Scandium	g	-	-	4.30	4.29	4.50	-	-	.06	-	.1
Selenium	lb	5.25	7.13	9.40	9.00	6.05	5.8	5.4	10.3	7.9	9.7
Silicon	ST	418.00	398.00	320.00	306.00	380.00	116.2	101.7	238.6	138.0	380.0
Silver	T.oz	1.60	1.23	1.85	1.54	2.70	211.6	185.6	135.2	156.3	367.0
Sodium	ST	17.90	24.50	28.00	19.70	19.70	120.5	266.9	400.7	399.6	1,323.8
Strontium	ST	64.00	72.00	51.30	54.00	58.00	.2	.2	(1)	1.1	2.0
Sulfur	LT	40.50	31.70	24.20	17.30	17.50	202.7	185.6	220.9	160.7	525.0
Tantalum	lb	6.95	10.00	9.60	8.26	15.70	1.0	5.0	10.1	9.6	63.0
Tellurium	lb	5.10	4.10	6.30	6.00	6.00	.3	.9	1.8	1.3	2.7
Thallium	lb	22.00	10.30	7.85	7.50	7.50	(1)	(1)	(1)	(1)	.07
Thorium	lb	10.80	8.60	8.35	7.97	8.50	(1)	(1)	(1)	(1)	25.5
Tin	lb	1.70	1.39	1.82	1.67	3.00	273.4	179.5	216.9	186.5	604.8
Titanium-Metal	lb	8.80	2.20	1.38	1.32	1.20	17.6	35.1	66.3	44.9	403.2
Titanium-Nonmetallic	lb	.63	.63	.47	.45	.58	270.9	413.8	438.3	423.9	2,099.6
Tungsten	lb	1.25	1.90	2.70	2.96	4.00	8.3	21.4	47.5	32.9	296.0
Vanadium	lb	3.30	3.40	4.60	3.00	3.15	7.3	14.8	64.6	40.3	195.3
Yttrium	lb	32.00	13.00	9.40	9.00	14.00	(1)	(1)	(1)	(1)	11.8
Zinc	lb	.24	.18	.16	.16	.25	551.3	339.7	408.2	435.5	1,550.0
Zirconium-Metal	lb	18.00	9.00	6.00	6.00	6.00	(1)	(1)	(1)	(1)	240.0
Zirconium-Nonmetallic	ST	162.00	133.00	121.00	109.00	116.00	(1)	(1)	(1)	(1)	19.4
Total							10,086.7	12,150.1	16,188.5	15,505.2	61,388.6
Asbestos	ST	121.00	130.00	121.00	118.00	130.00	88.1	91.9	85.0	89.5	315.9
Clays	ST	4.20	4.50	5.10	4.80	10.00	163.0	220.2	271.4	264.5	1,740.0
Corundum	ST	96.60	39.90	21.20	55.00	65.00	.3	.1	.04	.1	.03
Diatomite	ST	45.00	67.90	57.20	64.20	65.00	9.9	26.3	25.2	23.0	130.0
Feldspar	LT	11.00	13.00	15.60	15.00	15.00	4.6	6.2	9.0	8.1	37.5
Garnet	ST	130.00	129.00	108.00	102.00	102.00	1.4	1.1	1.6	1.6	5.4
Graphite	ST	83.80	48.40	47.40	46.50	50.00	(1)	(1)	(1)	(1)	4.8
Gypsum	ST	4.90	4.98	3.90	3.75	4.00	54.4	69.5	55.7	43.4	160.0
Kyanite	ST	104.50	94.00	101.00	74.00	103.00	(1)	(1)	(1)	(1)	64.9
Mica-Scrap & Flake	ST	44.20	38.80	22.20	23.00	25.00	3.2	3.8	2.6	2.9	11.2
Mica-Sheet	lb	1.40	.84	.75	.73	.75	17.7	6.5	4.9	4.0	.3
Perlite	ST	7.80	11.70	11.30	11.40	11.00	.8	3.4	4.9	4.8	14.9
Pumice	ST	6.50	2.90	1.24	1.07	1.20	4.8	6.7	4.2	4.0	14.4
Sand & Gravel	ST	1.40	1.40	1.24	1.25	1.35	519.2	984.5	1,184.0	1,148.8	4,320.0
Stone-Crushed	ST	2.35	1.95	1.65	1.75	1.70	188.1	852.6	1,069.9	1,146.3	4,284.0
Stone-Dimension	ST	55.00	52.30	63.70	56.70	49.00	102.9	117.7	110.6	100.5	187.2
Talc	ST	16.00	10.00	7.90	7.36	8.50	9.7	7.2	7.5	7.2	24.8
Vermiculite	ST	18.00	21.40	23.90	24.00	28.00	5.8	4.2	5.2	6.5	20.3
Total							1,180.3	2,390.7	2,837.0	2,888.7	11,315.8
Anthracite	ST	16.00	10.73	11.53	11.90	13.00	627.0	193.7	93.1	87.3	74.5
Bituminous Coal & Lignite	ST	8.60	6.40	6.55	7.07	11.00	3,890.3	2,429.3	3,382.0	3,498.7	11,000.0
Natural Gas	MCF	.11	.19	.18	.18	.58	678.2	2,307.8	3,795.9	3,983.9	28,420.0
Peat	ST	15.50	15.00	12.00	11.70	12.50	4.0	11.0	9.5	10.5	27.5
Petroleum 1/	bbl	4.40	3.85	3.16	3.22	4.30	10,450.0	13,804.1	16,950.2	17,872.5	62,390.0
Shale Oil	bbl	-	-	3.32	3.38	4.30	-	-	.3	.3	6,750.0
Uranium	lb	19.00	14.20	7.75	7.30	20.00	4.6	8.0	128.6	165.0	2,480.0
Total							15,654.1	18,755.9	24,359.6	25,618.2	111,062.0
Argon	ST	NA	671.00	289.00	270.00	300.00	NA	20.1	43.5	42.1	231.5
Helium	MCF	22.00	24.00	27.20	25.20	60.00	1.8	11.1	16.0	11.3	150.0
Hydrogen	MCF	.63	.35	.25	.26	.28	103.4	239.5	611.3	670.8	4,095.0
Oxygen	ST	NA	29.50	13.70	12.00	13.00	NA	114.6	150.5	156.0	838.5
Total							105.2	385.3	821.3	880.2	5,315.0
Grand Total							27,026.3	33,678.0	44,206.4	44,892.3	189,091.4

NA Not available.
1/ Certain data are withheld because the manner in which the information became available to the Bureau of Mines does not permit general disclosure.
2/ Includes natural gas liquids.

January 17, 1973

Table 12A
World Primary Mineral Demand in 1971, with Projected Demand in 2000, and Cumulative Demand, 1971-2000

Commodity	Units	1971			2000			Cumulative 1971-2000		
		United States	Rest of World	World	United States	Rest of World	World	United States	Rest of World	World
Aluminum	Million S.T.	5	8	13	26	49	75	370	680	1,050
Antimony	Thousand S.T.	15	61	76	48	90	138	822	2,170	2,992
Arsenic	Thousand S.T.	(1)	(1)	55	38	64	102	800	1,440	2,240
Barium	Thousand S.T.	799	1,541	2,300	1,380	4,500	5,880	31,000	81,000	112,000
Beryllium	S.T.	(1)	(1)	515	1,770	1,030	2,800	27,600	12,100	39,700
Bismuth	Million lb	2	7	9	4	10	14	81	251	332
Boron	Thousand S.T.	88	196	284	303	695	998	5,073	11,573	16,646
Bromine	Million lb	337	147	484	500	350	850	12,000	6,800	18,800
Cadmium	Million lb	11	16	27	31	45	76	560	825	1,385
Calcium	Million S.T.	88	393	481	241	1,000	1,241	4,460	19,240	23,700
Cesium	Thousand lb	(1)	(1)	14	20	25	45	350	430	780
Chlorine	Million S.T.	9	16	25	42	67	109	645	1,030	1,675
Chromium	Thousand S.T.	335	1,631	1,966	1,090	3,800	4,890	19,100	76,000	95,100
Cobalt	Million lb	13	41	54	25	92	117	540	1,840	2,380
Columbium	Million lb	4	13	17	19	26	45	288	545	833
Copper	Thousand S.T.	1,627	4,912	6,539	5,400	18,300	23,700	92,700	299,900	392,600
Fluorine	Thousand S.T.	645	1,656	2,301	2,400	6,100	8,500	39,000	101,000	140,000
Gallium	Thousand Kg	(1)	(1)	4	25	15	40	281	188	469
Germanium	Thousand lb	40	100	140	75	140	215	1,600	3,500	5,100
Gold	Million T.oz	7	31	38	14	43	57	293	1,081	1,374
Hafnium	S.T.	33	29	62	58	75	133	1,280	1,420	2,700
Indium	Thousand T.oz	(1)	(1)	1,950	800	2,400	3,200	19,000	55,600	74,600
Iodine	Million lb	5	16	21	16	36	52	269	733	1,002
Iron	Million S.T.	75	413	488	153	780	933	3,200	16,900	20,100
Lead	Thousand S.T.	945	2,964	3,909	1,430	5,000	6,430	34,000	113,600	147,600
Lithium	Thousand S.T.	(1)	(1)	7	11	19	30	183	279	462
Magnesium-Metal	Thousand S.T.	102	155	257	580	585	1,165	8,300	9,600	17,900
Magnesium-Nonmetallic	Thousand S.T.	938	4,400	5,338	2,160	7,920	10,080	43,500	176,500	220,000
Manganese	Thousand S.T.	1,170	8,828	9,998	2,360	18,300	20,660	50,000	379,000	429,000
Mercury	Thousand Fl	42	213	255	80	380	460	1,730	8,450	10,180
Molybdenum	Million lb	41	97	138	188	345	533	2,850	5,810	8,660
Nickel	Million lb	282	868	1,150	770	1,830	2,600	14,000	38,000	52,000
Nitrogen-Compounds	Million S.T.	11	34	45	40	120	160	667	2,010	2,677
Nitrogen-Gas & Liquid	Million S.T.	6	13	19	21	48	69	351	795	1,146
Palladium	Thousand T.oz	607	1,305	1,912	1,060	3,940	5,000	24,000	71,000	95,000
Phosphorus	Million S.T.	4	9	13	12	50	62	208	722	930
Platinum	Thousand T.oz	333	1,487	1,820	820	5,180	6,000	16,000	88,000	104,000
Potassium	Million S.T.	4	12	16	12	50	62	216	787	1,003
Rare Earths	Thousand S.T.	10	10	20	22	22	44	452	451	903
Rhenium	Thousand lb	8	1	9	18	11	29	360	147	507
Rhodium	Thousand T.oz	25	66	91	85	175	260	1,450	3,300	4,750
Rubidium	lb	(1)	(1)	1,460	2,200,	2,000	4,200	40,500	35,500	76,000
Scandium	Kg	14	7	21	25	20	45	554	366	920
Selenium	Thousand lb	879	2,207	3,086	1,620	2,890	4,510	35,000	74,000	109,000
Silicon	Thousand S.T.	451	1,279	1,730	1,000	3,800	4,800	20,300	68,000	88,300
Silver	Million T.oz	102	253	355	210	610	820	4,400	12,000	16,400
Sodium	Million S.T.	20	44	64	67	190	257	1,160	2,990	4,150
Strontium	Thousand S.T.	20	32	52	34	67	101	771	1,390	2,161
Sulfur	Million L.T.	9	29	38	30	105	135	514	1,750	2,264
Tantalum	Thousand lb	1,157	1,334	2,491	4,010	3,800	7,810	68,200	69,800	138,000
Tellurium	Thousand lb	212	242	454	366	445	811	8,300	9,700	18,000
Thallium	Thousand lb	(1)	(1)	27	9	30	39	220	720	940
Thorium	S.T.	(1)	(1)	330	1,500	3,000	4,500	21,100	42,700	63,800
Tin	Thousand L.T.	50	180	230	90	270	360	2,000	6,480	8,480
Titanium-Metal	Thousand S.T.	17	15	32	168	100	268	2,000	1,400	3,400
Titanium-Nonmetallic	Thousand S.T.	471	1,085	1,556	1,810	4,020	5,830	29,400	66,900	96,300
Tungsten	Million lb	11	54	65	74	125	199	1,000	2,530	3,530
Vanadium	Thousand S.T.	7	18	25	31	33	64	471	727	1,198
Yttrium	S.T.	(1)	(1)	150	420	400	820	6,200	5,500	11,700
Zinc	Thousand S.T.	1,361	4,229	5,590	3,100	9,200	12,300	62,000	188,000	250,000
Zirconium-Metal	Thousand S.T.	(1)	(1)	18	20	30	50	400	500	900
Zirconium-Nonmetallic	Thousand S.T.	(1)	(1)	220	167	260	427	3,200	5,900	9,100
Asbestos	Thousand S.T.	758	3,189	3,947	2,430	12,000	14,430	42,500	195,000	237,500
Clays	Million S.T.	55	474	529	174	656	830	3,035	16,265	19,300
Corundum	Thousand S.T.	2	9	11	1	21	22	43	413	456
Diatomite	Thousand S.T.	390	1,163	1,553	2,000	9,000	11,000	29,000	115,000	144,000
Feldspar	Thousand L.T.	537	1,410	1,947	2,500	6,000	8,500	37,700	93,900	131,600
Garnet	Thousand S.T.	16	5	21	53	35	88	911	456	1,367
Graphite	Thousand S.T.	(1)	(1)	435	95	1,380	1,475	2,200	23,100	25,300
Gypsum	Million S.T.	17	40	57	35	90	125	726	1,810	2,536
Kyanite	Thousand S.T.	(1)	(1)	389	630	1,125	1,755	8,960	17,690	26,650
Mica-Scrap & Flake	Thousand S.T.	125	47	172	448	150	598	7,500	2,600	10,100
Mica-Sheet	Thousand lb	5,478	16,912	22,390	600	6,000	6,600	62,000	298,000	360,000
Perlite	Thousand S.T.	418	780	1,198	1,350	1,900	3,250	23,400	36,900	60,300
Pumice	Million S.T.	4	17	21	12	45	57	208	836	1,044
Sand & Gravel	Million S.T.	919	5,775	6,694	3,200	22,000	25,200	54,000	368,000	420,000
Stone-Crushed	Million S.T.	655	3,650	4,305	2,520	12,400	14,920	40,700	208,000	248,700
Stone-Dimension	Million S.T.	2	50	52	4	162	166	79	2,800	2,879
Talc	Thousand S.T.	979	4,100	5,079	2,920	18,100	21,020	52,100	278,000	330,100
Vermiculite	Thousand S.T.	271	185	456	725	1,200	1,925	13,500	16,100	29,600
Anthracite	Million S.T.	8	191	199	2	130	132	124	4,583	4,707
Bituminous Coal & Lignite	Million S.T.	495	2,615	3,110	1,000	3,500	4,500	21,200	88,400	109,600
Natural Gas	Trillion C.F.	22	17	39	49	111	160	1,098	1,313	2,411
Peat	Million S.T.	1	215	216	2	540	542	43	10,328	10,371
Petroleum	Billion bbl	6	12	18	15	47	62	276	764	1,040
Shale Oil	Million bbl	–	47	47	1,500	500	2,000	15,000	5,000	20,000
Uranium	Thousand S.T.	11	10	21	62	90	152	1,240	1,540	2,780
Argon	Thousand S.T.	156	199	355	772	927	1,699	11,300	14,000	25,300
Helium	Million C.F.	447	242	689	2,500	600	3,100	35,520	11,652	47,172
Hydrogen	Billion C.F.	2,580	4,174	6,754	10,500	31,100	41,600	168,800	397,300	566,100
Oxygen	Million S.T.	13	34	47	65	95	160	962	1,764	2,726

1/ Certain data are withheld because the manner in which they became available to the Bureau of Mines does not permit general disclosure.

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Table 128

Value of World Primary Mineral Demand in 1971 with Projected Value in 2000 and Cumulative Demand, 1971-2000
(Million dollars)

(The values are based on U.S. 1971 prices and forecasted 2000 prices for materials in primary form)

Commodity	1971			2000			Cumulative Demand - 1971-2000		
	United States	Rest of World	World	United States	Rest of World	World	United States	Rest of World	World
Aluminum	2,604.7	4,640.0	7,244.7	19,536.0	36,260.0	55,796.0	244,300	448,800	693,000
Antimony	20.5	86.6	107.1	67.2	126.0	193.2	1,151	3,038	4,189
Arsenic	(1)	(1)	9.2	6.8	11.5	18.3	139	251	390
Barium	20.5	41.6	62.1	40.0	130.5	170.5	868	2,268	3,136
Beryllium	(1)	(1)	61.8	177.0	103.0	280.0	3,036	1,331	4,367
Bismuth	9.3	36.8	46.1	20.0	50.0	70.0	405	1,255	1,660
Boron	45.5	101.9	147.4	154.5	354.5	509.0	2,613	5,960	8,573
Bromine	57.3	25.0	82.3	85.0	59.5	144.5	2,040	1,156	3,196
Cadmium	20.8	30.7	51.5	107.8	157.5	265.3	1,512	2,228	3,740
Calcium	378.0	1,690.0	2,068.0	1,036.3	4,300.0	5,336.3	19,178	82,732	101,910
Cesium	(1)	(1)	-	-	-	-	1	-	1
Chlorine	703.0	1,200.0	1,903.0	3,165.0	5,025.0	8,190.0	48,375	77,250	125,625
Chromium	55.6	270.7	326.3	201.7	703.0	904.7	3,343	13,300	16,643
Cobalt	29.5	90.2	119.7	60.5	225.4	285.9	1,242	4,232	5,474
Columbium	6.8	21.5	28.3	30.1	40.8	70.9	661	672	1,333
Copper	1,692.1	5,108.5	6,800.6	8,100.0	27,450.0	35,550.0	120,510	389,870	510,380
Fluorine	90.3	231.8	322.1	720.0	1,830.0	2,550.0	8,580	22,220	30,800
Gallium	(1)	(1)	2.8	8.8	5.3	14.1	140	94	234
Germanium	5.3	13.3	18.6	15.0	28.0	43.0	264	577	841
Gold	270.7	1,278.8	1,549.5	1,144.0	3,440.0	4,584.0	17,873	65,941	83,814
Hafnium	5.6	4.9	10.5	9.9	12.7	22.6	218	241	459
Indium	(1)	(1)	4.9	2.4	7.2	9.6	53	156	209
Iodine	8.7	29.1	37.8	40.3	93.6	133.9	592	1,613	2,205
Iron	5,131.9	28,373.1	33,505.0	11,169.0	56,940.0	68,109.0	224,000	1,183,000	1,407,000
Lead	264.6	829.9	1,094.5	457.6	1,600.0	2,057.6	10,200	34,080	44,280
Lithium	(1)	(1)	12.2	19.4	34.2	53.6	329	502	831
Magnesium-Metal	73.1	111.6	184.7	417.6	621.2	838.8	5,976	6,912	12,888
Magnesium-Nonmetallic	90.0	422.4	512.4	207.4	760.3	967.7	4,176	16,944	21,120
Manganese	62.7	473.2	535.9	115.6	896.7	1,012.3	2,550	19,329	21,879
Mercury	12.1	62.2	74.3	56.0	266.0	322.0	865	4,225	5,090
Molybdenum	69.9	166.8	236.7	338.4	621.0	959.4	5,130	10,458	15,588
Nickel	375.3	1,493.0	1,868.3	1,024.1	2,433.9	3,458.0	18,200	49,400	67,600
Nitrogen-Compounds	633.1	1,904.0	2,537.1	2,382.0	7,200.0	9,582.0	38,686	116,580	155,266
Nitrogen-Gas & Liquid	148.9	323.0	473.9	627.0	1,440.0	2,067.0	9,477	21,465	30,942
Palladium	22.5	48.3	70.8	79.5	295.5	375.0	1,344	3,976	5,320
Phosphorus	142.3	351.0	493.3	600.0	2,500.0	3,100.0	9,360	32,490	41,850
Platinum	41.0	182.9	223.9	135.3	854.7	990.0	2,320	12,760	15,080
Potassium	187.0	564.0	751.0	660.0	2,750.0	3,410.0	11,016	40,137	51,153
Rare Earths	7.1	7.1	14.2	15.4	15.4	30.8	316	316	632
Rhenium	7.2	1.0	8.2	22.1	13.2	35.3	387	158	545
Rhodium	5.0	13.2	18.2	25.5	52.5	78.0	363	825	1,188
Rubidium	-	-	-	-	-	-	-	-	-
Scandium	-	.1	.1	.1	.1	.2	2	2	4
Selenium	7.9	19.9	27.8	9.7	17.3	27.0	263	555	818
Silicon	138.0	391.4	529.4	380.0	1,444.0	1,824.0	4,902	23,120	30,022
Silver	156.3	397.3	553.6	567.0	1,647.0	2,214.0	9,240	25,200	34,440
Sodium	399.6	866.8	1,266.4	1,323.8	3,743.0	5,066.8	22,852	58,903	81,755
Strontium	1.1	1.7	2.8	2.0	3.9	5.9	39	71	110
Sulfur	160.7	507.5	668.2	525.0	1,837.5	2,362.5	8,995	30,625	39,620
Tantalum	9.6	11.0	20.6	63.0	59.7	122.7	818	838	1,656
Tellurium	1.3	1.5	2.8	2.2	2.7	4.9	50	58	108
Thallium	(1)	(1)	.2	-	.2	.2	2	5	7
Thorium	(1)	(1)	5.3	25.5	51.0	76.5	346	700	1,046
Tin	186.5	673.3	859.8	604.8	1,814.4	2,419.2	10,304	33,385	43,689
Titanium-Metal	44.9	39.6	84.5	403.2	240.0	643.2	4,800	3,360	8,160
Titanium-Nonmetallic	423.9	976.5	1,400.4	2,099.6	4,663.2	6,762.8	29,400	66,900	96,300
Tungsten	32.9	159.8	192.7	296.0	500.0	796.0	3,500	8,855	12,355
Vanadium	40.3	108.0	148.3	195.3	207.9	403.2	2,826	4,362	7,188
Yttrium	(1)	(1)	2.7	11.8	11.2	23.0	143	126	269
Zinc	435.5	1,353.3	1,788.8	1,550.0	4,600.0	6,150.0	24,800	75,200	100,000
Zirconium-Metal	(1)	(1)	216.0	240.0	360.0	600.0	4,800	6,000	10,800
Zirconium-Nonmetallic	(1)	(1)	24.0	19.4	30.1	49.5	358	661	1,019
Asbestos	89.3	376.3	465.8	315.9	1,560.0	1,875.9	3,270	24,180	29,450
Clays	264.3	2,275.2	2,539.7	1,740.0	6,560.0	8,300.0	22,439	120,361	142,820
Corundum	.1	.5	.6	-	1.4	1.4	2	25	27
Diatomite	25.0	74.7	99.7	130.0	585.0	715.0	1,885	7,475	9,360
Feldspar	8.1	21.2	29.3	37.5	90.0	127.5	366	1,408	1,974
Garnet	1.6	.5	2.1	5.4	3.6	9.0	93	46	139
Graphite	(1)	(1)	20.3	4.8	69.0	73.8	106	1,109	1,215
Gypsum	63.4	150.0	213.4	140.0	360.0	500.0	2,831	7,059	9,890
Kyanite	(1)	(1)	28.8	64.9	115.9	180.8	806	1,592	2,398
Mica-Scrap & Flake	2.9	1.1	4.0	11.2	3.8	15.0	180	62	242
Mica-Sheet	4.0	12.3	16.3	.5	4.5	5.0	47	223	270
Perlite	4.8	8.9	13.7	14.9	20.9	35.8	257	406	663
Pumice	4.0	18.2	22.2	14.4	54.0	68.4	229	920	1,149
Sand & Gravel	1,148.8	7,218.8	8,367.6	4,320.0	29,700.0	34,020.0	20,200	475,800	546,000
Stone-Crushed	1,146.3	6,387.5	7,533.8	4,284.0	21,080.0	25,364.0	69,190	353,600	422,790
Stone-Dimension	100.5	7,835.0	2,935.5	187.2	7,938.0	8,125.2	4,187	148,400	152,587
Talc	7.2	30.2	37.4	24.8	153.9	178.7	417	2,224	2,641
Vermiculite	6.5	4.4	10.9	20.3	33.6	53.9	351	419	770
Anthracite	87.3	2,272.9	2,360.2	34.5	1,950.0	1,984.5	1,612	59,579	61,191
Bituminous Coal & Lignite	3,498.7	18,488.1	21,986.8	11,000.0	38,500.0	49,500.0	190,800	795,600	986,400
Natural Gas	3,983.9	3,060.0	7,043.9	28,620.0	64,380.0	92,800.0	439,200	605,200	1,044,400
Peat	10.5	2,515.5	2,526.0	27.5	6,750.0	6,777.5	516	123,936	126,452
Petroleum 1/	17,872.5	38,640.0	56,512.5	62,350.0	202,100.0	264,450.0	1,035,000	2,865,000	3,900,000
Shale Oil	.3	159.3	159.6	6,750.0	2,250.0	9,000.0	60,000	20,000	80,000
Uranium	165.0	146.0	311.0	2,480.0	3,600.0	6,080.0	34,720	43,120	77,840
Argon	42.1	53.7	95.8	231.5	278.1	509.6	3,221	3,990	7,211
Helium	11.3	6.1	17.4	150.0	36.0	186.0	1,527	501	2,028
Hydrogen	670.8	1,085.2	1,756.0	4,095.0	12,129.0	16,224.0	50,640	119,190	169,830
Oxygen	156.0	408.0	564.0	838.5	1,235.0	2,073.5	12,025	22,050	34,075
Total	44,892.3	142,195.3	187,087.6	189,091.4	582,283.0	771,374.4	2,960,265	8,821,344	11,781,609

1/ Certain data are withheld because the manner in which they became available to the Bureau of Mines does not permit general disclosure.
2/ Includes natural gas liquids.

Table - 13

U.S. Secondary Metal Demand

Current U.S. secondary metal demand, for each of the commodities where secondary supply accommodates a significant part of domestic demand, is compared to relationships at the start of the past two decades and projections at the end of the century.

These tabulations readily reveal those changes or trends in secondary metal demand for the various commodities, individually or as a group, that have occurred or are expected to occur.

As a result, where practicable, opportunities might be examined where remedial actions may be taken to increase the secondary portion of the total demand for a commodity. Concurrently, this would reduce the primary share of the demand and thereby improve the domestic reserve position for that commodity.

Table 13

U.S. Secondary Metal Demand in 1950

Commodity	Units	Demand				Price Unit	Average Unit Price 1971 Dollars	Demand (Million dollars)		
		Total Quantity	Primary Quantity	Secondary				Total	Primary	Secondary
				Quantity	Percent of total					
Aluminum	Thousand S.T.	990	914	76	8	lb	0.31	613.8	566.7	47.1
Antimony	Thousand S.T.	34	15	19	56	lb	.52	35.4	15.6	19.8
Beryllium	S.T.	120	120	-	-	lb	150.00	36.0	36.0	-
Bismuth	Thousand lb	1,853	1,853	NA	-	lb	3.70	6.9	6.9	NA
Chromium	Thousand S.T.	277	228	49	18	ST	221.00	61.2	50.4	10.8
Cobalt	Thousand lb	5,126	5,000	126	2	lb	3.14	16.1	15.7	.4
Copper	Thousand S.T.	1,757	1,272	485	28	lb	.37	1,300.2	941.3	358.9
Gold	Thousand T.oz	3,850	2,800	1,050	27	T.oz	61.90	238.3	173.3	65.0
Iron	Million S.T.	95	62	33	35	ST	74.00	7,030.0	4,588.0	2,442.0
Lead	Thousand S.T.	1,126	698	428	38	lb	.23	518.0	321.1	196.9
Magnesium	Thousand S.T.	23	18	5	22	lb	.39	17.9	14.0	3.9
Mercury	Thousand Fl	49	47	2	4	Fl	143.00	7.0	6.7	.3
Nickel	Million lb	205	200	5	2	lb	.89	182.5	178.0	4.5
Palladium	Thousand T.oz	150	129	21	14	T.oz	41.90	6.3	5.4	.9
Platinum	Thousand T.oz	309	275	34	11	T.oz	134.00	41.4	36.9	4.5
Rhodium	Thousand T.oz	14	14	NA	-	T.oz	221.00	3.1	3.1	NA
Silver	Million T.oz	185	135	50	27	T.oz	1.57	290.5	212.0	78.5
Tantalum	Thousand lb	150	150	NA	-	lb	6.96	1.0	1.0	NA
Tin	Thousand L.T.	97	73	24	25	lb	1.68	365.0	274.7	90.3
Tungsten	Thousand lb	6,797	6,597	200	3	lb	1.26	8.6	8.3	.3
Zinc	Thousand S.T.	1,221	1,147	74	6	lb	.24	586.1	550.6	35.5
Total								11,365.3	8,005.7	3,359.6
Secondary, percent of total										30

Table 13A

U.S. Secondary Metal Demand in 1960

Commodity	Units	Demand				Price Unit	Average Unit Price 1971 Dollars	Demand (Million dollars)		
		Total Quantity	Primary Quantity	Secondary				Total	Primary	Secondary
				Quantity	Percent of total					
Aluminum	Thousand S.T.	1,680	1,585	95	6	lb	0.36	1,209.6	1,141.2	68.4
Antimony	Thousand S.T.	32	12	20	63	lb	.43	27.5	10.3	17.2
Beryllium	S.T.	388	388	-	-	lb	85.00	66.0	66.0	-
Bismuth	Thousand lb	1,853	1,817	36	2	lb	3.09	5.7	5.6	.1
Chromium	Thousand S.T.	381	353	28	7	ST	165.00	62.9	58.3	4.6
Cobalt	Thousand lb	10,920	10,680	240	2	lb	2.11	23.0	22.5	.5
Copper	Thousand S.T.	1,536	1,107	429	28	lb	.44	1,351.7	974.2	377.5
Gold	Thousand T.oz	4,396	3,085	1,311	30	T.oz	48.00	211.0	148.1	62.9
Iron	Million S.T.	97	65	32	33	ST	81.00	7,857.0	5,265.0	2,592.0
Lead	Thousand S.T.	1,009	539	470	47	lb	.16	322.9	172.5	150.4
Magnesium	Thousand S.T.	55	51	4	7	lb	.48	52.8	49.0	3.8
Mercury	Thousand Fl	51	46	5	10	Fl	289.00	14.7	13.3	1.4
Nickel	Million lb	297	243	54	18	lb	1.02	302.9	247.8	55.1
Palladium	Thousand T.oz	414	380	34	8	T.oz	34.00	14.1	12.9	1.2
Platinum	Thousand T.oz	325	288	37	11	T.oz	114.00	37.0	32.8	4.2
Rhodium	Thousand T.oz	25	24	1	4	T.oz	187.00	4.7	4.5	.2
Silver	Million T.oz	197	148	49	25	T.oz	1.23	242.3	182.0	60.3
Tantalum	Thousand lb	578	508	70	12	lb	10.00	5.8	5.1	.7
Tin	Thousand L.T.	81	59	22	27	lb	1.39	252.2	183.7	68.5
Tungsten	Thousand lb	11,605	11,405	200	2	lb	1.92	22.3	21.9	.4
Zinc	Thousand S.T.	1,024	956	68	7	lb	.18	368.7	344.2	24.5
Total								12,454.8	8,960.9	3,493.9
Secondary, percent of total										28

Table 13B

U.S. Secondary Metal Demand in 1971

Commodity	Units	Demand				Price Unit	Average Unit Price 1971 Dollars	Demand (Million dollars)		
		Total Quantity	Primary Quantity	Secondary				Total	Primary	Secondary
				Quantity	Percent of total					
Aluminum	Thousand S.T.	4,707	4,491	216	5	lb	0.29	2,730.0	2,604.7	125.3
Antimony	Thousand S.T.	32	14	18	56	lb	.71	45.4	20.5	25.0
Beryllium	S.T.	415	415	-	-	lb	60.00	49.8	49.8	-
Bismuth	Thousand lb	1,774	1,769	5	(1)	lb	5.26	9.3	9.3	(1)
Chromium	Thousand S.T.	379	335	44	12	ST	166.00	62.9	55.6	7.3
Cobalt	Thousand lb	13,543	13,418	125	1	lb	2.20	29.8	29.5	.3
Copper	Thousand S.T.	2,072	1,627	445	21	lb	.52	2,154.9	1,692.1	462.8
Gold	Thousand T.oz	8,764	6,562	2,202	25	T.oz	41.25	361.5	270.7	90.8
Iron	Million S.T.	108	75	33	31	ST	68.70	7,426.5	5,131.9	2,294.6
Lead	Thousand S.T.	1,435	945	490	34	lb	.14	401.8	264.6	137.2
Magnesium	Thousand S.T.	105	102	3	3	lb	.36	75.0	73.1	2.0
Mercury	Thousand Fl	52	42	10	19	Fl	292.00	15.3	12.1	3.2
Nickel	Million lb	428	282	146	34	lb	1.33	569.1	375.3	193.8
Palladium	Thousand T.oz	760	607	153	20	T.oz	37.00	28.1	22.5	5.7
Platinum	Thousand T.oz	431	333	98	23	T.oz	123.00	53.0	41.0	12.1
Rhodium	Thousand T.oz	34	25	9	26	T.oz	200.00	6.8	5.0	1.8
Silver	Million T.oz	132	102	30	23	T.oz	1.54	202.7	156.3	46.3
Tantalum	Thousand lb	1,303	1,157	146	11	lb	8.26	10.8	9.6	1.2
Tin	Thousand L.T.	61	50	11	18	lb	1.67	228.7	186.5	42.2
Tungsten	Thousand lb	11,622	11,122	500	4	lb	2.96	34.4	32.9	1.5
Zinc	Thousand S.T.	1,441	1,361	80	6	lb	.16	461.1	435.5	25.6
Total 2/								14,956.9	11,478.5	3,478.7
Secondary, percent of total										23

1/ Less than one unit.
2/ Some data may not add to total due to rounding.

Table 13C

U.S. Forecasted Secondary Metal Demand in 2000

Commodity	Units	Demand				Price Unit	Average Unit Price 1971 Dollars	Demand (Million dollars)		
		Total Quantity	Primary Quantity	Secondary				Total	Primary	Secondary
				Quantity	Percent of total					
Aluminum	Thousand S.T.	28,400	26,400	2,000	7	lb	0.37	21,016.0	19,536.0	1,480.0
Antimony	Thousand S.T.	87	48	39	45	lb	.70	121.8	67.2	54.6
Beryllium	S.T.	1,790	1,770	20	1	lb	50.00	179.0	177.0	2.0
Bismuth	Thousand lb	4,200	4,000	200	5	lb	5.00	21.0	20.0	1.0
Chromium	Thousand S.T.	1,230	1,090	140	11	S.T.	185.00	227.6	201.7	25.9
Cobalt	Thousand lb	25,200	24,700	500	2	lb	2.45	61.7	60.5	1.2
Copper	Thousand S.T.	7,100	5,400	1,700	24	lb	.75	10,650.0	8,100.0	2,550.0
Gold	Thousand T.oz	25,500	14,300	11,200	44	T.oz	80.00	2,040.0	1,144.0	896.0
Iron	Million S.T.	220	153	67	30	S.T.	73.00	16,060.0	11,169.0	4,891.0
Lead	Thousand S.T.	2,730	1,430	1,300	48	lb	.16	873.6	457.6	416.0
Magnesium	Thousand S.T.	610	580	30	5	lb	.36	439.2	417.6	21.6
Mercury	Thousand Fl	102	80	22	22	Fl	700.00	71.4	56.0	15.4
Nickel	Million lb	1,100	770	330	30	lb	1.33	1,463.0	1,024.1	438.9
Palladium	Thousand T.oz	1,510	1,060	450	30	T.oz	75.00	113.3	79.5	33.8
Platinum	Thousand T.oz	1,095	820	275	25	T.oz	165.00	180.7	135.3	45.4
Rhodium	Thousand T.oz	110	85	25	23	T.oz	300.00	33.0	25.5	7.5
Silver	Million T.oz	420	210	210	50	T.oz	2.70	1,134.0	567.0	567.0
Tantalum	Thousand lb	4,250	4,010	240	6	lb	15.70	66.7	63.0	3.7
Tin	Thousand L.T.	130	90	40	31	lb	3.00	873.6	604.8	268.8
Titanium	Thousand S.T.	280	168	112	40	lb	1.20	672.0	403.2	268.8
Tungsten	Thousand lb	76,400	74,000	2,400	3	lb	4.00	305.6	296.0	9.6
Zinc	Thousand S.T.	3,300	3,100	200	6	lb	.25	1,650.0	1,550.0	100.0
Zirconium	Thousand S.T.	30	20	10	33	lb	6.00	360.0	240.0	120.0
Total								58,613.2	46,395.0	12,218.2
Secondary, percent of total										21

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Table - 14

World Mineral Resources

U.S., continental and world mineral reserves recoverable at current constant U.S. prices are presented in Table 14.

Such reserves are compared with the cumulative U.S. and world demands for primary minerals through the remainder of the century and the ratio of recoverable reserves to the cumulative demand for each commodity is presented in Table 14A.

These data provide an insight into the U.S. and world reserve position of the various commodities. By comparing the reserves with the cumulative forecasted primary demand for each of the commodities, the indicated adequacy or inadequacy of the U.S. or world reserves is readily apparent.

Additionally, for those commodities having inadeauate U.S. reserves to meet the cumulative forecasted domestic primary demand, the location of substitute sources are identified by continent throughout the world.

January 17, 1973

Table 14

World Mineral Resources Recoverable at U.S. 1971 Prices

Commodity	Units	United States	Other North America	South America	Europe	Africa	Asia	Oceania	World Total
Aluminum	Million S.T.	13	217	213	179	930	63	863	2,468
Antimony	Thousand S.T.	110	270	470	630	350	2,520	150	4,500
Arsenic	Thousand S.T.	700	400	700	400	500	200	-	2,900
Barium	Million S.T.	45	5	6	26	11	16	1	110
Beryllium	Thousand S.T.	28	-	182	67	59	72	12	420
Bismuth	Million lb	10	17	13	15	1	59	-	115
Boron	Million S.T.	40	-	10	20	-	40	-	110
Bromine	Billion lb	17	-	-	5	-	3	-	25
Cadmium	Million lb	264	215	67	188	54	67	67	922
Calcium		A	A	A	A	A	A	A	A
Cesium	Million lb	-	28	-	-	16	-	-	44
Chlorine		A	A	A	A	A	A	A	A
Chromium	Million S.T.	-	-	(1)	10	120	2	-	132
Cobalt	Million lb	56	1,130	-	500	2,294	-	1,480	5,460
Columbium	Billion lb	-	2	9	1	1	(1)	(1)	13
Copper	Million S.T.	81	41	79	50	54	24	11	340
Fluorine	Million S.T.	6	9	(1)	11	7	5	-	38
Gallium	Million Kg	1	7	4	9	45	3	41	110
Germanium	Thousand lb	900	800	300	800	400	300	500	4,000
Gold	Million T.oz	82	32	15	205	630	24	12	1,000
Hafnium	Thousand S.T.	75	-	5	20	2	8	88	198
Indium	Million T.oz	11	11	5	11	3	4	4	49
Iodine	Million lb	225	-	700	330	-	1,310	-	2,565
Iron	Billion S.T.	2	12	18	40	4	11	10	97
Lead	Million S.T.	17	10	4	12	2	5	7	57
Lithium	Thousand S.T.	2,767	115	8	215	45	25	2	3,177
Magnesium		A	A	A	A	A	A	A	A
Manganese	Million S.T.	-	2	45	205	148	33	144	577
Mercury	Thousand Fl	75	325	20	2,810	10	400	-	3,640
Molybdenum	Billion lb	6	1	2	2	(1)	1	(1)	12
Nickel	Billion lb	(1)	24	-	20	-	16	32	92
Nitrogen		A	A	A	A	A	A	A	A
Palladium	Million T.oz	1	7	1	120	100	-	-	229
Phosphorus	Million S.T.	39	-	5	505	82	310	7	948
Platinum	Million T.oz	1	7	4	60	285	-	-	357
Potassium	Million S.T.	50	10,050	550	10,185	100	300	100	21,335
Rare Earths	Thousand S.T.	5,045	250	350	510	55	1,100	400	7,710
Rhenium	Thousand lb	600	-	100	100	-	-	-	600
Rhodium	Million T.oz	(1)	(1)	(1)	4	10	-	-	14
Rubidium	Thousand lb	-	1,300	-	-	800	-	-	2,100
Scandium	Thousand Kg	100	20	-	25	100	-	40	285
Selenium	Million lb	53	27	51	33	35	16	7	222
Silicon		A	A	A	A	A	A	A	A
Silver	Million T.oz	1,300	1,395	670	1,790	20	70	205	5,450
Sodium		A	A	A	A	A	A	A	A
Strontium	Thousand S.T.	-	550	5	1,814	-	3	-	2,372
Sulfur	Million L.T.	75	400	30	105	15	570	5	1,200
Tantalum	Million lb	-	7	22	11	56	4	1	101
Tellurium	Million lb	16	8	16	10	11	5	2	68
Thallium	Thousand lb	150	160	50	140	40	50	30	640
Thorium	Thousand S.T.	2	5	10	5	15	140	30	207
Tin	Thousand L.T.	5	4	428	269	261	3,133	81	4,181
Titanium	Million S.T.	33	31	1	63	5	22	8	165
Tungsten	Million lb	175	25	130	53	22	2,320	25	2,750
Vanadium	Thousand S.T.	115	-	350	6,075	2,000	100	1,500	10,140
Yttrium	Thousand S.T.	1	2	3	2	(1)	22	6	36
Zinc	Million S.T.	30	40	8	28	6	10	9	131
Zirconium	Thousand S.T.	3,750	-	250	1,000	100	380	4,400	9,880
Asbestos	Million S.T.	9	52	2	50	21	8	9	151
Clays		A	A	A	A	A	A	A	A
Corundum	Thousand S.T.	-	-	-	200	200	100	-	500
Diatomite	Million S.T.	40	2	1	30	1	(1)	(1)	74
Feldspar	Million L.T.	500	200	6	75	10	30	3	824
Garnet	Thousand S.T.	700	-	10	500	1,010	10	10	2,240
Graphite	Million S.T.	-	1	(1)	4	1	4	(1)	10
Gypsum	Million S.T.	350	511	41	904	80	105	55	2,046
Kyanite	Million S.T.	15	1	-	8	2	2	(1)	28
Mica-Scrap & Flake	Million S.T.	250	-	100	50	250	750	-	1,400
Mica-Sheet	Million lb	-	-	1	-	2	15	-	18
Perlite	Million S.T.	200	1	-	50	-	20	2	273
Pumice	Million S.T.	200	-	-	600	-	-	-	800
Sand & Gravel		A	A	A	A	A	A	A	A
Stone-Crushed		A	A	A	A	A	A	A	A
Stone-Dimension		A	A	A	A	A	A	A	A
Talc	Million S.T.	150	10	2	100	2	95	2	361
Vermiculite	Million S.T.	100	-	5	5	75	5	-	190
Anthracite	Million S.T.	550	-	6	3,826	30	288	-	4,700
Bituminous Coal & Lignite		A	A	A	A	A	A	A	A
Natural Gas	Trillion c.f.	279	40	90	330	170	250	10	1,169
Peat	Million S.T.	1,380	240	10	17,980	-	90	-	19,700
Petroleum	Billion bbl	38	13	26	94	59	388	14	632
Shale Oil	Billion bbl	-	-	-	30	-	20	-	50
Uranium	Thousand S.T.	130	20	-	30	120	-	50	350
Argon		A	A	A	A	A	A	A	A
Helium	Billion c.f.	144	2	-	-	-	-	-	146
Hydrogen		A	A	A	A	A	A	A	A
Oxygen		A	A	A	A	A	A	A	A

A Adequate.
1/ Less than one unit.

January 17, 1973

Table 14A

Comparison of World Cumulative Primary Mineral Demand, 1971-2000, With World Mineral Resources Recoverable at U.S. 1971 Prices

Commodity	Units	Primary Mineral Demand 1971-2000			Mineral Resources Recoverable at U.S. 1971 Prices			Ratio of Recoverable Resources to Cumulative Demand		
		United States	Rest of World	World	United States	Rest of World	World	United States	Rest of World	World
Aluminum	Million S.T.	370	680	1,050	13	2,455	2,468	-	3.6	2.4
Antimony	Thousand S.T.	822	2,170	2,992	110	4,390	4,500	0.1	2.0	1.5
Arsenic	Thousand S.T.	800	1,440	2,240	700	2,200	2,900	.9	1.5	1.3
Asetos	Million S.T.	11	61	122	45	65	110	1.5	.8	1.0
Beryllium	Thousand S.T.	28	12	40	28	392	420	1.0	*	*
Biasuth	Million lb	81	251	332	10	105	115	.1	.4	.3
Boron	Million S.T.	5	12	17	40	70	110	8.0	5.8	6.5
Bromine	Billion lb	12	7	19	17	8	25	1.4	1.1	1.3
Cadmium	Million lb	560	825	1,385	264	658	922	.5	.8	.7
Calcium	Billion S.T.	5	19	24	A	A	A	*	*	*
Cesium	Thousand lb	350	430	780	-	44,000	44,000	-	*	*
Chlorine	Million S.T.	645	1,030	1,675	A	A	A	*	*	*
Chromium	Million S.T.	19	76	95	-	132	132	-	1.7	1.4
Cobalt	Million lb	540	1,840	2,380	56	5,404	5,460	.1	2.9	2.3
Columbium	Million lb	288	545	833	-	13,000	13,000	-	*	*
Copper	Million S.T.	93	300	393	81	259	340	.9	.9	.9
Fluorine	Million S.T.	39	101	140	6	32	38	.2	.3	.3
Gallium	Thousand Kg	281	188	469	A	A	A	*	*	*
Germanium	Thousand lb	1,600	3,500	5,100	900	3,100	4,000	.6	.9	.8
Gold	Million T.oz	293	1,081	1,374	82	918	1,000	.3	.8	.7
Hafnium	S.T.	1,280	1,420	2,700	A	A	A	*	*	*
Indium	Million T.oz	19	56	75	11	38	49	.6	.7	.7
Iodine	Million lb	269	733	1,002	225	2,320	2,545	.8	3.2	2.5
Iron	Billion S.T.	3	17	20	2	95	97	.7	5.6	4.9
Lead	Million S.T.	34	114	148	17	40	57	.5	.4	.4
Lithium	Thousand S.T.	183	279	462	2,767	410	3,177	*	1.5	6.9
Magnesium	Million S.T.	52	186	238	A	A	A	*	*	*
Manganese	Million S.T.	50	379	429	-	577	577	-	1.5	1.3
Mercury	Thousand Fl	1,730	8,450	10,180	75	3,565	3,640	-	.4	.4
Molybdenum	Billion lb	3	6	9	6	6	12	2.0	1.0	1.3
Nickel	Billion lb	14	38	52	(1)	92	92	-	2.4	1.8
Nitrogen	Million S.T.	1,018	2,805	3,823	A	A	A	*	*	*
Palladium	Million T.oz	24	71	95	1	228	229	-	3.2	2.4
Phosphorus	Million S.T.	208	722	930	39	909	948	.2	1.3	1.0
Platinum	Million T.oz	16	88	104	1	356	357	.1	4.0	3.4
Potassium	Million S.T.	216	787	1,003	50	21,285	21,335	.2	*	*
Rare Earths	Thousand S.T.	452	451	903	5,045	2,665	7,710	*	5.9	8.5
Rhenium	Thousand lb	360	147	507	400	200	600	1.1	1.4	1.2
Rhodium	Million T.oz	2	3	5	(1)	14	14	-	4.7	2.8
Rubidium	Thousand lb	41	35	76	-	2,100	2,100	-	*	*
Scandium	Kg	554	366	920	A	A	A	*	*	*
Selenium	Million lb	35	74	109	53	169	222	1.5	2.3	2.0
Silicon	Million S.T.	20	68	88	A	A	A	*	*	*
Silver	Million T.oz	4,400	12,000	16,400	1,300	4,150	5,450	.3	.3	.3
Sodium	Million S.T.	1,160	2,990	4,150	A	A	A	*	*	*
Strontium	Thousand S.T.	771	1,390	2,161	-	2,372	2,372	-	1.7	1.1
Sulfur	Million L.T.	514	1,750	2,264	75	1,125	1,200	.1	.6	.5
Tantalum	Million lb	68	70	138	-	101	101	-	1.4	.7
Tellurium	Million lb	8	10	18	16	52	68	2.0	5.2	3.8
Thallium	Thousand lb	220	720	940	150	490	640	.7	.7	.7
Thorium	Thousand S.T.	21	43	64	2	202	204	.1	4.7	3.2
Tin	Thousand L.T.	2,000	6,480	8,480	5	4,176	4,181	-	.6	.5
Titanium	Million S.T.	32	68	100	33	132	165	1.0	1.9	1.7
Tungsten	Million lb	1,000	2,530	3,530	175	2,575	2,750	.2	1.0	.8
Vanadium	Thousand S.T.	471	727	1,198	115	10,025	10,140	.2	*	8.5
Yttrium	Thousand S.T.	6	6	12	1	35	36	.2	5.8	3.0
Zinc	Million S.T.	62	188	250	30	101	131	.5	.5	.5
Zirconium	Million S.T.	4	6	10	4	6	10	1.0	1.0	1.0
Asbestos	Million S.T.	43	195	238	9	142	151	.2	.7	.6
Clays	Billion S.T.	3	16	19	A	A	A	*	*	*
Corundum	Thousand S.T.	43	413	456	-	500	500	-	1.2	1.1
Diatomite	Million S.T.	29	115	144	40	34	74	1.4	.3	.5
Feldspar	Million L.T.	38	94	132	500	324	824	*	3.4	6.2
Garnet	Thousand S.T.	911	456	1,367	700	1,540	2,240	.8	3.4	1.6
Graphite	Million S.T.	2	23	25	-	10	10	-	.4	.4
Gypsum	Million S.T.	726	1,810	2,536	350	1,696	2,046	.5	.9	.8
Kyanite	Million S.T.	9	18	27	15	13	28	1.7	.7	1.0
Mica-Scrap & Flake	Million S.T.	7	3	10	250	1,150	1,400	*	*	*
Mica-Sheet	Million lb	62	298	360	-	18	18	-	.1	.1
Perlite	Million S.T.	23	37	60	200	73	273	8.7	2.0	4.6
Pumice	Million S.T.	208	836	1,044	200	600	800	1.0	.7	.8
Sand & Gravel	Billion S.T.	54	366	420	A	A	A	*	*	*
Stone-Crushed	Billion S.T.	41	208	249	A	A	A	*	*	*
Stone-Dimension	Million S.T.	79	2,800	2,879	A	A	A	*	*	*
Talc	Million S.T.	52	278	330	150	211	361	2.9	.8	1.1
Vermiculite	Million S.T.	14	16	30	100	90	190	7.1	5.6	6.3
Anthracite	Million S.T.	124	4,583	4,707	550	4,150	4,700	4.4	.9	1.0
Bituminous Coal & Lignite	Billion S.T.	21	89	110	A	A	A	*	*	*
Natural Gas	Trillion c.f.	1,098	1,513	2,611	279	890	1,169	.3	.6	.4
Peat	Million S.T.	43	10,328	10,371	A	A	A	*	*	*
Petroleum	Billion bbl	276	764	1,040	38	594	632	.1	.8	.6
Shale Oil	Billion bbl	15	5	20	-	50	50	-	*	2.5
Uranium	Thousand S.T.	1,240	1,540	2,780	130	220	350	.1	.1	.1
Argon	Million S.T.	11	14	25	A	A	A	*	*	*
Helium	Billion c.f.	35	12	47	144	2	146	4.1	.2	3.1
Hydrogen	Trillion c.f.	169	397	566	A	A	A	*	*	*
Oxygen	Million S.T.	962	1,764	2,726	A	A	A	*	*	*

A Adequate.
* Ratio of 10 or more.
1/ Less than one unit.

Mr. OSBORN. Whenever you would like to have a little further discussion of this problem, Mr. Zinner is the Bureau of Mines expert on it.

Mrs. HANSEN. Please proceed, Mr. Zinner.

Mr. ZINNER. Madam Chairman, this is a series of tables and I would like to just go through them rather quickly so you know what they involve.

Incidentally, these all deal with 1971 data, which are the last firm data we have.

Table 1 is a balance of supply and demand showing the increments that make up supply, primary and secondary production, and imports, stockpile releases, and stocks at the beginning of the year and then how those are distributed during that same year.

There is a little illustration following that that shows the situation graphically and also introduces on a continental basis from where around the world our imports come from. Then to break down that import increment a little bit more, this table shows the commodities now by continent, and then on table 2A it finally gets down to countries representing the dollar value—these are all in thousands on table 2A—coming from specific countries.

I think the thing to note here is that petroleum throughout this whole series constitutes about a third of the total value of all the imports, but the aluminum value is the second largest followed by iron, and actually the value of metals and nonmetals is about equal to the fuels, as the tables will indicate.

Then over on table 3 is the value of imports compared to exports and you will see that there is a substantial difference, which is typical of the tabulations made from year to year.

Table 5, which describes the value of world primary production, permits a rapid insight into where the United States stands with regard to the rest of the world in that particular year.

PROJECTIONS OF MINERAL PRODUCTION AND DEMAND

Table 7, which is probably the most significant, 7, and 7A, now starts to make projections based on U.S. primary production and demand in 1971 compared to what we believe it will be in 2000, and then following table 8 there is a little graph that kind of presents the whole picture in one package. It simply shows that the current value of domestic primary demand—this has nothing to do with secondary materials—is about $45 billion, while the value of domestic primary production is about $35 billion, and if historical trends persist the value of primary production in 2000 is likely to be about $88 billion, but at the same time the value of primary demand is likely to be almost $190 billion.

If, in fact, we could maintain our present rate, though, of production to demand we would have to be producing about $145 billion worth of primary raw materials in the year 2000.

Also what this says is that our relative domestic primary supply position in terms of overall value has decreased from about 89 percent in 1950 to 78 percent now and promises to be about 47 percent at the end of the century.

Table 9 shows the ratio of U.S. primary mineral production to demand, or really the percent met from domestic sources, and for

each commodity. You can see how the position has changed from time to time and how it is likely to change in the future.

You can take iron, which is a pretty good example. It shows in 1950 we were producing 87 percent of our demand from domestic sources. It went down to 81 percent in 1960. It went down to 70 percent in 1970; it is up a little bit in 1971. It is projected to be less than 40 percent in the year 2000.

For any commodity that table can be useful for that type of speculation.

The average annual growth rates are shown on table 10. These data, I think, permit a rapid determination of all the average annual growth rates in primary materials demand for the individual commodities.

This is a rather disheartening table also but it does demonstrate I think that we are fairly conservative in our estimate of growth rate.

Mercury, for example, is projected at a relatively low rate but aluminum continues to be projected at something higher than GNP, probably over 6 percent.

Table 11 gives a little picture of what all this means in terms of per capita mineral demand. It demonstrates, both in terms of quantities and dollar value, what the per capita consumption is and is likely to be for all of these commodities.

Table 12 is an exhibit of the historical forecasted demand for primary materials in the United States and the rest of the world.

Table 12A specifically compares the United States to the rest of the world; 12B does it in terms of dollars.

USE AND VALUE OF SECONDARY MATERIALS

Table 13 is a series of tables here, which is a brief excursion into the matter of secondary materials. There are only about 21 commodities that are presently significant from a secondary standpoint and I think the thing that might be interesting to note is a little number in the lower right-hand corner of each of these tables that shows that secondary material made up about 30 percent of the value of this group of commodities in 1950.

By 1960 that was only 28 percent. By 1971 it was 23 percent and it is projected to be 21 percent. So if anyone thinks that the world will be saved by simply reusing all the materials we can salvage I think this demonstrates pretty well that, while secondary is a very important increment, the need for primary continues to grow at a faster rate.

Mr. EVANS. Madam Chairman, may I interrupt for a question there?

Mrs. HANSEN. Yes.

Mr. EVANS. You are measuring the current use of secondary materials, that is, what is actually being used now under current policy; isn't that correct?

Mr. ZINNER. That is correct. It is measuring for these three 10-year periods.

Mr. EVANS. And your projections are also based on present policies that exist in relation to secondary materials at the present time, isn't that correct?

Mr. ZINNER. In these forecasts that are made for each individual commodity we are weighing into the changing end uses, all the laws, all the regulations, all the changes in technology, all the policy changes,

that we think are in the wings and that we think might influence this situation in the next 20 or 30 years.

Mr. EVANS. Do these figures suggest to you——

Mr. ZINNER. These figures weigh all of that into the calculations.

Mr. EVANS. Do they suggest to you that we are doing all we should be doing in terms of public policy to encourage recovery of resources?

Mr. ZINNER. They suggest that there is a great deal more to be done in this area of secondary materials but it also suggests at the same time that achieving the maximum that can be achieved technologically or otherwise, that the demand for primary materials are going to continue to grow in any event.

Mr. EVANS. And yet isn't it true that the demand for primary materials is going to be weighed against finite quantities?

Mr. ZINNER. Absolutely, and this next table I think begins to get to that. The last one is probably the most important because in this case we are weighing these demands and the accumulated demands from now to the end of the century against known resources at current prices and current technology.

I know no other way to assess resources except in terms of dollars. At some price you can have almost anything. The question is what price are we able and willing to pay?

Mr. EVANS. Well, in your opinion are we giving sufficient attention to the price we are paying for the development of recoverable resources?

Mr. ZINNER. We certainly are not.

Mr. EVANS. Thank you, Madam Chairman.

Mr. ZINNER. Very quickly, Madam Chairman, that is what these tables hope to show. Of course there is a great deal that could be said on the subject but I don't want to use a lot of Dr. Osborn's time here.

Mrs. HANSEN. Thank you very much.

Mr. OSBORN. Mr. Zinner has brought home, I think, with this material, the very important fact that it isn't just importing petroleum and liquid natural gas that is getting us into trouble on this balance of trade and balance of payments. It is also the other minerals, and so let me just give a couple of examples of the sort of thing that the Bureau of Mines is doing which is traditional under our Organic Act.

Our authority is to do what a Government research group can do, without taking initiative away from private industry and so on, to assure an adequate supply of mineral resources. Let me just give you a couple of examples of successes.

RESEARCH ON NONMAGNETIC TACONITE ORES

I think one of the best examples is the work that our people did at our Minneapolis Metallurgy laboratory where they worked for several years on the nonmagnetic taconite ores. These are the hematite ores, the reddish iron ores.

The steel industry has been able to use the magnetic taconite ores. By crushing very finely they can separate out the magnetite and this has kept going therefore the big iron ore industry in Minnesota because the old rich ore is gone.

But they couldn't use—this was waste rock, the nonmagnetic. Our people developed the technique, a flotation technique, which is prac-

tical for using the waste rock, this nonmagnetic, and Cleveland Cliffs Iron Ore Co. is now constructing a plant costing $165 million up by Ishpeming, Mich., which will be opened in a few months and will employ about 560 people.

It will produce 4 million tons a year of very high grade iron ore pellets to feed into the country's blast furnaces.

CONTROL OF PARTICLES FROM TACONITE PRODUCTION

Mrs. HANSEN. Dr. Osborn, when I was in northern Wisconsin this fall the problem of taconite production came into a sharp focus because the people around Lake Superior objected to the particles that are going into the lake.

Mr. OSBORN. Very serious problem. One would think that this could have been anticipated by the industry when they built this plant, oh, at least a decade ago. It is a very fine silica. It is not a poison in the usual sense.

Mrs. HANSEN. No.

Mr. OSBORN. It is very fine silica. It was thought from some experiments I guess that were carried out that this would settle and wouldn't cause any trouble, but it is causing trouble. It is staying in suspension and a very great deal of effort is being put on this problem now, about how to handle this silica.

Mrs. HANSEN. There is work going on to try and solve the problem.

Mr. OSBORN. Exactly. A tremendous amount of work is going on now. It may be that we will have to bring it—by "we" I mean the companies—might have to impound these wastes on land, putting them inside big dammed areas where the water can run off and it can gradually settle out the way other companies are doing up there.

But, on the other hand, there is a possibility that this can be flocculated so it will sink, and they are working on that, too. The new plant that I mentioned is probably going to have trouble with waste rock, too. Every place you have some problem with waste rock.

Our people continually try to work ahead on these problems to help out industry. I mean to help out the whole problem of mineral development.

Mrs. HANSEN. I heard a lot of criticism from the people on the south shore but the people across the lake want the industry because of the employment opportunities.

Mr. OSBORN. Yes, I know. And we have the problem in Florida that I mentioned of the phosphate slimes. In the West there are problems, in Arizona. A copper mine which is getting started will be producing from a big open cut, 40,000 tons a day of rock ground very finely because it is only 0.4 percent copper so they really have to grind this fine to get the copper out.

Then what do you do with 40,000 tons a day of very finely ground material?

DISPOSAL OF WASTE ROCK IN OIL SHALE AREA

Mrs. HANSEN. What are you going to do about the millions and millions of tons of rock in the oil shale area?

Mr. OSBORN. We were going to go out to the oil shale country.

Mrs. HANSEN. I think it is time that the committee did get out to inspect the oil shale areas.

Mr. OSBORN. We would be very glad to go out with you.

Mrs. HANSEN. There have been some proposals to fill certain canyons.

LEASE OF OIL SHALE PILOT PLANT AT RIFLE, COLO.

Mr. OSBORN. Yes, I think you should see this and this summer would be even better than last summer from a couple of standpoints. We believe that by summer the old Rifle, Colo. plant of the Bureau of Mines will be back in operation. We kept this on a standby basis since it was closed down a decade or so ago but this costs us, I think, $120,000 a year, just to maintain it. We are signing a contract that should result in having a combination of companies invest something like $7.5 million to use our pilot plant.

They aren't paying us $7.5 million but they are agreeing to spend that much in experimentation on oil shale. This will also cut our maintenance costs out there. If you would go out this summer maybe that would be in operation. It would be something worth seeing.

OIL SHALE EXPERIMENT BY ATLANTIC RICHFIELD

Also another group of companies, spearheaded, I believe, by ARCO, Atlantic Richfield, is a few miles from there carrying on other experiments.

Mrs. HANSEN. Atlantic Richfield is carrying out their own experiments?

Mr. OSBORN. They are carrying out their own over there with a different process of recovering the oil. The retorting is by quite a different process from the one the Bureau of Mines uses.

Mrs. HANSEN. They all essentially have the same problem of disposing of the so-called spoils.

IN-SITU RETORTING EXPERIMENT AT ROCK SPRINGS, WYO.

Mr. OSBORN. We have reported I think—I know we did last year—on our experimental work with in-situ retorting, underground. This is continuing at Rock Springs, Wyo., where we are working at a depth of about 140 feet and it is similar to gasification of coal underground.

In other words, we start a fire down there and burn a small amount of that oil to develop the heat. The heat front then moves through the sale. The gas comes out of another hole and then it condenses to a liquid. This work has a way to go.

In other words, the system drives the oil up as a gas instead of mining the rock and gets oil out at the surface. This is a very interesting experiment. If you should go out there this summer I would hope you could see some of that work.

Mrs. HANSEN. I would hope some of the committee members would be able to go.

Mr. OSBORN. I am taking up an awful lot of time in this little review that I thought would take just a few minutes.

Let me just skip over the other examples of what we have been doing, because these subjects will probably come up later.

BUREAU RESEARCH LABORATORIES

Let me mention something that I think is important for you to know. The Bureau of Mines has 15 major research laboratories in the country, and several smaller ones.

Mrs. HANSEN. Please insert in the record the location of the 15 major research laboratories.

Mr. OSBORN. Be glad to.

[The information follows:]

MAJOR BUREAU OF MINES RESEARCH LABORATORIES

Location of facilities owned and operated by the Bureau of Mines: Pittsburgh, Pa.[3 4]; Bruceton, Pa.[1 3]; Morgantown, W. Va.[3]; Salt Lake City, Utah[2 5]; Albany, Oreg.[2]; Bartlesville, Okla.[3]; Grand Forks, N. Dak.[3]; Rolla, Mo.[2]; Laramie, Wyo.[3]; Reno, Nev.[2]; Boulder City, Nev.[2]; Minneapolis, Minn.[1 2]; Tuscaloosa, Ala.[2]; Juneau, Alaska[4]; College Park, Md.[2 6]

Location of laboratories operated in leased quarters: Denver, Colo.[1 4]; Spokane, Wash.[1 4]; San Francisco, Calif.[3]

Mr. OSBORN. And then several smaller ones and various stations are maintained. For example, at Wilkes-Barre, Pa., we have a station of about 60 engineers, but we don't call that a research laboratory. These laboratories were built following the authority in the Foster Act of 1915 which specifically stated that the Bureau of Mines would establish these laboratories about the country in various places where they could work on the problems particularly appropriate to that general region.

REVIEW OF BUREAU RESEARCH PROGRAMS BY NATIONAL ACADEMY OF ENGINEERING

Now, what has concerned me in the 2½ years I have been down here as much as anything else is the quality of this work and the basis for the planning of the programs. So we developed a contract with the National Academy of Engineering last June to appoint a committee of distinguished people in the country in this field, a committee of, I believe it is, 15 of the top men in the various fields in this country that are interested in what we are doing in our laboratories.

They do this on their own time. People aren't paid a consulting fee when they do a job for the National Academy of Engineering. They do get their traveling expenses if they want them. The Committee visited all of our laboratories and we will have a report from them in about a month, and I wanted you to know this. They probably will be candid with us. I am sure they will be. I would be if I were on the committee.

[Discussion off the record.]

Mr. OSBORN. We have lots of good results, but are we getting as many as we should with the money? We have not had a review committee before, and I think that this is going to be very helpful to us.

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[1] Mining research centers.
[2] Metallurgy research centers.
[3] Energy research centers.
[4] Field operation centers for resource studies.
[5] Conveyance to the State of Utah, and replacement, authorized May 1, 1972. Public Law 92–287.
[6] Conveyance to the State of Maryland, authorized Oct. 1, 1965. Public Law 89–227.

The other thing I would like to mention is that we are using Public Law 480 funds, so-called, these counterpart funds in Poland and Yugoslavia.

RESEARCH PROJECTS IN POLAND—COUNTERPART FUNDS

Poland is very much like the United States from the standpoint of its energy situation except it doesn't have any oil or gas. It has to get it all from Russia. But they do have a lot of coal, and therefore they have the same problems. They have the health and safety problem. They have the pollution problem. They have them just as we have, and they have a very fine Central Institute for Mining Research at Katowice.

I was over there for a couple of days this summer to see what they are doing. I wouldn't say that they are ahead of us, but in certain areas they are doing work that is parallel with ours, and they have a very fine underground mine, for example, for experimentation. In that respect they have a better one than we have.

And so we have three projects going now, $110,000 a year, using that money that is over there. Two of the projects have to do with initiation of explosions, how do they get started. Secondly, the means of extinguishment, sensing an explosion that has occurred and extinguishing it automatically before it goes any further.

This is one of our principal projects, and they will take a part of it. They are going on now.

The third one has to do with roof control, which is a big problem on accidents. Also, we are just now signing a contract with them on the coal conversion work because they have a great interest in gasification and liquefaction to become somewhat independent from Russia for the fluid fuels.

We hope that this work can be expanded, but I wanted you to know that this supplements our research and, in a fairly important way, by experimental work by some really quite distinguished Polish scientists.

RESEARCH PROJECTS IN YUGOSLAVIA

Mrs. HANSEN. What type of work are you performing in Yugoslavia?

Mr. OSBORN. In Yugoslavia it is iron and nickel. We have two projects there. One of them has to do with a reduction of iron ore using lignite. We are very much interested in this. We have lignite in North Dakota, large amounts. We have iron ore in Minnesota, and we have done some work and we think their work will be useful as a guide as to whether or not it may be practical to use lignite to reduce the iron ore right up there in Minnesota.

The other project in Yugoslavia has to do with recovery of nickel from very low grade nickel sulfide deposits. Our interest is because, partly anyway, in northern Minnesota and Michigan and under Lake Superior, there is a huge body of igneous rock called the Duluth gabbro.

This rock is like a granite. It contains about 0.2 percent nickel, as I remember, and about a half percent copper. There are millions of tons of it. As a matter of fact, there are cubic miles of this stuff, and it is a potential future supply of copper and nickel for this country,

if we don't disturb the canoeing people and so on. This is a problem. Maybe we can mine under Lake Superior because there is plenty of this rock, so this is what is going on in Yugoslavia.

Mrs. HANSEN. Do any of the other Great Lakes have this same kind of deposit?

Mr. OSBORN. No, they don't. It is just up there in the pre-Cambrian rock which is exposed in northern Michigan, Minnesota, and southern Canada.

Those were the remarks I wanted to make, Mrs. Hansen.

Mrs. HANSEN. Thank you very much, Dr. Osborn.

Do you have a question at this point, Mr. McKay?

Mr. MCKAY. Not at this point, Madam Chairman.

Mrs. HANSEN. Mr. McDade?

COMMENTS ON SERVICE OF DR. OSBORN AS DIRECTOR OF THE BUREAU OF MINES

Mr. MCDADE. Yes, I certainly do, Madam Chairman, in fact several. Initially, Dr. Osborn, I want to welcome you before the committee. I have been in Washington 10 years now and I have seen several people, distinguished all, serve as the Director of the United States Bureau of Mines and I say without hesitation that in my judgment you are the best I have seen.

Mr. OSBORN. Thank you.

Mrs. HANSEN. I want to join Mr. McDade in his remarks.

Mr. MCDADE. I think we share that view largely on both sides of the aisle, Doctor. You are to be complimented for it. I want to pay a special tribute to one of your strong right arms, Mr. Joe Corgan, who does such tough hard work in the field, who has brought the first efforts at new initiatives into the Bureau in environmental matters that we have seen in a long time and so I do want to extend both my compliments and my warmest welcome to you and to your associates.

Mr. OSBORN. Thank you.

Mr. MCDADE. Having said that, I do have to ask you some rather disagreeable questions. I want the record to indicate very clearly at this point that in no way do I want to imply in asking these questions that you, Doctor, as the Director of the Bureau, or your associates directly or inferentially advocate the matter that I am going to address to you now.

ESTABLISHMENT AND FUNCTIONS OF THE BUREAU OF MINES

When was the Bureau of Mines established?

Mr. OSBORN. 1910.

Mr. MCDADE. As I understand it, the Bureau of Mines basically has three functions—research, the collection of the data necessary to do that basic research, and recently all the enforcement functions which you were given as a result of the dreadful disaster that took place in Farmington, W. Va.

Is that a reasonable explanation of the duties of your shop?

Mr. OSBORN. Yes, sir.

Mr. MCDADE. You emphasized very much in your statement the importance of science and technology and what the Bureau of Mines

is trying to do in terms of meeting the energy problems of the Nation, meeting the problems of the Nation related to shortages of metals and all the rest of your activities.

There is a very heavy emphasis on research, isn't there?

Mr. OSBORN. Yes, sir.

Mr. MCDADE. In fact, apart from that new function that was added, that is, basically your mission in the Federal Government, is to be a cutting agency, a lead agency in research?

Mr. OSBORN. Plus the gathering and analysis of data on the mineral resources.

PROPOSED REORGANIZATION OF THE DEPARTMENT OF THE INTERIOR

Mr. MCDADE. Earlier in this hearing, in fact the day that the Under Secretary appeared, this committee was presented a chart that proposes reorganization within the Department of the Interior. Are you familiar with that chart?

Mr. OSBORN. Yes, sir.

Mr. MCDADE. Let me direct your attention to it and I note in one of these lovely little boxes that we see so many times when reorganizations are proposed the name U.S. Bureau of Mines and in the statement itself it says that the Bureau of Mines would be set up under a new Assistant Secretary.

LOCATION OF BUREAU OF MINES FUNCTIONS UNDER PROPOSED REORGANIZATION

Now, there is a heck of lot in what is in a name. Is that Bureau of Mines that I see represented on that chart the Bureau of Mines that you and I know that exists today and that has existed since almost the turn of the century?

Mr. OSBORN. No. That chart that Mrs. Hansen has in front of her, which is what you must be referring to——

Mr. MCDADE. It sure is.

Mr. OSBORN. That Bureau of Mines there is only the enforcement function.

Mr. MCDADE. What you are saying is that your basic research functions, both in data acquisition and in your research activities, are not contained for purposes of this proposed reorganization within that little box we call the Bureau of Mines; is that right?

Mr. OSBORN. That is correct.

Mr. MCDADE. Whereabouts are they? Do you have that chart in front of you? I have an extra one. I would be glad to have you look at it.

Mr. OSBORN. As I understand it, and I have nothing more than you have in writing, but I have been told that where it says Office of Research and Development, there is where our research laboratories at least would largely be administered, and then up in a box called Office of Energy and Mineral Data Analysis would be broken off and put in there. That includes our mineral intelligence work, plus some other functions I think.

Mr. MCDADE. So as this chart is presented to the committee what we are seeing really is a fractionation of your Bureau into a troika sort of an operation, three separate components; is that right?

Mr. OSBORN. That is correct.

OFFICE OF ENERGY AND MINERAL DATA

Mr. McDade. Let me ask you something further. I notice this Office of Energy and Mineral Data. That is currently within your Bureau. Is that accurate?

Mr. Osborn. It must be. That is, the only energy and mineral data and analysis group is in the Bureau of Mines.

Mr. McDade. Well, in fact you have one of the largest data gathering groups within the U.S. Government, do you not?

Mr. Osborn. It is fourth largest.

Mr. McDade. That again is separated from the research functions according to this chart. Isn't that correct?

Mr. Osborn. Yes, sir.

ROLE OF MINES DIRECTOR IN REORGANIZATION

Mr. McDade. Do you advocate such a change?

Mr. Osborn. No.

Mr. McDade. Why not?

Mr. Osborn. Well, this destroys the Bureau of Mines.

Mr. McDade. Can you effectively perform research functions without the close coordination of the data that is necessary to perform that research function?

Mr. Osborn. I don't think so.

Mr. McDade. Did you advocate this troika setup and the abolition as we know it of the Bureau of Mines?

Mr. Osborn. I had nothing to do with it.

Mr. McDade. I want the record to indicate very clearly to me you, as the Director of the Bureau of Mines, do not advocate this institutional change within the Department?

Mr. Osborn. That is correct.

Mr. McDade. Is it your feeling that you cannot perform your functions if this change takes place?

Mr. Osborn. I feel that they will not be done as well.

Mrs. Hansen. When is this transfer scheduled to take place?

Mr. Osborn. I don't know.

Mr. McDade. Let me ask you this.

Your budget that you are presenting to this committee today is based on the Bureau of Mines and when I use that phrase I mean the Bureau of Mines as the world has known it since about 1910.

Mrs. Hansen. Will the gentleman yield at this point?

Mr. McDade. I would like him to answer the question before, Madam Chairman.

Mr. Osborn. Yes, sir. What we are defending here is a budget for the present structure of the Bureau of Mines.

Mr. McDade. And not a budget based on this splitting off of all of your functions into new reorganizations?

Mr. Osborn. That is correct.

CONGRESSIONAL APPROVAL IN TRANSFERRING FUNDS

Mrs. Hansen. What I want to say to you, and I hope the message gets through loud and clear at Interior, when you defend this budget

and when we appropriate the money we don't want to see somebody decide to move it lock, stock, and barrel.

Last year you will recall you appeared and testified for a budget and you had barely left the room when RIF notices were issued cutting items that you had just defended. The next bureau that appeared caught the harvest of our ill will.

I am sure the committee joins me, that we are not going to appropriate one cent to be transferred to other activities without complete congressional approval by this committee.

Mr. McDade. Yes.

Mr. Evans. Amen.

Mr. McDade. I do find it, you know, less than salutary that when this plan was presented on the first day of hearings in front of this committee we were led to believe, and I think it was a reasonable assumption, a conclusion for members of the committee to draw, that the Bureau of Mines, as indicated on this chart, was going to remain the Bureau of Mines. Not be split all over the lot in a way that would take out so many vital functions that you testified at length here today about, your research capabilities, the emphasis on your laboratories, the fact that the Bureau is probably the oldest agency in the Federal Government to do this kind of basic research, and now we propose to just split it all up. There has not been any kind of a frank or a free disclosure of that proposal in front of this committee and I will join with my chairman in resisting this just as strenuously as I can, Doctor, and I do regret that I have to raise this with you.

Mrs. Hansen. These fellows like to draw charts. They drew charts last year and they weren't even accurate about their charts.

Mr. McDade. So I do want to express my deep reservation about it and I do think that in presenting this budget it is important for us to realize that it is based on the Bureau of Mines functioning as it did in the previous fiscal year.

That is all I have at this time. I will have some more questions that I will submit later.

Mrs. Hansen. I am so glad you brought this matter out because this was next on my priority list.

Mr. Veysey.

EFFICIENCY OF VARIOUS WAYS OF OBTAINING COAL

Mr. Veysey. Thank you, Madam Chairman.

Going back to some of your earlier remarks, Dr. Osborn, I wanted to ask you about the alternative proposals that you are working on for gasification of coal or using coal in various other ways. Would you comment as to what percentage of the energy in the coal you recaptured in this manner?

You did comment someplace else that it is inefficient to use underground mining because you have to leave pillars behind and so forth and that might take 50 percent of it.

What percentage do you recover to gasify it?

Mr. Osborn. Well, on the gasification loss, I think Dr. Henrie can give us a number. Whether it is underground or at the surface either one——

Mr. VEYSEY. Two ways.

Mr. OSBORN [continuing]. You lose a part of the energy in any conversion.

Mr. HENRIE. You lose about 30 percent. You recover about 70 percent of your energy through gasification, of your total energy.

Mr. VEYSEY. If you use coal from strip mining and gasified it on the surface, then you would get 70 percent of the heat value out of that; is that correct?

Mr. OSBORN. Yes, sir.

Mr. VEYSEY. But if it was underground mined coal you still have the pillar problem and the loss in that way?

Mr. OSBORN. Yes, sir.

Mr. VEYSEY. You don't overcome that, unless you go to this underground gasification system. Now, what does that do for you?

ADVANTAGES OF UNDERGROUND COAL GASIFICATION

Mr. OSBORN. The underground gasification does several things.

In the first place we would expect that the recovery of the coal, that is, the coal that would be consumed, would be more than the usual 55 or 58 percent that you take out when you mine.

Mr. VEYSEY. It would be more than that? You don't know yet how much?

Mr. OSBORN. No; but let us say it ought to be, say, 80 or 90 percent. We don't have to deliberately leave any down there but we might lose some if we don't get the temperature right.

Mr. VEYSEY. But does all of the energy in the coal, both the volatile components and the carbon, come out in the form of gas?

Mr. OSBORN. The idea is to get it all out, yes. That is part of the experimentation, to make sure that we can get, or approach, anyway, the optimum conditions of pressure and temperature to get it all consumed, but would you say 80 percent is a rough figure, Tom, on what we could expect to get of the coal by gasification?

Mr. HENRIE. Yes, sir.

Mr. OSBORN. Something like that.

Maybe with time and more experience with tough engineering problems we could approach 90 percent or more, but certainly way above the 55 percent, or 58 percent, or about half that you get from mining, depending on the area.

Secondly, I am sure you know that one of our great problems in underground mining is the health and safety problem. Now, if it can be stripped, fine, that is, in the areas where it can be reclaimed properly, but a large part of our coal, most of our coal, is too deep for stripping, and this is what we are pointing toward.

The alternative is to mine it. I really think, and this will come up later, that some fine progress is being made in the health and safety field by industry but, nevertheless, it still remains by far the most dangerous of all of our major industries, so this would eliminate that.

I think this is very important.

Also the gas that we recover can quite easily be cleansed of sulfur, whereas the coal when you bring it up still has the sulfur in it. You can remove it from the gas at fairly low cost.

Mr. VEYSEY. From an economic point of view how does it seem to measure out?

Mr. OSBORN. This is one of the things we have to find from these field demonstrations but there has been experience elsewhere. We have a little information on what the Russians did. They have had four plants going in the last 20 or 30 years. As I understand it one of them might have been as large as 250,000 kilowatts. It was experimental, but apparently operated for some time.

Then they closed it down and they have this technology then on the shelf. They don't need gas. They have all the natural gas they need. They are like we were 20 or 30 years ago as far as natural gas goes.

But since the earlier work the Bureau of Mines did—we worked on this in the early 1950's to some extent—the technology of underground fracturing, directional drilling, and a lot of new technology, the feasibility of this type of gassification, has improved considerably. We think that the operation is going to be entirely feasible and that the economics will be very favorable.

Mr. VEYSEY. Would be overall very favorable?

Mr. OSBORN. Yes.

Mr. VEYSEY. Let me turn to another phase.

BUREAU EFFORTS TO RECYCLE SOLID WASTE

I was most interested in your discussion of some of your efforts to recycle solid waste. At what point in time did the Bureau of Mines get into dealing with municipal wastes?

Mr. OSBORN. About 4 years ago?

Mr. HENRIE. I would say about 6 years ago.

Mr. OSBORN. It really started with the 1965 Solid Waste Disposal Act. We received a total of something like $10 million over the years under that authority. There are many forms of solid waste in the mineral industries and, of course, part of the work was on other solid waste, tailings, and this sort of thing.

Mr. VEYSEY. You have been doing research and developmental work in that period of time?

Mr. OSBORN. Yes.

Mr. VEYSEY. I didn't quite get a full answer to the question I attempted earlier as to whether or not we have a fractioned arrangement, that is, do we have a lot of different groups working on it, or is this your sole and exclusive responsibility.

Mr. OSBORN. The Bureau of Mines, as far as Government in-house research is concerned, is the only Government agency working on this. The law is specific in regard to the Department of the Interior's role in this regard.

Mr. VEYSEY. You indicated the Department of Agriculture might be working on agricultural wastes. That is one exception perhaps.

Mr. OSBORN. I don't think I said that.

Mr. HENRIE. I said that.

Mr. VEYSEY. I am sorry.

Mr. HENRIE. And they were very interested in this project here and they invited us to meetings to explain our programs.

Mr. VEYSEY. Is it a fact that the Department of Agriculture then is working on research and development of possible recycling agricultural wastes and you are working on municipal wastes or industrial wastes and somebody else——

Mr. HENRIE. I don't know whether they have actual research projects but they were really interested in this program to see if they could coordinate their efforts with ours.

Mr. OSBORN. Our people know what is going on. It is all open information. I don't think Agriculture is doing any of this work, and EPA is not doing any of this work. EPA does have some contracts with industry and with universities on many of these problems but ours is the only process that I know of that has been fully demonstrated.

May I go back just a moment and say that for over 50 years the Bureau of Mines has been working on this matter of recycling of secondary materials and, along with industry, developed the techniques and the equipment and the ways of doing all this, you know, whether it is heavy media, or whether it is magnetic, whatever separation technique it is. So when we got specifically into this urban waste problem starting in 1965, we hit it on the run because we had the techniques well developed. This process has not required any new machinery.

It has been a matter of assembling the right types of equipment that we know can do the job.

OTHER AGENCY WORK ON SOLID WASTE

Mr. VEYSEY. It seems logical that you would have an interest in this and the capability of doing it. I was groping for whether we have other agencies that are duplicating the same thing.

Mr. OSBORN. No.

Mr. VEYSEY. Or whether you have the exclusive responsibility?

Mr. OSBORN. I would say the latter.

Mr. VEYSEY. Thank you very much.

EXPLANATION OF NEW BUREAU OF MINES APPROPRIATION STRUCTURE

Mrs. HANSEN. This year the Bureau of Mines budget is presented under a new appropriation structure. Please briefly describe the philosophy behind this, Dr. Osborn.

Mr. OSBORN. Mrs. Hansen, this new budget structure can be illustrated several ways.

I have it illustrated a couple of different ways. But the objective is to fit the budget structure to our program structure; in other words, to get it away from commodity titles, and better define our programs which are energy, metallurgy, and so on. This is a chart showing how old categories compare to our new titles.

Mrs. HANSEN. In other words, this is a streamlining of the appropriations process?

Mr. OSBORN. Yes. It hasn't changed any of the numbers.

Mrs. HANSEN. No.

Mr. OSBORN. It has grouped them differently as shown here, these being the old groupings or categories, coal, petroleum, oil shale, and so on, on the basis of commodities.

Now we have the major categories of energy, metallurgy, mining, data collection, and analysis, and so on.

Mrs. HANSEN. Please insert your chart in the record.

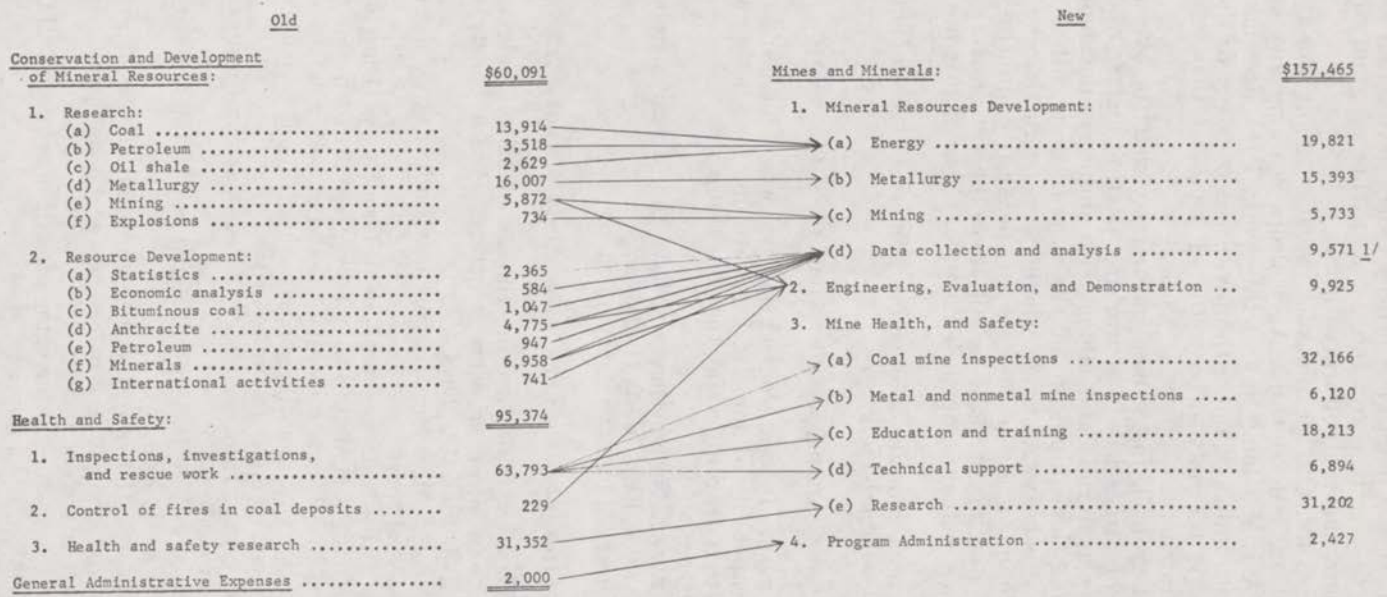
Mr. OSBORN. Be glad to.

[The information follows:]

BUREAU OF MINES

Comparison of 1973 Appropriation Structure with New Structure for 1974

(Amounts in thousands of dollars)



1/ Includes funds for the State Liaison Program which is currently funded from all activities.

LANGUAGE CHANGE IN NEW APPROPRIATION

Mrs. HANSEN. I note that the new language for "Mines and Minerals" refers to "mined area and mineral waste reclamation and recycling; environmental functions * * *."

These phrases were not in your previous language. What is your legislative authority for these activities?

Mr. OSBORN. Can you comment on that?

Mr. ZINNER. Really, the Organic Act of 1910, as amended in 1913, treats with the subject of avoiding waste, and you could use that authority alone really to support this.

Mrs. HANSEN. Please insert a brief summation of the language in the record.

Mr. ZINNER. Yes; we would be very happy to.

[The information follows:]

EXPLANATION OF LANGUAGE CHANGES

The mined area and mineral waste reclamation language covers the work that the Bureau previously performed under the "anthracite" budget line. The work was described in the 1973 budget as follows: "Investigations are directed toward developing the engineering and economic data for anthracite required by Government, industry, and the general public necessary to minimize adverse effects of past mining practices, to create an environment conducive to economic growth, and to preserve a substantial energy resource. Research is conducted on techniques for surface mine reclamation, abatement of acid mine drainage problems, and using mine waste bank materials for abating mine subsidence hazards."

Authorizing legislation is 30 U.S.C. 3 and 30 U.S.C. 571. And 30 U.S.C. 3 reads in part: "It shall be the providence and duty of the Bureau of Mines * * * to conduct inquiries and scientific and technologic investigations concerning

mining and the preparation, treatment, and utilization of mineral substances with a view to improving health conditions, and increasing safety, efficiency, economic development, and conserving resources through the prevention of waste in the mining, quarrying, metallurgical, and other mineral industries; * * *."

30 U.S.C. 571: "* * * It is therefore declared to be the policy of the Congress to provide for the control and drainage of water in the anthracite coal formations and thereby conserve natural resources, promote national security, prevent injuries and loss of life, and preserve public and private property, and to seal abandoned coal mines and to fill voids in abandoned coal mines, in those instances where such work is in the interest of public health and safety."

The recycling and environmental functions are authorized under the authority of the Secretary of the Interior under the Solid Waste Disposal Act as amended by the Resource Recovery Act of 1970 (42 U.S.C. 3251–3259), and the Bureau's Organic Act (30 U.S.C. 3). In this connection, please refer to an opinion dated March 2, 1972, from the Department's Associate Solicitor, Mineral Resources and General Legal Services to Assistant Secretary—Management and Budget which is found on pages 392 and 393 of the House Appropriations Subcommittee hearings on Department of the Interior and related agencies appropriations for 1973. The opinion in part reads as follows:

* * * * * * *

"The various sections of the act confer authority and impose duties upon the 'Secretary.' Thus, section 204 of the act provides that 'The Secretary shall conduct * * * research, investigations, experiments * * * and studies relating to' various specified matters (40 U.S.C. § 3252) provides in part as follows:

"SEC. 203. When used in this act—

"(1) The term 'Secretary' means the Secretary of Health, Education, and Welfare; except that such term means the Secretary of the Interior with respect to problems of solid waste resulting from the extraction, processing, or utilization of minerals or fossil fuels where the generation, production, or reuse of such waste is or may be controlled within the extraction, processing, or utilization

facility or facilities and where such control is a feature of the technology or economy of the operation of such facility or facilities."

Section 214 (42 U.S.C. 3257) of the act provides in part that:

"This act shall not be construed as superseding or limiting the authorities and responsibiilties under any other provisions of law, of * * * the Secretary of the Interior, or any other Federal officer, department, or agency."

For many years, the Bureau of Mines has carried on research in respect of various types of wastes under its Organic Act (30 U.S.C. 3). Although the Administrator of the Environmental Protection Agency may, by virtue of the Solid Waste Disposal Act, be authorized to conduct research in these areas, the authority of the Bureau of Mines remains unimpaired, by virtue of section 214 of the act.

Mr. ZINNER. The Resources Recovery Act, against which we claim no funding, still also extends to the Secretary of the Interior responsibilities for waste materials that are generated in the production processing or use of mineral raw materials also, so those two authorities, I think, are the substance of our language.

RATIONALE FOR DELETION OF LANGUAGE ON PUBLIC RELATIONS

Mrs. HANSEN. You have requested deletion of the provision in last year's act that "No funds appropriated by this act shall be used to pay any public relations firm for any promotional campaign among coal miners." What is the rationale for this?

Mr. ZINNER. I guess that is an oversight. This provision was added, I believe, by your committee, and we have no objection to it. We just forgot about it.

Mr. WILES. Madam Chairman, as I remember that, I believe it was added on the floor, and if the committee wants it to stay in, fine.

Mr. ZINNER. There is no objection to it at all.

REPROGRAMING OF FUNDS

Mrs. HANSEN. The new appropriation structure will give you added flexibility to reprogram funds. Do you expect to be requesting reprograming of funds between the health and safety activity and the mineral resources development activity?

Mr. OSBORN. No.

Mrs. HANSEN. If you have any funds that you plan to spend for any other purpose other than what they were justified for, you would present a reprograming request to the committee?

Mr. OSBORN. Yes.

AUTHORIZED POSITION LEVEL FOR 1973 AND 1974

Mrs. HANSEN. What is your authorized position level for 1973 and 1974?

Mr. THOMSON. It is 6,186 for 1973 and 6,176 for 1974.

Mr. OSBORN. For 1974 we would have an increase of 75 or 80.

Mr. THOMSON. There is a decrease in other programs to offset it.

Mr. OSBORN. Entirely.

Mr. THOMSON. Yes.

Mrs. HANSEN. What is your end-of-year ceiling for these years?

Mr. THOMSON. The end-of-year ceiling for permanent employment for both years is 5,828.

Mrs. HANSEN. What is your present employment?
Mr. THOMSON. 5,797.
Mrs. HANSEN. The committee will adjourn until 1:00 p.m.

AFTERNOON SESSION

Mrs. HANSEN. The committee will come to order.

HELIUM FUND

Please discuss with us the current status of the helium program. A $34 million 1973 supplemental is projected in the budget. You know you haven't much hope of receiving those funds.
Mr. LIPPER. This bothers me a little.
Mrs. HANSEN. You may proceed.
We are very happy to have you here, Mr. Lipper.

BACKGROUND ON HELIUM CONTRACTS

Mr. LIPPER. Thank you, Madam Chairman. By way of quick background, the controversy we are in the helium contracts stems from contracts that were entered into in 1961 under authority of the Helium Act amendments of 1960. Up until that time the Bureau of Mines had a monopoly on helium production in the United States. It owned and operated its own helium recovery plants to provide helium for Government needs. At that time the Government was the predominant user of helium, using 90 to 95 percent of it. In those times much of it was used in the Atlas missile program. We had Atlas ICBMs scattered

around the country. The idea of the helium conservation program, since it was a declining resource and the demand was expected to increase in the future, was that people thought it would be a good idea to conserve some of the helium that was wasted in natural gas for use at a time in the future for Government purposes when there might not be enough helium in the gas coming out of the ground to meet those needs.

The Secretary of the Interior was given contracting authority in the amount of $47½ million a year for a period of 25 years. The Secretary of the Interior had that authority under the Helium Act. It was recognized that early in the program the income to the Bureau from helium sales would not be enough to pay the cost to purchase helium during the early years, so borrowing authority was authorized. This was done on an annual basis. In effect we had fixed expenditures and we were put in the position of having to borrow the difference between income from sales and those expenditures.

The price of the Bureau helium was increased from about $19 per thousand cubic feet in 1961 to $35 a thousand in order to generate additional revenue. That set a price umbrella that encouraged private production outside the conservation program and there began to be some erosion in the market. It was thought at the time the helium program was authorized that by 1985, or thereabouts, the annual demand for helium would be about 2 billion cubic feet a year. The experience followed that 1960 projection quite well up until about 1966. By that time the Atlas program was pretty well phased out and the missiles that were in the silos then were the solid fueled Minuteman missiles that did not require helium. The space program began to use large

quantities of helium, first for Mercury and then Gemini and later on the Apollo program and helium use rose to 940 million cubic feet in 1966. By that time there were several private helium producers who were selling at a lower price than the Bureau because they did not have the conservation cost to carry. Since 1966 not only has the total demand dropped, but the Bureau sales have dropped.

In calendar year 1972 the total demand was 620 million cubic feet.

COURT DECISIONS ON HELIUM PURCHASES

Mrs. HANSEN. Mr. Lipper, will you also discuss the court decision relative to the competitive use of helium by the Government.

Mr. LIPPER. Yes. Our sales are under 200 million cubic feet. Two-thirds of the total is supplied by private producers, one-third of the total is supplied by the Bureau of Mines.

In about December 1968, the Secretary of the Interior undertook to issue regulations which would require the contractors of Federal agencies to purchase their helium from the Bureau of Mines. The act requires the agencies to buy their helium requirements from the Secretary through the Bureau. After considerable litigation the court held that the Secretary of the Interior did not have the authority to regulate the contractors of other agencies, but that the agencies could enforce his through the procurement procedure. I might go on with the development in that respect, Madam Chairman, if I might.

Mrs. HANSEN. Please do.

PROBLEMS IN THE FEDERAL CONTRACT MARKET FOR HELIUM

Mr. LIPPER. At that time we thought that the Federal contract or market was about 200 million cubic feet a year. You have asked me questions about the size of it and I have had to tell you we did not know and the agencies did not know. We have a little better information now than we did at that time, but it is not very clear.

We had had collective meetings with the Federal agencies to ask them to adopt procurement policies that would help us corral this Government contract market. They threw up their hands and said the administrative job was much too much. Two years ago I put our people out on the road to find out what was going on and to work with private contractors who were buying our helium under GSA contracts and furnishing it to agencies. We found that many of those distributors were not playing ball with us. We found that some of them were selling more helium to Federal agencies than they were buying from us.

We are not liked in those distributor areas now because we have insisted, and have threatened disqualification under the regulations of distributors that we have caught violating the regulations. They have purchased their back quantity that they owed to keep their books balanced. So we figure with a consistent dropoff in total demand that we have built up the market we would otherwise have by about 10 percent. As the result of that we have become solvent as far as our own operations are concerned and have built up a very small cash backlog. We were essentially bankrupt in September 1970. We had about a month's payroll backlog. In addition to those efforts I decided with Hollis Dole's backing—he was very much concerned about the

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program at that time—that if we could not get at these federal agencies collectively, we would go at them individually. We sent one of our people out almost full-time on the road around AEC's contractor type operations to find out how they were conducting their operations. We found out that some of those contractors were buying privately produced helium. The AEC headquarters was not very happy at what we found, but last July or August they issued new procurement regulations which stipulate that their cost-type contractors will specify on the purchase order that Bureau of Mines helium will be used to supply their helium needs, be it gaseous helium or liquid helium. We do not have liquefaction facilities.

There is no reason why the private producers cannot provide the liquefaction service with their facilities and provide the helium. NASA has always been the largest single helium user and they have always cooperated with us.

HELIUM USE AND COOPERATION BY OTHER AGENCIES

Mrs. HANSEN. What is their current use per year?

Mr. LIPPER. They are down to 150 or 170 million cubic feet, which is almost two-thirds of our total sales now.

They have reviewed their procurement regulations and have tightened up on this in an effort to get the market channeled our way. The purpose of this, we feel, is that the Government ought to use its own assets instead of buying these assets from someone else. We have continued to check with DOD and we found that the contractor market has declined. We are probably losing some sales that we cannot yet identify. We did identify a fairly large area, we think, of helium use, and that is on contracts that are financed by the National Science Foundation at universities. We think the research that is financed by DOD, National Science Foundation, AEC, and NASA could use as much as 70 million cubic feet a year, with most of it being National Science Foundation.

The National Science Foundation people have been cooperative with us, and we have made an official request from the Secretary's Office—it is a letter—to the National Science Foundation, to the Department of Defense, and to NASA, to investigate with us what this picture is and to adopt procurement regulations which would channel those purchases of helium back to the Bureau.

INTERIOR REGULATIONS ON HELIUM USE IN INTERIOR CONTRACTS

I might also add that before we did any of this, the Department of the Interior adopted procurement regulations requiring that any helium used on Interior contracts must be purchased from the Bureau.

We set our own house in order before we started beating these other people over the head. This is not going to solve the major financial problem, but it should go a long way to put the Government in the position of using its own assets.

HELIUM SUPPLY AND DEMAND

Mrs. HANSEN. I think the committee should know how much helium we have currently purchased and have on hand in storage.

Mr. LIPPER. We have about 35½ billion cubic feet of helium in the storage field.

Mrs. HANSEN. How many years supply does this represent?

Mr. LIPPER. That depends entirely on demand.

Mrs. HANSEN. Based on current demand.

Mr. LIPPER. For round numbers let us say it is about 70 years. That is the arithmetic. There are some other comments we could make on that.

I do not want to get too long-winded about this.

HELIUM EXPORTS

Where the private market has been increasing is in the area of exports. Helium using technology in Japan, Great Britain, West Germany, and France has increased. When we got into the conservation program in 1960, exports were about 3 million cubic feet a year. They currently are running at the 140 million cubic feet a year level.

Europe is in the process of developing its own helium supply. There will be a plant in Poland onstream within 18 months that will pretty well take care of Europe's helium needs. I found in two meetings I have attended in Europe during the past year in connection with work of the Organization of Economic Cooperation and Development that Europeans are not concerned about helium supplies, although their helium using technology is ahead of ours. Unless there are other things, I think perhaps we could get to where we are on the contracts.

HELIUM CONTRACTS

Mrs. HANSEN. Are there any questions on this background?

Mr. EVANS. I have one short question.

What is there in the law that has required us to produce, keep, and hold so much?

Mrs. HANSEN. He will explain this in just a minute. Mr. Lipper, would you like to discuss this off the record?

Mr. LIPPER. Just a moment, please, if we could go off the record.

[Discussion off the record.]

Mr. LIPPER. Questions began to arise in Interior at some unknown time, but about 1968 Interior began to look at features surrounding the helium program.

Mrs. HANSEN. After our hearings, I think.

DECLINING HELIUM DEMAND AND TERMINATION OF CONTRACTS

Mr. LIPPER. I am not quite sure of the timing.

I became aware of it in December, 1968, or thereabouts, after considerable study and controversy. In the face of declining helium demand partly occasioned by a decline in Bureau sales, but largely by an overall decline in helium demand—coupled with the fact that at that time when the review started we had about 20 billion cubic feet of helium in storage. We had never sold any of it, and Bureau sales had been met from the Bureau's own production. After an effort to rework these contracts on a voluntary basis with each of the four contractors to restructure them and failing in accomplishing that, on January 26, 1971, Under Secretary Fred Russell, issued termination notices under

each of the four contracts. His action had been preceded on December 24, 1970, by one of the contractors—Northern Helex—filing suit in the Court of Claims on account of non-payment of bills. We had been in the non-payment situation since December, 1968, when there was not enough borrowing authority available to cover the bills incurred from the contractors.

I might say these were 22 year take or pay contracts, very tightly written. As I testified before this committee before, I think they were very favorable for the contractors. The Government was unable to meet its contractual obligations for payments under the contracts. At the time Northern Helex filed suit in 1970 the contractors had gone without payment for about 15 months.

Subsequently there were supplemental appropriations and the contractors were ultimately paid up to March 28, 1971, which was to be the effective date of the January 26, 1971, termination notices. The contracts have a provision in them that if in the opinion of the Secretary of the Interior there has been a diminution in helium demand, the discovery of large new helium resources, or other similar circumstances, he may then terminate the contracts. This was the basis for Under Secretary Russell's termination. I might point out that it was necessary for the Under Secretary to do that because at that time the Department did not have a Secretary, and Mr. Russell was exercising the authority of the Secretary. That determination was challenged by three of the contractors. The three who challenged were National Helium Corp., Cities Service Helex, and Phillips Petroleum Co. They challenged the January 26 termination on the basis that the Secretary had not considered the environmental impact of contract termination, and made some other procedural objections, that the Administrative Procedures Act had not been followed and no public hearings had been held.

DISTRICT COURT INJUNCTION

The district court in Kansas, issued an injunction on March 27, less than 24 hours ahead of the termination date of the contracts, putting the Secretary of the Interior and the Director of the Bureau of Mines under an injunction which prevented them taking any action leading to termination of the contracts pending completion of an environmental impact statement.

ENVIRONMENTAL IMPACT STATEMENT

That injunction was appealed to the Tenth Circuit in Denver. I might insert here, I am not an attorney, I am an engineer, administering and managing the helium program. So my use of some of these legal terms may not be precisely accurate. The appeals court in October 1971, upheld the lower court and work began on preparing a draft environmental impact statement which was issued in May of 1972.

That was circulated to the contractors and to interested agencies for their comment and review. Now I need to drop back to January or the month of January, 1972, when the breech of contract suit with Northern Helex was heard before the full Court of Claims on the matter of whether or not the Government had breached its contract on account of non-payment of bills. The full Court held that the govern-

ment had breached the contract and referred the matter back to a commissioner of the Court of Claims for determining the amount, if any, of damages due under that contract. That issue is now being litigated before the commissioner.

The deadline for receiving comments on the draft environmental impact statement was early in July of last year, 1972. The comments were received, and on November 16, 1972, a final environmental impact statement was issued that had considered all the comments of all the interested parties. Papers were then filed with the district court petitioning for the lifting of the injunction, on the ground that the impact statement had been issued. That hearing was deferred until January 8, 1973, at which time the Justice Department, which defends these things, petitioned the court to permit the Secretary to go ahead and make his decision with respect to the contracts.

The court stated, in an order filed January 15, that it had not intended by its earlier injunction to inhibit the Secretary's making a decision, but only to prevent the implementation of that decision should it be for termination, which was slightly confusing to both sides.

NEW CONTRACT TERMINATION NOTICES ISSUED

On February 2, 1973, Secretary Morton issued new termination notices to the three contractors, National Helium Corp., Cities Service Helex, and Phillips Petroleum Co., and we again petitioned the district court in Kansas to lift the injunction. On March 14 the court refused to lift the injunction, saying that it wanted to look into merits of the impact statement.

The judge kept the injunction in effect, and in that court tomorrow in Wichita, Kans.—tomorrow is March 29, 1973—the attorneys of the Justice Department will be appearing before that court to petition that all aspects of the case except NEPA be dismissed—the contractors have been discussing contractual aspects of the case and at the same time, to petition for a summary judgment. If those two motions are granted, as I understand it, the contracts then would terminate under the February 2 termination notice at 8 a.m. on April 4, 1973. So the outcome of that is unknown at the moment. We have to await the results of the hearing.

"NORTHERN HELEX" SUIT

Back to the *Northern Helex* suit for damages on breach of contract. That trial began in the Court of Claims this past Monday, and it is expected it will run for 2 to 3 weeks.

The proceedings there are to determine the amount, if any, of damages due the contractor. That, madam Chairman, is where we stand at the moment, except that I might say again that on our own operations I think we have a viable operation, it is alive, and I felt that we needed to keep it that way until we could get this matter rationalized, because I did not want to get in the position to have to come here and say we mismanaged the program so bad we could not even pay our operating expenses.

We have avoided that, and I think we see no problem for the next couple of years.

COMMENTS ON CONDUCT OF HELIUM PROGRAM

Mrs. HANSEN. Mr. Lipper, I personally want to congratulate you on doing an excellent job in this area. As you are well aware, there has been criticism from the committee in the past on this program. I am perfectly frank in saying that there was little degree of frankness between the Department and the committee until a few years ago. You and Secretary Dole were very frank with the committee. The committee is very grateful for the type of management work that you have performed and the determinations you have taken in the public interest.

Mr. LIPPER. Thank you.

Mrs. HANSEN. Mr. McDade and I have sat through these discussions for a great many years, and I think he probably joins me in that statement.

Mr. MCDADE. I certainly do, Madam Chairman.

I want to commend you, Madam Chairman, in taking the lead, because I firmly believe if this committee had not raised a lot of questions perhaps you would not have gotten any answers.

We are delighted that you are making progress.

[Discussion off the record.]

Mr. LIPPER. If there are specific questions, I would be glad to do what I can to answer them.

Mrs. HANSEN. Are there any questions from the committee? If not, we very much appreciate your statement.

Mr. LIPPER. Thank you.

NUCLEAR STIMULATION OF GAS AND OIL PRODUCTION

Mrs. HANSEN. Dr. Osborn, there has been some conversation in the committee and the press at various times about possible underground nuclear explosions to stimulate gas and oil shale production. Do you have any comments in this regard?

Mr. OSBORN. Let me say first that the Bureau of Mines is not directly concerned with this.

Mrs. HANSEN. Who is performing the work?

Mr. OSBORN. The Atomic Energy Commission, working with a combine of industrial concerns.

Mr. MCKAY. Is this the program "Wagon Wheel?"

Mr. HENRIE. Yes. Wagon Wheel, Rulison and Rio Blanco.

Mr. OSBORN. We are not directly responsible. We comment on environmental statements and this sort of thing. Our people at Laramie know what is going on.

Mrs. HANSEN. Where is the work proceeding, in Wyoming?

Mr. OSBORN. Yes, and Colorado.

Mr. MCKAY. How does the Bureau feel about that operation?

Do you approve of it? Do you see some problems with it, some dangers?

Mr. OSBORN. I really cannot comment on that myself. I am just not knowledgeable personally. We could give you a comment, if you would like.

Mrs. HANSEN. We would appreciate having a statement for the record.

[The information follows:]

Underground Nuclear Explosions to Stimulate Gas and Oil Shale Production

The Bureau of Mines has participated with the Atomic Energy Commission in gas-stimulation experiments over the past several years and consider this to be a worthwhile effort. That participation has been of two kinds: (1) Providing technological engineering advice and (2) Participating in experiment design and preshot and postshot reservoir evaluation.

We regard nuclear-explosive fracturing as a possible means for producing gas from a vast resource that now is not producible commercially through conventional methods. The technique is not yet proved, but Rio Blanco could well determine whether this procedure is technically feasible. Additional experiments would have to be made to determine economic practicability.

Problems encountered in nuclear-explosive gas stimulation are ground motion resulting from contained nuclear explosions, opposition from environmental groups, and the reluctance of the public to accept burning gas containing small amounts of radio-nuclides. Also required is the development of "hardened" nuclear explosives that can be detonated sequentially, as would be required for Project Wagon Wheel in Wyoming.

In addition to gas stimulation, Bureau engineers have provided engineering assistance in the fracturing of oil shale prior to in situ retorting. To date there have been no field experiments in this category.

Mines and Minerals

Mrs. Hansen. We will insert justification pages 1 through 68 in the record at this point.

[The pages follow:]

DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

Highlight and Summary Statement

The Bureau of Mines mineral resource program goals in 1974, as in previous years, are to foster and encourage private enterprise in the wise and effective development and use of our minerals and energy resources in the best interests of the Nation's social, economic, and security requirements. Specifically, studies are directed to the means by which current and emerging demands may be met, the real cost of such achievements, and the assessment of related social and economic factors. Ways are sought to fulfill our material needs in a manner that minimizes occupational hazards to workers in the industry, reduces wastes, and ensures that mineral raw materials are supplied and mineral-based products are used and disposed of efficiently and without objectionable social and environmental costs.

The objective of the Bureau's health and safety program is to provide the safest possible working environment for the miner. This involves administering and enforcing the Federal Coal Mine Health and Safety Act of 1969 (P.L. 91-173), and the Federal Metal and Nonmetallic Mine Safety Act (P.L. 89-577). Related research programs are designed to develop the scientific, technologic, and engineering base required to provide a safer environment and working conditions for miners and mine workers.

Revised Appropriation Structure

The Bureau of Mines budget estimate for fiscal year 1974 is presented under a revised appropriation structure. The revised structure combines the Bureau's three operating appropriations (Conservation and Development of Mineral Resources, Health and Safety, and General Administrative Expenses) into a single appropriation entitled "Mines and Minerals". The appropriation is then divided into three major activities and an administrative activity. Two of the activities are further divided into nine subactivities as shown herein.

The revised appropriation structure is directly related to the Bureau's missions. The structure reduces the fragmentation in the current budget--eliminating a considerable amount of redundancy and thereby improving the budget presentation. For example, under the previous structure the energy situation and need for an adequate supply of fossil fuels is described under three headings (Coal, Petroleum, and Oil Shale) whereas the revised structure reduces this to one. The justification for evaluating mineral supplies and requirements is partially repeated six times in the previous structure while only one description is used in the new structure.

Budget Estimate--FY 1974

The budget estimate for the Bureau of Mines, exclusive of the Helium program, totals $136,824,000. This represents a decrease of $20,017,000. The budget request is distributed by activity and subactivity as follows:

MINES AND MINERALS

	Adjusted Appropriation 1973	Budget Estimate 1974	Net Change
1. Mineral Resources Development:			
a. Energy	$19,821,000	$18,096,000	$-1,725,000
b. Metallurgy	15,393,000	14,393,000	-1,000,000
c. Mining	5,733,000	5,033,000	-700,000
d. Data collection and analysis	9,563,000	9,263,000	-300,000
2. Engineering, Evaluation and Demonstration	9,896,000	7,296,000	-2,600,000
3. Mine Health and Safety:			
a. Coal mine inspections	31,734,000	31,734,000	- -
b. Metal and nonmetal mine inspections	6,074,000	7,574,000	+1,500,000
c. Education and training	18,121,000	5,321,000	-12,800,000
d. Technical support	6,894,000	7,194,000	+300,000
e. Research	31,185,000	28,317,000	-2,868,000
4. Program Administration	2,427,000	2,603,000	+176,000
Total, Mines and Minerals	156,841,000	136,824,000	-20,017,000

No provision has been made for Helium Fund borrowing authority in the 1974 budget estimate because of the uncertainty as to the status of helium purchase contracts. A supplemental appropriation to the Helium Fund is being requested in 1973 to permit the liquidation of obligations that have been or may be incurred under existing contracts during 1973.

Program Changes

The reduction of $20,017,000 consists of increases totaling $3,176,000 and decreases of $23,193,000.

The increase of $3,176,000 includes $1,500,000 to employ 75 additional mine inspectors to broaden the coverage and increase the number of inspections in underground metal and nonmetal mines; $200,000 for additional instructors to teach health and safety courses such as mine rescue, mine fires and explosions and other safety courses; $300,000 for technical personnel to support mine inspectors and mine operators in overcoming difficult engineering problems; $1,000,000 to intensify safety research pertaining to metal and nonmetal mines; and $176,000 to reimburse the employee compensation fund for payments made because of injury or death of employees.

The decrease of $23,193,000 consists of $300,000 for research on subsurface disposal of industrial wastes; $899,000 for research projects on conversion of organic and wood wastes to oil; $526,000 for oil shale research; $1,000,000 for mineral and metal recycling research; $700,000 for explosives research and extraction technology; $300,000 for mineral data collection and analysis; $800,000 for mined land investigations and demonstrations; $1,000,000 for coal mine waste hazard investigations; $800,000 for research on filling mine void areas; $13,000,000 for a nonrecurring item for construction of a Federal Mine Health and Safety Academy; and $3,868,000 for research on health related and safety problems in coal mines.

In addition, to the $136,824,000 requested for FY 1974, the President's Budget includes $7,000,000 for proposed legislation covering mined area protection. The proposed legislation is to encourage States to provide for a program to reclaim lands that may be damaged by future mining, and to prevent further detriment to the Nation from such mining operations through the establishment of criteria and standards for the reclamation, conservation, and protection of mined areas.

Mineral Resources Development

Energy - The estimate provides $18,096,000 to conduct scientific and engineering research directed toward more efficient production and use of the Nation's fossil fuel resources. The on-going programs emphasize the conversion of coal to clean synthetic fuels, methods for stimulating natural gas and oil production, and technology that will enable oil shale to be developed in harmony with the environment. In 1974, the Bureau expects to complete construction of a 75 ton-per-day pilot plant to demonstrate the feasibility of converting coal to substitute natural gas using the SYNTHANE process. This process is an outgrowth of research on coal gasification conducted over the past several years in the Bureau's laboratories.

To a large extent, the petroleum and natural gas research program of the Bureau of Mines is oriented towards improving recovery methods. Laboratory and field research will be conducted on the production of oil from heavy-oil deposits in eastern Kansas and California and tar sand deposits in Utah; the utilization of natural fracture systems and the application of combined hydraulic and explosive fracturing for increasing production; combinations of fluids injected to stimulate oil production; and the radiation-halo method of locating and delineating oil and gas deposits.

The oil shale program falls into two major categories, advancement of technology for energy utilization, and application of improved technology to produce clean energy. In the first area, work will feature such concerns as the possibilities of producing gas from oil shale and shale oil as an alternative to producing clean liquid fuels. The second area will emphasize continued development of the in-situ retorting process, featuring coordinated field, pilot plant, and laboratory experimentation to better define the factors affecting in-situ production of oil shale.

Metallurgy - The estimate provides $14,393,000 for metallurgy research to seek new and improved processes to extract, recover, purify, fabricate, and recycle metallic and nonmetallic minerals for the most efficient utilization of the Nation's mineral resources. Of particular interest are research projects leading to improved ways to increase recovery of metals and minerals from domestic deposits and to prevent waste in their preparation, treatment and use.

The Bureau-developed citric acid process for removing sulfur dioxide emissions from base metal smelter stack gases is ready for large scale testing. The Bureau, in cooperation with industry, is proceeding with plans to construct a prototype plant adjacent to an operating smelter to treat smelter gas under actual operating conditions. The citrate absorption process is one of the more promising methods for removing nearly all of the sulfur oxides from waste gases.

A new phase of the pollution abatement program will be focused on the large quantities of waste slimes which are generated and stored during the production of phosphates for fertilizer raw materials. A recent break in a slime storage dam spilled 2 billion gallons of slimes into a Florida waterway. The Bureau and the phosphate industry have joined in a cooperative effort to develop effective techniques for dewatering phosphate slime wastes or devising processes that will reduce the quantity of such wastes.

Mining - The estimate provides $5,033,000 for mining research which is intended to develop the scientific, technological, and engineering base for new and improved mining methods. Basic and applied research is undertaken to increase mining efficiency with full consideration for the health and safety of mine workers, bring marginal mineral deposits into production, maximize recovery of irreplaceable resources, and minimize pollution and damage to the environment.

Data Collection and Analysis - The estimate provides $9,263,000 for the development of a coordinated body of basic mineral intelligence essential for Government and industry planning and decisionmaking as well as meeting the broad requirements of the Mining and Minerals Policy Act of 1970 (P.L. 91-631). The Bureau secures production, consumption, and end-use data for some 90 minerals (metals, minerals, and mineral fuels) by a series of surveys. Information on the volume of production, types of consumption and end-use patterns, and stocks available are secured by the use of statistical survey forms from 75,000 respondents.

Trend and correlation analysis of supply and demand for the individual commodities will continue. The Bureau's energy data collection and analysis program particularly concerns the factors and information needed to guide national policy in matters related to the supply and demand of fossil fuels. Priority will be given to determination of mine productive capacity potentials and mining costs of reserves of metallurgical grade coal, low-sulfur coals, coal potentially available to support conventional synthetic fuels plants and coal potentially available for underground gasification.

Engineering, Evaluation and Demonstration

The estimate provides $7,296,000 for programs dealing with availability of essential mineral and energy needs, impact of environmental controls on mineral supply and demand, appraisal of the energy supply situation, mineral surveys as directed by law under the Wilderness Act, and research and demonstration programs associated with the detrimental effects of past mining practices.

Research and demonstration studies and on-site field work projects directed to the development of systems and techniques for resolving mine area problems resulting from past mining practices and the prevention of similar problems in current and future mining will continue. Specifically, efforts will be on the development of practical methods for the restoration of mined land surfaces, control of subsidence caused by mining, control of fires in inactive coal deposits, and disposal of mine refuse.

Mine Health and Safety

Coal Mine Inspections - The estimate provides $31,734,000 for the coal mine inspection program which is designed to provide the coal miner with a safe and healthful environment in which to work.

Under provisions contained in the federal Coal Mine Health and Safety Act of 1969, the Bureau is required to inspect both safety and health hazards with authority to require the mine operator to take necessary corrective action to meet prescribed standards while at the same time providing assistance to the operator in devising ways to correct existing hazards.

In addition to the inspection and enforcement program, the Bureau is planning on intensifying efforts to eliminate hazardous conditions through special emphasis programs, such as roof control, accident investigations, and haulage.

Metal and Nonmetal Mine Inspections - The estimate provides $7,574,000 to administer the Federal Metal and Nonmetallic Mine Safety Act. The inspection

program consists of visits to more than 14,000 noncoal mines and mills across the Nation, inspecting these mines for possible violation of standards, and, if violations are found, issuing either notices of noncompliance or withdrawal orders. Supplementing the inspection program is a new thrust aimed at identifying and monitoring those mines and those conditions which might result in a large loss of life.

Education and Training - The estimate provides $5,321,000 for the education and training program which is directed toward improving mine health and safety by creating an awareness of hazards and a positive attitude toward safer work habits. Safety training in underground metal and nonmetal mines will receive added emphasis as a result of the Sunshine mine disaster. During the current year all metal and nonmetal mine personnel will be given instruction in how to react to underground emergencies. Also, activities will be directed toward developing a safety training capability in industry.

Safety training efforts in coal mines will emphasize job safety analysis and the development of programs to qualify miners for other skilled jobs. In addition, courses such as roof control and haulage which have been successful in reducing accidents will be continued.

Technical Support - The estimate provides $7,194,000 for technical support activities. Emphasis will be placed on improving ventilation in the mines because of its wide-ranging significance in reducing the potential for gas and dust explosions and fires, in minimizing the consequences in the event of a fire, and in reducing dangers of health hazards from dust and radiation. Special attention will be given to analyzing and improving distribution systems to reduce the potential of underground fires.

Research - The estimate provides $28,317,000 for the mine health and safety research program. The aim of this program is the development of new and improved technology for mining coal, metals, and nonmetallic minerals to promote health and safety and improved working conditions in mines to achieve maximum conservation of human resources. This involves the conduct of fundamental and applied research to overcome current health and safety problems and future problems that will accompany deeper mining, increased mechanization and other tecnological changes in mining methods. Concern also is extended to health-related factors involving respirable dust, radioactive minerals, noxious gases, toxic materials, and noise; and the safety problems involving fires, explosions, ground control and support, materials handling, transportation, illumination, communications, and other mining process elements such as human engineering. The ultimate goal is advancing the development of complete mining systems which will be inherently safe.

Program Administration - The estimate provides $2,603,000 to cover the expenses of the immediate Office of the Director and those administrative functions in the Headquarters Office and the central administrative offices that service and support the Bureau's operating functions. In addition, this activity provides the necessary funds to reimburse the employee compensation fund for payments made resulting from the injury or death of employees under the jurisdiction of the Bureau of Mines.

Mines and Minerals

Appropriation, 1972	$125,300,000	
Supplemental appropriation, 1972	6,550,000	
Second Supplemental appropriation, 1972	1,872,000	
Total appropriation, 1972		$133,722,000
Transferred to "Operating Expenses, Public Buildings Service," General Services Administration		-443,932
Transferred to "Salaries and Expenses, Office of the Secretary of the Interior," for contract compliance		-70,100
Total available, 1972		133,207,968
Appropriation, 1973		157,465,000
Transferred to "Operating Expenses, Public Buildings Service," General Services Administration		-624,000
Total available, 1973		156,841,000

Summary of Increases and Decreases, 1974

	Base for 1974	Increase (+) or Decrease (-) 1974	
Mineral Resources Development:			
Energy			
Research on subsurface disposal of industrial wastes	300,000	-300,000	
Conversion of wood and organic waste to oil	899,000	-899,000	
Oil shale research	1,117,000	-526,000	-1,725,000
Metallurgy			
Mineral and Metal recycling research	2,647,000	-1,000,000	-1,000,000
Mining			
Extraction technology and explosives research	5,733,000	-700,000	-700,000

	Base for 1974	Increase (+) or Decrease (-) 1974	
Data Collection and Analysis			
Support of Materials Policy Commission	300,000	-300,000	-300,000
Engineering, Evaluation, and Demonstration			
Coal Mine waste hazard investigations	1,000,000	-1,000,000	
Research on filling critical mine void areas	800,000	-800,000	
Mined area investigations and demonstrations	4,719,000	-800,000	-2,600,000
Mine Health and Safety:			
Metal and Nonmetal Mine Inspections			
Additional mine inspectors	6,074,000	+1,500,000	+1,500,000
Education and Training			
Additional instructors to teach health and safety in underground metal and nonmetal mines	5,121,000	+200,000	
Construction of a mining health and safety academy	13,000,000	-13,000,000	-12,800,000
Technical Support			
Engineering specialists to deal with health and safety problems in metal mines	6,894,000	+300,000	+300,000
Research			
Research on health and safety problems in metal and nonmetal mines	2,963,000	+1,000,000	
Research on health and safety problems in coal mines	28,222,000	-3,868,000	-2,868,000
Program Administration			
Employee compensation payments	427,000	+176,000	+176,000
Net decrease, 1974			-20,017,000
Budget estimate, 1974			136,824,000

MINES AND MINERALS

Analysis by Activities

	F.Y. 1972 Amount Available	Fiscal Year 1973 Total Appropriation	Transfers 1/	Adjusted Amount Available
1. Mineral Resource Development:				
(a) Energy	$ 14,847,832	$19,821,000	- -	$19,821,000
(b) Metallurgy	13,863,335	15,393,000	- -	15,393,000
(c) Mining	5,762,498	5,733,000	- -	5,733,000
(d) Data collection and analysis	9,398,241	9,571,000	$ -8,000	9,563,000
2. Engineering, Evaluation and Demonstration	6,064,938	9,925,000	-29,000	9,896,000
3. Mine Health and Safety:				
(a) Coal mine inspections	30,001,969	32,166,000	-432,000	31,734,000
(b) Metal and nonmetal mine inspections	5,830,000	6,120,000	-46,000	6,074,000
(c) Education and training	5,138,000	18,213,000	-92,000	18,121,000
(d) Technical support	6,780,000	6,894,000	- -	6,894,000
(e) Research	32,780,559	31,202,000	-17,000	31,185,000
4. Program Administration	2,370,036	2,427,000	- -	2,427,000
Unobligated balance lapsing	370,560	- -	- -	- -
Total	133,207,968	157,465,000	-624,000	156,841,000

1/ Represents transfers to General Services Administration

MINES AND MINERALS

Analysis by Activity

	F.Y. 1972 Amount Available	F.Y. 1973 Amount Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973	Page Reference
1. Mineral Resource Development:					
(a) Energy	$ 14,847,832	$19,821,000	$18,096,000	$ -1,725,000	10
(b) Metallurgy	13,863,335	15,393,000	14,393,000	-1,000,000	18
(c) Mining	5,762,498	5,733,000	5,033,000	- 700,000	25
(d) Data collection and analysis	9,398,241	9,563,000	9,263,000	- 300,000	31
2. Engineering, Evaluation and Demonstration	6,064,938	9,896,000	7,296,000	-2,600,000	35
3. Mine Health and Safety:					
(a) Coal mine inspections	30,001,969	31,734,000	31,734,000	- -	41
(b) Metal and nonmetal mine inspections	5,830,000	6,074,000	7,574,000	+1,500,000	45
(c) Education and training	5,138,000	18,121,000	5,321,000	-12,800,000	48
(d) Technical support	6,780,000	6,894,000	7,194,000	+ 300,000	51
(e) Research	32,780,559	31,185,000	28,317,000	-2,868,000	54
4. Program Administration	2,370,036	2,427,000	2,603,000	+ 176,000	65
Unobligated balance lapsing	370,560	- -	- -	- -	
Total	133,207,968	156,841,000	136,824,000	-20,017,000	

1. Mineral Resource Development

(a) Energy: Fiscal Year 1973, $19,821,000; fiscal year 1974, $18,096,000; decrease, $1,725,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1) $- 899,000	-28	- -	- -	Terminate development of process to convert wood and organic wastes to oil.
(2) - 300,000	-12	- -	- -	Terminate studies of subsurface disposal of industrial wastes.
(3) - 526,000	-24	591,000	24	Terminate studies of environmental problems associated with oil shale processing, and reduction of large pilot plant experimentation on in situ retorting.
$-1,725,000	-64			

PROGRAM STATEMENT

The startling increases in per capita consumption of energy in the United States have helped turn this Nation, which was once largely dependent on domestic energy raw materials, into a major importer. Since 1950 the demand for energy has more than doubled, while our available supplies of oil and natural gas have declined. Available data show quite clearly that demand for natural gas, for example, currently exceeds supply. The gap between demand and supply will continue to grow and, by 1985, the gap is projected to be 17 trillion cubic feet; an amount nearly equal to the total amount of natural gas this Nation consumed in 1966.

The United States is well endowed with energy resources and has always been able to meet its energy requirements at reasonable costs. Although great quantities of these resources have been consumed, it has been difficult in the past to foresee a scarcity of energy sources. However, the Nation's energy requirements have grown quite rapidly and are expected to continue to grow, as shown in Figure 1.

Fossil fuels currently supply 95 percent of our primary input of energy and even in the year 2000 are expected to supply 75 percent of our energy needs which will, at that time, be three times larger than at present. The critical problem is not the adequacy of resources, but rather how to produce and use these resources in a manner that is both ecologically sound and economically acceptable. Toward these ends, the Bureau of Mines conducts the largest in-house Federal research effort devoted to fossil fuels. This program is carried out by about 900 people at six research facilities. The on-going programs emphasize the conversion of coal to clean synthetic fuels, methods of stimulating natural gas and oil production, and technology that will enable oil shale to be developed in harmony with the environment. The mission for this research has been formulated as follows:

> To develop effective means that will increase the availability and improve the utilization of the Nation's energy resources

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UNITED STATES ENERGY CONSUMPTION BY SOURCE
1971 - 2000
(QUADRILLION BTU's)

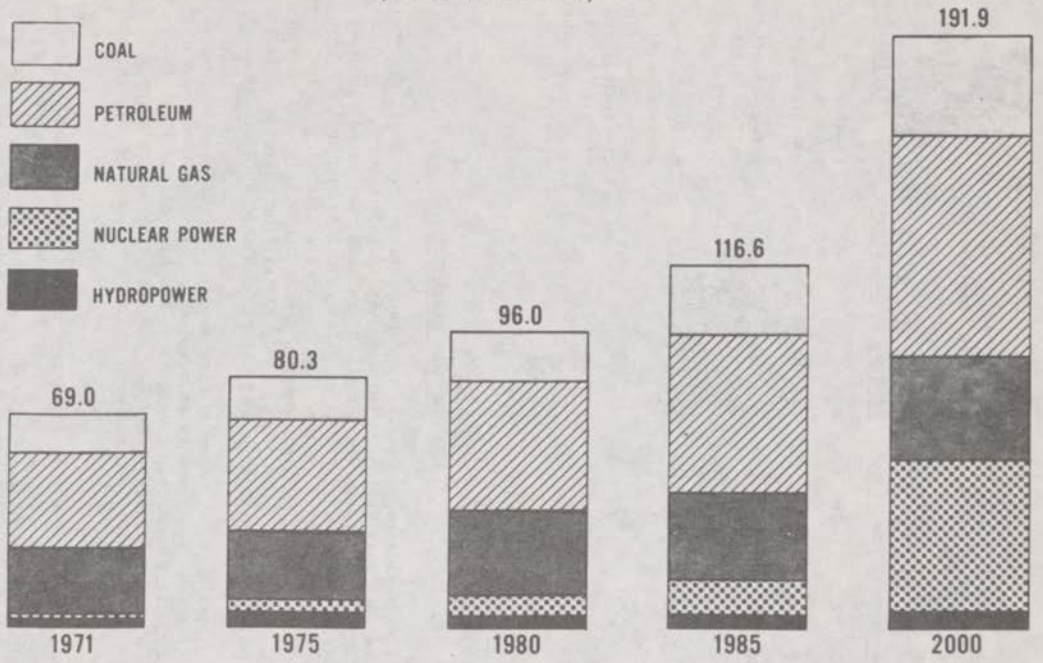


FIGURE 1

at reasonable costs and in a manner that will attain desirable social and environmental improvements.

PROGRAM OF WORK

The research outline below encompasses a full range of scientific and engineering effort directed toward coal, petroleum (and natural gas), and oil shale. The energy programs have been classified and are presented under three major categories: (a) advancing energy utilization technology, (b) application of improved technology to provide clean energy, and (c) managing energy wastes and pollutants.

(a) Advancing Energy Utilization Technology: $4,821,000 (decrease, $1,199,000)

Coal--Increased efficiency and wise utilization of coal will be promoted through research and development, with particular emphasis on the two largest areas of use--combustion and carbonization.

New concepts will be explored on coal burning research to produce clean hot gas for a variety of uses, including magnetohydrodynamics (MHD), which offers a means for the direct generation of electric power with increased efficiency and low pollution.

Additional information will be developed on the mineral content and new technology explored to alleviate ash fouling and environmental pollution associated with the use of lignite and Western coals in power generation. Equipment and techniques will be further developed for burning coals and chars more efficiently.

New technology will be explored for making metallurgical quality coke that will both reduce pollution associated with this large-scale use of coal and permit the use of a wider variety of coals in the coking blend.

New information will be obtained on the physical and chemical nature and reactions of coal to help solve problems that arise during various preparation and utilization processes.

Petroleum--More oil and gas could be recovered from underground formations if advantage can be taken of the naturally existing subsurface fracture system. Field tests will continue on the delineation of natural and induced fracture systems in subsurface formations. A deviated well was drilled in fiscal year 1973 in a gas field to intersect natural fractures. This test will be evaluated and the results published. Potentially, this technology can be applied to petroleum production as well as underground gas-storage operations.

Improving recovery of oil and gas from known reservoirs, particularly those of low productivity, will intensify. Field tests of solvent injection, gas injection, water injection or combinations thereof as well as subsurface fracturing using chemical explosives or massive hydraulic pressures will be conducted in reservoirs known to contain presently unrecoverable oil. Research will be continued on the recovery of oil from heavy oil and tar sand deposits.

Studies will continue on the direct location of oil and gas deposits through radiation measurements, prediction methods for oil and gas production using advanced stimulation techniques, and on supporting research-reservoir geochemistry and rock and fluid characteristics.

Development of investigational tools for the separation and characterization of the heavy ends of petroleum will be completed and will be applied to a selected group of crude oils. These oils are quite different in character, in refining properties, and in geologic age.

Oil Shale--Research designed to promote efficient utilization of the Nation's oil-shale resources will be concentrated in two principal areas of concern: Improved technology of producing high quality fuel products, and improved definition of the nature of the Nation's oil-shale resources, for the most part in the Green River Formation of Colorado, Utah and Wyoming.

Increased effort will be devoted to investigating the possibilities of producing gas from oil shale and from shale oil as an alternative to producing clean liquid fuels from shale. This work, initiated during fiscal year 1973 primarily as an evaluation of presently available information and of related technologic development, will be increasingly augmented by laboratory and bench-scale experimentation.

Work on upgrading of shale oil for production of liquid fuels will be continued, with emphasis on hydrogenation and related techniques for preparation of high quality refinery charge stocks from in situ crude shale oils. Product variations versus processing history also will be studied.

Research on the process-related properties of organic materials in oil shale will feature two studies having important bearing on in situ- processing. The first of these is concerned with the effects on shale-oil yield and quality of prolonged preheating of shale at subretorting temperatures, such as is typical of in situ processing. The second is concerned with effects on shale-oil recovery of contact between shale and water under in-situ conditions.

Continued evaluation will be made of specific oil shales for fuel and minerals potential. This portion of the program will include the completion of analyses of cores from Wyoming's Washakie Basin in the area where lease sites were selected in connection with the Department's prototype oil shale leasing plans.

Solution of many of the problems encountered in oil-shale research requires accurate knowledge of the composition of materials that can only be obtained by application of innovative techniques of instrumental analysis. Therefore, development and application of such advanced analytical methods form an integral part of the research discussed above, as well as of the work on in situ processing of oil shale discussed elsewhere.

(b) Application of Improved Technology to Provide Clean Energy: $11,577,000 (decrease, $233,000)

Coal--The major coal research and development effort will be directed toward processes for synthesizing low-sulfur fuels from coal, including substitute natural gas, low-Btu gas, and fuel oil.

The main thrust of the program on coal gasification will be to demonstrate in a large pilot plant the possibilities for commercial development of the Bureau developed SYNTHANE Process for making substitute natural gas. In fiscal year 1974, construction of the pilot plant will be virtually completed. Concurrently, laboratory studies will continue to aim at process improvements that will reduce gas costs, and at finding means to minimize the environmental impacts that would associate with commercial coal-to-gas plants.

The other Bureau developed process for making substitute natural gas from coal--The HYDRANE Process--will be further developed. Laboratory work on process details and process development will be carried out to obtain information needed to assess its commercial possibilities.

Production of low-sulfur, low-Btu gas from coal, which has considerable interest for power generation in the electric utility industry, will continue to be investigated in a large pressurized, fixed-bed gasifier. Parallel work on removing pollutants from the product gas, while hot, will be continued.

Further, in connection with making low-sulfur, low-Btu gas from coal, laboratory studies will be conducted on a pressurized, fluidized bed of coal. Successful development of a process based on coal gasification in a fluidized bed would provide industry with an alternative approach to a clean fuel for large boilers, and combined cycles based on gas turbines.

In situ gasification of coal (underground gasification) will be explored with the main emphasis on field studies in actual coalbeds. Laboratory studies to support the field studies will continue.

Work will continue on unconventional means for gasifying coal, such as heat pipes and gasification-combustion in a single reactor.

Bureau developed processes for converting coal to low-sulfur fuel oil include: (1) catalytic, direct hydrogenation of coal and (2) hydrogenation of coal with carbon monoxide and steam. In 1, the results with a novel turbulent-type reactor have been so favorable, in terms of yields of a low-sulfur oil using comparatively small amounts if hydrogen, that the work will be expanded. In 2, coal conversions with carbon monoxide and steam continue to improve, and the work will be expanded, with major emphasis on removing unwanted solids from the product oil, and finding means for reducing the consumption of carbon monoxide.

Since hydrogen and carbon monoxide are primary reactants for the coal liquefaction reactions, efforts to find cheaper ways to make these gases commercially will continue.

Processes will continue to be explored for removing sulfur and ash from coal by chemical or other novel means.

Petroleum--Automobiles with present-day emission control systems show striking loss of mileage based on unit fuel consumption, and the 1975-6 controls are expected to increase the fuel consumed per mile even more. Using the special capabilities now existing, representative models of production automobiles with latest emission devices will be tested in programmed operating cycles, using commercial gasolines as well as special fuels. Fuel and engine parameters will be adjusted to increase miles per gallon while maintaining acceptable emission levels. One of the special fuels tested will be gas from coal in engines designed to take advantage of the unique qualities of gaseous fuels.

The reference data bank of unique crude oil characteristics for identification of possible oil spills will be expanded and refined. Data on weathered crude oil samples will be included in this bank. Accurate, comprehensive chemical and physical property data will be determined for a selected group of pure polynuclear aromatic hydrocarbons and related compounds.

Oil Shale--A coordinated effort in the oil-shale program, involving field, pilot-plant, and bench-scale experimentation, is directed toward determining the applicability of in situ retorting to the production of shale oil. In situ retorting features the important environmental advantage of avoiding the spent shale disposal problems associated with any mining and aboveground processing system. In addition, if in situ retorting proves to be practical, the oil shale reserve base could be materially broadened from the 80 billion barrels of oil considered recoverable within current technologic and economic limitations to include much of the remaining 520 billion barrels from better known, higher grade, shales that are presently not economically attractive because of depth of burial, location, or thinness of deposit. These shales represent more than 20 times the currently proven domestic reserves of petroleum. Conjecturally, material amounts of the leaner deposits of the oil shale, estimated to represent trillions of barrels of oil, could become economically recoverable while concurrently processing the intermingled richer measures by in situ methods.

Field experimentation on in situ retorting, including formation fracturing and fracture evaluation preparatory work, will be continued in the general Green River/Rock Springs area of Wyoming. Emphasis will be on improving techniques for effectively initiating and controlling in situ processing and for monitoring the underground situation in regard to migration of liquids and gases during and following retorting. Complementing the field-scale in situ retorting research, pilot-scale work will be included using batch-type surface retorts in which the effects on retorting efficiency of such variables as rate of heating and gas flow can be determined more precisely and expediently than under actual in situ conditions. Supporting in situ research also will be conducted using laboratory and bench-scale equipment to study such basic in situ retorting factors as the effects on oil yield and quality of prolonged heating of shale at sub-retorting temperatures and the mechanisms involved as retorting of massive chunks of shale progresses.

The Bureau of Mines has recently leased its oil-shale facility at Anvil Points, Colorado for surface retorting research by a private firm. This research will be monitored and evaluated by Bureau personnel.

(c) Managing Energy Wastes and Pollutants: $1,698,000 (decrease, $293,000)

Coal--Improved technology will be developed for identifying and removing undesirable minerals from coal, and gaseous and particulate pollutants from stack gas. Corrosion of fireside surfaces will be investigated to provide means of eliminating or alleviating this serious combustion problem.

In cooperation with university and private industries, coal mine wastes and fly ash will be used to restore vegetation to lands that have been disturbed during mining operations. The study will include attempts to reclaim western lands affected by strip mining.

Petroleum-- New technology is being developed that is needed to recover and recycle waste lubricating oils drained periodically from over 100 million automobiles and trucks, from diesel locomotives and from stationary powerplants. The initial laboratory evaluation of commercial re-refined lubricating oils will be completed, together with tests of re-refined oils produced in laboratory processing equipment. In addition, cost analysis of the best developed re-refined processes will be completed.

EXAMPLES OF RECENT ACCOMPLISHMENTS

The Bureau of Mines process for producing substitute high Btu gas from coal, designated the SYNTHANE Process, has advanced to an important stage. A 75 ton per day pilot plant has been designed and construction of the plant has begun. Construction is expected to be completed 19 months after the date of the construction contract award. The construction and operation of this pilot plant will provide operating and engineering data necessary for a scale up to commercial production plants which will use the SYNTHANE Process to help relieve the critical shortage of natural gas. In support of the 75 ton per day scale up, laboratory and small pilot plant research was continued which includes a 4 month test of the methanation unit.

Research and development of a new Bureau process to produce high Btu gas from coal, named the HYDRANE Process, is progressing rapidly. The HYDRANE Process differs from SYNTHANE in that the bulk of the methane is produced by direct reaction of hydrogen with coal. Significant advantages of the HYDRANE Process include a considerable reduction in system coal requirements per unit of methane produced, a very important economic factor. A laboratory pilot unit (10 lbs/hr) has been designed and constructed and is now operating. Operation of this plant is providing information necessary for scale up to a larger pilot plant which is a preliminary step to commercial sized reactors.

In the novel Bureau of Mines hydrodesulfurization process, a coal and oil mixture along with hydrogen is passed through a fixed bed of cobalt-molybdate catalyst under turbulent flow conditions. In work conducted on this project, the Bureau's pilot plant was operated continuously for a period of twenty hours with recycling of both the vehicle oil and unconsumed hydrogen. Treatment of bituminous coal containing 4.6 percent sulfur and 17 percent ash yielded a high value fuel oil having only 0.19 percent sulfur and 1 percent ash. This product is capable of more than satisfying EPA air quality standards for sulfur in fuels to be used in electric powerplant operation.

In a coal field located near Hanna in south central Wyoming, field tests on gasifying coal in place (underground gasification) have been initiated. Coal in the bed being tested is 20 feet thick and the average overburden is 400 feet. In initial work, a test hole was bored to confirm that subsurface conditions are suitable for the planned experiments. Foremost among the benefits to be derived from gasifying coal in place are the elimination of hazards to workers and the potential alleviation of adverse environmental effects associated with the mining of coal.

A continuous pilot plant is being operated to develop engineering data to scale up the process for converting organic wastes to crude oil. Earlier tests showed that organic wastes including animal manure and urban wastes could be converted to low-sulfur oil, potentially usable for power generation. A survey, conducted on U.S. generated organic wastes, indicated that annual production approximates 880 million tons per year. Of this, 136 million tons are concentrated at locations where disposal requires some special expense and this amount is potentially available for conversion to oil. Further, work has been initiated on designing a pilot plant to study the production of oil from wood chips.

In efforts to improve recovery from heavy oil reservoirs which, in California alone, may contain 33 billion barrels of oil, solvents have been injected in five wells in California. All wells showed increased production after treatment; one well went from 3 to 28 barrels of oil per day. Future tests will attack the problem of most efficient combination of solvents and additives to be used for maximum recovery and whether the economics are favorable for wide application.

A field test of an explosive fracturing-solvent injection (SOLFRAC) method to increase recovery of heavy oils from shallow deposits in Kansas is being expanded to a five-well pilot test. Recovery from the initial test in three wells was 15 percent of the viscous oil in place. A solvent distillation unit has been designed and placed in operation at the test site to separate the produced oil from the solvent to improve the economics of the procedure.

In cases of pollution of coastal waters, beaches, and inland waters by oil spills or discards, it often is difficult to identify the source of the polluting oil. To assist in this problem, a data bank has been established that includes metal content and a chromatographic visual profile of 200 crude oils transported by water in both domestic and foreign commerce. The data bank also includes the same information for artificially weathered samples of the oils. Data from an oil involved in a pollution incident can be matched against data in the bank through computer programs.

Emphasis in the fuels combustion research program has been shifted from emission control to improved fuel economy. Tests designed to study the effects of fuel volatility on emissions and performance have indicated significant effects on fuel consumption as well. Automobile engines modified to run on natural gas or substitute natural gas (gas from coal) were tested at elevated compression ratios (as high as 12.5:1) which take advantage of their naturally high octane. Results from one engine showed that increasing the compression ratio from 8.6 to 12.5 resulted in a 10 percent increase in fuel economy with both fuels. Because

of the improved efficiency, the increase in compression did not increase the mass emissions of carbon monoxide or oxides of nigrogen; hydrocarbon emission (essentially all methane) did increase slightly. Fuel consumptions have been measured on certain 1973 model cars which can be used for comparative baseline data to appraise the impact of emission control procedures and adjustments in engine/fuel parameters made to optimize fuel economy.

Assays of 6,000 oil shale samples were completed on schedule, representing about 12,000 feet of cores and drill cuttings taken to determine potential oil shale lease-sites for nomination in the Department's oil shale development program. The data are a significant addition to the information that is being developed on the government oil-shale lands in Colorado and Utah. With no more than two leases in each state--Colorado, Utah, and Wyoming--to be immediately offered, some of the data developed will be reserved for use in the further orderly development of the oil-shale resource.

Samples from two cores analyzed for dawsonite content, using x-ray diffraction, expanded the knowledge of extent of deposition of this mineral. Dawsonite, of potential significance as a source of both sodium and aluminum compounds, occurs in intimate association with oil shales in the deeper deposits of the Piceance Creek Basin in Colorado. However, the extent of the mineral deposit is poorly defined. Although one core was from what is believed to be near the outer edge of the deposit, it contained a continuous dowsonite-bearing section 169 feet long. The second core, taken six miles west of the first, had a 680-foot continuous dawsonite section plus several shorter sections. Improved definition of these mineral deposits will have an important bearing on oil shale development and mining plans because of the potential by-product credits.

Mild oxidation was shown to have potential as an economic method of preparing low-pollution shale-oil fuels. In one study, such treatment removed about one-half of the nitrogen from a naphtha. In a related study of a shale gas oil, denitrification reactions were evaluated under a Bureau grant to the University of Wyoming. Results of this environmentally important study were presented at a national meeting of the American Chemical Society.

Two new research scale oil-shale retorts were placed in operation. In one, gallon-sized samples of crude shale oil and 50-pound samples of spent shale are prepared under closely controlled conditions. In addition to providing retort engineers with required kinetic and mechanistic data, these materials can be used in environmental studies. The second is a half-ton retort. In the first run of this retort, a 500-pound block of shale retorted satisfactorily, reaching a maximum internal temperature of 1,090 degrees Fahrenheit after 18 hours while a bed of smaller-sized shale surrounding the block reached 1,650 degrees Fahrenheit. This retort, which permits both visual and instrumental observation of the retorting shale, will provide better understanding of the environmentally attractive in situ mode of processing that is being developed.

(b) Metallurgy: Fiscal year 1973, $15,393,000; fiscal year 1974, $14,393,000; decrease, $1,000,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-1,000,000	30	$1,647,000	83	Reduction in mineral and metal recycling research

PROGRAM STATEMENT

The Mining and Minerals Policy Act of 1970 (P.L. 91-631) reflects the new national determination to face issues that are at the center of social and economic progress. The first annual report to the Congress by the Secretary of the Interior on the state of the domestic mining, minerals, and minerals reclamation industries, as required by the Act, has identified problem areas facing the Nation as well as opportunities for improving its mineral position. Those pertinent to the Bureau of Mines Metallurgy programs are as follows:

- Development of the mineral resources of the United States is not keeping pace with demand.

- Domestic demand for petroleum and natural gas already substantially exceeds readily available domestic productive capacity.

- Foreign actions are adversely affecting supply and cost of imported mineral materials.

- Competition is growing for foreign mineral supplies.

- Increasing dependence on foreign sources for mineral supplies constrains U. S. foreign policy and threatens stability of U. S. economy.

- Environmental regulations threaten major disruptions of some domestic mineral production.

- The trend toward increased importation of processed materials of mineral origin increases balance-of-payments problems.

- Research affecting mineral production and use is being decreased when instead it should be expanding.

The 1970's will long be remembered by the mining and minerals industry as the decade when the new dimension of environmental quality had to be added to the minerals processing flowsheet and at very substantial costs. To comply with the new air quality standards set by the Environmental Protection Agency, the cost of the copper smelting industry alone is estimated at nearly $700 million.

In addition to the problems of maintaining the quality of the environment in our mining and minerals industry the Secretary warned in his report to Congress that, in the development of our mineral resources, the Nation is failing by far to keep pace with rapidly expanding demand with consequent alarming increase in dependence on foreign sources for its essential mineral needs. In 1970, domestic mineral production fell $8.6 billion short of primary domestic demand. If the current trend continues, by 1985 the value of primary domestic mineral production will fall $31 billion short of domestic demand. Balance of payment problems are currently of serious proportions, and those projected for the future appear to be intolerable. Avoiding the consequences to the Nation can best be accomplished by greater domestic mineral production from the resources that are available. This production requires more efficient, nonpolluting technology in order to recover all of the mineral values from ores that are becoming leaner and leaner with time. The problems are compounded by the fact that there has been a serious

decline of American investment in research and development in the non-military sector. Currently, we are spending, in terms of gross national product, only half that of West Germany, France, Great Britain, Italy, or Japan. Also, many of the most important advances in metallurgical processes in the last ten years resulted from foreign research. Typical is the evolving technology overseas that is reducing the competitive position of the U. S. steel industry.

The desire for environmental quality--cleaner air, cleaner water, cleaner land, and improved health and safety--has had a major impact upon the metallurgical industry, resulting in constraints on mining and mineral processing operations which have seriously interrupted portions of these activities. Within the last 18 months, over 35 percent of the existing United States zinc smelting capacity has been closed. There is serious concern for the copper, mercury, phosphate and other industries where the deterring effects of the new constraints are also being felt. Unless new and improved technologies are developed, the demand for a cleaner environment will eventually have an adverse effect upon a large portion of the Nation's metallurgical industry.

The demand for new energy sources has a direct bearing on the minerals industry. To decrease the competition within the U. S. for the energy that is available, research is required to provide the technology that will allow the metallurgical industry to use more abundant, less utilized sources of energy, such as lignite, high-sulfur coal, and petroleum residues, in its processes or that will devise methods that use less energy, especially electric power.

In broad outline, the Metallurgy program--aimed at conservation of national mineral resources--develops new or improved ways to increase recovery of metals and minerals from domestic deposits and to prevent waste in their preparation, treatment, and use. Preventing waste includes improved pollution control because most pollutants contain potentially valuable constituents. The program also includes economic recovery of metals and minerals from low-grade deposits and from metal and mineral wastes. To lessen the demand placed on national mineral resources, research is also performed to give greater useful life to goods made from minerals. The program is divided into four objective-oriented segments, which are aimed at improving (1) primary metal and mineral recovery processes through advancing minerals technology; (2) pollution abatement and control techniques; (3) mineral and metal recycling technology; and (4) minimizing mineral and metal needs through better performing materials and wider use of materials that are abundant.

PROGRAM OF WORK

Advancing Minerals Technology: $6,573,000

The United States faces an ever challenging problem of providing the mineral and metal raw materials needed for a vigorous industrial base while simultaneously conducting an adequate export-import program with a favorable balance of trade. We also must have the assurance that in times of international stress the defense posture of our Nation will not be seriously affected. With limited deposits of high-grade ores, we must increase our domestic capability to utilize abundant low-grade ores as the higher grade deposits are consumed and depleted. In order to do this, new and nonstandard processes are being evolved which advance minerals technology for recovering the needed metals from their ores at maximum efficiency and with minimum adverse environmental effect.

A major portion of the Bureau of Mines Metallurgy program is being undertaken to assist private enterprise to achieve these objectives. Investigations are wide in scope and include virtually all major commodities and the technology needed to process them. The efforts range from work on mineral concentration to new steelmaking concepts. Studies are underway which will improve the froth flotation process for the separation of mineral concentrates from gangue by applying advanced concepts of surface chemistry and physics. Other studies will derive information

required on chemical properties, kinetics, and mechanisms of metallurgical reactions to improve extraction processes.

An extensive effort is underway to help solve the problems being encountered in the high-cost processing of base metal ores. Innovative technology is under investigation to replace the outmoded techniques which currently do not permit economic processing of low grade sulfide ores, nor permit the economic treatment of complex lead-zinc ores found in abundance in the U. S. Improved processes for smelting base metal sulfide concentrates will result in improved reduction efficiency, decreased power consumption, and will lead to the concentration of sulfurous emissions for easier removal and recovery or elimination of their formation altogether. Other research involves the search for new economical techniques for obtaining titania from abundant domestic ilmenite resources thereby alleviating our nearly complete dependence on already dwindling world rutile supplies.

New technology to increase recovery of phosphate fertilizers from unbeneficiated minerals in Florida are sought which will not only prevent indiscriminate phosphate losses, but will also aid in preventing slime disposal problems. Still other research involves changes in iron and steelmaking technology. Use of more abundant energy resources such as lignite, coal char, and waste petroleum products will not only reduce the demand for higher cost, less abundant low-sulfur coal, but can also supply higher heat energy inputs thereby decreasing the need for electrical energy. Research on continuous charging and preheating of materials should decrease heat times with a concurrent savings in energy input.

Effecting Pollution Abatement: $4,138,000

"Zero discharges" for metallurgical processing is a goal that has yet to be achieved. Even though major efforts at improvement are being made, the minerals industry generates large volumes of solid and liquid wastes that must be disposed of, discharges water that is not always as clean as that entering its processes, and emits stack gases that are not compatible with new environmental standards.

The Metallurgy program includes investigations that will assist private enterprise to develop methods for minimizing pollution by ongoing mineral mining and processing industries and for recovering residual metals and minerals now being discarded. In addition, alternative processes are being developed to decrease polluting emissions. Some of the more serious and urgent problems are those arising from smelting copper, lead, and zinc ores and from disposal of slimes generated in the processing of phosphate ore, iron ores, and bauxite. Other problems are concerned with the use and reuse of large volumes of water often required in mineral processing operations.

The Bureau-developed citric acid process for removing sulfur dioxide emissions from base metal smelter stack gases and producing elemental sulfur for marketing or safe disposal is ready for large scale testing. The Bureau in cooperation with industry is proceeding with plans to construct a prototype plant adjacent to an operating smelter to treat 1,000 cubic feet of smelter gas per minute. The citrate absorption process, which is one of the more promising methods for removing nearly all of the sulfur dioxide from waste gases, has received wide attention not only from the smelting industry but also from the petroleum refinery and coal-fired power generating interests. A recent announcement was made of a joint effort by three private companies to test the citrate process at a coal-fired steam generating station in Indiana. The hard engineering and economic data obtained from both the Bureau's and this pilot-plant operation will help demonstrate the commercial feasibility of the citrate process.

A new phase of the pollution abatement program will be focused on the tons of slimes which are generated and stored during the production of phosphates for fertilizer raw materials. A recent break in a slime storage dam spilled 2 billion gallons of slimes into a Florida waterway. The Bureau and the phosphate industry have joined in a cooperative cost-sharing, concentrated effort to

develop effective techniques for dewatering phosphate slime tailings at an acceptable cost or to develop alternative processing methods that will alleviate or minimize the slime disposal problem.

Other related studies will be concerned with the dewatering of the red mud generated during the production of alumina from bauxite and on the safe disposal of the tailings produced during the processing of iron ore. Research will also be continued on the use of potable water for mineral processing operations in addition to work on removal of contaminants from mineral processing waters to encourage greater recycling of the water resource and at the same time recover any contained residual mineral values.

In view of the Bureau's recognized expertise in the reclamation and safe disposal of a variety of mineral solid wastes, studies will be continued on the stabilization of fine mineral wastes such as the tailings from copper, uranium, and lead-zinc operations. Technical assistance will be provided to the minerals industry to assist them in their own efforts to reclaim the vast piles of mineral wastes scattered over the land.

Improving Mineral and Metal Recycling: $1,647,000 (decrease, $1,000,000)

The Nation's metallic and nonmetallic mineral resources are neither infinite nor renewable. Thus, in order to augment our primary supply of virgin metals and minerals to meet an ever increasing demand, it is essential that this country recover, recycle, and find uses for as much of its industrial, manufacturing, and post-consumer wastes as possible. Current practice of mining and manufacturing, with their attendant generation of throw-away wastes, not only needlessly accounts for consumption of primary materials and energy, but also results in usurption of potentially valuable land for fill, and in addition, poses a constant threat to pollution of the environment.

One of the more serious problems, and one that literally resides at the door of every citizen, is the disposal of urban refuse and trash. Over 12 million tons of iron and steel products, over 1 million tons of nonferrous metals such as copper, aluminum, tin, zinc, and lead, and 13 million tons of glass contained in this resource alone are burned or buried each year on our city dumps. In FY 1973, substantial funds were expended for the purchase of equipment and construction of a pilot-plant to process raw refuse and recover products that will supplement both energy and mineral raw material needs. The project has advanced to a stage which permits the pilot-plant treatment of urban refuse at a rate of five tons per hour. Refuse from several sources has been treated in the plant on a limited basis and results indicate that materials with a wide variety of physical and chemical characteristics can be effectively separated and recovered. Optimization of the plant flow sheet and an evaluation of the economic considerations associated with the process are prime objectives of future work.

The Bureau has had a substantial research effort over the past five years on separating, recovering, and upgrading the ferrous and nonferrous values contained in junk cars and related ferrous scrap such as large appliances. Work on the recovery of nonferrous metals from junk auto shredder operations has been highly successful and will be terminated at the end of FY 1973. Concurrently, studies will be started on the problems associated with recovery of metal values from obsolete airplanes, which contain a wide variety of aluminum and high-temperature alloys in addition to the precious metals associated with electronic equipment. Work will be continued on compiling data on burning of junk autos and obsolete railroad cars in a smokeless incinerator. In addition, a variety of metallurgical processing wastes, such as steel dusts, slags, drosses, industrial and manufacturing discards and effluents, and sludges will be examined for possible recovery and recycling of the contained metal and mineral values.

Minimizing Mineral and Metal Needs: $2,035,000

In recent years research to develop improved metallic and nonmetallic materials, which was formerly conducted and supported by a variety of governmental and academic organizations, has been reduced to a minimal effort. Based on the results of this research, the United States was a leader in the production of a variety of improved performance materials and achieved a position of preeminence in the manufacturing, nuclear energy, and aerospace fields. Now, the diminished effort on materials research has had a notable adverse impact on the Nation's ability to provide the new types and quality of metal and nonmetal material substances required to most efficiently and effectively conserve our mineral resources. There is an urgent need to revive research in this area. To fill the void, the Bureau's limited material development research effort will be reoriented with the objective of delineating the broad research needs required for a major materials program thrust in the future.

A program for development of high-quality and improved-performance materials will lead to a subsequent reduction in the quantity of minerals and metals required for goods. Among the several facets of the Bureau research on this objective are fundamental studies to determine the oxidation kinetics and the corrosion mechanisms of iron and iron-chromium alloys in order to provide the base from which better materials can be made. Other research studies are designed to develop less corrosive materials of construction for metallurgical processing and applications such as pipelines to transport sour natural gas and petroleum. Further research is underway to develop improved systems for joining aluminum and copper base metals which will lead to extending the temperature range for utilizing these metals in automobile radiators, heat exchangers, and temperature sensitive devices where application at higher temperatures will permit greater operating efficiencies.

Another approach to more efficiently using the Nation's minerals and metals is to utilize materials which are in extremely large supply. The Bureau is conducting an extensive research effort to develop new uses for the large tonnages of low-cost sulfur that will result from implementation of control measures to reduce the amount of sulfur oxides discharged into the atmosphere. An annual sulfur surplus of as much as 9 million tons is expected by 1980. The Bureau's research is aimed at development of major new uses for the excess; testing to establish physical and chemical properties of potential uses that have been previously examined but not sufficiently for commercial acceptance; and the systematic collection of basic knowledge that will contribute to identifying new and novel consumption potentials. The research involves the use of sulfur in construction materials for surfacing highways and airport runways and in a variety of tiles, bricks, ceramic pipe, and concrete for use in building construction, decoration, sanitary disposal, or other areas where environmental conditions are detrimental to conventional materials.

Other projects where abundant resources are being adapted for their particular useful characteristics include development of improved mold materials to facilitate cast metal foundry operations; generation of better drilling fluids for use in high-temperature and high pressure drill-hole conditions such as are encountered in very deep oil wells; and extension of glassy slags and unsegregated waste glass as a raw material for use in various glass containers.

EXAMPLES OF RECENT ACCOMPLISHMENTS

Heavy and precious metals research by the Bureau continues to find wider application by the minerals industry. The carbon-in-pulp recovery process developed by the Bureau for extraction of gold from cyanide leach ore pulps is well on the way to commercialization. A 2,350 ton-per-day mill being constructed by the Homestake Mining Company in Lead, South Dakota, is nearing completion, and is expected to be in production by spring 1973. This will result in an increased gold recovery estimated at about 8,000 ounces per year at lower operating costs.

The Bureau-developed technique for treating carbonaceous gold ores by the electro-oxidation process also is nearing commercial acceptance for treating mercury ores found in Nevada. These ores cannot be economically treated by current technology either because of their low grade or because they present an air pollution abatement problem. Plans to construct a 50 ton-per-day pilot plant using technology licensed from the Department of the Interior are in the final stages of completion. With the application of this new process the customary roasting step with its inherent air emission problems would be eliminated.

In the area of pollution abatement research the Bureau has made good progress in further developing the citrate process for reducing or eliminating air pollution associated with the minerals processing industries. Research and development efforts have been intensified to obtain engineering and cost data which will demonstrate the citrate process as a viable method of treating industrial waste gases containing sulfur dioxide.

Cooperating with the Bunker Hill Company, the Bureau is constructing and will operate a pilot plant capable of treating 1,000 cubic feet per minute of gas containing 0.5 percent sulfur dioxide at the company's Kellogg, Idaho, lead smelter. Originally conceived as a potential method of controlling sulfur dioxide emissions from smelters treating sulfide ores, the process involves absorption of sulfur dioxide in a citric acid and sodium citrate solution and subsequent reaction with hydrogen sulfide to recover elemental sulfur. Over 95 percent of the sulfur dioxide in gas streams, that carry only a fraction of a percent, can be recovered. The process chemistry has already been proven on a small scale utilizing reverberatory furnace gas generated at a western copper smelter. Based on the data collected from this operation, a preliminary cost estimate indicated that for a typical copper smelter the unit cost would be about 2 cents per pound of copper produced or approximately $36 per ton of sulfur recovered. No credit was taken for the sale of byproduct sulfur.

The Smelter Control Research Association, an organization of the major United States copper producers, has expressed interest in the citrate process and has indicated its desire to participate in a joint program with the Bureau to evaluate the process for treating dilute copper smelter gases. Interest in the citrate process has also been shown by utilities operating coal or oil fired power plants, by the chemical industries, oil refining companies, and pollution engineering firms. An independent pilot plant test of the citrate process has been started jointly by Pfizer Inc., Arthur G. McKee and Company, and Peabody Engineering. The plant, capable of treating 2,000 cubic feet of gas per minute, will be mobile so that after the initial test on flue gas from a coal-fired steam-generating station in Terre Haute, Indiana, it can be moved to other plants emitting sulfur dioxide. The Bureau will continue to provide the companies involved with technical advice concerning plant design and operating procedures.

In another development the M. W. Kellogg Company has announced plans to design a citrate plant to treat 80,000 cubic feet per minute of stack gas, about 10 percent of the total, at a power plant of a major western utility. A successful operation would reportedly lead to an installation capable of treating all of the power plant stack gases.

Under its program, Improved Mineral and Metal Recycling, the Bureau has been investigating novel methods for removing copper and tin from molten scrap iron in order to increase the quality of scrap used in the reuse cycle. Scrap iron and steel containing these two metals are generally unacceptable for recycle by iron and steel producers because of the harmful effects on mechanical properties of iron alloys. To solve this problem a method has been developed for removing copper that involves subsurface injection of sodium sulfate into the molten scrap iron bath. Field testing of the technique on 5-ton heats at a cast iron pipe and foundry company has shown that significant amounts of the detrimental copper are removed.

In other investigations, a patented process was developed for recovering usable grade iron ore from a northern Michigan nonmagnetic taconite formerly considered waste. The technique has been adopted by industry and presently the Cleveland Cliffs Iron Company is constructing a new $165 million iron ore and pellet production plant at Tilden, Michigan. The facility will treat 10 million tons of ore containing about 35 percent iron, and will produce 4 million tons of high-grade iron ore pellets. At least 1 billion tons of ore which heretofore could not be economically processed will be added to the reserves.

In other research, technology developed by the Bureau on recovering metals and minerals from municipal incinerator residues will be demonstrated in a 250 ton-per-day plant to be constructed at Lowell, Massachusetts, under a $2.4 million grant recently awarded by the Environmental Protection Agency. The City of Lowell and the State of Massachusetts are contributing to the project which will have a total cost of $3.2 million. Negotiations are now underway for Bureau engineers to serve as advisors and to participate actively in the start-up operations.

(c) Mining: Fiscal year 1973, $5,733,000; fiscal year 1974, $5,033,000; decrease, $700,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-700,000	-20	$5,033,000	262	Reduction in combustion and fire research and in improved extraction technology research.

PROGRAM STATEMENT

The quantity and quality of worldwide mineral resources including fossil fuels are rapidly diminishing. The United States relies on foreign supplies to bolster its dwindling domestic resources. In view of increasingly intransigent foreign nationalism, such dependence is becoming intolerable. Inasmuch as available domestic mineral resources at any particular technologic level are finite, either new deposits must be found and brought into production, or the technologic level must be improved if the United States is to maintain a stable mineral and energy base. It is essential to assure that adequate engineering and scientific capability and knowledge in mining technology is developed and maintained to enable industry to meet mineral and fossil fuel needs in a manner that is consistent with national environmental and social goals. Technological limitations, environmental constraints and economic reality are rapidly converging throughout the mining industry. The need for improved extraction technology is urgent and immediate.

Objectives. The objectives of the mining program are to (1) continually improve the extractive system through technological advancement of the total mining process, and (2) to maintain technical competence to effectively conduct special studies pertinent to national interests and to plan, direct and oversee research programs. Implicit in the above is concern for the health and safety of the workers and preservation of environmental values.

PROGRAM OF WORK

Improving Extraction Technology: $2,171,000 (decrease, $500,000)

In order to meet the continually expanding demand for minerals at acceptable levels of social, environmental and material cost and to provide an alternative choice to the increasingly restrictive climate of international trade, it is imperative that our domestic mining industry be kept competitive through continuous upgrading of existing extraction technology. This area of research is directed specifically to achieving this objective by systematic research in each of the functional areas of the mining system.

Ground control includes the control, stabilization or support of surface and subsurface mine structures through the design of the mine structure or by artificial means. Research will continue to investigate the relationship of the geologic features; the physical and mechanical properties of the rock; the state of stress in the rock; and the deformations and change in stress induced by mining, to the design of surface and underground mine structures. Research in the design of underground structures and in the use of mine waste materials for backfill will continue in order to determine means for control and reduction of surface subsidence due to mining. Artificial support system research will also be conducted through the evaluation of new methods of support and investigations of the support/rock interactions in order to achieve design criteria for support systems under various conditions. Field tests of electrokinetic densification of tailings will be conducted if laboratory tests are successful.

Fragmentation is a key element in extraction technology. It encompasses a variety of methods used to break the rock or earth encountered during mineral extraction. Research will be aimed at improving various methods of fragmentation such as chemical, mechanical, thermal, electrical, hydraulic, and explosive. Choice of a particular fragmentation method will strongly influence the associated mining subsystems such as ground control, materials handling, environment, and health and safety. The fragmentation process may in fact determine selection of the overall mining method. Mechanical fragmentation studies will focus on problems associated with the rapidly developing field of mechanized mining and tunnel and shaft boring. Thermal and electrical fragmentation studies will be directed toward determination of, and improvement in the extent of applicability of these novel methods. Explosive excavation research will be directed at improved explosive utilization for extending the applicability and lowering the cost of blasting. Fundamental studies of rock behavior and rock properties will be continued to help explain the mechanisms of rock failure and to suggest more efficient ways of inducing failure in rocks.

Materials handling research will continue in two areas, determination of the physical characteristics of mined materials which influence the design and construction of materials handling systems and research on specific in-mine materials handling problems identified by a survey of materials handling systems.

Advancing Mining Technology for Marginal Resources: $1,925,000

Much of the Nation's store of mineral resources occurs in such a manner to be of marginal value because of technological, sociological, or environmental problems or combinations of these problems. Mining research in this area is directed to the identification, delineation and solution of problem areas that are amenable to technological solution.

The development of many marginal mineral resources depends in part upon the solutions to problems of ground control and waste disposal. The research program will include continuation of the analysis of rock mass behavior in order to develop criteria for mine structure design, with an emphasis on caving mining systems. Methods for the pre-mining determination of the engineering characteristics of rock masses will be investigated. Efforts toward the development of improved methods of artificial support will continue. Research will be directed toward providing technologically and environmentally sound solutions to the waste disposal problems associated with low-grade mineral resources.

New and improved methods of fragmentation having particular application to marginal resources will be investigated. Field efforts will include experiments with mine production blasts in sortable native copper ores to design blast patterns or utilize explosives in such a way as to produce a product size which can be effectively sorted underground prior to hoisting without further crushing. These efforts, if successful, will reduce the costs of the entire mining process. Additionally, emphasis will be placed on improving the effectiveness of low cost explosives in common use today, such that large, low grade deposits such as the copper porphyries of the Southwest can be mined more economically. Because of the emerging trend toward in-place mining of marginal mineral deposits, the need has increased for understanding the degree of fragmentation produced by non-nuclear explosives. Blasting studies aimed at understanding and maximizing the rubble zone surrounding a deep blasthole have taken on additional importance and will be continued.

Drill-blast studies will attempt to improve on existing tunneling methods. In-mine experiments utilizing larger boreholes drilled with specialized equipment to greater depths should permit excavation of longer distances with each blast. The resulting benefits may include improved tunneling rates with the drill-blast method, lower costs, and less blast damage to the mine roof.

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Efficient mining of marginal mineral deposits not only requires new and more efficient mining systems, but the fragmentation subsystems selected as probable candidates must be studied and their performance optimized for each type of marginal deposit. Prototypes of various fragmentation systems will be tested under field conditions. Fragmentation systems to be studied under the marginal minerals program include mechanical, chemical, explosive, thermal, electrical, and hydraulic.

Choice of the most appropriate mining method and the best fragmentation subsystem for any mineral deposit depends to a large extent on the character of the rock. Research on rock samples from a variety of these marginal resource deposits will provide the fundamental data and behavioral properties needed to characterize each, and will provide data needed for selecting an optimum mining system.

Because many of the present day marginal deposits are large in extent and regular in geometry, they appear to lend themselves to modern continuous mechanical fragmentation techniques which include tunnel boring, raise boring, and shaft drilling. The application of these methods to marginal minerals is influenced by cutter costs and excavation rate capabilities. Research efforts will be centered around improving cutter life and cutter performance.

Developing Advanced Mining Concepts: $405,000

The thrust of this program area is to proceed from technological capabilities and institutional or societal requirements to advanced mining concepts which extract maximum utility from these technologies and/or provide maximum satisfaction for these exogenous needs. These concepts, if and when implemented, will provide maximum return in terms of increased economy of production and safety and minimize the impact of mining on the environment.

Specific areas of investigation for this program include the investigation of the nature of near-face environmental constraints associated with novel fragmentation techniques, the continued development of combined thermal hydraulic disintegration techniques, research aimed at the development of better methods of gaining and maintaining access to deeper mineral deposits, and other investigations related to concepts which maximize the impact on technology in the development of improved mining systems.

Explosives: $532,000 (decrease, $200,000)

The primary objective of the explosives research program of the Bureau of Mines is to provide technologic information and guidance to Federal, State, and local governmental agencies having problems involving: the safe handling and use of commercial explosives and blasting agents; safety characteristics of explosives certified by the Bureau for use in underground bituminous coal mines; and the means of controlling unwanted fires and explosions in minerals, mineral fuels and their products.

Technologic data is developed to characterize hazards inherent in production, handling, and use of explosives and other hazardous materials in dangerous environments. As the only Federal agency authorized by the Congress to investigate commercial explosives, the Bureau provides governmental organizations and industry with authoritative information on the safe handling and use of these potentially hazardous materials.

Research will continue on the evaluation of safety characteriestics of permissible explosives to determine that they are being manufactured to specifications originally approved by the Bureau, and thus continue to meet minimum safety standards. In addition, hazardous mining materials such as blasting

agents and two-part explosives will be evaluated for safety characteristics. A program of fundamental and applied research will evaluate (1) the development of safer explosives for use in underground coal mines and the underground operations where gas and/or dust explosion hazards may exist; (2) develop and evaluate new explosive systems with safety characteristics equal to, or better than, the present certified permissible explosives.

Permissibility studies on explosives incendivity will be continued with emphasis on the mechanism of initiation of dust-air mixtures. Research will continue on the new concept of identifying explosives after they have been detonated using fluorescent tracers; application of this identification technique will be extended to the full range of explosives and hopefully to explosive devices such as detonators and detonating cord. Basic research in detonation will be continued in order to advance the state-of-the-art in this area of research and to maintain inhouse expertise in detonation phenomena.

Cooperative research with other government agencies and industries having problems with fires, explosives, and explosions will be continued. The broad experience of the Bureau will be available as needed for consultation regarding potentially hazardous situations.

EXAMPLES OF RECENT ACCOMPLISHMENTS

Ore recovery ratio is a primary indication of extraction efficiency. As size of pillars left by mining is decreased, ore recovery ratio increases. In-situ stress measurements and triaxial strength tests on model pillars containing planes of weakness showed conclusively that in-situ strength of full-size mine pillars containing planes of weakness can be predicted with accuracy. With this information stable pillars can be designed using safety factors as low as 1.5 as compared to a value of 4 now generally used. With these new techniques, productivity can be increased without a sacrifice in safety.

Other advances in understanding pillar behavior were made through stiff loading tests on model pillars. In the case of partially failed pillars, it was learned that load carrying losses are proportionate to decrease in effective cross sectional area of the pillar. Maximum stress on the undisturbed section remains a constant, and can be estimated from prefailure load-deformation curve. Confirmation was also made regarding benefits of as little as 1 to 4 psi radial confining pressures. Such minimal pressures can increase post-failure strength of pillars by as much as 10 percent.

Several major improvements were made in in-situ stress determination techniques. By means of a special type of borehole deformation gage, accurate stress measurements can now be made in high stress areas where discing occurs. Another improved type of borehole gage eliminates drift problem. This gage is so stable that it can be used to measure change in stress with time.

A field technique was developed and tested for locating hidden faults which cause serious ground support and hydrologic problems in certain uranium deposits in Wyoming. Technique depends on surface electrical resistivity measurements that profile moisture anomalies associated with these faults. The method is fast, inexpensive, and does not require specialized training.

Field tests are underway at two underground sites on 8-foot diameter and 3-foot diameter thin wall metal culverts to verify cushioning effect of back packed sand. Theoretical analysis predicts that a 2-foot thick layer of sand around an 8-foot diameter corrugated aluminum culvert can reduce maximum stress by a factor of ten. If proved in these field tests a new support system will be available to operators to keep mine tunnels open under heavy ground conditions.

As a first step toward proving out a new mining method for native copper ores of the Upper Peninsula of Michigan, electronic sorting of coarse ores was shown to be feasible. Pre-sorting underground will reduce hoisting costs and improve grade of ore. Further work will determine if pre-sorting can be enhanced by controlled blasting producing optimum size ore fragments.

A combined thermal-hydraulic rock fragmentation technique was successfully tested in the lab. Results are encouraging in that if rock is first heated and then subjected to a hydraulic jet, fragmentation occurs more readily with less energy required.

Hydraulic pipeline transportation tests to study the effect of particle size on head loss produced some surprising results. At high velocities with six sizes of glass beads, no discernable differences in head loss were found. As velocity increased, all head losses approached that of clear water. Below 7.5 fps, head loss has an inverse relationship to particle size. That is, an increase in particle size results in a decrease in head loss indicating that less energy is dissipated in particle interaction as particle size increases. These results are in contradiction to the widely accepted Durand equation which states that head loss is directly proportional to particle size.

A new and novel technique shows promise for identifying the type and source of explosives from past detonation products. If successfully developed, this technique would be valuable for tracing illegal explosives used in subversive activities, and use of non-permissible explosives in gassy mines. Technique involves mixing phosphor-impregnated ceramic beads into explosive formulations (see Figure 1). These phosphor grains after detonation would be detected by ultraviolet light and collected for post-detonation identification.

Two new high-density water-gel explosives were formulated. They offer an explosive strength of 120% TNT, relatively low sensitivity, and good toxic fume characteristics. These high-strength gels should gain widespread acceptance in both open pit blasting and underground non-coal mines in view of their improved fume characteristics.

An investigation was completed for the U. S. Coast Guard evaluating causes of explosions observed during unconfined liquefied natural gas spills on water. Results indicate that the explosion hazard is real, although the amount of released energy is small. Explosions have been observed only with "weathered" LNG in which the methane content has been reduced significantly. Layering and downwind spread of flammable vapors are significant hazards. A final report on this investigation has been submitted to the Coast Guard.

A definitive test for incendivity of detonators was developed and a number of detonators checked to ascertain the risk of methane-air ignition. A detonator design is not considered acceptable if two detonators fired simultaneously will ignite a methane-air mixture. Certain types of detonators in current use have been identified as especially hazardous because a single detonator will cause ignition.

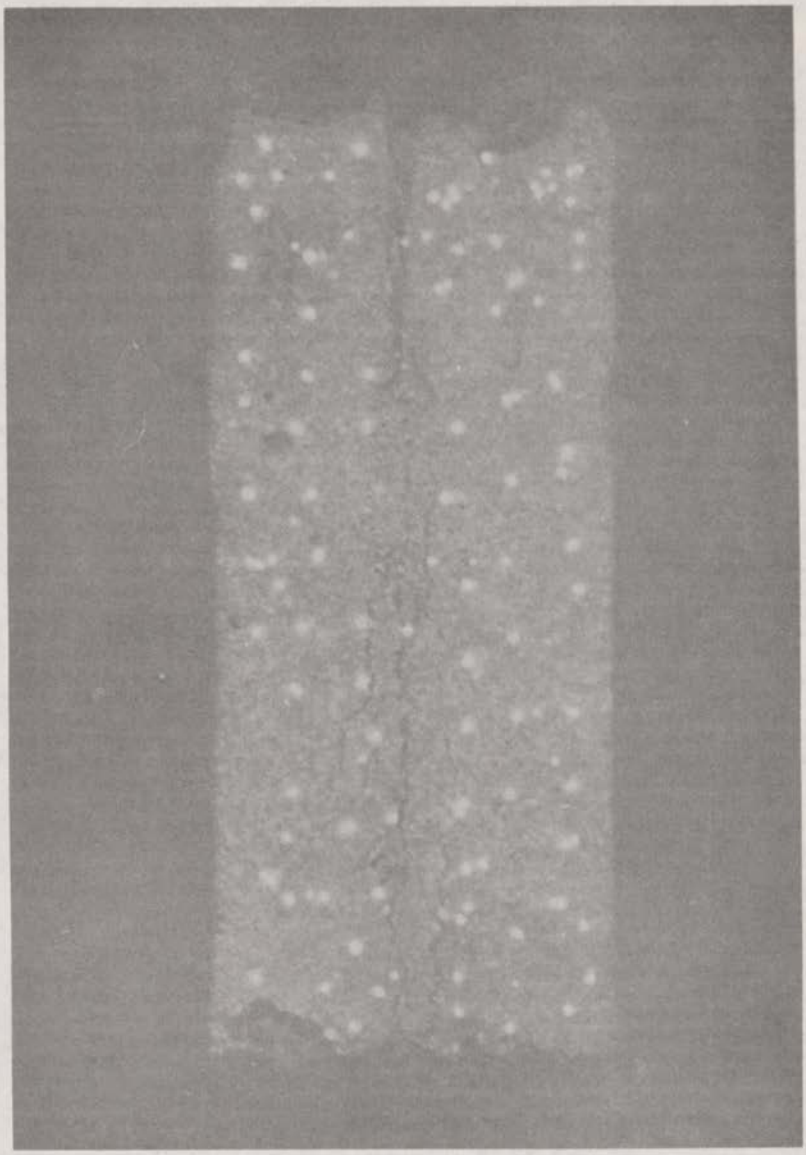


Figure 1 - A sectioned stick of permissible explosives containing phosphorescent tracers used to identify the explosive after detonation. Exposure was made under ultraviolet light.

(d) Data Collection and Analysis: Fiscal year 1973, $9,563,000; fiscal year 1974, $9,263,000; decrease, $300,000. The decrease consists of:

Increase (+) or Decrease (-)				
Amount	Positions	Total Program	Total Positions	Explanation
$-300,000	-12	- -	- -	Support of the Materials Policy Commission under P.L. 91-512

PROGRAM STATEMENT

The objective of the Bureau of Mines data collection and analysis program is the development of a coordinated body of basic minerals intelligence essential for Government and industry planning and decisionmaking as well as meeting the broad requirements of the Mining and Minerals Policy Act of 1970 (P.L. 91-631). The Bureau's data collection is the single federal program directed to canvass industry for such information. The knowledge developed through analyses of these data provides a basis for assessing the domestic and world mineral resource situation and anticipating changes in supply and demand patterns. This knowledge serves as an indispensable planning guide to the Bureau's research organization and represents an important input to the Bureau and Department policy-making procedure. It also serves as a major input for the National Commission on Materials Policy and in the Secretary's report to the Congress on the state of the domestic mining and mineral industries under Public Law 91-631. The basic method of disseminating results of data collection and analysis efforts to the public is through periodic publications. Another method is through Information Circulars, special reports and advisory service intended to keep information continuously available as to trends and problems in all phases of the mineral industry including environmental concerns.

Serious mineral supply-demand problems persist within the United States. They compound because of the rapid growth in worldwide consumption of minerals and the increasing complexity of the world mineral supply situation, including the question of environmental quality. Basic to this situation is the fact that domestic consumption of minerals consistently exceeds domestic production. Thus, the United States faces vigorous competition with other developed countries for the mineral raw materials available in world markets. Furthermore, the competition for these mineral raw materials rapidly intensifies through the national aspirations of underdeveloped nations to process the mineral raw materials that they produce in order to gain maximum economic benefits from those resources. The situation requires an intensive and continuing appraisal of mineral production, trade, usage, reserves and resources.

Continuing analyses in the energy fields consider the resource, qualtiy, and supply-demand relationships of petroleum, natural gas, coal, and nuclear minerals not only from domestic sources, but worldwide. The analyses of changes in energy mix resulting from fuel quality requirements, economic and environmental restrictions, and availability lead to forecasts of supply-demand relationships and substitutability under existing and emergency conditions. These forecasts include analyses of a wide range of technical, economic, and engineering aspects of finding, producing, processing, transporting, and utilizing fossil fuels including the manufacture of synthetic fuels. Shortages of domestic sources of petroleum and natural gas, and delays in nuclear power development, focus attention on coal and the problems associated with its near- and long-term availability.

The growing problems of energy supplies and new environmental restrictions emphasize the need for improved and timely fuel resource information. This

program is the only one in Government or industry designed to provide such energy mineral supply information on a national basis.

The Bureau's efforts in economic analyses direct attention to multicommodity situations for which Government decisionmakers need up-to-date knowledge, namely: 1) the existing situation, 2) trends into the future, and 3) the impact of choosing among alternatives. Typical subjects include overall economic activity as related to the country's minerals industries; the impact of international developments on the domestic minerals industries; labor supply for the mineral industries; and the interactions among mining, costs, prices, environmental controls and tax structure.

PROGRAM OF WORK

Production Surveys - The Bureau of Mines secures production, consumption, and end-use data for some 90 minerals (metals, minerals, and mineral fuels) by a series of voluntary industry surveys. Information on the volume of production, types of consumption and end-use patterns, and stocks available are secured on the use of over 200 statistical survey forms from 75,000 respondents. The statistical surveys are conducted monthly, quarterly, or annually, depending on the need of the data. The total number of reports received and processed per year is some 150,000, the number of line items handled is about 1,400,000, and the number of information items approximates 7 million.

An important part of the surveys is the development and maintenance of mailing lists of respondents. New mineral producers and consumers must be identified through a complex intelligence network involving State and Federal agencies, trade journals and associations, and general news sources. Corporate mergers and acquisitions require constant attention to assure accurate mailing lists.

Collection of data on mineral deposits of major economic or strategic importance augments the current mineral resource inventory system. Both domestic and foreign deposits will be assessed with a view to determine clearly the mineral supplies available to the United States. Peripheral studies, but nevertheless important in developing mineral supply knowledge, include technology of extraction, byproduct-coproduct relationships, environmental restraints, and the availability of secondary mineral materials.

State and Local Cooperation - The Bureau of Mines works closely with State and local agencies primarily through a corps of 38 Liaison Officers who provide coverage in all 50 States and Puerto Rico. These employees, each eminently qualified in the minerals field, foster and facilitate Federal, State and local cooperative efforts in solving supply and environmental quality problems associated with the development and maintenance of a sound mineral resource base for the Nation.

Through close working arrangements with taxing authorities, health and safety organizations, economic boards, and university staffs, the Bureau has access to a large body of knowledge accumulated at the State and local level. Such broad cooperation is aimed at making State mineral information consistent with national data, comparable among States, and in reducing the burden on respondents by avoiding the submission of similar reports to both Federal and State agencies.

Analysis and Evaluation - Trend and correlation analysis of supply and demand for the individual commodities will continue. Productivity forecasts developed from compiled manpower and capital requirements data represent multi-commodity analytical effort. The requirement of P.L. 91-631 to evaluate the economic health of the minerals industry will initially focus on profitability, rate of return, cash flow and related indications of corporate vigor. The ultimate goal is an appraisal of the industrial ability to finance investments necessary to sustain the total level of effort in exploration, development, and production

required to provide a continuous adequate supply of mineral raw materials. Analysis of tax laws applicable to the mineral industries also will continue.

The Bureau's energy data collection and analysis program particularly concerns the factors and information needed to guide national policy in matters related to the supply and demand of fossil fuels. Continued collection of data on energy sources, particularly coal, petroleum and natural gas, augments the current energy data bank information. Priority will be given to determination of mine productive capacity potentials and mining costs of reserves of metallurgical-grade coal, low-sulfur coals, coal potentially available to support conventional synthetic fuels plants and coal potentially available for underground gasification. Analyzing the impact on the environment of mining, processing and utilizing energy minerals continues.

In the minerals program, the Bureau evaluates, interprets, and analyzes the technical and economic status of all mineral and metal commodities, ranging from aluminum to zinc, to provide a continuous flow of relevant knowledge. This is essential to the Federal, State and local governments. In providing essential data, emphasis is given factors affecting the national mineral supply position, requirements, environmental problems (such as air pollution, solid waste disposal, and multiple land use), national defense, international trade, and conservation.

Dissemination of Data - The basic methods of disseminating results of data collecting and analysis efforts to the public are through periodic publications. These include the Minerals Yearbook, Mineral Facts and Problems, Mineral Industry Surveys and the Secretary's report to the Congress on the state of the domestic mining and mineral industries. In addition, Information Circulars, special reports and advisory services to such groups as the National Commission on Materials Policy augment those efforts to keep the government, industry, and the public up-to-date regarding trends and problems in the mineral industry. Response to Congressional inquiries and technical reviews of pending legislation further disseminate available mineral intelligence.

The Bureau also provides mineral information and staff participation in activities of United Nations regional organizations, the Organization for Economic Cooperation and Development, the World Bank, etc. Assistance will be provided as requested to the Department of State in the selection of personnel and functions of mineral and petroleum attaches.

EXAMPLES OF RECENT ACCOMPLISHMENTS

An assessment was made of the economic impact of sulfur oxide emission constraints at nonferrous metal smelters and refineries. A zinc situation paper was prepared because of the recent shutdown of several plants which could not meet environmental requirements. The studies revealed that a prohibitively large capital investment would be required to meet the sulfur oxide standards using current technology. Additional research was recommended.

World supplies of platinum-group metals were assessed to determine their sufficiency to meet the combined normal demand and the large potential demand which will result if these metals were adopted for automobile emission control devices. The study, made at the request of the Envrionmental Protection Agency, disclosed adequate platinum resources, largely from South Africa and USSR.

A mathematical model of the domestic iron and steel producing system was completed. It will enable predicting future needs for raw materials, fuels and electrical energy required in the production of iron and steel under current technology and is a prelude to a more extensive model extending to the recycling of scrap and the processing of ores into high quality furnace feed.

Worldwide sulfur supply-demand relationships were studied, with particular attention given to the impact of environmental controls on sulfur supplies. Industry, interagency, and international consultations confirmed that mineral and energy producing and consuming industries are faced with a serious adverse sulfur oversupply, caused by environment-related sulfur production. Consequently, a joint Bureau-industry research program was established with a primary objective of developing new uses for sulfur to utilize the large supply.

The Bureau continued as the prime Government source of raw data and of analysis for a multitude of energy studies. These included a "Mobilization Base Study for Solid Fuels," a review of energy demand since 1947 accompanied by supply-demand projections through 2000, and "National Coal Policy" report to the Congress. Anticipating continuing requests for data because of the energy crisis the energy data bank has been expanded and a model was developed to appraise the crude oil reserve situation under varying assumptions.

A Decision Option Document was prepared for the proposed prototype oil shale leasing program. The paper included an economic analysis of oil shale production compared with alternative sources of energy. In addition, an economic and social impact statement was prepared for the oil shale industry, applicable to the States of Colorado, Utah, and Wyoming, as a segment of the Interior Department's Oil Shale Environmental Statement.

2. Engineering, Evaluation, and Demonstration: Fiscal Year 1973, $9,896,000; fiscal year 1974, $7,296,000; decrease, $2,600,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$ -800,000	-3	- -	- -	For research at Rock Springs, Wyoming, on filling mine void areas.
-1,000,000	-10	- -	- -	Coal mine waste hazard investigations
-800,000	- -	3,919,000	44	Mined area investigations and demonstrations.
-2,600,000	-13			

PROGRAM STATEMENT

The Bureau's engineering, evaluation, and demonstration programs are designed to help assure: (1) the availability of essential mineral and energy resource needs for the advancing and expanding economic and social requirements of the Nation, and (2) the quality of the environment in mining and mineral areas that out of necessity must effect greater utilization and development of their resources. The Bureau also monitors and assesses the environmental impact of programs and projects of the Federal Government oriented to mining, mineral processing, and related resource areas as provided for under the National Environmental Policy Act of 1969.

Technical and economic information is provided to help resolve environmental and safety problems associated with past mining practices, e.g., mine subsidence, surface-mined land disturbance, underground and outcrop mine fires, waste banks, mine water control, etc. Further, the Bureau administers and carries out certain projects specifically authorized by Congress--P.L. 83-738, Mine Fire Control Act; P.L. 84-162, the Mine Drainage Act; P.L. 87-181, an amendment to P.L. 84-162, to provide for public health and safety mine sealing projects; and P.L. 89-4, as amended, the Appalachian Regional Development Act, Section 205, Mining Area Restoration.

To maintain its position in the worldwide competition for minerals the United States should: optimize its use of domestic resources by orderly development of mineral and fuel reserves with due consideration for environmental quality; identify and locate new supply sources and consider the implications of development and utilization of these sources; direct its energies toward eliminating the adverse environmental effects associated with the mining; direct its attention, through legislation or other appropriate action, to the resolution of current problems associated with past mining and mineral processing methods and technology; and if any, environmental degradation.

PROGRAM OF WORK

Engineering and Environmental Investigations: $1,991,000

Field investigations are undertaken to fully develop a clear, complete and reliable set of information for use in averting or resolving mineral and energy problems. Current emphasis is upon mineral related environmental issues--responding to growing public awareness of environmental damage which has stimulated governmental actions such as those to find low-sulfur fuel supplies and to cope with subsidence problems.

Because of the critical domestic energy supply situation, emphasis is placed on the availability and costs of producing petroleum in different geographical areas, evaluations of domestic petroleum production capacity, and the availability of petroleum supplies from offshore areas. In field investigations on coal, emphasis is given to the impact of environmental controls on supply and demand. Included are studies on the availability of low-sulfur coals to meet air pollution requirements and availability of strippable coal including information essential to the determination of land reclamation policies.

Mine maps will continue to be gathered and developed into a repository which includes data on past and current mine operations. Maps will be microfilmed and the systematic indexing-data-retrieval system will be continuously expanded to assure maximum utility of the repository. Emphasis on areas of adverse environmental impact (present or anticipated) will continue and such information will include, but not limited to, mine surface and underground mine waste disposal areas, assay plans, geology, and other data pertinent to the efficacy of the information-data system.

Microfilming of mines and mineral processing reports for the continued assessment of the technology of mineral extraction, by product--co-product relationships, environmental considerations, alternate materials, etc., will continue.

Concern over the effects of mining on the environment highlights the need for reliable and essential information on land use before, during, and after mining. Studies to determine the effects on and the needs for surface and underground mined lands will continue so that a firm basis may be available for establishing adequate restoration and protection guidelines, principles, and programs.

Programs will continue on clay testing; investigations on the effect of mining to surface streams; subsidence potentials of mine areas; and investigations on simultaneous surface mining/reclamation methods. The development of guidelines and criteria for mining and environmental quality will be looked into with consideration given to the unique physical conditions extant in different mining areas, with different mined commodities, etc.

The work on solid waste appraisal will continue with emphasis on the production of reports on methods to dispose of coal refuse and fly-ash, surface mine reclamation methods, costs in Eastern Montana coal mines, and the resource potential of selected inactive mines in California, Idaho, and Nevada. Examination, sampling, and appraisal of wastes at current and past domestic mine sites and powerplants will continue with a view to determining optimum methods and costs for safe disposal or utilization of the wastes and to establish an inventory of the qualitative and quantitive characteristics of the waste.

Geophysical work, drilling, and analysis to determine the quality and quantity of North Slope Alaska coal resources will continue. Gulf of Alaska oil seeps will be identified. Flows from major seeps will be monitored to determine characteristics of the oil and the environmental impact of the seeps will be determined. Mineral surveys of certain Alaska Native Land Claims will be made in cooperation with Interior and other Federal Agencies and the State of Alaska to aid in the selection and disposition of land.

The Bureau will continue to carry out its responsibilities under the National Environmental Policy Act of 1969 in applying its special expertise to the review of environmental impact statements on the air quality implications of energy development, mining and mineral land decisions, solid waste and recycling enterprises, and public works activities that involve potential mineral land or general mineral resource conflicts.

Mined Land Investigations and Demonstrations: $3,919,000 (decrease, $2,600,000)

Research and demonstration studies and on site field work projects directed to the development of systems and techniques for resolving mine area problems resulting from past mining activities and the prevention of similar problems in current and future mining activities will continue. Specifically, efforts will be directed toward mine subsidence prevention and control through expansion of the current single borehole injection system to use courser sized flushing materials and by modification toward utilization of burned coal mine refuse.

Methods will be expanded for stabilizing coal mine waste banks through vegetative growth and the utilization of another mineral waste product (fly ash). New techniques for the extinguishment of burning coal mine refuse dumps which pollute the air will also be looked into. Also, ways of utilizing or removing nonburning banks--which are aesthetically displeasing, a source of acid water generation, and have potential for becoming air pollution sources if they become ignited--will be investigated.

Investigations and studies for sealing strip mine pits to prevent the generation of acidic mine waters and projects to further demonstrate the feasibility of converting publicly owned strip mined areas to usefulness as local and/or community park lands (such as the present Keyser Valley Museum project in Lackawanna County, Pennsylvania) will be continued.

Investigation of techniques and methods for preventing the occurrence of underground and outcrop mine fires, such as the development or use of materials that can permanently seal strip mine outcrops so that accidental or natural causes (fires and lightning) will be prevented for igniting the exposed coal will be investigated and monitoring of mined areas by infra-red and other air-borne thermal scanning for mine fires and burning mine waste banks will continue.

The monitoring of water levels and conditions in abandoned mine workings to identify harmful water build-ups and discharges will continue. Under the Anthracite Mine Water Control Act, additional phases of a project for setting up a series of modern water monitoring/recording stations for the anthracite region will be expanded jointly by the Bureau and the Commonwealth of Pennsylvania.

Publications dealing with all aspects of the Engineering, Evaluation, and Demonstration Activity will continue including special interest areas that will identify, evaluate for potential danger, and publicize hazards to the general public such as surface hazards in abandoned mined areas, open mine shafts, excavations, abandoned mine structures, etc.

Control of Fires in Coal Deposits: $226,000

A continuing responsibility of the Bureau under the Mine Fire Control Act of 1954, P.L. 83-738, is the administration and conduct of projects directed to the extinguishment of underground and outcrop coal mine fires on public lands, Indian lands, and on private property. In the latter case, projects are jointly financed on a 50/50 basis with a local cooperating political entity or private property owner. On public and Indian-owned lands, where the greater number of fires occur, control costs are defrayed 100% by the Bureau.

Work plans for fiscal year 1974 anticipate the control of fires on Federal lands in Colorado (1), Montana (2), Utah (1), and Wyoming (1). One project for the control of a fire on State-owned land in Alaska is also anticipated.

Wilderness Mineral Surveys: $925,000

Pursuant to the Wilderness Act of 1964, the Bureau of Mines with the Geological Survey is responsible for making mineral surveys in 54 wilderness areas taken

directly into the National Wilderness Preservation System, 34 primitive areas being reviewed for suitability, and other Forest Service lands being considered for inclusion. Emphasis to date has been to complete the mineral surveys in the primitive areas in time for the Forest Service to hold to the 10-year review deadline as provided in the Act. Mineral surveys in the wilderness areas began in fiscal year 1970 and will continue on schedule in fiscal year 1973. Work in other study areas will be scheduled so as not to conflict with wilderness and primitive schedules.

Work will continue in the Jarbidge, Nevada, Cabinet Mountains, Montana, South Warner, California, and Teton, Wyoming, wilderness areas, and in the Indian Peaks, Uncomphagre, and Mt. Zirkel contiguous, Colorado, Cloud Peak contiguous, Wyoming, and Thundering Fiords, Alaska, study areas. New areas will not be known until priorities have been established by the Forest Service.

River Basin Studies: $235,000

Under the Missouri River Basin Program the Bureau will continue both basin-wide and specific mineral resource studies as they relate to water requirements, State and local water statutes, and conflicting land use. Examinations of reservoir sites proposed by the Bureau of Reclamation, Corps of Engineers and Soil Conservation Service will be continued to determine local effect of structures on mineral potential and area effect of water storage on mineral-producing industries.

Work units programmed for fiscal year 1974 are: (a) Mineral development and water requirement studies in basins and sub-basins--Platte River Basin, Nebraska, Devils and Red Lake River Sub-basins, North Dakota and Minnesota; Cannonball and Grand River basins, North and South Dakota, and the Glendo and Great Divide areas, Wyoming; (b) Studies of petroleum and natural gas--water requirements for secondary recovery of petroleum by water flooding in North Dakota; (c) Studies of coal and lignite--alternative modes and costs for transporting low-sulfur Upper Missouri Basin coal eastward with related studies of commitments of Basin coal reserves to thermal power, synthetic liquid, and gaseous fuels; (d) Effects of State laws on water supply available for mineral industry; and (e) Studies on encroachment of competing land uses on future mineral development.

Mineral examinations will continue to be made of proposed reservoir sites to determine if such projects would have an adverse effect on mineral resources. Requests are expected for 45-50 onsite examinations during the year.

Program Support Activities Funded by
Transfer from Appalachian Regional Commission

Pursuant to Section 205, P.L. 89-4, as amended, the Bureau will continue to engineer, manage, and administer mining area restoration projects approved by the Appalachian Commission. Specifically, the Commission will supply funding to the Bureau for contracts and grants to the States in the Region, and related costs for the conduct of public works type projects for the control of underground mine fires, the prevention of mine subsidence, the reclamation of publicly-owned surface mined lands, the removal of non-burning and the extinguishment of burning coal-mine waste banks, the sealing of abandoned oil and gas wells, and such other programs and projects that the Commission may deem appropriate under the auspices of Section 205.

EXAMPLES OF RECENT ACCOMPLISHMENTS

Two significant experiments were initiated with the recently developed "single-borehole" technique of backfilling mine voids where men connot penetrate to guide or control filling operations, in order to prevent subsidence. At Scranton, Pennsylvania, some 300,000 cubic yards of mine refuse material from

an unsightly bank on the surface was crushed and injected underground by the new method to provide protective support beneath 20 acres of a heavily built-up area bearing an estimated $2 million in real estate. Testing here established that finely crushed coal refuse can be effectively used as a filling agent in the new process, thus offering an additional means of disposing of accumulated coal wastes in mining regions. In Rock Springs, Wyoming, preliminary steps, including the placing of benchmarks to measure surface subsidence and the drilling of exploratory boreholes, were completed on a much larger and longer range project to not only provide surface support in the city but also examine closely the applicability of the single-borehole technology under a wide range of conditions.

The Bureau of Mines, in cooperation with Lackawanna County, Pennsylvania, initiated a demonstration strip mined area reclamation project to prepare a 126-acre tract of deep and strip mined land for use as a public recreation area and museum depicting the history and importance of anthracite mining. Completed contract work included backfilling of strip pits with refuse from adjoining spoil banks, establishment of stable contours, construction of base grades for access roads, installation of compacted red ash fills for parking areas, and channelization of drainage crossing the property. A comprehensive land-use development plan was formulated with the assistance of the National Park Service and a detailed vegetation scheme developed under the supervision of personnel of the U. S. Forest Service.

Other Bureau efforts in the area of reclaiming surface mined lands for recreational purposes included cooperation with the Bureau of Outdoor Recreation in establishing a pilot program for restoring several abandoned surface-mined sites and with the National Park Service in planning and evaluating a sizeable tract of mined land on the Appalachian Plateau for inclusion in the National Park System. In the pilot program, 52 surface mined sites in 29 States were evaluated to determine their availability and work begun on one of the 14 sites selected. A 400,000-acre tract of land was delineated with the Park Service on the Cumberland Plateau in eastern Tennessee and Kentucky for future parkland.

The third in a series of demonstration projects aimed at developing technology to combat burning coal refuse banks was concluded with the excavation, movement and disposal of the last 85,000 cubic yards of material from the former National Mine refuse bank in Scranton. This work represented the final phase of a project which completely extinguished and removed this 390,000-cubic-yard bank which had been contributing to local air pollution for over two decades.

The fourth phase of a long-range project to establish a comprehensive system of sophisticated underground mine water pool monitoring stations in the anthracite mining region was initiated. Boreholes were drilled throughout the Western Middle Field in which monitoring devices are to be placed which can provide better data with which to assess water quality and anticipate surface floods, subsidence and inundation of coal reserves.

Compendia of data obtained mostly from airborne infrared sensing were issued covering fires in refuse banks, abandoned underground mines and coal outcrops in the anthracite coal mining region. Similar aerial sensing was performed over sites of flood refuse disposal from Tropical Storm Agnes to detect possible combustion.

Pursuant to Section 205 of Public Law 89-4, as amended, and in cooperation with the Appalachian Regional Commission, the Bureau of Mines continued to engineer, manage and administer a number of work action programs aimed at the resolution of environmental problems associated with the mining of anthracite and other minerals. Since the implementation of this Act in 1965, the Bureau of Mines has completed 30 mine fire control projects, 7 subsidence control projects, 7 surface mine reclamation projects, and 3 oil well sealing projects.

Five fires were brought under control in Alaska (1), Colorado (3), and New Mexico (1). In addition to protecting the environment, these projects resulted in preserving an estimated 36 million tons of coal.

An intensive investigation was conducted by a special task force on nearly 140 coal waste embankments identified through an extensive inventory effort and preliminary evaluation as representing potential severe hazards. Specific recommendations for corrective measures developed by the task force were implemented on a number of sites evaluated as possible imminent hazards. Detailed evaluation and recommendations were also being developed for all the sites investigated. Intensive engineering investigations were also completed, as part of a contract study, on the Saunders, West Virginia, coal waste dam that failed in February 1972 and on several other similar embankments in the general area of Logan, West Virginia. Results of this analysis should provide some valuable information for the development of construction criteria for the long-term control of coal waste embankments.

A report on the economic impact of the bulk movement of minerals and current and future development in the mineral industry that may affect the economy of the Upper Great Lakes Region was prepared for the Corps of Engineers. The information assembled on the role of water borne transportation in mineral processing and related manufacturing in the Upper Great Lakes Region will enable the Corps to make a comprehensive Regional study to guide its planning.

Mine maps continued to be collected, researched, microfilmed, and made part of a computerized file system. Maps of eastern bituminous coal mines permanently closed or abandoned, submitted to the Health and Safety district offices in compliance with Section 312(c) of Public Law 91-173, were processed on a continuous basis and made a part of the mine map repository. The importance of this service is emphasized by the large number of inquiries by telephone and personal visits. The maps have been used most frequently by home owners, prospective real estate buyers, real estate developers, building contractors, and planning organizations.

A study was made to estimate undiscovered oil and condensate reserves in the Gulf of Mexico, the availability of offshore rigs to explore for and develop these reserves, and the ability of the industry to fabricate offshore production platforms and equipment. The purpose of the study was to estimate the availability of crude oil and condensate from the Gulf of Mexico for 1972 through 1985.

A study is nearing completion identifying areas throughout the United States with known coal reserves of sufficient tonnage to support coal gasification or liquefaction plants. This will provide a basis for detailed feasibility and engineering studies by industry, and be a step forward in the conservation of critical reserves of petroleum and natural gas and efforts to help reduce levels of air pollution.

The Bureau of Mines provided information and an evaluation of metallic minerals, coal, petroleum and natural gas on lands withdrawn under Sections 17-D1 and 17-D2 of the Alaska Native Claims Settlement Act. The two reports presented a detailed summary of present knowledge and recommendations regarding boundaries and ultimate managements of those lands. Information on mineral and energy deposits was also provided to the Native Regional Corporations and Native Villages. The large extent of mineralization in Alaska is disclosed in the reports. This large mineral potential increases the difficulty of land use decisions and will require a more intensive study of the mineral resources.

3. Mine Health and Safety

(a) Coal Mine Inspections: Fiscal year 1973, $31,734,000; fiscal year 1974, $31,734,000; no change.

PROGRAM OF WORK

The major objective of the coal mine inspection program is to provide the coal miner with a safe and healthful environment in which to work.

The Federal Coal Mine Health and Safety Act of 1969 expanded greatly the scope of previous Federal laws and regulations, and established many new mandatory standards. Its requirements cover the inspections of both safety and health hazards with authority to require the mine operator to take necessary corrective action to meet prescribed standards while at the same time providing assistance to the operator in devising ways to correct existing hazards. Such inspections include roof control, ventilation, electrical equipment, transportation, rock dusting, mechanical hazards, respirable dust, noise levels, toxic materials, explosion hazards, mine atmospheres, and similar items all designed to protect the health and safety of miners.

The Act requires four complete safety and four complete health inspections of each underground coal mine each year, and one spot inspection of hazardous mines every five working days. Although the Act does not specify the number of inspections for surface coal mines, the Bureau of Mines requires at least two complete safety and one complete health inspection each year and as many spot inspections as may be required to gain compliance with the Act.

In addition, thousands of special inspections are made in the mines to determine whether violations of the Act, as reported in notices issued, have been abated in the time set by the inspector, whether conditions or practices that caused the issuance of Withdrawal Orders have been abated to the extent that the orders can be revised or terminated, and whether Withdrawal Orders are being complied with.

Coal Mine Inspections

	Calendar Year 1972 (Forecast)	Calendar Year 1973 (Forecast)
Underground Mines		
Complete Safety Inspections	6,000	8,000
Complete Health Inspections	3,000	8,000
Spot Safety Inspections	10,000	10,000
Spot Health Inspections	3,000	4,000
Spot Safety Inspections of Hazardous Mines	15,000	15,000
Other Inspections and Surveys[1/]	9,000	10,000
Subtotal	46,000	55,000
Surface Mines		
Complete Safety Inspections	3,500	5,000
Complete Health Inspections	400	2,500
Spot Safety Inspections	3,700	2,500
Spot Health Inspections	100	2,500
Spot Safety Inspections of Hazardous Mines	600	1,000

	Calendar Year 1972 (Forecast)	1973 (Forecast)
Surface Mines (cont.)		
Other Inspections and Surveys 1/	1,200	1,500
Subtotal	9,500	15,000
Investigations (Fatality, accident, violation follow-ups, etc.)	21,500	20,000
Total	77,000	90,000

1/ Includes all complete and spot electrical, roof control, haulage, preparation plans, and river dock inspections.

As an adjunct to the inspections, special programs have been devised to further the safety effort. For example, in 1971 the Bureau inaugurated a program entitled "Winter Alert" where every available enforcement officer including the Washington staff spends as much time as possible in the mines to search for conditions which might cause a disaster. Specialists in roof control and haulage made complete surveys of mines where roof falls and haulage accidents are occurring in an effort to correct bad practices or systems and thereby reduce the number of fatal and serious accidents from these two most prevalent sources.

In addition to the enforcement of the Act and these special accident-prevention programs previously mentioned, each district is being staffed with specialists and engineers to give advice and assistance to mine operators in every phase of mining in order to improve health and safety in their operations.

Inspection manuals on both health and safety for underground and surface mines are being updated frequently and copies are furnished to operators and mine workers organizations to apprise them of the application of the Act and thereby hopefully gain more safety through a thorough understanding of what is specifically required by the Act and other measures necessary for a safe and healthful mine.

The Bureau will continue to provide personnel and other assistance to the Interim Compliance Panel to enable it to carry out the functions under the Act. Essentially, the functions of the panel are to work toward the orderly implementation of the Act through authorization of temporary deviation from its mandatory provisions until required technology and equipment are available to correct the substandard conditions in a particular mine.

The Act also provides for assessing civil penalties for violations of the mandatory health and safety standards and other provisions. In carrying out these functions, violation citations are reviewed to insure that a violation did occur, ascertain the circumstances surrounding the violation, determine the degree of liability, establish the amount of penalty that is warranted, and review cases for formal adjudication.

The estimate includes $1,000,000 for the purpose of assisting States in financing the cost of improvements in their mining safety programs as provided in the Act. Specific objectives of the grants are to develop and enforce more effective coal mine health and safety laws and programs related to coal mine employment, and to promote Federal-State coordination and cooperation in improving health and safety conditions in coal mines. Section 503 of the Act directs the Secretary of the Interior to approve applications by the States for Federal grants if they meet certain criteria specified in the Act.

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EXAMPLES OF RECENT ACCOMPLISHMENTS

Fatalities in coal mines have been reduced from 260 in 1970 to 181 in 1971, with a corresponding drop in the fatal injury frequency rate per million man-hours from 1.00 in 1970 to 0.72 in 1971. The fatal injury frequency rate through October 1972 is down to 0.58.

The respirable dust levels in underground mines have been cut in half since implementation of the health provisions of the Federal Coal Mine Health and Safety Act of 1969. Ninety five percent of the coal mine sections were in compliance with the previously required 3.0 milligram or less level of respirable dust concentrations, and 83 percent of the sections are now at or below the 2.0 milligram standard which became effective on January 1, 1973.

From the standpoint of work statistics, 9,100 inspections were made in 1970, 26,000 in 1971, and about 46,000 will be made in 1972. In 1970, 38,000 Notices of Violation were issued; in 1971, 64,000; and according to present trends, 70,000 will be issued in 1972.

The following are some of the significant programs which have been initiated to improve coal mine health and safety:

The campaign on roof fall fatalities launched in July 1971 has been fruitful in that fatalities from this cause have been reduced from 22 in January through October of 1971 to 12 for the same period of 1972. The campaign is being continued with great expectations for further reductions in fatalities from this source.

A similar effort is being made to reduce haulage fatalities and although no substantial reduction has yet been achieved, the program will be accelerated since haulage has been approaching the No. 1 position long held by roof fall fatalities.

A Violation Severity Rating to show the status of mines as a result of the number of violations found by inspectors and weighed according to severity divided by the number of inspection hours has been inaugurated as a management tool to more effectively deploy inspection personnel. The rating of mines is made available to operators and inspections at mines on the top of the list are increased accordingly.

A program designated as Accident Reduction Thrust followed the Winter Alert in order to continue the presence of inspectors in the mines during all available times, the theory being that the presence of an inspector is a deterrent to poor work habits and delay of hazard correction.

Regulations concerning the approval and testing as well as the use of diesel engines have been prepared and are now being studied by all concerned parties before publication in the Federal Register. When published, these standards will permit diesel-powered machinery to be used underground as a replacement for electric equipment.

Regulations for the installation of cabs and canopies on underground equipment were published in the Federal Register to become effective on January 1, 1973. It is believed that these devices may prevent many fatalities and serious injuries from roof falls.

Cooperative tests by the Bureau and coal companies on mine illumination have been started to determine an effective system of lighting for working areas of a mine. As soon as a feasible system is found, regulations requiring its use will be promulgated.

Health standards, affecting over 2,000 surface mine sites and approximately 50,000 surface employees, went into effect June 30, 1972. The main thrust of the mandatory health standards for surface work areas of coal mines is to regulate workers' exposures to respirable coal mine dust, noise, and airborne contaminants.

While the dilution factors inherent in open-air work control most exposures to respirable coal mine dust at surface coal mines, the 2.0 milligram of standard may be violated while working with bulldozing, drilling, and augering equipment. In addition, a dust exposure problem may occur in preparation plants or other structures where the natural movement of air is restricted. These factors have led to a conclusion that a "high risk" concept is applicable for surface operations. Therefore, steps are being taken to prepare a surface program similar to the underground program.

The noise levels generated by the heavy equipment in use at surface coal mines often lead to exposures greater than that allowed by the standard. Following the issuance of a Notice of Violation, a hearing protection plan must be submitted by the operator. As an interim measure, until the noise sources can be controlled, it has been decided to allow the use of acceptable hearing protective devices in those situations where no safety hazard will be created by the use of ear plugs or muffs. If an inspection determines that ear protection is not being used as required, a Notice of Violation will be issued for the operator's failure to abide by his hearing protection plan.

Studies are being performed to determine the extent of exposure to airborne contaminants other than respirable coal mine dust. It has been determined that shop welders are exposed to iron oxide fumes rather than to respirable coal mine dust. Therefore, the standard of exposure has been adjusted for this category of employees.

(b) Metal and Nonmetal Mine Inspections: Fiscal year 1973, $6,074,000; Fiscal year 1974, $7,574,000; Increase, $1,500,000. The increase consists of:

Increase (+) or Decrease (-)

Amount	Positions	Total Program	Total Positions	Explanation
$1,500,000	83	7,574,000	371	To increase metal and nonmetal mine inspection frequency.

COST FACTORS INVOLVED IN INCREASE

The increase will provide for 75 mine inspectors at a cost of $1,030,000; 8 support personnal at $58,000; personnel benefits, $90,000; travel, $80,000; supplies, equipment, and other expenses, $242,000.

NEED FOR INCREASE

As a result of the disaster at the Sunshine Silver Mine in Kellogg, Idaho, the Secretary of the Interior recognized the need and expressed a desire to increase the health and safety inspection frequency of underground metal and nonmetal mines from one to four times per calendar year. As the initial step toward this goal, an additional $1,500,000 is requested to permit the Bureau of Mines to broaden the coverage and increase the number of inspections from one to two and a half times per calendar year in underground mines. Inspection work in other mines would remain unchanged.

Currently, there are some 1,200 underground metal and nonmetal mines in the United States. To require their inspection two and a half times a year will increase the total number of regular inspections by 1,800. The total number of spot inspections needed to follow-up on the abatement of violations will also increase by about 1,800.

PROGRAM OF WORK

The Federal Metal and Nonmetallic Mine Safety Act, P.L. 89-577, empowers the Department of the Interior, Bureau of Mines, to promote safe and healthful working conditions throughout all noncoal mines within the United States and its territories. To accomplish the objective of the Act, the Bureau has responsibility for the development and implementation of an effective inspection program for all noncoal mines to obtain compliance with promulgated health and safety standards.

The inspection program covers more than 14,500 noncoal mines and mills across the Nation, and consists of observations and measurements of conditions and practices to determine compliance with mandatory health and safety standards. If violations are found notices of noncompliance or withdrawal orders are issued. Follow-up spot checks are made to determine if violations have been corrected.

An expansion of the inspection program is under development. Particular concern is directed to identifying conditions which might result in a large loss of life. This program is being developed to provide an engineering evaluation of the total mining system to determine the potential for any combination of violations and adverse circumstances that when taken together could result in a catastrophe.

The Bureau is also concerned with the development and promulgation of more comprehensive and effective health and safety standards. To aid in this program,

technical personnel are developing guidelines and procedures for carrying out the inspection programs, and recommending to the Secretary of the Interior new or amended standards for promulgation.

The Act provides that the Bureau may enter into agreements with the various State mine inspection agencies whereby the State agency maintains the primary responsibility for the enforcement of promulgated health and safety standards. Once a State has met certain requirements and has agreed to certain conditions, a State Plan Agreement is signed between the Department of the Interior and the State. Once this Agreement has been consummated, the role of the Bureau is one of monitoring the effectiveness of the State Agency's enforcement program. This is carried out through a joint Federal-State inspection program and a State reporting system. The State agency must report to the Bureau on each State inspection indicating violations which are cited and conditions which have been corrected. State Plan Agreements are presently in effect with Arizona, California, Colorado, New Mexico, and New York.

Bureau of Mines inspectors began making inspections of explosives storage facilities at mines and mills on behalf of the Bureau of Alcohol, Tobacco and Firearms, Internal Revenue Service, under Part 181 of Title 26, Code of Federal Regulations. The knowledge and experience of Bureau of Mines inspectors enabled them to quickly and effectively enforce the Treasury regulations as to security and safety of such explosives storage facilities. As no additional funds have been provided, this increased workload has resulted in a slight decrease in the efficient utilization of our inspectorate work force towards its primary goals; however, it has resulted in an overall saving to the Government.

Lastly, the Bureau conducts investigations of all mine related fatal accidents. The purpose of these investigations is to determine the cause and conditions of such accidents and to develop standards which in the future will prevent their occurrence. During the current fiscal year an injury reporting system was developed and implemented whereby all mine related injuries will be reported to the Bureau. A methodology for the analyses of such information is being developed.

EXAMPLES OF RECENT ACCOMPLISHMENTS

Enforcement of mandatory health and safety standards was substantially enhanced in the past fiscal year by an increase in the number of qualified inspectors plus the intensive training given to the staff. The number of qualified inspectors increased from 96 at the start of the fiscal year to 140 at the end of the year, not including seven inspectors still in training.

Ten new mine rescue stations completely equipped to respond to mine emergencies were established in FY 72. These added facilities now make it possible to respond quickly to disaster situations with men and equipment throughout the Bureau's 6 metal and nonmetal health and safety districts.

The metal and nonmetal mine health program was also expanded and strengthened in FY 72. A Chief of the Health Division was appointed. Industrial hygiene facilities were installed and placed into operation in 10 subdistricts. These facilities consist of a darkroom containing a micro-projector for counting the number of respirable particles in a sample. Midget dust impingers and laboratory equipment for cleaning, preparing, and calibrating field sampling equipment are part of the industrial hygiene facilities. Similar facilities are being installed in four additional subdistricts.

As part of the Health program, 24 inspection personnel were trained in dust sampling and counting, 21 in radiation monitoring, and 34 in noise hazard analysis.

Findings stemming from the Bureau's investigations of fatal accidents were promptly released to the industry in the form of "Fatalgrams," so that mine operators and others could take necessary measures to prevent recurrence of like tragedies. Industry response during the year to this form of communication was complimentary.

In order to promote sound and effective coordination in Federal and State activities relating to health and safety in metal and nonmetal mines throughout the Nation, the Metal and Nonmetallic Mine Safety Act provides for State Plan Agreements. It is the policy of the Department to encourage such coordination and to share with the States the responsibility for promoting health and safety in the metal and nonmetal mines.

Five State Plan Agreements have been approved and signed to date with three others in the final stages of preparation. An additional eleven States are well along in achieving full compliance with the requirements of Section 16 of the Act but are not in a position to consummate an agreement without funding by the Government. Preliminary correspondence has been exchanged with an additional nine States, each of which has expressed a desire for a State Plan Agreement but require financial assistance in order to modify their laws, rules or regulations and to restructure and equip an acceptable agency.

Development of a suitable procedure to be followed for the purpose of evaluating the manner in which a State Plan is being carried out is required by the Act and is well along toward completion. Many criteria will be used, including such items as a complete statistical analysis of the trends and cause of accidents to be made at regular intervals, and a periodic summation of notices and orders issued and abatements thereof.

A management Control System has been devised and initiated. This system which keeps track of all inspections, violations of standards, etc., is designed to provide all levels of management in the metal and nonmetal health and safety activity with operational information to enable district managers to schedule inspections efficiently and to help headquarters officials as well as field staff with planning, manpower utilization, and evaluation of the efficiency and effectiveness of various programs and projects. Additional inputs and advances in programming of the informational material for the Management Control System into the Bureau computers were made during the year.

As a supplement to the System, a plan was developed and put into effect in January 1972 for microfilming reports of inspections and investigations including those reports made by States under State Plans. The concept here was to provide rapid retrieval of the data once the program is fully implemented.

(c) Education and Training: Fiscal year 1973, $18,121,000; fiscal year 1974, $5,321,000; decrease $-12,800,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+200,000	11	$5,321,000	157	To provide instructors to teach health and safety in underground metal and nonmetal mines.
-13,000,000	- -	- -	- -	A nonrecurring item for construction of a Federal Mine Health and Safety Academy.
$-12,800,000	+11			

COST FACTORS INVOLVED IN INCREASE

This increase will provide for 11 additional training instructors at a cost of $147,000; personnel benefits $12,000; travel, $12,000; and supplies, equipment, and other expenses, $29,000.

NEED FOR INCREASE

The increase of $200,000 will provide for additional instructors to teach health and safety in underground metal and nonmetal mines and is coincident with the increases being proposed relative to metal and nonmetal mines inspection and technical support programs.

Currently, training is being done by a small field staff of instructors who attempt to meet the training needs of coal miners and metal and nonmetal miners. There is an immediate need for additional instructors who would be trained to teach health and safety courses such as Mine Rescue, Mine Fires and Explosions, and other courses designed particularly for underground metal and nonmetal miners. Special attention will be devoted to training in Mine Emergency Procedures and expanded instruction concerning the use of mine rescue equipment.

PROGRAM OF WORK

The Bureau of Mines education and training activities cover a broad spectrum of services designed to: (1) Assist the mining industry to meet Federal and State regulatory health and safety requirements for training of certified and qualified workers; (2) enhance in-house Bureau capabilities, particularly for training new Federal Mine Inspectors, upgrade the present inspection force, provide training in special safety programs for industry such as haulage safety, and (3) provide assistance to the mining industry on programs of education and training, where health and safety is the theme.

Historically, the mining industry, as a whole, has lagged behind other industries in the recognition and establishment of structured programs as a means of accident prevention. Promulgation of the Federal Coal Mine Health and Safety Act of 1969, however, has brought about a change in the attitude of the mining industry towards training. The need for health and safety training is now recognized and the Bureau of Mines is assisting the industry to provide the needed training.

In order to respond to the need and to the multitude of requests from industry for training assistance, the Bureau has found it necessary to expand its

education and training efforts. Nine training centers have been established throughout the country and staffed with instructors who can provide needed training when and where the industry requests it. The programs offered through the centers are primarily instruction in such areas as: mine rescue, first aid, accident prevention, roof and rib control, haulage safety, and many others. Although relatively new, the training centers are having a tremendous impact and are constantly adding to their training capabilities.

In addition, the Bureau plans, develops, and disseminates health and safety training courses, course materials and training aids. These courses are designed to help qualified instructors both within the mining industry and at the Bureau's Training Centers to organize and present classroom training in the array of health and safety subjects such as: mine ventilation, oxygen deficiency and methane detection, fighting mine fires, and safety management. To enrich and enhance course instruction and to meet specific requirements, motion picture films, television productions, and other audio-visual aids are developed by specialists within the Bureau.

A significant program for education and training in the Bureau of Mines has been the establishment of the Federal Mine Health and Safety Academy at Beckley, West Virginia. Here, new Federal Mine Inspectors are prepared during an intensive 18-month course of study for their eventual role as mine inspectors and specialists.

The Academy also provides refresher courses of up to six months duration to update the skills and knowledge of more experienced mine inspectors. In addition to Bureau personnel, the Academy when completed will be able to accommodate a sizable number of mining industry workers.

As the need for training intensifies, the Bureau seeks to coordinate and cooperate with State and Federal agencies and private organizations to accomplish the desired objective. Experimental programs for the upgrading of mine employees, or for the pre-employment training of prospective miners where health and safety is tied closely to skills development, are being done through a Federal Interagency Funding Agreement with the Department of Labor, and the Department of Health, Education and Welfare. The construction and use of simulated mines for training purposes, the investigation of the cultural and behavioral factors involved in mine health and safety education and training, and closer ties with State organizations are characteristic of the new and total effort of the Bureau to eliminate mine accidents and health hazards.

Education and training is carried out as an integrated program serving both the coal and the metal and nonmetal mining industries. It is estimated that the program costs are divided as follows: Coal $3,891,000; and metal and nonmetal, $1,430,000.

EXAMPLES OF RECENT ACCOMPLISHMENTS

To help meet the requirements for health and safety training of miners, as specified by the Federal Metal and Nonmetallic Mine Safety Act of 1966 and the Federal Coal Mine Health and Safety Act of 1969, personnel of the nine Bureau training centers presented courses in such key subjects as first aid, accident prevention, roof control, and mine rescue to over 60,000 coal miners and to almost 10,000 non-coal miners. In addition, Bureau trained and certified industry instructors presented courses to over 70,000 coal miners and 12,000 non-coal miners. The training centers are staffed with 80 full-time instructors who can offer over 90 courses. To support this training program some 40 new courses were developed and the appropriate text books, manuals and audio visual aids produced. Several motion picture films were completed on a variety of safety topics, including two films on the special problems encountered in low-coal mining.

The Federal Mine Health and Safety Academy in Beckley, West Virginia was opened in 1971 to reduce the Bureau's dependency on outside sources, such as mining companies and mining schools, for men trained as professional mine health and safety experts. Most graduates will become Federal mine inspectors. The first class of inspector trainees numbered fifty two. Of these, 26 were graduated in August 1972, while the remaining trainees are scheduled to graduate early in 1973. The Academy to date has also provided upgrade training to 775 coal mine inspectors and 56 industry personnel.

Working drawings and specification for permanent quarters for the Academy are being prepared with contracting for building construction scheduled for early 1973. Site clearing and preparation work is nearly completed.

Another approach to promoting health and safety in mining is furnished by the Holmes Safety Association, which consists of a National Council, State councils, district councils and local chapters. The objectives of the Association are to prevent fatalities and injuries and to improve health and safety among officials and employees in all phases of the mineral industries. The activities of the Association were expanded with the establishment of nearly 100 new chapters. The number of chapter meetings and the attendance by members increased some twenty percent to nearly 30,000 and over 300,000 respectively.

A cooperative effort from last year with the Departments of Labor and of Health, Education and Welfare to design and conduct programs that would train inexperienced men to become miners was continued this year and expanded to include the training of inexperienced men to become operators of ore-carrying vehicles and the training of experienced miners to upgrade their capabilities. Emphasis in the training is placed on mine health and safety in order to achieve the two-fold objectives of alleviating the industry's manpower shortages and providing a means for improving its health and safety record.

(d) Technical Support: Fiscal year 1973, $6,894,000; fiscal year 1974, $7,194,000. Increase, $300,000. The increase consists of:

Increase (+) or Decrease (-)				
Amount	Position	Total Program	Total Positions	Explanation
$+300,000	15	$7,194,000	255	To expand technical capability in reducing fire hazards in metal mines and improving stability of tailing dumps.

COST FACTORS INVOLVED IN INCREASE

12 engineers and 3 support personnel, $215,000; personnel benefits $18,000; travel of personnel $25,000; supplies and equipment, $42,000.

NEED FOR INCREASE

Improvements in electrical power distribution systems and ventilation in the metal mines are urgently needed to prevent mine fires, such as the one that occurred at Kellog, Idaho, in May 1972. Increased attention in technical assistance to industry is now being directed to this area, but expansion is needed to reduce the possibility of other disasters. Another area requiring expanded technical assistance is related to the structural stability of mill tailing dumps. While the hazard of coal waste embankments was demonstrated by the tragic failure of the Saunders, West Virginia, structure in early 1972, the danger from failures of mill tailing deposits could be even greater at other locations because of their size and proximity to populated areas.

PROGRAM OF WORK

The overall technical support function was recently organized into a single operating unit through the consolidation of several related activities. These include the technical support activities in both safety and health for coal and for metal and nonmetal mines and the accident analysis function.

Technical assistance and engineering consulting services are provided on health and safety problems to mine inspectors, mine operators, the mining industry and manufacturers of mining equipment and supplies. Where complex problems are encountered, technical investigations are conducted to develop solutions. Further, technical advice is made available to the Secretary of the Interior, other government agencies, and Congress to aid in their responsibilities in making enforcement, management, or statutory decisions.

In conjunction with the above effort, technical support also has the responsibility of reviewing existing mandatory health and safety standards and making recommendations for their improvement. Related to this work is the continuing evaluation and recommendation of standards as well as the testing and approval of equipment and materials meeting these standards for safe operation or use underground.

Technical support has the important responsibility to assist in rescue operations at a mine site in the event of a disaster. A system developed for post-disaster rescue operations is updated, maintained, and serviced in ready condition for immediate deployment through contracts with private firms.

Technical Support will continue to provide assistance on critical engineering problems affecting the health and safety of miners, including ventilation, roof and ground control, dust collection and abatement, and other related health

and safety practices, devices, techniques, and equipment. In addition to efforts to reduce fire hazards in the metal mines and special attention to the stability of mill tailing dams, a critical area that will receive continued emphasis is the determination of cause-and-effect relationships of accidents in the mines through intensive field studies. Another important area requiring greater emphasis in FY 1974 is the improvement of standards for "permissible" equipment.

Summaries of accidents will continue to be prepared by cause of accident, location in mines, and miners involved. These data will be correlated with existing personal injury statistics, inspection data, and other statistical information as a basis for determining the effectiveness of existing inspection programs and for implementing improvements in these programs.

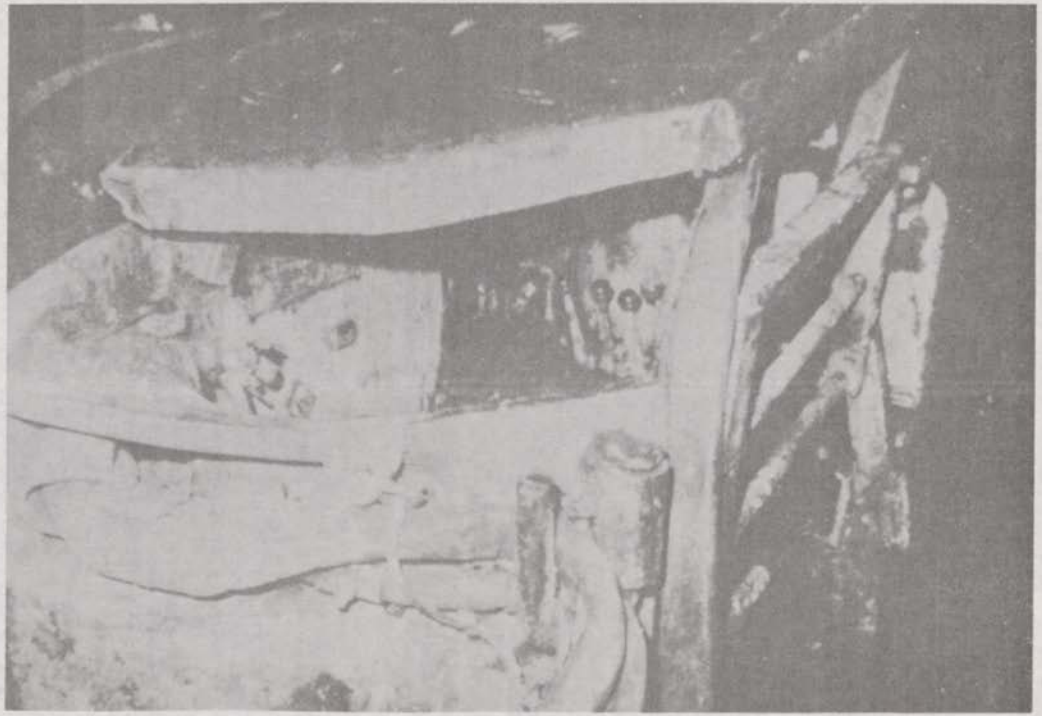
The technical support and accident analysis programs are carried out as integrated programs serving both coal and non-coal programs. Application of costs between coal and non-coal functions are estimated as follows: Coal $5,861,000; non-coal $1,333,000.

EXAMPLES OF RECENT ACCOMPLISHMENTS

The state-of-the-art study on the use of cabs or canopies in underground coal mines and a computer program for strength analysis were published. In addition to the processing of a large number of designs and redesigns for manufacturers and coal mine operators, a dramatic confirmation of the developed specifications occurred when a cab, which had been analyzed and found to meet the required specifications, fully protected a continuous miner operator caught under a massive 90-foot thick roof fall for nine hours. Significant achievements in other areas of protecting against roof falls included improvements in roof bolt installation practices, evaluation of resin grouted bolts which established the feasibility of using these bolts as the sole means of roof support, and the development of improved pressure cells and instrumentation for roof bolt evaluation.

In the general area of methane, dust, and radiation control, special ventilation surveys were conducted and immediate as well as long-term recommendations were made for a large number of coal mines having severe problems of meeting required standards. Investigative work related to dust collectors led to the development of design parameters for the industry to make the major improvements required in future personal sampling equipment and to increase the precision of dust measurements with equipment of different manufacturers. Results of a survey of underground bituminous coal mines showed significant reductions in dust concentrations since the passage of the 1969 Federal Coal Mine Health and Safety Act. A comprehensive evaluation of asbestos hazards throughout the mining industry has led to the development of technical information from which substantially improved control measures can be mounted against the crippling effects of exposure. Improvements continued to be developed for uranium mines to significantly reduce radiation hazards.

An intensive investigation of potential hazards associated with methods of affixing wire rope attachments was completed, providing reliable criteria for the use of these attachments in a safe manner. Rules and regulations were promulgated for the approval of portable coal dust/rock dust analyzers, continuous-duty portable methane detectors with warning light, and fuses for direct-current use to provide short-circuit protection for trailing cables in coal mines.



This rear view of the protective cab on the continuous miner demonstrates its effectiveness. Even though the rectangular steel tubing used in constructing the cab has failed, it still provides protection. The operator remained unhurt under a fall approximately 90 feet thick for a period of 9 hours before rescue.

(e) Mine Health and Safety Research: Fiscal year 1973, $31,185,000; fiscal year 1974, $28,317,000; decrease, $2,868,000. The change consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+1,000,000	+20	$3,963,000	80	For inhouse and contract research on current health related and safety problems in metal and nonmetal mines.
-3,868,000	0	24,354,000	390	For contract research on current health related and safety problems in coal mines.
-2,868,000	+20			

COST FACTORS INVOLVED IN INCREASE

20 permanent positions (scientists and engineers) at annual average wage of $15,000, $300,000; personnel benefits, $24,000; travel and transportation of persons, $15,000; supplies and equipment $100,000; and research contracts $561,000.

NEED FOR INCREASE

Metal and nonmetal mine research: The increase is requested to provide for additional effort to intensify research to avert a repetition of the recent tragedy at the Sunshine Silver Mine in Kellogg, Idaho. This is to give the miner maximum protection and survival capability in the event of such an occurrence and to provide increased effort in other critical areas. Items included are:

$500,000 is for research in the area of fire and explosion prevention. Research will be initiated in the areas of ignition research, flame propagation, fire detection and alarm, and suppression and extinguishment--with emphasis on the identification and characterization of combustible mine materials, evaluation of the effect of fuel loading on flame propagation in mines, a systems study on containment and extinguishment of fires and restoration of normal environment, the development and evaluation of reliable sensors specific to flammable substances in mines, mine timber treatment to reduce fire potential, and the development of automatic extinguishment systems for fires in stationary or mobile electrically powered equipment. Research in these areas has been known to be lacking as was demonstrated by the Sunshine disaster.

$50,000 is for research on new methods and techniques for detecting toxic gases in deep metal mines and the development of techniques for determining the quantity of toxic gases produced by various combustible materials commonly found in metal mines. The characterization of toxic products from the combustion of fire-resistant materials in oxygen-depleted atmospheres is of primary concern.

$100,000 is for expanding research on developing ventilation systems to maintain a safe and healthful atmosphere in noncoal underground mining operations. A recent survey revealed that many vein-type, multilevel mining operations have serious problems in circulating adequate air volumes for cooling the mine atmosphere and diluting and removing contaminants. A substantial part of the increase is for developing improved regulators and stoppings so that the coursing of uncontaminated ventilating air will be assured under adverse conditions such as concussion from blasting.

$250,000 is for developing and demonstrating a mine surveillance system for deep underground metal mines. An effective surveillance system installation would have prevented the recent Sunshine Mine disaster where 91 men lost their lives.

$50,000 is for conducting research in the development of fire-retardant substitutes for timber as a mine-support method.

$50,000 is for initiating an effort to develop new mining methods for uranium mining which will reduce the exposure of miners to the inherent hazards associated with present methods.

PROGRAM STATEMENT

Health and safety hazards in mining are numerous, severe, and out of proportion to those in other industries. Although the problems relative to coal mines have been more widely publicized, the conditions in other mines also are of major concern and in need of immediate attention.

The research program is planned to continue development of new and improved technology for mining of coal and noncoal. This program involves the conduct of fundamental and applied research to overcome current health and safety problems and future problems that will accompany deeper mining, increased mechanization, and other technological changes in mining methods to meet increasing mineral demands. Areas of concern are the control technology and other mining factors for health-related problems involving respirable dust, radioactive minerals, noxious gases, toxic materials, and noise; and the safety problems involving fires and explosions, ground control and support, materials handling, transportation, illumination, communications, post-disaster survival and rescue, mine recovery, and other mining process elements such as human-factors engineering. The program also involves the development of criteria for Federal schedules to regulate the approval and certification of mining machines, equipment, and devices.

Objective: The objective of this program is to promote health and safety and improved working conditions in mines to achieve an appreciable safer environment for miners and maximum conservation of human resources. The ultimate goal is the development of advanced complete mining systems which will be as inherently safe as possible.

PROGRAM OF WORK

Health Related Research in Coal Mines: $3,328,000 (decrease, $1,682,000)

A total of $2,084,000 is for research on respirable dust. The purpose of this research is to develop and demonstrate the technology required to reduce respirable dust to a minimum while mining coal and eliminate dust related industrial diseases such as "black lung." The program is directed primarily toward control at the working face by inhibiting dust formation through water infusion preconditioning and modification of mining machine and cutting bit parameters. Surfactants, gels, and foaming agents are being investigated as additives to water for suppression control when respirable dust formation cannot be prevented. Advanced state-of-the-art respirable dust collectors will be sought in conjunction with ventilation to remove the dust hazard from a mining environment. As promising means and techniques develop for controlling dust, underground testing and evaluation will be scheduled. Similar approaches will be used for dust control outby the face area at transfer and loading points.

Research will continue on development of fundamental knowledge of dust through a balanced program. This involves studies on formation, nature and behavior of respirable dust; aerodynamic studies of ventilation air at the face; basic

mechanisms of respirable dust collection and capture; as well as, dust generation characteristics of typical coal beds. In addition, research will be conducted in support areas of qualitative and quantitative instrumentation for dust analysis and respirator function and design.

A total of $549,000 is for continuing research on minimizing or suppressing noise that can adversely affect the health and safety of mine workers. Work will be continued on reducing noise from existing mining machinery through modification and maintenance procedures and on developing improved instrumentation. Research will be started on noise problems in surface operations.

A total of $695,000 is for research to eliminate or reduce hazards relative to toxic gases and materials. This research includes the development of methods for predicting toxic fumes from explosive formulations, evaluation of the toxic products produced when commonly used fire extinguishant agents are applied to established coal mine fires, the development of new analytical techniques for identification of toxic products in underground atmospheres, and the identification and analysis of coal mine combustion products produced as a result of underground fires. The reduction of toxic gases and materials introduced into the underground environment due to the operation of diesel-powered equipment will be pursued through evaluation of methods of modifying engine operation parameters which affect pollutant production.

Safety Research in Coal Mines: $21,026,000 (decrease, $2,186,000)

A total of $5,452,000 is for continuing research in ground control for underground coal mines. Primary emphasis will be given to the reduction of injuries due to the failure of the immediate roof in coal mines. Secondary emphasis will be placed on mine design to reduce the incidence of larger roof falls and coal bumps. Research directed at roof control will include efforts to improve the technology of roof-bolting, to develop improved artificial support methods for coal mines, to develop methods of detecting potential roof falls, and the development of those mining methods, such as longwall and shortwall, which provide positive protection against roof falls by placing the miner under powered supports. Research directed at mine design and coal bumps will include theoretical and analytical studies of mine design, investigations of the characteristics of geologic defects encountered in coal measure rocks, and development of the microseismic technique for monitoring rock mass behavior and predicting roof falls and bumps.

A total of $3,526,000 is for research related to industrial-type hazards, human factors research, illumination, and non-emergency communications. The standardization of dynamic controls on electic face equipment will be pursued with demonstration of recommended procedures in operating mines. New methods of providing circuit interrupt capabilities in trolley wire circuits and other electrical circuits carrying high currents will be evaluated. Research into methods of reducing the various electrical hazards inherent in underground mining operations will be continued. The design and evaluation of protective canopies for underground low-coal electric face equipment will be continued with studies to assess the results of the application of protective canopies and incorporation of new design changes. Research will continue on remote machine operations with emphasis on guidance.

Research on illumination will include in-mine evaluation of hardware developed in fiscal year 1973, development of hardware for advanced concepts of mine illumination, and establishment and validation of additional criteria for underground illumination standards.

Research will be continued to develop improved operational mine communications and surveillance systems for underground coal mines. The improved communications system will permit instant voice communications between the mine surface

and roving miners in working sections of the mine through the use of mine telephones, existing electrical power trailing cables on mining equipment, and wireless walkie-talkie type radios. Alternate communications links will also be developed using overland radio and borehole powerline cables. Improved mine surveillance systems will be developed to monitor and warn surface personnel of impending danger based upon sensors for methane, carbon monoxide, air velocity, smoke, and temperature at strategic locations.

A total of $3,598,000 is for fire and explosion prevention research. Research will be continued in the areas of ignition research, flame propagation, fire detection and alarms, suppression and extinguishment of fires, and methanometry. Systems for explosion suppression will be evaluated and new fire detection devices will be studied to determine their applicability for providing early warning of underground fires. Suppression and extinguishment research will be continued in the areas of rock covered mine fires, fires in underground coal mine conveyor belts, burning on pillars in coal mines, coal mine reopening after fires, evaluation of mechanisms of methane flame suppression and dust explosion extinguishment, and the suppression of coal dust explosions by passive and triggered barriers. A multientry underground explosion facility will be completed for the evaluation of triggered barrier research. Research will continue on developing and evaluating optimum methane monitoring systems and determining the reliability of methane monitors; improved portable instruments for measuring methane and other gases will be developed.

Work will be continued in cooperation with industry on the techniques for various situations for plugging of abandoned oil and gas wells penetrating coalbeds so that they can be mined through safely.

A total of $2,956,000 is for research on methane control which is aimed at degasification of coalbeds to the maximum practicable extent prior to mining and control of residual methane during mining. Studies to devise methods for efficient control of methane will continue with simultaneous development of technology that can be applied to various coal seams of commercial importance. Research will be continued to develop the engineering criteria needed for measuring and predicting, in advance of mining, the quantity of methane in a block of coal, the pressure under which it occurs, and the coalbed characteristics that govern its movement. Efforts will be continued to develop practical methods for removing large volumes of methane before mining begins and for controlling drainage of methane from the solid coal ahead of the working face during mining. Research will be emphasized on developing improved ventilation systems for diluting methane effectively and controlling emission from gob areas, and on removing methane from these abandoned caved areas.

A total of $1,933,000 is for research leading to the development of advanced mining systems which will avoid the health and safety hazards inherent in present mining practices. Research will be continued toward culmination on hydraulic transport systems which hold promise of reducing this significant class of accidents. As a complement to this, other research will be directed toward the application of complete hydromining systems with their recognized potential for improved health and safety. Additional research will be directed at other novel mining systems which have promise for improved mining conditions.

A funding level of $1,140,000 is for continuing research to develop the technology for improving a miner's chances of survival and rescue following a disaster and to increase the safety of reopening a mine after a fire or explosion. The survival and rescue program involves three major areas including life support, communications, and rescue. Research will be continued or initiated to determine the oxygen requirements of a miner from a breathing apparatus during an emergency, development of improved oxygen sources for emergency escape breathing apparatus, development of portable bulkheads for refuge chamber

construction, development of a superior personal carbon monoxide sensor, development of faster drilling methods to decrease the time locating and communicating with trapped miners, and improving the instrumentation for monitoring the underground environment from the ground surface through a borehole in relation to rescue operations and mine recovery.

A total of $2,421,000 is for engineering research including underground demonstrations for health-related and safety research accomplishments and for provision of special underground test facilities. Systems engineering research is being conducted to develop statistical analysis methods for predicting coalbed and enclosing strata characteristics with data obtained from a minimum number of boreholes drilled from the ground surface. Operations research techniques are being developed to assist in the design of new or improved total mining systems that will enhance the health and safety of American miners, will preserve or do minimal damage to the environment, and will provide the Nation's mineral requirements at an acceptable total cost. These techniques involve computer simulation and other mathematical models of the whole or parts of a mining system, all of which would be invaluable to and in the design and operation of a mine.

Metal and Nonmetal Mine Research: $3,963,000 (increase, $1,000,000)

A total of $855,000 is for research on fire and explosion prevention and on toxic gases. Research into methods of reducing fire hazards will be increased with emphasis primarily in the fire detection and alarm, suppression, and extinguishment areas. Research will be initiated in the areas of ignition and flame propagation. The program will include the identification and characterization of combustible mine materials, evaluation of the effect of fuel loading on flame propagation in mines, the development and evaluation of reliable sensors specific to flammable substances in mines, mine timber treatment to reduce fire potential, and the development of automatic extinguishment systems for fires in stationary or mobile electically powered equipment. Research will be increased on the evaluation of toxic gases and materials found in metal and nonmetal mines due to the combustion of fire-resistant materials and the use of fire extinguishants on fires. The characterization of toxic products from the combustion of fire-resistant materials in oxygen-depleted atmosphere is of primary concern. Research will be initiated on new methods and techniques for detecting toxic gases in mines.

A total of $537,000 is for research on non-emergency communications and post disaster rescue and communications systems. A substantial effort will be directed to developing and demonstrating a mine surveillance system for deep underground metal mines. An effective surveillance system installation would have prevented the Sunshine Mine disaster where 91 men lost their lives. Research will be conducted to develop improved hoist communications to permit voice communications between the hoistman and personnel at various underground working levels. This system would replace the present less-effective code method using bells or buzzers. Effort will be applied to develop more efficient and reliable communications equipment for rescue teams to converse with each other and with personnel at underground fresh air bases and on the surface. These systems will utilize wireless radio rather than sound powered telephones which require heavy bulky reels of wire. A cooling garment will be developed for rescue team members, which will increase the safety and extend the working time of rescuers following a mine fire.

A total of $850,000 is for research in ground control in metal and nonmetal mining. Research will continue in the development of new techniques in mine support systems, including rock bolting. Research will be conducted to develop fire-retardant substitutes for timber as a mine support method. The efforts to develop techniques for the detection of unstable conditions in underground and surface mining will continue. Research will be conducted to develop methods for

determination of the behavior of a rock mass in order to develop more reliable mine design criteria.

A total of $907,000 is for research on radiation hazards encountered primarily in uranium mining. The effort is to develop new technologies for control, detection and monitoring radiation levels in mines and to ultimately reduce the miner's exposure. Priority research efforts will be made to develop a practical workable personal dosimeter to evaluate miner's individual radiation exposure and to develop improved instrumentation for monitoring and surveying mining operations. Research will also be conducted on development of effective control measures to prohibit radon gas emanation into the working areas of the mine and on control or removal of radon daughters from ventilation air before reaching the working face.

A total of $301,000 is for research on respirable dust to develop the means of reducing the dust to a minimum during mining and thus eliminate dust related lung diseases, such as silicosis. Research will be continued in the instrumentation field to develop suitable instrumentation for field analysis of silica. Dust control techniques and equipment will be specifically developed and evaluated for control of dust at chutes, dumps and crushers.

A total of $135,000 is for research on industrial type hazards, systems engineering, and advanced mining systems. Control standardization studies will be continued in an effort to increase equipment safety. A study to identify health and safety hazards and to postulate potential improvements will be continued. Research will be initiated to develop new mining methods for uranium mining which will reduce the exposure of miners to the inherent hazards associated with present methods.

A total of $378,000 is for research on ventilation and on use of diesel engines. Research will be expanded on the problems of maintaining adequate ventilation and suitable temperatures in vein type, multi-level mines and in mines with openings of large cross section. A substantial effort will be directed to developing improved regulators and stoppings so that the coursing of uncontaminated ventilating air will be assured under adverse conditions such as concussion from blasting. Research will continue on the development of techniques for adequate control of potential hazards associated with use of diesel engines in mines.

EXAMPLES OF RECENT ACCOMPLISHMENTS

A major advance in ground control occurred with the successful underground installation and testing of a pumpable roof bolt. Liquid roof bolts installed at the White Pine Copper mine exhibited anchorage capability exceeding that of conventional expansion-shell roof bolts. An additional test of the pumpable roof bolt is now in progress at White Pine, with a coal mine demonstration to be accomplished as soon as possible. The pumpable bolt provides continuous anchorage along the length of the roof bolt hole, an advantage over the point anchorage of conventional bolts. It offers the potential of providing a system that can be installed ahead of the last permanent supports without exposing an individual to unsupported ground.

A mobile advancing roof shield designed to protect miners in the working face area has been demonstrated at the Bureau's mine in Bruceton (Figure 1). Opportunities for demonstration in commercial mines are being sought.

Water infusion tests in the Pittsburgh coalbed have shown that the techniques developed by the Bureau are effective in reducing methane emission in the face area by 50 to 80 percent. An analysis of data from various sources established that more than 231 million cubic feet of methane are being emitted per day by underground bituminous coal mines in the United States and that the emission rate depends on the nature of the coalbed and the surrounding strata, the coal production rate, and the mine depth. When this information is available for

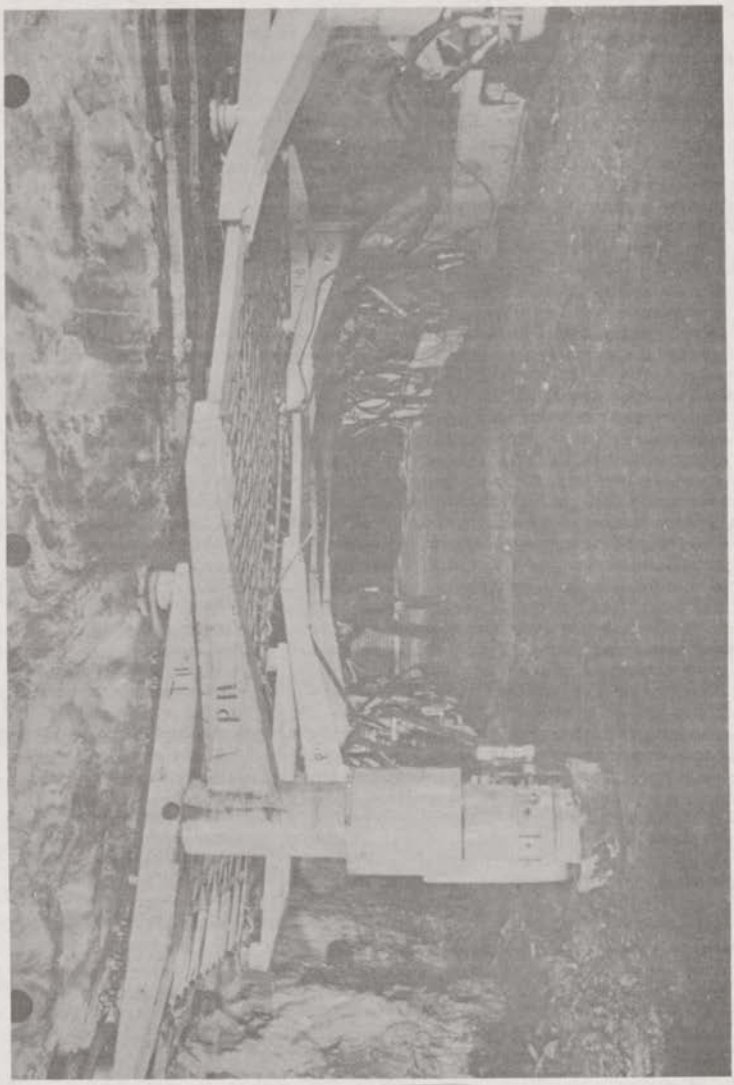


Figure 1 - Mobile shield being demonstrated at Safety Research Coal Mine in Bruceton.

a particular coalbed it can be used to predict the methane emission rate and to plan methane control procedures.

A new generation of emergency mine communications was developed offering greater range, coverage and reliability. One system permits voice communications from the mine surface through the conventional trolley system to a wireless personal pager carried by a roving miner. Range is up to 500 feet from a trolley wire. An alternate system provides two way voice communication between personnel on the mine surface and mining machine operators underground by using the mining equipment trailing cables in conjunction with the conventional mine telephone system. Another alternative communication system utilizes transmission through borehole power-line cables and then by radio to conventional mine communications equipment. These developments will provide voice communications with all underground operating crews immediately after a disaster so that instructions can be given to increase their probability of survival and rescue.

Three borehole devices and an unmanned vehicle were developed for probing mine openings during post disaster rescue operations. The probes, designed for use in small diameter holes drilled from the ground surface into underground openings, will permit both visual and voice communication and determination of mine air temperature and gas composition. A probe drill guidance system has been developed to reduce probe hole drilling time. The system will enable a drill operator to survey the bottom of the hole, calculate hole coordinates with an on-site computer, alter the course of the drill bit, if necessary, without removing or disconnecting the drill string. The unit will be tested and demonstrated in mid-FY 1973. The prototype remote-controlled vehicle will provide means for assessing mine conditions ahead of rescue crews. The vehicle, to be demonstrated in FY 1973, has a television camera for visual inspection and will have sensors for determining air quality and temperature.

A portable area lighting system and a machine-mounted lighting system utilizing circularly polarized high-pressure sodium lamps were designed for illumination of underground coal mines. These systems produce more than the minimum light required by the proposed standards.

An underground demonstration of respirable dust suppression using foam at tranfer points showed that significantly lower respirable dust levels can be maintained using a foam system as opposed to water sprays or direct ventilation. European techniques for water infusing coalbeds prior to mining for control of respirable dust have been adapted for use in United States coal seams. Some reduction in generated dust has been observed at the coal face and work on optimization is in progress. A research and development contract has resulted in the delivery of two prototype mine dust meters that provide real-time instant indication of respirable and float dust concentrations in the mine environment. Underground tests are underway to evaluate the design characteristics of ruggedness, accuracy, dependability, practicality, and safety.

A prototype noise control system that was developed for a percussive drill is free from muffler icing problems and reduces the sound level from 115 to 101 decibels. This reduced noise level would permit operation of the drill in compliance with the standards for two hours as compared with a quarter hour for the unmodified drill. Prototypes of a discriminating ear protective device, which permits the wearer to hear low-level warning signals but still provides protection from sounds in excess of 90 decibels, were fabricated, tested in the laboratory, and found generally satisfactory in preliminary underground evaluation.

Continued work on a nuclear technique coal dust incombustibles content analyzer has developed advanced prototype designs of both cup and in-situ types of devices. Laboratory testing of the cup device (Figure 2) using a large suite of coal dust samples and comparison with volumeter and chemical analysis of

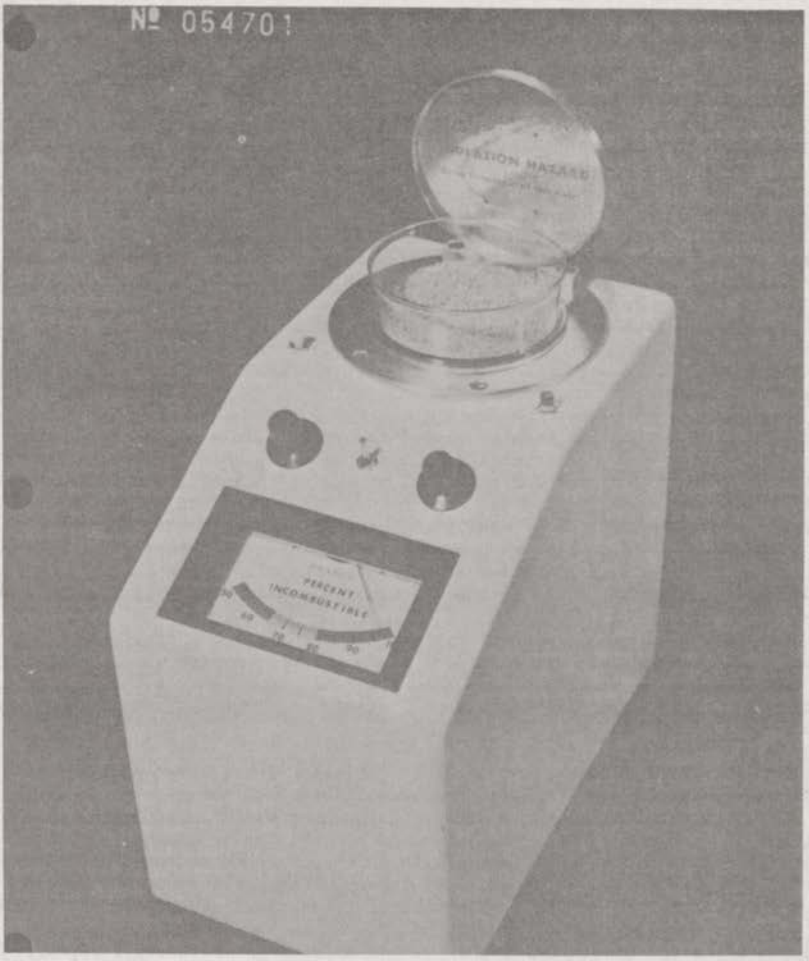


Figure 2 - Prototype nuclear technique incombustible meter.

these samples has demonstrated that the accuracy and reliability of the incombustibles meter is equal to that of the commonly used volumeter method. When this development is completed, it will permit on-site and timely analysis of the incombustible content of mine dust and facilitate better control of this fire and explosion prevention measure.

In FY 1971, the Bureau developed a new, relatively inexpensive, and easily installed device called the Horizontal Roof Strain Indicator. This device was installed in three mines near Pittsburgh and two near Birmingham during FY 1972. Analysis of the data from these mines, which represented a wide range of geologic and mining conditions, is nearing completion. Preliminary results have indicated that 1/1000 inch per inch horizontal strain occurring within two days after bolt installation signals an unstable roof condition. Additional field tests are planned to establish reliable criteria for detecting unstable roof conditions. In other research directed at the identification of potential roof falls, it has been shown that the first major parting in a mine roof can be detected, the distance to the parting measured, and the inclination of the parting plane determined by means of sonic testing the roof with pulsed shear waves.

A filtering technique has been developed to prevent mining machinery noises from interfering with the detection of rock noises so that microseismic techniques can now be employed during normal mining operations. Tests performed in a coal mine have shown that these rock noises can be located. It is anticipated that the technique will be as useful in the prediction of coal bumps as it has been in the detection of rock bursts in the Coeur d'Alene mining district. Coal bumps are also being studied at the Sunnyside mine where the effects of a single entry longwall system on the frequency of coal bumps will be determined.

The feasibility of remote control systems and the development of remote control sensors and devices was explored and a laser guidance system was developed for use in alignment of continuous operations as well as a shuttle car guidance system with obstruction detection capabilities. A demonstration of this concept should come in FY 73.

A major short term thrust was initiated to develop inherently safer mining equipment and technique. Non-fatal accident data were obtained and correlated with fatality data to precisely define the hazards which exist in the working sections of continuous and conventional mines. All major mining equipment manufacturers were contacted and details on the characteristics and number of units in the field were obtained. The impact of proposed equipment design changes was estimated in terms of potential lives saved and accidents reduced and found to be significant. Design modifications for equipment to be used in full scale underground demonstration were completed and selected equipment ordered from manufacturers. Modification of equipment received is underway in preparation for underground tests in FY 74. Construction of a mine mockup facility has been completed to facilitate equipment development and checkout prior to use in the underground demonstration.

An experimental pneumatic pipeline system for horizontal transport under either vacuum or pressure has been installed to determine air requirements and haulage capabilities as influenced by pipe and coal variables. Tests using the vacuum flow method have demonstrated that size of material is not critical when adequate conveying velocities are maintained. This implies that crushing will ordinarily not be required to transport coal from a continuous miner working face.

A coal mine systems computerized simulator has been developed as a convenient and rapid tool for evaluating changes in mine design and operational planning that might significantly impact on the health, safety, and economics of underground coal mining operations.

A technique for nondestructively analyzing percent alpha quartz collected on field filter samples of respirable dust was developed. This approach, using infrared spectrometry, is faster and simpler than the currently used method and lends itself to use in field laboratories. A prototype instrument is being assembled.

A passive personal dosimeter for nuclear radiation was designed and assembled to effectively deal with radon daughter plate-out problems. A radon gas wall emission meter and an instant working level meter were developed and will be field tested during FY 73. A feasibility study showed gas centrifugation to be an impractical approach to radon gas removal. Results of model studies to determine the optimum configurations of different rectangular shaft timber supports, lining, and fixtures indicated that airway resistance could be reduced up to 25 percent by modifications which are relatively minor and can be readily applied in mines with severe ventilation problems.

4. Program Administration: Fiscal year 1973, $2,427,000 fiscal year 1974, $2,603,000; increase, $176,000. The increase consists of:

Increase (+) or Decrease (-)				
Amount	Positions	Total Program	Total Positions	Explanation
$176,000	- -	$603,000	- -	To reimburse Employee Compensation Fund.

NEED FOR INCREASE

Employee compensation payments--The increase of $176,000 is due, in part, to the higher salary levels which form the basis for compensation, cost-of-living increases, and the increased cost for medical care. In addition, new claims for compensation and long-term disability and death cases have increased.

PROGRAM OF WORK

General administration--The sum of $2,000,000 is requested to provide funds for the immediate Office of the Director and part of those administrative functions in the Headquarters Office and the Eastern and Western Administrative Office that support the Bureau. The balance of the cost for general administrative positions is charged to program funds appropriated directly or transferred from the Department of Defense; Atomic Energy Commission; Department of Health, Education, and Welfare; or other agencies.

The Office of the Director provides executive direction in conducting programs designed to conserve and develop mineral resources and to promote healthful working conditions in the mineral industries.

The general administrative functions include the development, presentation, and execution of budgets; administration of equal opportunity under civil rights laws and Executive Orders; planning, coordinating, and evaluating the Bureau's financial management program; maintaining payroll, retirement, and leave records; maintaining accounts for control of funds and recording assets, liabilities, and income and expenses; preparing financial reports; recruiting, training, placing, classifying, and servicing employees; management of ADP systems and programs; organization and staffing management; files, mail, and communication services; contracting for supplies, equipment, construction, research and development, grants, and other services; and recording, utilization, maintenance, and disposal of Government property.

Costs of general administration are met from the Program Administration activity, assessments on other activities, and charges assessed to the Helium Fund and contributed, transfer, and working funds. A breakdown of the source of funding is as follows:

	Amount Available 1972	Amount Available 1973	Estimate 1974	Increase (+) or Decrease (-)
Program Administration .	$2,011,000	$2,000,000	$2,000,000	- -
Other Administrative Funding:				
Mineral Resources Development	793,000	839,000	890,000	+51,000
Engineering, Evaluation, and Demonstration	114,000	187,000	139,000	-48,000

	Amount Available 1972	Amount Available 1973	Estimate 1974	Increase (+) or Decrease (-)
Mine Health and Safety	1,435,000	1,528,000	1,525,000	-3,000
Helium Fund	61,000	61,000	61,000	- -
Contributed, Transfer, and Working Funds ..	306,000	310,000	310,000	- -
Total, Administrative Funding	4,720,000	4,925,000	4,925,000	- -

Employee compensation payments--The $603,000 is to provide funds to reimburse the Employee Compensation Fund for payments made because of injury or death of employees under the jurisdiction of the Bureau of Mines, as required by Section 209 of Public Law 86-767.

PERSONNEL SUMMARY

	Actual 1972	Estimate 1973	Estimate 1974
Total number of permanent positions	5,567	5,629	5,619
Full-time equivalent of other positions	243	240	240
Average paid employment	5,656	5,698	5,688
Average GS grade	9.1	9.1	9.1
Average GS salary	$13,793	$13,910	$14,013
Average salary of ungraded positions	$9,691	$10,224	$10,787

ITEMIZATION OF ESTIMATE

Department of the Interior
Appropriation Title: Mines and Minerals

	Actual 1972	Estimate 1973	Estimate 1974	Bureau of Mines Increase (+) or Decrease (-)
Program and Financing				
Total direct obligations	$132,837,408	$156,841,000	$136,824,000	-20,017,000
Unobligated balance lapsing	370,560	- -	- -	- -
Budget authority	133,207,968	156,841,000	136,824,000	-20,017,000
Budget authority				
Appropriation	133,722,000	157,465,000	136,824,000	-20,641,000
Transferred to other accounts	-514,032	-624,000	- -	+624,000
Appropriation (adjusted)	133,207,968	156,841,000	136,824,000	-20,017,000

	Actual 1972	Estimate 1973	Estimate 1974	Increase (+) or Decrease (-)
Direct Obligations by Objects:				
11 Personnel compensation	$74,558,000	$79,716,000	$80,445,000	+729,000
12 Personnel benefits	6,449,000	6,957,000	7,100,000	+143,000
13 Benefits for former personnel	25,000	- -	- -	- -
21 Travel and transportation of persons	5,336,000	5,643,000	5,780,000	+137,000
22 Transportation of things	928,000	893,000	900,000	+7,000
23 Rent, communications, and utilities	3,174,000	2,971,000	2,970,000	-1,000
24 Printing and reproduction	616,000	618,000	620,000	+2,000
25 Other services	26,098,000	31,006,000	23,154,000	-7,852,000
26 Supplies and materials	3,994,000	4,002,000	3,890,000	-112,000
31 Equipment	7,736,000	7,770,000	7,700,000	-70,000
32 Lands and structures	272,000	2,090,000	590,000	-1,500,000
41 Grants, subsidies, and contributions	2,293,000	3,295,000	3,295,000	- -
42 Insurance claims and indemnities	365,000	380,000	380,000	- -
Adjustment for rounding	-1,048	- -	- -	- -
Total direct obligations	131,842,952	145,341,000	136,824,000	-8,517,000
ALLOCATION TO GENERAL SERVICES ADMINISTRATION				
21 Travel and transportation of persons	- -	4,000	- -	-4,000
24 Printing and reproduction	1,000	8,000	- -	-8,000
25 Other services	225,000	828,000	- -	-828,000
32 Lands and structures	768,000	10,660,000	- -	-10,660,000
Adjustment for rounding	456	- -	- -	- -
Total obligations, General Services Administration	994,456	11,500,000	- -	-11,500,000
Total obligations	132,837,408	156,841,000	136,824,000	-20,017,000

DETERMINATION OF PROGRAM PRIORITIES

Mrs. HANSEN. Your request for this appropriation shows a net decrease of $20,017,000. Many of the decreases are for items which were added by Congress last year.

Conversion of wood and organic wastes to oil, coal mine waste hazard investigations, mined area investigations and demonstrations, filling mine void areas. Have you assumed the general policy that the executive branch knows more than Congress in determining the priorities of your Bureau?

Mr. OSBORN. As I said in my introductory remarks, some of these reductions are completed programs. The $13 million Beckley Academy, for example.

Mr. MCDADE. That is education and training.

Mr. OSBORN. That is just for construction.

Mr. MCDADE. That shows under education and training.

Mr. OSBORN. Yes.

Mr. MCDADE. That is a brick and mortar completed item.

Mr. OSBORN. Yes, sir. The $0.3 million for our mineral supply program, which was in support of the Materials Policy Commission, which terminates its work this year. That is done. The third one is the $1 million coal mine waste hazard investigations, which this committee, I think very wisely last year following the Buffalo Creek disaster, added to our budget in order to make a study and do anything we could to prevent this from ever happening again.

Mrs. HANSEN. The study will be completed at the end of this fiscal year?

Mr. OSBORN. Yes.

BUFFALO CREEK STUDY

Mrs. HANSEN. Do you have any comments to make about the Buffalo Creek problem?

Mr. OSBORN. Yes, I would be glad to make a couple. In connection with this $1 million expenditure, but not included in that, we contracted with an engineering company, that is expert on dams, to make a thorough study of the construction of the dam at Buffalo Creek and what went wrong. This has now appeared as a two-volume report. This is an excellent report on the whole problem with this type of dam and how it should be constructed so that this cannot happen. This report is available. It came out about a month ago. There are many diagrams with it. The list of possible hazardous similar situations in Appalachia is being carefully monitored by our health and safety people to see that water does not rise behind any of these embankments.

Mrs. HANSEN. How many of those dams do we have?

Mr. OSBORN. There are about 52 that we are now monitoring that we think there could be a possible problem if there were a very heavy rainfall. We are keeping our eye on this. I would say that the chances of another happening like that are very, very slim. We have them all spotted and described.

Mrs. HANSEN. Why was this work not done prior to last year?

Mr. OSBORN. It was not in the authority of the Bureau of Mines.

Mrs. HANSEN. Was it under the jurisdiction of the State?

Mr. OSBORN. Yes. Ours is the health and safety of the workers in mining, and this gets way outside of it.

We certainly are doing everything we can, whether we have very much authority or not.

When you provided the $1 million, we certainly did have authority.

Mrs. HANSEN. The committee did not wait for an authorization.

Mr. OSBORN. This $1 million specifically directed to the subject was the authorization.

Mrs. HANSEN. Are the States, with these problems, willing to use your expertise and advice, particularly if it costs them money?

Mr. OSBORN. Yes. We work very well with the States.

Mrs. HANSEN. What are the other reductions?

ROCK SPRINGS, WYO., EXPERIMENT

Mr. OSBORN. The Rock Springs, Wyo., $800,000. That was the first installment on a program similar to the ones in Scranton. We have an identical problem out there. That $800,000 was spent, and is not shown being continued for next year.

Mrs. HANSEN. Is this project complete?

Mr. OSBORN. No; we are about a quarter done.

Mr. MCDADE. You will be hearing on this again from the Senate side.

Mrs. HANSEN. Yes. Why was it discontinued?

Mr. OSBORN. It has not been yet.

Mrs. HANSEN. Why is it proposed to be discontinued?

Mr. OSBORN. I think this was removed by OMB.

Mrs. HANSEN. Was there a good reason?

Mr. OSBORN. Our budget has to fit the allowance constraint.

Mrs. HANSEN. How much was your total budget request when it left your department and sent to OMB?

Mr. OSBORN. I do not know.

We don't see it anymore, Mrs. Hansen.

[Discussion off the record.]

Mr. EVANS. Could we ask him to supply for the record the document he proposed to the Secretary so that he could compare that with what came back from the OMB?

Mrs. HANSEN. Can you supply that document?

Mr. OSBORN. I do not think this is exactly what you want.

Mr. WILES. Madam Chairman, you asked what we sent to the Office of Management and Budget from the Bureau of Mines. The total sent was $177 million. The allowance was $136.8 million.

The reduction was $40.2 million. However, in that $20.2 million there was included at the time the budget was sent $34 million for helium, which was taken out and put in the supplemental in 1973.

Mrs. HANSEN. That still leaves about $6 million that does not appear in the Bureau of Mines budget.

Mr. WILES. The items on which Dr. Osborn has testified were already out. But the Rock Springs project is the one I am trying to find out—who took that out.

Mrs. HANSEN. It seems strange to invest $800,000 for a project and then not request additional funds to complete the project. This does

not make good sense. The Scranton project has proved to be extremely worth while.

Mr. OSBORN. It is saving the city.

Mrs. HANSEN. This project is about a quarter completed?

Mr. OSBORN. Yes.

Mrs. HANSEN. Under usual budget procedure, another increment would have been requested this year and in preceding years until the project was completed. Instead of that, we are left with work that is only a quarter complete. There is no apparent programing beyond fiscal year 1973. Is that correct?

Mr. WILES. Yes, ma'am. I do not know who took that particular project out. There are so many projects in the Department, when I try to keep track of all of them I fall down on the job.

Mrs. HANSEN. Did this fall by the wayside at OMB?

Mr. WILES. I am not sure about that.

BUDGET CONSTRAINTS, EXPENDITURE CEILINGS

Mrs. HANSEN. The things that trouble me most about OMB are their arbitrary decisions based on "budget constraints and expenditure ceilings." This committee reviews your budget request in great detail, and, based upon national needs and national concerns, makes determinations. The committee sits here day after day discussing the problems of our environment and resources. You showed us a chart the other day where the imports of all our essential minerals are greater than total exports. The committee takes cognizance of these situations. We try to plan and program ahead so that this country will have a viable economy in the future and at the same time protect our environment.

Then the accountants at OMB decide to cut viable projects for "budget constraints."

Dr. Osborn, your Bureau is one of the managers of this country's resources. This committee has jurisdiction over a major segment of the land owned by the United States, which is about a third of the national area.

I have a strange suspicion that the Office of Management and Budget does not regard our resources as either needing management or requiring inventorying. All they see is the dollars-and-cents side of a ledger. I just do not think it works that way.

RESULTS OF DISCONTINUING ROCK SPRINGS PROJECT

Mr. MCKAY. Madam Chairman, if I may, in connection with this $800,000 for this research project in Rock Springs, if in fact now you did not continue, would that void the effects of your experiment?

Mr. OSBORN. No; we will have learned a lot. The project was set up to see if it is possible to shore up this large area of relatively valuable real estate that is surely going to be sinking and cracking and breaking up. We have done about a quarter of the area. We have learned a lot.

Formerly you would backfill with sand and crushed rock. In that area we used sand so we are learning something we did not learn in Scranton where we crushed the rock. At the bottom of the hole, the sand would pile up as a cone and you could not move it very far.

You cannot put men underground in these mines because it is far too dangerous. With this process, developing the very high velocity slurry, we can use just a few holes. From one hole we can spread the fill material underground for a distance of a couple of hundred feet in many directions. To answer your question specifically, no. What we have done now will hold up that part of the town.

We have learned quite a lot. But it is certainly unfinished if the rest of the town begins to subside.

Mr. McKay. If I know anything about sand, if there is a place it can shift to, it will shift under pressure.

Mr. Osborn. No.

Mr. McKay. You mean it will stack up and hold the weight and won't move, even if it has a place to which it can move.

Mr. Osborn. We have many acres of mined out coal seam there. Let us say there are coal seams 8 feet thick. The sand will fill the voids solidly for quite a distance, it will taper off around the edges.

Mr. McKay. Except at the ends it will slough off.

Mr. Osborn. It will slough off a little near the edges of the filled area.

Mr. McKay. Effectively the experiment is reduced proportionately by the amount you have been unable to do.

Mr. Osborn. At least that much.

I think you have a point, too, that in the end it will not be as effective as if the whole thing was done.

Mrs. Hansen. Yet, you testified about the necessity for adequate knowledge. These are answers you must have before coal production is greatly expanded. Please provide for the record a detailed list of the reductions, showing the project, the amount, the positions, and the locations.

[The information follows:]

BUREAU OF MINES

List of Reductions by Projects

Activity and Project Title	Location	Positions	Amount	Rationale
ENERGY				
Research on subsurface disposal of industrial wastes	Bartlesville, Oklahoma	-8	$ -200,000	This program was designed to study an increasing industry practice with significant environmental implications and does not have direct application to solving energy problems. Therefore, the project will be terminated in order to pursue higher priority energy research.
	Morgantown, West Virginia	-4	-100,000	
Conversion of wood and organic wastes to oil:				
Wood wastes	Albany, Oregon	- -	-300,000	This is a non-recurring item for the planning and designing of a pilot plant to convert wood wastes to low-sulphur oil.
Organic wastes	Pittsburgh, Pennsylvania	-28	-599,000	This project is being phased out in order to concentrate on other research dealing with technology to provide clean energy.
Oil shale research	Laramie, Wyoming	-24	-526,000	Oil shale environmental studies will be terminated because of the increasing activity by others in this area of concern. Environmental studies are being funded jointly to the extent of about $700,000 by the Department, the Environmental Protection Agency the State of Colorado, local Colorado jurisdictions, and industry.

Activity and Project Title	Location	Positions	Amount	Rationale
METALLURGY				
Mineral and metal recycling research	College Park, Maryland	-19	$ -686,000	A substantial amount of funding was allocated in fiscal year 1973 to purchase and install major pieces of equipment for a 5-ton per hour pilot plant; therefore, these funds will not be required in fiscal year 1974. Also, selected research concerned with the development of processes for recovering and refining metals and minerals from refuse, and for devising new uses for materials removed from refuse will be curtailed or terminated in order to provide for higher priority programs.
	Albany, Oregon	-8	-228,000	
	Rolla, Missouri	-3	-86,000	
MINING				
Improving extraction technology	Twin Cities, Minneapolis	-10	-358,000	Reduction in research dealing with materials handling ground control, and rock fragmentation in order to provide funds for other programs.
	Denver, Colorado	-1	-36,000	
	Spokane, Washington	-1	-36,000	
	Washington, D. C.	-2	-70,000	
Explosives research	Pittsburgh, Pennsylvania	-6	-200,000	This decrease applies to combustion and fire research and will be continued under Coal Mine Health and Safety Research

Activity and Project Title	Location	Positions	Amount	Rationale
DATA COLLECTION AND ANALYSIS				
Support of Materials Policy Commission	Washington, D. C.	-12	$ -300,000	The National Materials Policy Commission will terminate within 90 days after submission of its final report on June 30, 1973, and the Bureau of Mines phase of assistance to the Commission has essentially been completed.
ENGINEERING, EVALUATION, AND DEMONSTRATION				
Coal mine waste hazard investigations	Various Locations	-10	-1,000,000	The coal mine waste hazard investigation was completed during the current fiscal year. This is a non-recurring item.
Research on filling critical mine void	Rock Springs, Wyoming	-3	-800,000	It is anticipated that one phase of the subsidence control demonstration project at Rock Springs, Wyoming, can be adequately tested or much of the data can be developed during the current fiscal year.
Mined area investigations and demonstrations	Anthracite Area of Pennsylvania	- -	-800,000	The decrease was made in order to provide for other programs.
EDUCATION AND TRAINING				
Construction of a mining health and safety	Beckley, West Virginia	- -	-13,000,000	This is a non-recurring item for construction of a Federal Mine Health and Safety Academy.

Project Title	Location	Positions	Amount	Rationale
RESEARCH				
Research on health and safety problems in coal mines	Various Locations	- -	$-3,868,000	For contract research on current health-related and safety problems in coal mines. $1,682,000 of the decrease is mostly in respirable dust work. Several short-term contracts are scheduled for completion and these will not be replaced by other contracts since more than 80% of coal mining sections met the 2 mg/cubic meter standards. $2,186,000 of the decrease is for research on methane and explosive work, ground control projects, hydraulic transportation of coal, and remote control of existing face equipment. Certain phases of these projects will be completed and the timeframe for others will be extended.
Total		-139	-23,193,000	

Mrs. HANSEN. I have received a letter from the entire Oklahoma delegation, headed by the distinguished Speaker Carl Albert, on Bartlesville. As I understand it. Bartlesville is being cut back?

Mr. OSBORN. It is having to be cut back.

REDUCTIONS AT ENERGY RESEARCH CENTERS

Mrs. HANSEN. The letter says:

> We of the Oklahoma delegation are most concerned about one particular part of the administration-proposed budget cutback which will affect an installation in Oklahoma. The administration proposes $300,000 cutback for energy research centers operated by the Bureau of Mines in Bartlesville and Morgantown, W. Va. Two-thirds of the deleted appropriation will be tied to Bartlesville and one-third will be for the Morgantown facility. There will be no attempt to phase out either one of the facilities, but the cutbacks, we are informed by those who are knowledgeable, will directly affect the personnel because other costs are fixed.

Mr. OSBORN. That is true.

Mrs. HANSEN. The Oklahoma delegation is very concerned about this situation. They would like to have the funds restored. I have received another letter from Congressman Harley Staggers of West Virginia, in which he calls attention of the committee to the Morgantown facility. Will you discuss the reductions briefly for the committee?

COAL MINE HEALTH AND SAFETY RESEARCH CUTBACK

Mr. OSBORN. Yes, I think this may be the best time to start on the most important and largest one of all, and that is the minus $3.9 million research on health and safety problems in the coal mines.

Mrs. HANSEN. Why is that being cut?

Mr. OSBORN. Could I approach that by giving you a 5-minute talk?

Mrs. HANSEN. You certainly may.

Mr. OSBORN. I would like to start by giving you this report which we have just produced. Not many eyes have seen this yet. We have tried in this report to summarize clearly the present status of the coal mine safety research, for which we have had about $30 million for research in the initial years of this program.

In our health and safety program in coal, as most of you know, we have four major programs. One is the enforcement program. The second is the education and training program. The third is for technical support and the fourth is the research program to develop safe techniques, safe machinery, different ways of predicting rock falls and that sort of thing. The hope is—and I am sure it will be realized—that as we improve in all of these, in inspections, in the training of the men in safety and in the research, that we can cut down on the accident rate and particularly the fatality rate.

It takes a while to get a program going. There was practically no money in the Bureau of Mines for this except for explosions research until 1970. So it took time for us to rev up for it.

We are now going strong and I think this report will indicate we are making some good progress.

INJURY FREQUENCY RATES

On page 3 is a diagram indicating the position of coal mining with respect to injury frequency rates and you will see among the major industries it is the most dangerous from the standpoint of disabling injuries.

Coal mining remains above 40 injuries per million man-hours, whereas construction in general is below 30. If we could turn to page 5, this is a very interesting diagram. The main curve coming down, the one in red above the green, shows the drop in fatalities per million tons of coal produced. This is an illustration of the tremendous increase in productivity in coal production in this country. So although the full number of fatalities was coming down, this steep decline in fatalities per million tons represents mainly the tremendous increase in productivity from a few tons per man-day up to nearly 20 tons on an average per man-day in this country. If you look at the fatality per million man-hours which is that black curve, although it came down some to 1950, you will notice that the fatalities per million tons remained right around one. In other words, one man killed for every million man-hours for the last 20 years, until now since 1970 when the law went into effect or a year after the law went into effect, fatalities per million man-hours has dramatically dropped. There is more about that later if you want.

MINE EXPLOSIONS

On page 7 is an illustration with a curve, which has to do with the number of fatalities per year from explosions. As is stated over in the description on the left, which I won't take the time to read now, the Bureau of Mines was a direct outcome of terrible explosions between 1900 and 1910, and one in 1907 killed 362 men in one explosion. So the Bureau of Mines, although it had a multiple mission, one of them was to work on this explosion business. So the research of the Bureau of Mines for many years was almost entirely on explosives and developing permissible explosives that could be handled safely, and on the matter of gas problem in the mines, to avoid these explosions, and working on a means of neutralizing coal dust. Coal dust, very fine, is an explosive itself. This was controlled by developing a powdered rock technique, of spraying on powdered limestone to dilute the coal dust on the walls, roof and floor. If you look at the curve, you will notice that the Bureau of Mines was started in 1910. I do not know that the shape of this curve is all because of the Bureau of Mines. The industry had something to do with it. Nevertheless, in 1910 the Bureau was established and a few years later it began experimenting with rock dusting to dilute the coal dust that would be explosive, and with electrical equipment, electric caps, improved ventilation to get rid of the methane.

And so the number of miners killed from explosions has gone down really quite dramatically and it is certainly due in some part to the development of technology in the Bureau of Mines.

Now we come up to the present then when the funding was large enough to cover in fact all of the areas in coal mining which have to do with health and safety. Our people have divided these into 10 areas: Ground control, which means research and preventing the roof and

the walls of the mines from falling on men, which is the largest killer of men underground; and explosions; industrial hazards—that means machinery accidents and problems because of improper illumination and so on—methane control—there are a series of very important projects going on now to prevent methane accumulation which starts explosions—respirable dust, which is a health problem, as I mentioned earlier, and so on down to finally, really quite a lot of work is being done on the noise problem.

PRIOR YEARS FUNDS FOR COAL MINE HEALTH AND SAFETY RESEARCH

Now, I show here—I am beginning to get at your question now about that cut—the height of the column in each case is the millions of dollars put into this particular field of research.

The green is 1972, the yellow 1973, and red is 1974. There was this constraint on how large the budget of the Bureau of Mines could be. We had to cut it back and we felt——

Mrs. HANSEN. There is something cannibalistic about cutting back on an item that is man's life or death.

Mr. OSBORN. That is right, but let me complete my sentence.

Mrs. HANSEN. I am not criticizing you or the Bureau.

Mr. OSBORN. In each of these areas, and I want to go over a couple of them as examples, we have been making some good progress, and we have also found out some areas of research that we think cannot be productive.

We can cut out, and in some cases we have completed the particular projects, and so our cuts, which are from the height of the yellow down to the height of the red, we don't think are at all disastrous, that our program will still be very strong. It is a strong program.

On the other hand, there is no question that if all of these columns were twice this high, we would have maybe four times as good a program. I think it goes up more than just with the arithmetical increase. So whether the program ought to be down here or up here or up here or here, isn't something that I think one can really get his teeth into.

In other words, just how big should this be? I think we have a strong program now.

Mrs. HANSEN. Based on current funding, you have a strong program?

Mr. OSBORN. Yes.

Mrs. HANSEN. Let us analyze your budget a little bit further. In all budgets, as you are well aware, there is about a 10-percent inflation factor.

Mr. OSBORN. Oh, yes.

INFLATION AND ENVIRONMENTAL IMPACT

Mrs. HANSEN. So when you cut a budget by $1.3 million, your actual reduction is much greater due to this 10-percent inflation factor. So that the cuts that the budget indicates are really not the actual amounts, they are only part.

Mr. OSBORN. That is right. Especially true in technology where equipment that we use in research is becoming more complicated and expensive.

Mr. MCDADE. Would you yield at that point?

Mrs. Hansen. Yes.

Mr. McDade. Dr. Osborn, I realize the important picture that you are painting for us about how much is enough, but let me ask you this question. Your budget reflects a cut of $3.9 million in health and safety.

Mr. Osborn. In coal.

Mr. McDade. Yes.

Mr. Osborn. $1 million of that is moved to metal, but $3.9 million cut in coal.

Mr. McDade. In coal mine health and safety?

Mr. Osborn. Yes.

Mr. McDade. In research?

Mr. Osborn. Yes.

Mr. McDade. If you had that $3.9 million in fiscal 1974, could you spend that money efficiently?

Mr. Osborn. Yes.

Mr. McDade. Could you spend the money? There wouldn't be any duplication, would there?

Mr. Osborn. Oh, no.

Mr. McDade. There wouldn't be any wastage of taxpayers' dollars?

Mr. Osborn. No.

Mr. McDade. Would every bit of it return to the taxpayers and to the men who work in the mines in increased protection of their health and their safety?

COMPLETING RESEARCH PROGRAMS

Mr. Osborn. I think there is no question of that. If you look at, let us say, page 11, talking to your point, Congressman McDade, here is a synopsis of one of our 10 programs. Each page from now on represents one of the programs, and you will notice the little blue diagram in the lower left. This shows the expenditure to date, and you will notice this program is down just a little.

Now, over on the right bottom is a circle, and this circle, if we completed it colored, would indicate that now we have done about all we think we need to do in this field. We have completed a little over a quarter of the work on ground control; we estimate—this is just an estimate.

Mr. McDade. Would you tell me how much money you could spend in ground control in 1974?

Mr. Osborn. What?

Mr. McDade. How much could you spend efficiently that we are talking about.

Mr. Osborn. Yes, I think we certainly could get that information for you.

[The information follows:]

The Bureau could spend efficiently an additional $3.7 million on ground control research.

Mr. Osborn. But I was going to point out looking at this circle that the faster we complete this circle, the faster we develop the full program on ground control, or if we have less money——

Mrs. Hansen. Which is why Congress has said to you in their mine

health and safety legislation, "You find the answers that will eliminate to the fullest possible degree hazards in the mines."

Mr. OSBORN. Right.

Mr. MCDADE. How much of the $3.9 million cut is in this type research?

Mr. OSBORN. I can get you the exact figure, Congressman McDade.

[The information follows:]

Approximately $390,000 of the reduction has been applied to ground control research.

Mr. OSBORN. From this diagram on page 9 you will notice that about $200,000 or $300,000 was cut.

Now, if you go on to methane, for example, page 17, you notice there we are quite a bit farther along in completing the modern research program, that needs to be done on methane; in other words, to do all the research that we think can be productive to eliminate the methane hazard in coal mines.

See, we think we are farther ahead in that one than we are, let us say, in any of those previous ones.

Mrs. HANSEN. You have barely begun your advanced mining system.

Mr. OSBORN. Right.

ACCELERATION OF PROGRAMS

What I am trying to say is that the more funds that we have, the faster we can complete that circle, providing we have the people and providing a piece of research isn't dependent on something we are doing right now.

In other words, we couldn't complete this circle in a year I am sure.

Mrs. HANSEN. How many pieces of this research are dependent upon the completion of what you are currently doing?

Mr. OSBORN. Would you let us put that in the record?

Mrs. HANSEN. Please do.

[The information follows:]

Practically none of the research on other potential advanced mining systems under consideration is dependent upon the research now underway in this category. However it is expected that future developments in the other research areas will lead to research on even more potential advanced mining systems.

Mr. OSBORN. We have to think about that. But I think it is clear, though, that in, anyone of these areas we certainly could work considerably faster than we are now to complete that circle.

Mrs. HANSEN. I want to call the committee's attention to the respirable dust chart where the circle is not halfway complete.

EXPENDITURE LIMITATION

Mr. OSBORN. Mr. Zinner just reminded me that in the law there is a limit of $30 million on what we can spend annually, but we are down to what? $27 million?

Mr. ZINNER. Yes; maybe less.

Mr. OSBORN. Yes. Is that it or $26.5 million.

Mrs. HANSEN. How much authorization remains?

Mr. OSBORN. I can find that.

Mrs. HANSEN. But your budget I presume as it left your Department was within the authorization. Is that correct?

Mr. OSBORN. At it left where? Left the Department?

Mrs. HANSEN. As it left your Department.

Mr. OSBORN. As it left the Bureau of Mines. Well, yes; it would have been for the full amount, I am sure, that maximum amount, which is $30 million. This is what we started with when the program started about 2 years ago.

Mrs. HANSEN. That is right.

Mr. OSBORN. Coal is about $25 million.

Mr. MCDADE. $25 million of the $30 million?

Mr. OSBORN. No; coal is about $25 million of the total $28.3 million and the other is in metal mines.

So, in other words, for Coal Mine Health and Safety Research, the 1974 budget here shows about $5 million below the maximum allowed of $30 million.

Does that answer your question?

Mrs. HANSEN. Yes.

Mr. OSBORN. So this book I hope will be helpful in showing the 10 areas of research that can be done in this field, where we think we are, and on the right you will notice 3 or 4 items which are beginning to come into use now; in other words, that because of this research, or partly because of this research—sometimes it is working with industry and so on—we are ready to or already have adopted some of it in the mines. Those are listed.

Mr. EVANS. Madam Chairman, may I ask a question.

Mrs. HANSEN. Yes.

DETERMINATION OF BUDGET CUTS

Mr. EVANS. As a matter of policy who determines these cuts? Are you told that you have to cut x number of dollars and then you go over your budget and you make recommendations, or are you told what to cut, item by item?

Mr. OSBORN. Yes. In the last 2 years we have been presented with questions like this: "What would be your distribution of budget funds if you have a 13-percent decrease, if you have no decrease, if you have an increase?" And, of course, we never have an increase, but we put that down anyhow.

That then goes up to the Department and that we don't see any more, do we?

Mr. ZINNER. No.

Mr. EVANS. Do the cuts that are effected reflect the input that you have given?

Mr. OSBORN. Partly.

Mrs. HANSEN. To what extent?

Mr. OSBORN. Well, it is a little hard to say. I don't believe we indicated the cut in any of these energy programs and it was cut $1.7 million.

Mr. WILES. Madam Chairman, the way it has worked for the last 2 years is in the Department there is a budget committee and what they get——

MEMBERS OF BUDGET COMMITTEE

Mrs. HANSEN. Who is on your budget committee?

Mr. WILES. It was changed in the last 2 years. The year before last it was Dr. Pecora, Secretary Larson, and Secretary Bodman. That was last year. In the year before that it was a larger committee. It was Pat Ryan, Frank Bracken, Dick Hite, Ken Brown, and I was on it that year.

Mr. EVANS. Who is on it this year?

Mr. WILES. This year it will probably be the Under Secretary when we get to that point in the budgeting, and the new Assistant Secretary for Management, and new Assistant Secretary for Programing and Budget.

Mr. EVANS. It sounds to me like a floating crap game. That is why we have so darn much trouble finding out who made what recommendations and when. That is not even talking about the Bureau of the Budget, is it?

BUDGET BUREAU PLANNING ALLOWANCE

Mr. WILES. Let me go a little further. What we do is we get from the Budget Bureau a planning allowance, which is a big number, and what we have done for the last 2 years is the committee has listened to the bureaus and taken that number in large pieces and has given a portion of that number to each Assistant Secretary, who in turn has divided that number up among his bureaus.

Now, the bureaus then decide what they can fit within their number and what they can't, so when you get down to the individual projects, the bureaus are selecting those projects.

I think that you will agree, Madam Chairman, when you have one number for a huge department you have to have some mechanism to review that number.

Mrs. HANSEN. We do understand, but I think the thing that bothers this committee is the eternal budget restraints.

As I told the Geological Survey yesterday, you have two resources, people and land, and both of them have felt the impact of budget constraints.

This troubles the committee because lives could be saved if you had had the money to complete your research.

The Buffalo Creek tragedy will probably never occur again because a million dollars was provided.

ENERGY PROGRAM

It has been very frustrating trying to develop viable programs and then all of a sudden discover you don't have the very tools that are part of the process.

Mr. MCDADE. Before we leave that might I make an inquiry, please.

Mrs. HANSEN. Absolutely.

Mr. MCDADE. Also on page 7, Doctor, there is an $800,000 cut under the title "Mined Area Investigations and Demonstrations." Could you tell me what that is please?

Mr. OSBORN. That is also shown on page 35. That was cut from the work going on in the anthracite region.

Mr. MCDADE. We used to have an account in this budget where we used to separate a small portion of the Bureau of Mines fundings for use in the anthracite field, did we not?

Mr. OSBORN. Yes. That was a commodity-type listing, yes.

Mr. MCDADE. We had that last fiscal year, didn't we?

Mr. OSBORN. Yes, sir.

Mr. MCDADE. What was the amount last fiscal year?

Mr. OSBORN. $4.7 million.

Mr. MCDADE. I looked through the justifications and I am correct, am I not, that there is no longer any separate breakout for the antracite area?

Mr. OSBORN. Well, that is correct, let me say, with one reservation. On page 37, what is called "Mined Land Investigations and Demonstration," $3.9 million, that is the same thing. If you add to that the $800,000 that was taken out you get up to $4.7 million.

Mr. MCDADE. Am I correct that the antracite account has been merged into engineering, evaluation, and demonstration for purposes of your accounting?

Mr. OSBORN. Yes, that is correct, wouldn't you say, Paul?

Mr. ZINNER. Yes, but it does appear——

Mr. MCDADE. As "Mined Land Investigations and Demonstrations."

Mr. ZINNER. Yes.

Mr. MCDADE. Why have we taken out that title that was so easy to follow if one wanted to find out how much was being spent for this purpose in the anthracite area? Why have we abandoned it?

Mr. ZINNER. The problem came from the whole structure, Mr. McDade, under the title that we used to call resource development in which statistics and economic analysis bituminous coal and all these others appeared as a mixture between topical and commodity titles. With the exception of anthracite, work under all of these titles was all being done as part of the data collection and analysis.

If we had an anthracite area title or something like that it would have been more definitive. Probably it could have been shown as a separate line under the new title of "Engineering, Evaluation, and Development."

We have no objection to doing that. Anthracite as a commodity doesn't fit—actually we are doing no research on anthracite itself——

Mr. MCDADE. We don't want to take a lot of time. If we talk about mined land investigations and demonstrations—anthracite, we could so title it and I could keep track of it.

Mr. ZINNER. Or anthracite area, any designation you wish.

Mr. MCDADE. I assume we can do that without a lot of difficulty?

Mr. ZINNER. No problem at all.

Mr. OSBORN. If you folks approve it. Don't you have to approve it?

Mr. ZINNER. This is the way it appears, of course, in the printed budget, too, but there is no reason we can't explain this with subtitles or something or other.

Mr. MCDADE. I would like to have "Mined land investigations and demonstrations—anthracite."

Mr. ZINNER. "Mined land investigations and demonstrations—anthracite area?"

Mr. MCDADE. Fine.

Mr. ZINNER. Anthracite area. All right. That is page 37.

Mr. MCDADE. Thank you very much, Madam Chairman.

CONVERSION OF WOOD AND ORGANIC WASTE TO OIL

Mrs. HANSEN. You are requesting a reduction of $1,725,000 for mineral resources development energy.

What is the rationale for the reduction of $899,000 for research on the conversion of wood and organic wastes to oil? What use was made of the money provided in 1973?

Mr. OSBORN. On the last question, we can say that $300,000 of that was for the design of a demonstration size pilot plant, for converting waste sawdust or wood chips and so on to the low-sulfur fuel oil, both as an environmental and an energy program.

Mrs. HANSEN. How much potential does this process have?

Mr. OSBORN. Well, the potential of that and also the agricultural wastes depend partly on the credit the program will get for disposing of these wastes.

Mrs. HANSEN. As you are well aware, something has to be done because the logs are either pressed or burned.

Mr. OSBORN. Our figures show for wood waste 55 million tons per year generated, 5 million tons readily available for such a process. For each ton dry weight we can make about a barrel and a half of oil and using some of that oil for energy for the job we still recover about a barrel and a quarter of oil for each ton of waste, whether it is wood or whether it is agricultural waste. Our people estimate it something like this: That if the credit for getting rid of the stuff is $4 or $5 a ton, then the cost of the oil is competitive; it is probably going to be competitive with what we are paying.

We will soon have $5 oil. In fact, we have it some places now in this country, $5 a barrel oil.

Mrs. HANSEN. What percentage of our total energy needs would this provide?

Mr. OSBORN. Using only that that is available, not that scattered around the country, let us say conservatively a half million barrels a day.

Mrs. HANSEN. And the Alaska pipeline is to bring in 2 million.

Mr. OSBORN. Yes. We are using about 16 million barrels of oil a day, so this would be about 3 percent of the oil supply.

Mrs. HANSEN. Hasn't the time arrived when it is necessary to develop all sources that we can?

PILOT PLANT DEMONSTRATION

Mr. OSBORN. Yes. I think that this is entirely a practical way to move and we need to have a demonstration size pilot plant to learn more about the process and the costs. So this $300,000 of that $899,000 was for that, for the design. The rest was on the agricultural waste that has been worked on at Pittsburgh. The $300,000 design contract is out at Albany, Oreg., and if we build a demonstration pilot plant it will be at Albany.

There are a couple of possibilities here.

Mrs. HANSEN. OMB has a real genius for taking things out of the budget that are sponsored by members of the committee.

Mr. OSBORN. Well, California is a State where there are large quantities of agricultural wastes.

Mrs. HANSEN. Also Wisconsin.

Mr. OSBORN. Yes; and so we think that, although we are specifically designing it for sawdust, we will design it in such a way that we can use any of these wastes in the pilot plant to get good cost figures. Eventually such plants could be of a size that could be located where the wastes are piling up, like Los Angeles, for example.

Mr. EVANS. Would the gentlewoman yield right there?

Mrs. HANSEN. Yes.

Mr. EVANS. You say your current estimates are if credit were given for transportation of waste disposal, this factor, somewhere between $4 a ton and $5 a ton, that your estimates on the experiment so far show you that the cost per barrel would be about competitive with what other costs are per barrel of oil today.

I suppose that $4 per ton or $5 per ton could come in many ways, whether it be in tax deductions, or investment credits, or some other Government policy.

Mr. OSBORN. Yes; the industries that are piling up these wastes have got to pay to get rid of them sooner or later. You can't just keep piling it up. We might as well expect that local governments will ultimately require that they get rid of this mountain of cow manure, for example. Someone certainly will have to pay to move it someplace and, of course, the problem is where to move it.

Mrs. HANSEN. The problem is what to do with it.

Mr. OSBORN. Whether it needs a Government monetary incentive or not I wouldn't know. I wouldn't think it would. It would go into the cost of operating a feed lot, for example.

Mr. EVANS. The possibility of State, or local, or national law requiring the disposition of it?

Mr. OSBORN. It is becoming a dangerous hazard.

Mr. EVANS. Thank you, Madam Chairman.

SUBSURFACE DISPOSAL OF INDUSTRIAL WASTE

Mrs. HANSEN. You and others in the Department have previously told us that subsurface disposal of industrial wastes was a critical problem. Why are you now proposing to reduce this program by $300,000?

Mr. OSBORN. Well, this got into the cutting scheme, Mrs. Hansen. It is not as high priority as some of the other energy programs, to be sure, but still it is an important project from the standpoint of helping to develop means whereby we can dispose of industrial wastes underground because the underground is a region which can be used. But, on the other hand, it has to be used wisely so that we don't contaminate underground water or cause other problems, so I think it is an imporant area.

Mrs. HANSEN. Is AEC working on similar programs?

Mr. OSBORN. Yes.

Mrs. HANSEN. Have you been working with AEC?

Mr. OSBORN. Well, not very much. Anything that any one group does on underground disposal is going to be of use to others because there are going to be an awful lot of engineering problems involved.

The AEC has a very special problem because they are worrying about materials which will be radioactive for thousands of years and just what may happen, let us say, thousands of years from now with respect to releasing some of that radiation.

In fact, the problem is so serious now that there certainly is considerable thought among people in the AEC that the storage ought to be above ground and then just keep moving it because——

Mrs. HANSEN. Where are they going to move it?

Mr. OSBORN. Into another tank. At least you know where it is.

Mr. MCKAY. It will dissipate quicker if you keep moving it.

Mr. OSBORN. In Hanford, Wash., some of these very hot boiling solutions are in concrete tanks. They are set in the ground and the water table is way below. That is a dry country and——

Mrs. HANSEN. It was a dry country.

Mr. OSBORN. It was. This has a half-life of several thousand years but the tanks, concrete, won't last more than about 50, so you have to keep moving it, but at least you can monitor it and you know what is happening. Some thought was given to storing it in salt mines in Kansas, a logical place, but they didn't keep the people in Kansas informed and when they did the people in Kansas wouldn't have it.

Its a tough problem. Our underground disposal would have some spinoff for their problems but our immediate concern is with solutions, let us say acid solutions. They might even be, say, cyanide solutions. They can be corrosive and there are places where we can put that sort of thing which doesn't endanger humans. It is a matter of putting these in an appropriate place.

Mrs. HANSEN. This is a critical area in view of the demands of the public on freedom from poison and pollution.

Mr. OSBORN. Oh, it is terribly important. When the clean air and clean water standards came in, this forced people underground, so to speak. If you can't dump in the river what do you do? Dig a hole and put it underground?

In two places that I know of in the country, there have developed sort of geysers—a geyser is an intermittent thing. This is more continuous—where the water was fountaining up. On an analysis it was found that the waste from some plant in that part of the area which was putting water underground had finally worked its way to the surface. The number of disposal wells in increasing rapidly and let me repeat that putting solutions underground can be done, is being done, particularly in the oilfield country, on a very large scale.

They are pumping the saline solutions back down so if you know what you are doing it is appropriate. About $100,000 of this $300,000 was being spent at our Morgantown Laboratory where in that part of West Virginia, because of the large petrochemical industry based on the coal in West Virginia, there are a lot of chemical industry by-products and solutions they just don't know what to do with and so our people have been working with them on outlining possible zones underground where these could be put.

Mrs. HANSEN. Therefore this was cut.

Mr. OSBORN. Yes; we just ran out of money on that.

OIL SHALE PROGRAM

Mrs. HANSEN. Why are you reducing the oil shale program by $526,000 when we are faced with ever-increasing energy demand?

Mr. OSBORN. We have obtained a large amount of data on that program.

Mrs. HANSEN. All that you need?

Mr. OSBORN. No; but about half of that was on environmental problems associated with oil shale development and about half was on our underground retorting experiment near Rock Springs, Wyo.

Now, those have been carried on to the point, as I say, where we have some good results that industry can and will use, and in cutting back the budget this was one of the places where we have made a good start and this was cut off.

Mr. EVANS. How much was cut?

Mrs. HANSEN. $526,000.

Mr. OSBORN. That is about a third of the whole program out there.

Mrs. HANSEN. In spite of the fact that additional answers are necessary. How long will this delay providing the answers?

Mr. OSBORN. I really can't answer that. If you go ahead with a project and you don't have the final answer you just won't do it as well.

In other words, it might not delay the project but the project just won't work out as well. I mean this is always a possibility.

SYNTHANE PILOT PLANT

Mrs. HANSEN. What is the 1974 request for the Synthane pilot plant? Please provide for the record the amounts provided for this project in previous years and expected future year costs.

[The information follows:]

SYNTHANE PILOT PLANT

Funds provided for the Synthane pilot plant were $1.5 million in fiscal years 1971 and 1972, and $6 million in 1973, and $6 million is requested for fiscal year 1974. These $15 millions will cover design and construction, which is scheduled for completion August 1974. It is expected that $3.5 million will be required in fiscal year 1975 for startup and operation costs.

Mrs. HANSEN. Will all of the 1973 amount be obligated? Do you expect to obligate the entire 1974 amount?

Mr. OSBORN. Yes, for both questions.

Mrs. HANSEN. If so, why does the $6 million need to remain available until expended?

Mr. OSBORN. Well, the contract has now been let for construction of this plant——

Mrs. HANSEN. Is that to provide for liquidation of the contract upon completion and your acceptance?

Mr. OSBORN. Yes.

Mr. ZINNER. On the first phase of the plant.

Mr. OSBORN. The $6 million, the first phase.

Mr. ZINNER. But very little of that will be spent this year; will be obligated but it won't be spent.

Mrs. HANSEN. When do you expect to liquidate that contract?

Mr. OSBORN. In August 1974 we ought to be through, shouldn't we?

Mr. ZINNER. Yes.

Mr. OSBORN. We are supposed to be through with the main contract by August 1974. It is supposed to begin operation in August 1974. Now, maybe there will be some delays.

Mrs. HANSEN. "To remain available until expended" is one of the favorite limbs on which we have impoundments.

Mr. WILES. I think I can explain that. This is a construction of a pilot plant, isn't it?

Mr. OSBORN. Yes.

Mr. WILES. So the Bureau when it got that money—I guess the bill came through in late July—had to go out and have the plant designed and then go out for bids and if the bids would have come in way over they couldn't award. They would have had to redesign and there would be a possibility that you go over to the next fiscal year and that is why that is. As I understand, there is another phase of the contract. You have to go through the same contracting procedures, don't you?

Mr. ZINNER. Yes. This $6 million only pays for half of the plant cost so the other half is contingent on the appropriations in 1974. It is all contract work.

Mrs. HANSEN. Please insert a complete explanation of this in the record.

Mr. WILES. All right, Madam Chairman.

[The information follows:]

There are certain contingencies in construction contracts (unlike other procurements) that do not lend themselves to fiscal year constraints. Inasmuch as the contract for construction of the synthane plant extends into fiscal year 1975, we believe that the additional $6 million requested should be available until expended. For instance, there will be changes in the contract; at this time we cannot predict with any certainty the size or the scope of the changes. Having funds appropriated on a "no-year" basis will assure orderly completion and no delay in this important project.

METALLURGY—MINERAL AND METAL RECYCLING RESEARCH

Mrs. HANSEN. You are requesting a reduction of $1 million for mineral and metal recycling research. This is at College Park, Md. You have turned over your process to EPA, and they are going ahead——

Mr. OSBORN. It is almost like that, not quite; that is, EPA has made a contract with the city of Lowell, Mass., which puts in about a fourth of the money.

They in turn have a contract with Raytheon, and Raytheon then is coming to us for engineering advice and they have their people out working with us at College Park, so it isn't exactly turned over to EPA. It is now the contractor that is using it. We are working with him on it.

So although, of course, we could easily argue for maintaining the program at its former level, we do think that this reduction won't seriously impede our research in the recycling field.

Mrs. HANSEN. It won't jeopardize the further implementation of what you have developed?

Mr. OSBORN. That is what we believe. We believe we can live with this.

DECLINE OF INVESTMENT IN RESEARCH AND DEVELOPMENT

Mrs. HANSEN. There is an interesting statement in your justifications:

> The problems are compounded by the fact that there has been a serious decline of American investment in research and development in the nonmilitary sector. Currently, we are spending, in terms of Gross National Product, only half that of West Germany, France, Great Britain, Italy, or Japan.

Yet we are supposed to be the Nation that leads the world.

Mr. OSBORN. We lost our lead—we are talking about extractive metallurgy here.

Mrs. HANSEN. I understand.

Mr. OSBORN. We lost our lead, this country did, in extractive metallurgy in the late 1930's. We had the lead or were certainly one of the two or three leaders, but I would say we had the lead up to then.

A study made by a committee in the National Academy of Sciences published in 1969 quite clearly shows this, based on an examination of the literature, the papers as published, beginning about 1910 and coming up to the present.

Mrs. HANSEN. We have never regained it.

Mr. OSBORN. No. We are still slipping.

Mrs. HANSEN. Any prospect of regaining the lead?

MINERAL ENGINEERING COLLEGES

Mr. OSBORN. Well, it looks discouraging. For the long haul, a requirement is going to be a strong base in the universities. There has to be something for mineral resources like we have for agricultural resources in the universities.

Mrs. HANSEN. The mineral engineering colleges have been decreasing. Isn't that correct?

Mr. OSBORN. Oh, they are almost gone. They never were anything like the agricultural colleges. The first Hatch Act of 1887 established an experiment station at a land-grant college, in each State, with matching State funds.

This has built up to the point that now almost all the States have a very fine agricultural college, and each State has some kind of one, as for example, even Alaska has an agricultural college even though they import almost all their food. There has never been a Hatch Act type of program for the mineral resources like there was for the agriculture resoruces. The mining schools were only for training mining engineers, and they have gradually faded out.

There has not been this competence developed in the faculty and in the research group in the colleges.

Mrs. HANSEN. Why?

Mr. OSBORN. Well, in the resource field we are just apparently never going to have it without Government support. I don't think in agriculture there would be anything either if it weren't for the Hatch Act and the subsequent amendments.

Mrs. HANSEN. Why do you suppose in the years gone by someone didn't recognize this fact and make an effort to establish at least one outstanding——

Mr. OSBORN. It is a little hard to understand why they didn't. It isn't because the Congress has not had a lot of wise people. It is not

because of that. They have. I, for example, have recently read the committee reports, in connection with the Foster Act of 1915, that established the Bureau of Mines Experiment Stations, and they discussed this very point.

In the case of agriculture, there was this strong research group with a high degree of competence in agricultural resources at one place in each State, at one university in each State.

Inasmuch as this was not true of mineral resources, at least the Bureau of Mines ought to have a series of experiment stations and that is why we have come up with these 15 major labs that we have now, but the base in the universities just doesn't exist, and this is my old stamping ground.

I mean, that is where I was for 24 years before I came down to our Nation's Capital. The fields which have service courses have lots of students and therefore have adequate funding by the university to establish a good faculty and the faculty has some time for research.

In the two areas of agriculture and minerals, the basic sciences respectively are biology and geology, lots of students, good strong programs. For example, there are 85 geology departments in the country with Ph. D. programs; another 150 universities with master degrees. If the Geological Survey wants to get a top geologist, all they have to do is look around the country and they have dozens applying with Ph. D.'s or whatever they are looking for in the way of a geologist, but in the applied fields, the faculty would be small if there weren't some special support.

In the applied biology, except for medicine, it is agriculture, and we have given it that support so they have these strong programs.

In applied geology, which is mineral engineering, mining, extractive metallurgy, and petroleum engineering, and so on, there just hasn't been a program. The universities are not going to give the support.

VETO OF MINERAL RESOURCE BILL

Mr. McKay. Didn't we pass something for that last year?

Mr. Osborn. The President vetoed the bill I think you are referring to.

Mrs. Hansen. I wonder who gives the President his advice.

The reason these bills are introduced and passed is because Congress has determined additional technology is needed. We are assisting nations all over the world, yet we can't even run our own.

Mr. Osborn. Well, we have the mineral resources in this country. We have tremendous mineral resources and they are the life blood of this country just like our agricultural resources. We have done so well with agricultural resources we are now exporting on a tremendous scale, of course.

In the case of mineral resources we have a big net increase in imports and that amounts to the same as our negative balance of payments. The long range improvement is going to depend, I think, on a base being built up in the universities.

I, of course, am strongly for this and was before I came down here.

Mr. Evans. May I ask a question here?

NUMBER OF MINE COLLEGES AND UNIVERSITIES

How many colleges and universities in the United States do we have like the Colorado School of Mines?

Mr. OSBORN. There are 15 mining departments in the country, not one of them with very much strength in research and development. This is what we are talking about, not students. There are really only three in the country that have even moderately strong mining engineering and graduate research programs and Colorado School of Mines has virtually no graduate research program in mining.

Mr. EVANS. What are the other two?

Mr. OSBORN. Penn State University, and the School of Mines in Rolla, Missouri, and University of Utah. Those three have fairly good mining graduate and research programs but they are nothing compared to even plant pathology.

Mr. MCKAY. You are struggling to keep alive for the very reason you are talking about. That is why the bill was introduced.

Mr. OSBORN. That is right.

Mr. EVANS. What has been the experience in the last 10 years in terms of students going to the institutions you referred to that specialize in mining?

Mr. OSBORN. It dwindled. The number of departments of mining decreased by a third in just a 5-year period in the sixties, but they never were strong in research like agriculture colleges. They were really just turning out mining engineers, but another factor was that in the post-war period where support of university research programs, you know, tremendously expanded, mineral engineering, and I use that rather than mining because I am including extractive metallurgy, petroleum engineering, and so on, mineral engineering just fell through the cracks.

The Department of Defense didn't support them, NASA didn't. NSF was all science. Those fields just didn't get the support. If you don't have the support, then you can't get a program going that even looks good to the student. This is another factor.

Mrs. HANSEN. The Western Interstate Committee on Education agreed all their institutions were being underfunded. So they agreed that there should be one or two schools of mines where all the students would attend. This was a good idea if they could have developed one or two good colleges.

Mr. OSBORN. But there weren't the resources to develop even one.

Mrs. HANSEN. That is right.

Mr. EVANS. By resources you mean——

Mr. OSBORN. Financial.

Mr. EVANS [continuing]. Financial.

Mr. VEYSEY. May I ask a question at this point.

Mrs. HANSEN. Yes.

Mr. VEYSEY. Going back to where we started this discussion about the decline of American investment in research and development, you have been relating this mostly to the academic arena. Let me ask you a question as to what proportion of the total research would be carried on in the academic sphere as compared with the industrial sphere, particularly in process development?

Mr. OSBORN. In process metallurgy, extractive metallurgy, and mining?

Mr. VEYSEY. Yes.

Mr. OSBORN. These fields we are talking about?

Mr. VEYSEY. Yes.

Mr. OSBORN. The work done in the universities is just a fraction of that done either in industry or in Government.

Mr. VEYSEY. You would expect, I suppose, with large units operating in the field, U.S. Steel and others of that size, that they would be conducting substantial research and development themselves.

Are they in fact doing it?

Mr. OSBORN. Well, U.S. Steel has a pretty good——

Mr. VEYSEY. I just happened to pick them.

Mr. OSBORN [continuing]. It has a pretty good sized program although 2 years ago it abolished its large so-called Fundamental Research Laboratory, just phased it out in a year. Bethlehem Steel has a program about half as big. The other steel companies have no research really. They have engineering groups, of course.

We found in a study we contracted for about a year ago with Battelle to try to get at this very thing—we wanted to see what was happening in the mineral industries, what was the trend in research in the mineral industries.

For universities we have separate studies. We found a very interesting thing. In mining, the total money put in over the last 5 or 10 years.

Mr. ZINNER. The year following the passage of the Mining and Minerals Policy Act.

Mr. OSBORN. In 1970, but it was comparing it with the previous years.

Mr. ZINNER. One year.

Mr. OSBORN. We found that the total amount of funding was remaining constant but the amount put into actual mining research had dropped off to something like half and that going into environmental problems had taken up the slack, so——

Mr. VEYSEY. Then the environmental concerns are probably a major portion.

Mr. OSBORN [continuing]. But the total isn't going up any.

Mr. VEYSEY. Would you generally agree that the amount of money that a big corporation puts into research and development relates to their net income picture? As they are making money they are likely to bury that in R. & D., whereas if they are breaking even or losing they don't have much to throw around that way and they tend to cut back.

Is that what has been happening?

Mr. OSBORN. No; I don't think that that is the main factor.

Mr. VEYSEY. Would you not agree that corporations behave that way?

Mr. OSBORN. Well, they have been in the habit, in the case of mining companies, of putting a certain amount into research and development and they are holding at about that level but changing it over to solve immediate environmental problems rather than in developing extractive metallurgy technology to cope with new supply problems.

Mr. VEYSEY. Then your testimony would be that they are switching over to environmental concerns and out of basic research and development?

Mr. OSBORN. Yes; in the case of mining, that is right.

EXTRACTION TECHNOLOGY AND COMBUSTION AND FIRE RESEARCH

Mrs. HANSEN. You are requesting a reduction of $700,000 for extraction technology research and combustion and fire research. What specific projects are involved? Please provide a list for the record showing the projects and the rationale for their elimination.

[The information follows:]

MINING RESEARCH REDUCTION

There are two components involved in the $700,000 reduction consisting of (1) improving extraction technology, and (2) explosives research. The first has to do with materials handling, ground control, and rock fragmentation. The second with combustion and fire research. A list of the projects under each heading is as follows:

IMPROVING EXTRACTION TECHNOLOGY—$500,000

Properties and Mechanics of Movement of Mined Materials Project—reduced in scope as a matter of priority of effort considering fiscal constraints.

Laboratory Studies of Head Loss in Hydraulic Transportation—project completed.

Gravity Flow of Granular Materials—project completed.

Instrumentation Evaluation—project reduced in scope to reflect reduced need for instrumentation evaluation.

Mechanical Drillability Studies—project completed.

Case History Studies of Machine Boring—project completed.

Influence of High Loading Rates and Anisotropy on Rock Deformation and Fracture—project completed.

Experimental Determination of Rock Response to Heating—project completed.

Defect and Fracture Analysis of Mesofabric and Microfabric Changes in Deformed and Fragmented Rock—project completed.

Effect of Geology on Rock Fragmentation by Different Energy Sources—project completed.

Acoustical Determination of Elastic and Deformational Properties of Rock—project completed.

No new effort was initiated in the above areas because of fiscal constraints.

EXPLOSIVES RESEARCH—$200,000

Flame Propagation and Quenching Mechanisms—project will be continued under the coal mine health and safety program.

Ignition Hazards Investigation—project will be continued under the coal mine health and safety program.

Unification of Ignition and Flammability Phenomena—project will be continued under the coal mine health and safety program.

Mr. OSBORN. Dr. Henrie, would you like to touch on this.

Mr. HENRIE. Yes.

This is a $200,000 reduction. Essentially what has happened here is the people who were working on those projects found it best to orient their work to problems found in coal mining. As a result we have transferred this $200,000 of project work to the fire and explosions program being done over in health and safety research.

DATA COLLECTION AND ANALYSIS

Mrs. HANSEN. You are also requesting a reduction of $300,000 for data collection and analysis.

Mr. OSBORN. That $300,000 I mentioned earlier, Madam Chairman, that——

Mrs. HANSEN. That was terminated?

Mr. OSBORN. Yes.

Mrs. HANSEN. When will the report be available?

Mr. OSBORN. The report will be issued June 30.

Mrs. HANSEN. What types of support did you provide?

Mr. OSBORN. We provided all of the input in the mineral data field for that commission, virtually all of it.

Mrs. HANSEN. You say in your justifications, an investigation was completed for the U.S. Coast Guard evaluating causes of explosions observed during unconfined liquefied natural gas spills on water. Did the Coast Guard provide the funding for this project?

Mr. OSBORN. Yes. We got funds for that, didn't we?

Mr. HENRIE. Yes.

NATIONAL COAL POLICY

Mrs. HANSEN. What is the "national coal policy" report?

You say there will be, "A review of energy demand since 1947 accompanied by suppy-demand projections through 2000, and a 'national coal policy' report to the Congress." You remember last year in our report the committee asked for a national coal policy before additional funds were appropriated for coal research.

We haven't seen the "national coal policy" report.

Mr. OSBORN. No. This is still going on and it is a departmental rather than just a Bureau of Mines project, but we are continuing to supply data to them.

Mrs. HANSEN. When will the report be ready?

Mr. OSBORN. Do you know, Frank?

Mr. WILES. No; I don't.

Mr. OSBORN. I don't know either.

Mrs. HANSEN. When was it begun?

Mr. WILES. I believe after the appropriation last year, Mrs. Hansen.

Mrs. HANSEN. You mean after the committee told you to prepare one?

Mr. WILES. I think so.

Mrs. HANSEN. Why do you suppose the committee hasn't been informed that the Department is working on a "national coal policy?" I think the committee should have a statement of your goals.

Mr. OSBORN. Would you like us to give you a sentence or two on that?

Mrs. HANSEN. We would like it very much otherwise OCR may find itself without funds.

[The information follows:]

With respect to the request for the status of the "national coal policy" report, this report is in secretarial review. This report is being prepared by the Department and the Bureau of Mines is one of a number of groups providing inputs. The Bureau's participation has been to delineate economically recoverable coal reserves and to determine factors such as supply/demand relationships, the impact of environmental regulations, oil imports, and nuclear powerplant growth on coal use.

ENGINEERING, EVALUATION, AND DEMONSTRATION

Mrs. HANSEN. You are requesting a reduction of $2.6 million for "Engineering, evaluation, and demonstration." You have already spoken about Rock Springs and Lowell.

Mr. OSBORN. Yes.

Mr. MCDADE. I would like to ask a couple of questions.

Mrs. HANSEN. Yes.

Mr. MCDADE. Doctor, you are, of course, thoroughly familiar with the solid waste problem that exists in connection with past mining and the enormous number of spoil banks that exist in States that are engaged in extracting industries. Is the Bureau doing anything at all at this juncture to try to examine the mineral content of those banks with a view toward seeing if there is any recycleable material?

Mr. OSBORN. We are not doing anything at the moment. We have in the past. For example, there is a report of the Bureau of Mines maybe 10 years ago which examined the possibility of producing alumina from this waste rock and there have been studies I know, at Penn State University, and I am sure also the Bureau, on utilization of some of the higher coal containing wastes, you know, as a low grade fuel.

Mr. MCDADE. As a fuel, yes.

Mr. OSBORN. But I am sure there is more to do on this. We have kind of scratched around on it in the past.

Mr. MCDADE. Is it your feeling that this is a fertile field for investigation for purposes of perhaps recapturing some of these metals and recycling?

Mr. OSBORN. Yes, I think so.

Mr. MCDADE. Would you furnish for the record, some information to me about the scope of the work that might be done and the cost?

Mr. OSBORN. Yes, be glad to.

[The information follows:]

MINE WASTE BANKS

Several years ago the Bureau of Mines made a survey of the mine waste banks in the anthracite fields of Pennsylvania. The survey recorded a total of 863 banks containing approximately 900,000,000 tons of mine refuse. The rock in these waste piles varies from hard conglomorates to softer shales. The waste piles are scattered over an area of approximately 500 square miles. The total area actually occupied by the piles of waste is about 19 square miles. They have been reworked from time to time to obtain available carbon for heat and power purposes. Some of these waste banks are still being used for that purpose by local power companies. There has also been some light weight aggregate made from this waste.

A detailed survey has not been made to determine other possible minerals in the waste piles. An analysis of these banks for minerals other than carbon should be undertaken on a spot basis. Such a project would be worthwhile and would cost approximately $200,000 for the first year.

RECLAMATION PROJECTS IN THE ANTHRACITE AREA

Mr. MCDADE. I notice, too, then in this account you have been concerned with a lot of reclamation projects in the anthracite area and I believe your people are familiar with one of the problems that have occurred particularly as an aftermath of Agnes where a lot of stripped pits were filled with refuse and are now catching fire because of the natural chemical decombustion of the contents of those pits.

Is the Bureau doing anything specifically to attack that problem?

Mr. OSBORN. During the aftermath of the Agnes flood of the waste materials and other debris were being piled into these pits. Our people, especially Mr. Corgan, were very much concerned that spontaneous combustion could occur in this tremendous pile, several hun-

dred feet long, in some cases, of waste materials from the damaged houses. Partitions, rugs, furniture—everything went into this trash pile. We predicted that it would heat up and eventually catch on fire and our concern principally was that then the coal at the bottom, because these pits go right down into old coal mines, would catch on fire. We have already spent millions of dollars putting out these kinds of fires. So we wrote a strong letter to General Lincoln of OEP stating our concern over the method being used for disposing of this debris. We proposed a plan for burning it on the surface in a way that would not pollute the air and we thought perhaps there would be funds at that time to do this.

I also took a copy of that letter to Mr. Goddard, who is secretary of environmental resources in Pennsylvania, and had quite a talk with him about this danger. No one believed Mr. Corgan that there was any danger.

Mr. McDade. They believe him now, I think.

Mr. Osborn. Yes. So when we were up there about 2 months ago with Congressman Flood in the Wilkes-Barre area in connection with termination of two of our mine-fire projects, Dr. Goddard was with us and so I just mentioned to him that one of his pits was on fire, like we said it would be, and he said, "It can't be on fire."

I said, "No? Why not?"

He said, "The people tell me it is not on fire."

We drove by and, of course, it was on fire. You can imagine how it smells with all this trash burning. The smoke is wafting over the trailer park housing these displaced people whose houses were demolished by the flood. Not only that, but the ground is cracking in these huge pits and the smoke is coming up and there are two dangers. One is from carbon monoxide poisoning around there where kids are likely to be, or anybody. They may walk out on the pit area and fall in.

We have some pictures here. We are horrified, but this is just what we said would happen. Here are some pictures of the debris that isn't supposed to catch on fire.

This is what is happening here. You can see this picture. That is pretty hot. That is a fire. So what we are doing is monitoring the pits that are not already on fire by infrared flights. Two of the seven disposal pits are already in bad shape. We are appalled on two accounts. In the first place, the pits should have been monitored better by the State when we warned them that this would happen, and, second, we are disturbed that they just wouldn't listen.

Now I don't know where they are going to get funds to do anything about it.

Mrs. Hansen. Revenue sharing.

Mr. Osborn. It is a State problem.

Mr. McDade. The State now wants to give them back to us and say, "You fill them up now." Is there any money in this budget to cap this kind of a mine fire or strip fire now that it is going?

Mr. Osborn. That coal may catch on fire and we will be back for a couple million dollars to put it out.

Mr. Evans. Pennsylvania waits until the fire gets down to the coal and then knocks on our door for help.

Mr. Osborn. Are you familiar with that anthracite region?

Mr. Evans. No.

Mr. OSBORN. Ordinarily you think of a coal seam as being horizontal but this area has been part of the mountain-making development millions of years ago and some of those anthracite beds are very steep and so they have been stripped down the seam, down in one case about 700 feet. They have stripped down a 30- or 40-foot thick seam of coal which was previously mined underground up to that point.

In fact, they mined underground first and later stripped down to the earlier mining. Now they throw trash into the pits. When it catches fire it can go down into these underground workings where there is plenty of air, and those mines are open to the surface in many cases and this is what we have been fighting, as Congressman McDade very well knows.

It is really a disastrous situation.

To answer your question, Congressman McDade, I really don't know whether any of the funds we have might be used for that or not. Do you have any ideas on that, Paul? Do we have the authority to do that? I don't think we have.

Mr. ZINNER. I don't know under what authority we could do anything about it.

STRIP-MINED LAND

Mrs. HANSEN. What percent of the strip-mined land in the United States is under public ownership? Insert the information in the record.

[The information follows:]

STRIP-MINED LAND UNDER PUBLIC OWNERSHIP

It is estimated that through 1971 a total of 4 million acres of land has been surface mined in the United States. The percentage of this land that is under public ownership is estimated to be small, probably less than one half of 1 percent of this total acreage. To date most of the surface mining has been in the eastern part of the United States. It is expected that the percentage of surface mined land that is publicly owned will increase in the future as the demand for power increases in the West.

MINE FIRES

Mrs. HANSEN. Are all your mine fires out in the United States?

Mr. OSBORN. No. We have 248 at the moment that we know are burning.

Mrs. HANSEN. Are these all over the country?

Mr. OSBORN. Yes. Fifty-nine are in Appalachia. Most of the balance are west of the Mississippi with the largest concentration in Montana.

Mrs. HANSEN. What is being done to correct this situation?

Mr. OSBORN. Well, we are watching them. We don't have the funds.

Mrs. HANSEN. That is what amazes me. I think you mentioned this morning, we have an investment to make upon that which we have taken out yesterday.

Mr. OSBORN. We estimate that for each mine fire we have put out the cost of that fire represents about 5 cents per ton of the coal that has been saved.

Mr. MCKAY. How much coal have you lost by the fires in tons?

Mr. OSBORN. Some of them have been burning for hundreds of years

probably. Well, of course, we could not even estimate that. Have we made an estimate of that, Joe?

Mr. CORGAN. We have an estimate of the reserves in danger of 566 million.

Mr. OSBORN. Tons?

Mr. CORGAN. Yes, tons.

Mr. OSBORN. 566 million tons endangered by present fires. But how much has been burned? Do you have any idea?

Mr. ZINNER. You couldn't measure that.

Mrs. HANSEN. Our inventory of coal could be reduced by 566 million tons?

Mr. ZINNER. Yes. It is a year's production.

Mr. MCKAY. What kind of funding do you have for research in putting fires out, or are you at zero?

Mr. OSBORN. You hit on an important point there. Our funds are really for research and development and demonstration.

Mr. CORGAN. Public Law 83–738, the act of 1954, is the special authority for work on coal mine fires.

Mrs. HANSEN. We have spent quite a bit of money in Pennsylvania for a demonstration project.

Mr. OSBORN. Those demonstrations were on coal waste bank fires. All we have in this budget is $226,000 for putting out fires under Public Law 83–738.

Mr. ZINNER. The authority limits this work to $500,000 a year. It also provides that there should be 50–50 matching funds on private lands. On the public domain it would be all Federal money.

Mrs. HANSEN. Aren't many of the fires in old mines.

Mr. ZINNER. Yes.

Mr. MCKAY. Have most of your funds been used for putting out fires or on research how you can better put out fires?

Mr. OSBORN. The former.

Mr. MCKAY. So you are not doing much of anything in research on an inefficient way to put out fires?

Mr. OSBORN. Maybe I answered that too fast. In the extinguishment programs I am familiar with, each one has been a special problem in itself, so it has been experimental and with the objective of putting it out. I am thinking of the one where we dug a 190-foot-deep trench 4,400 feet long and filled that with sand to stop the progress of the fire. We learned a lot doing this. This was a type of fire in a sloping bed. It will still burn for a while but we have it cutoff so that it will burn itself out. Probably most of our work really has been as much an experiment as with the objective of putting out the fire.

Mr. MCKAY. Simply because you did not know anything different so you had to try something.

Mr. OSBORN. That is right. There is so little known about some of these fires.

Mr. EVANS. Madam Chairman, what did they ask for in terms of money this year?

Mrs. HANSEN. $226,000.

Mr. EVANS. Is that carryover or is that new authority?

Mr. OSBORN. We have that in the budget for 1974.

Mrs. HANSEN. $226,000 is in the 1974 budget.

Mr. OSBORN. I have a list of mine fires here. For 1974, for control of mine fires in the West and Alaska we plan to spend $35,000 in Colorado on fires, $4,000 on Montana fires, $70,000 in Utah, $1,000 in Wyoming, and $10,000 in Alaska.

COAL MINE INSPECTIONS

Mrs. HANSEN. You are requesting no change in funding for coal mine inspections.

Mr. OSBORN. Yes.

Mrs. HANSEN. I have a news clipping entitled "Mine Safety Penalty System is Upset." It says:

> The system of the U.S. Bureau of Mines for imposing costly civil penalties on coal mine operators who violate Federal safety standards has been struck down by the U.S. district court.

Do you want to comment on that?

Mr. OSBORN. Yes, I would be glad to say a bit about this very important subject.

We have prepared here a brief discussion of the coal mine health and safety activities for 1972 where the prose is only a few pages, and then we have a few diagrams that are extremely interesting. For example, this one, which is the number of fatalities in coal mines in 1970, 1971, 1972, and 1973. So far in 1973 the number of fatalities is only half of that of last year, and last year was well below the previous year. I was wondering if you would permit our placing this in the record because this is quite a helpful statement.

Mrs. HANSEN. Please do.

[The information follows:]

COAL MINE HEALTH AND SAFETY ACTIVITIES FOR 1972

The Bureau of Mines, charged by the Secretary with administering the Federal Coal Mine Health and Safety Act of 1969, intensified its enforcement of the health and safety standards in 1972 to achieve immediate improvement in the coal miners' welfare. The steps taken earlier to strengthen the organizational structure were accelerated so that the provisions of the law could be applied more widely and with greater uniformity and efficiency. In addition, cooperative programs with mine management and labor were launched, and special campaigns were vigorously pursued to give an added thrust to all the efforts being made to improve the safety record of the industry.

The best available figures show the number of active underground and surface mine operations to be 1,663 and 1,915 respectively. These are not fixed figures nor are they constant because, generally, there is a fluctuation in the number of producing mines during the course of a year. In any given year some are abandoned, others are opened, and others are temporarily shut down or operated seasonally.

Another feature of the year was a 6.4-percent gain in the output of coal (bituminous, lignite, and anthracite). Production in 1972 was estimated to be approximately 597 million tons, surpassed only in the last 10 years by the 609 million tons produced in 1970. In this 10-year period, production of coal from surface mine operations increased from 35 percent of the yearly production to 52 percent in 1972.

As experience was gained in administering the act, it became clear that certain changes in organization and assignment of functions could increase efficiency of operations and enhance program planning. One of the major changes was an increase in 1971 in the number of health and safety field districts from five to nine. Furthermore, a plan for rotating district managers was placed into effect in October 1971. The plan requires district managers to spend 1 year at an institution of higher learning taking courses in management and public administration, to devote 1 year as a visiting professor at the Health and Safety

Academy at Beckley, W.Va., and to work 1 year on the staff of the Assistant Director—Coal Mine Health and Safety.

The primary purpose of establishing the rotation plan was to complement a long-range management development program for top field officials. Ancillary benefits will include more uniform application of the Federal Coal Mine Health and Safety Act of 1969 in all districts, a better knowledge and understanding of the coal mining industry in all areas of the United States, an opportunity to become more proficient in management and administrative procedures, and finally, the capability of bringing to the classroom information gained through years of varied experience in coal mine health and safety. The plan also anticipates that key managerial positions would be filled by experienced and knowledgeable mining engineers, a key step in improving the professionalism of the staff.

The fuller application of the law's provisions and the innovative projects undertaken, as well as the changes made by mine operators, appeared to have had an effect on the year's fatality record. Fatalities in coal mines in 1972—though still far above the national industrial average—were the lowest in the statistical history of the industry. Work-connected deaths, underground and surface, totaled 156. The frequency rate as well as the number of men killed, established a record low of 0.56 per million man-hours. Improvement was shown in nearly every hazard area.

Nonfatal injury experience is not encouraging. Preliminary figures for 1972 show that the disabling injuries were incurred by coal miners during the year at a rate of 47.73 per million man-hours worked. This compares with a rate of 45.85 in 1971 and 41.76 in 1969, which was the last full year of reporting injuries on a voluntary basis. Mandatory injury reporting as required by section 111(a) of the act, became effective March 30, 1970, the operative date of the Federal Coal Mine Health and Safety Act of 1969, and since that time there has been an increase in the disabling injury frequency rate mainly because injury occurrences were more accurately reported. Furthermore, injury reporting became even more accurate on April 1, 1972, when CFR—Part 80—Notification, Investigation Reports, and Records of Accidents became effective. CFR—Part 80 established uniformity in classifying and reporting injuries and consequently resulted in injuries formerly reported as no-lost time now being reported and classified as disabling.

Mine accident records show that, over the years, falls of roof and rib have been the leading cause of work-related deaths, usually accounting for more than half of all underground coal mine fatalities. Therefore, the Bureau in 1971 launched the most comprehensive campaign in the history of mining against this "No. 1 Killer." To carry out this project, veteran mine inspectors were designated roof-control leaders. The objective was to explain to each worker and supervisor in a mine the correct roof-support system for that mine and to help in problem situations that could be solved with known technology. Industry cooperated wholeheartedly in the campaign. The number of fatalities attributed to roof falls declined sharply and in 1972 accounted for 51 deaths as compared to 61 in 1971 and 84 in 1970.

Another major campaign was project "Winter Alert." The chronicle of major disasters inscribed over a period of more than half a century of coal mining, tells us that such catastrophes are more likely to occur during the winter months. Consequently, an intensive effort was begun in October to minimize the possibilities of large-scale mine explosions, fires, and similar occurrences during the period of greatest danger. The rationale behind this mammoth field project was that the presence at the mines of Federal enforcement personnel would emphasize the importance of safe work habits and encourage the maintenance of a hazard-free working environment. The project was begun in October and will not be terminated until the end of March 1973.

The goal set by the Bureau of Mines to build up its inspection force will be met. At the end of calendar year 1972, the number of inspectors, engineers, specialists, and aides had been actually increased to 1,282. As the inspection force grew in numbers and in experience, mines underwent more and more inspections and investigations. Nearly 60,000 health and safety inspections were conducted in 1972. This compares with 26,000 inspections conducted in 1971. In addition, thousands of roof-control plans, ventilation plans, and other plans that the law requires mine operators to submit for approval were reviewed by Bureau engineers and specialists versed in these techniques.

Federal inspectors, on the basis of observations, samplings, and measurements during the course of their official mine inspections, issued 76,001 notices of violation to mine operators. The notices issued during the year encompassed violations of virtually the entire range of health and safety conditions and practices and approved roof-control plans. It should be noted that the conditions most frequently cited represented the most serious hazards in the underground mining of coal. They are the hazards that can result in roof-fall and haulage accidents and in disastrous mine explosions. Consequently, the Bureau is considering every possible means of zeroing in more precisely on these hazards.

Section 103(i) of the act directs the Secretary to provide a minimum of one spot inspection every 5 working days by one of his duly authorized representatives (DAR) if he finds a mine (*a*) which liberates excessive quantities of methane (defined by the Bureau as in excess of 1 million cubic feet a day) or (*b*) in which a gas ignition or explosion has caused a death or serious injury during the previous 5 years or (*c*) which has other especially hazardous conditions. The Bureau also included in this category of hazardous mines any mine in which two or more fatalities had occurred within the past 12 months. In addition, the Bureau decided to designate as hazardous and requiring inspection at least every 10 days, those mines liberating between 100,000 and 1,000,000 cubic feet of methane a day and those having a fatality within the past 12 months. The number of underground mines requiring spot inspection at 5-day intervals was approximately 174 in 1972.

In accordance with section 104(a) of the act, inspectors issued 1,319 orders of withdrawal requiring that men be removed from mines or sections of mines because of the presence of an imminent danger. Orders for the withdrawal of men were also issued by the Bureau inspectors for reasons other than an imminent danger. For example, 1,485 orders of withdrawal were issued for failure to abate a notice of violation as prescribed by section 104(b) of the act, or for unwarrantable failure as defined in sections 104(c)(1) and 104(c)(2) of the act. The primary reason for less orders of withdrawal in 1972 is that compliance is more readily met through experience and greater effort to comply even in the face of generally shorter periods of time granted for compliance.

As for the major health problem of the coal industry, namely the threat of coal workers' pneumoconiosis or black lung from the breathing of respirable coal dust, all indications at the end of 1972 were for a continuation of the progress achieved since the act went into effect. Compliance by the industry with the initial dust standard of 3.0 mg/m^3 exceeded all expectations. As of December 26, 1972, more than 96 percent of the 2,900 to 3,025 underground mining sections were in compliance with the 3.0 mg/m^3 standard and about 80 percent of the working sections were able to meet the more stringent standard of 2.0 mg/m^3 which became effective December 30, 1972. Moreover, about 40 percent of the sections showed less than 1.0 mg/m^3 of respirable dust. The average dust concentration for all samples collected in all mines during the first 6 months of 1972 is 1.7 mg/m^3.

Mines in which the respirable dust samples showed an average concentration in the mine atmosphere of the sections sampled in excess of 3.0 mg/m^3 were issued 2,400 notices of violation as required by section 104(i) of the act. In 20 instances withdrawal orders were issued because of failure to abate the violation in the time either originally set or extended by the inspector. In addition, mine operators were given more than 9,000 notices for violations based on section 104(b) of the act.

The average dust concentration has been decreasing in 29 mines for which we have data collected during survey work conducted prior to the establishment of the act. Since 1970, the data has been retrived from the operators' dust sampling program and a review of the data shows favorable improvement. A comparison was also made between the Bureau's independent measurements of respirable dust and the figures obtained from the operators' sampling programs. The overall results indicate substantial agreement between the two sets of data.

Expecting that the recent trend in the industry toward the long-wall system of underground mining will continue and may even accelerate, the Bureau initiated health surveys of long-wall sections. An extended experimental project was completed in August 1972, on a section that appeared to have the most difficult respirable dust problems of any long-wall plow in this country. The combination of several procedures lowered the average respirable dust concentrations from 12 mg/m^3 to below 3.0 mg/m^3.

The act in section 203(b) provides for the transfer of miners who show evidence of the development of pneumoconiosis to positions in the mine with lower con-

centrations of respirable dust. Before the close of the year, approximately 600 miners had exercised their right of transfer to a less dusty atmosphere.

Health standards affecting over 2,000 surface mine sites and approximately 50,000 surface employees went into effect June 30, 1972, to regulate workers' exposure to respirable coal mine dust, noise, and airborne contaminants. While the dilution factors inherent in open-air work control most exposures to respirable coal mine dust at surface coal mines, the 2.0 mg/m^3 standard may be violated while working with bulldozing and augering equipment. In addition, a dust exposure problem may occur in preparation plants or other structures where the natural movement of air is restricted. These factors have led to a conclusion that a "high-risk" concept is applicable for surface operations. Therefore, steps are being taken to prepare a program similar to that for underground.

The noise levels generated by the heavy equipment in use at surface coal mines often lead to exposures greater than that allowed by the standard. Following the issuance of a notice of violation, a hearing protection plan must be submitted by the operator. As an interim measure, until the noise source can be controlled, it has been decided to allow the use of acceptable hearing protective devices in those situations where no safety hazard will be created by the use of ear plugs or muffs.

Studies are being performed to determine the extent of exposure to airborne contaminants other than respirable coal mine dust. It has been determined that shop welders are exposed to iron oxide fumes rather than to respirable coal mine dust. Therefore, the standard of exposure has been adjusted for this category of employees.

The increase of the Bureau's inspection force has required procurement of additional monitoring equipment for health activities. However, the improved availability of health-inspection equipment, and the implementation of a projected program to train and retrain inspectors will allow the Bureau of Mines to increase the number and effectiveness of health inspections during 1973.

It also became evident in 1972 that although the act had been passed by the Congress near the end of 1969, many of its detailed provisions, some of them quite complex, were still not generally understood by the industry. The Bureau, therefore, considered it imperative to advise the industry of its responsibilities under the law and the manner in which the law was being administered. Consequently, the information and educational forums which began in 1970, were greatly expanded in 1972, and were supplemented by wide dissemination of messages, manuals, and other pertinent communications. Many meetings were organized by the Bureau, most of which were held in places most convenient to a majority of the mine operators and workers. The requirements of the law, the rules and regulations issued by the secretary pursuant to the act, interpretations of the act, and procedures followed by the interior agencies in enforcing the law, were explained in detail and fully discussed with those in attendance. In addition, special seminars and institutes were held on such topics as respirable dust, noise control, and prevention of roof-fall accidents.

Also, meetings have been held from time to time with equipment manufacturers to inform them of the Bureau's experiences in field work and to apprise them of the results of laboratory investigations, field testing of equipment and procedures, and of research work. These meetings were informal in character and designed to influence the manufacturers in designing safer mining machinery to reduce hazards.

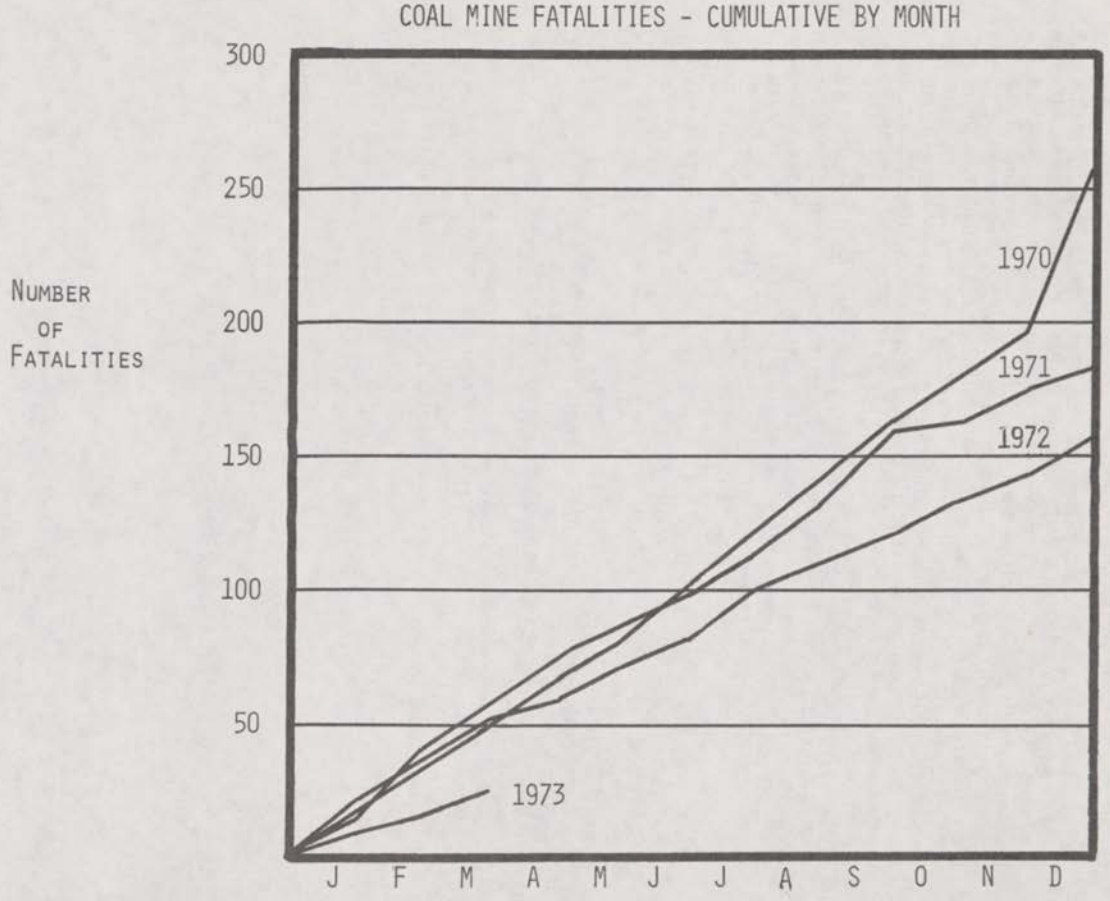
The expanded inspection schedules established by the Federal Coal Mine Health and Safety Act of 1969 requires the most effective and efficient use of the inspectors' time. This in turn necessitated cutting paper work to the bone, which was accomplished by revising the form of the inspection report to a single page of information and data with no narrative plus a copy of each notice and order issued during an inspection. The number of forms used for issuing notices and orders was reduced from 15 to 4. Time and money were also saved by duplicating, instead of having typed, inspectors' handwritten notices and orders for distribution. The effectiveness of the inspection force was further enhanced in 1972 by revising and reissuing Inspection Manuals covering the applications and interpretations of all the provisions in the Federal Coal Mine Health and Safety Act of 1969 and the supplemental regulations published in the Federal Register. Copies were distributed to the industry to keep operators and workers alike fully cognizant of the manner in which the Bureau applies the health and safety standards and regulations.

The programs of enforcement and industry guidance carried forward in calendar year 1971 were augmented and reinforced in 1972. Campaigns similar to the

one launched in 1971 against falls of roof, face and rib was initiated in 1972. The first of these campaigns was a major thrust against transportation hazards. At first the "mine transportation systems evaluation and training" program had little or no effect on the number of accidental haulage deaths. This trend became apparent near midyear and an immediate review of the accident causes and program resulted in revisions of the program. Under the revised program, 14 underground haulage deaths occurred during the last 6 months, a reduction of 9 or 40 percent from the 23 occurring during the first 6 months. Accidental deaths at surface mine operations had also increased before midyear and again the causes of death were analyzed and a preventative program was developed and put into effect with favorable results. During the last 6 months, 11 deaths occurred at surface operations, a reduction of 54 percent from the 24 deaths occurring during the first 6 months of 1972.

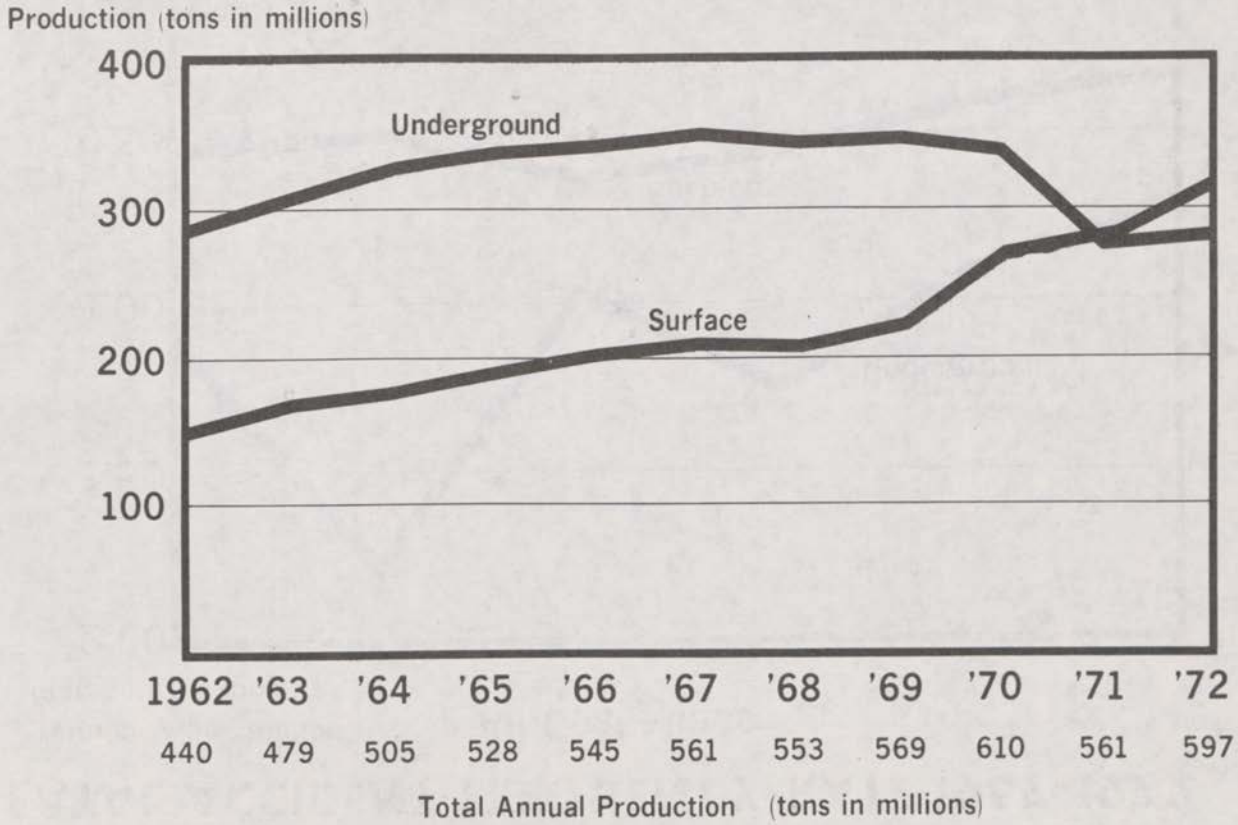
Other serious incidents, such as Blacksville No. 1 mine and Itmann No. 3 mine, prompted development of regulations for improved diesel equipment for underground use, improvements in mine ventilation systems, improved procedures for moving equipment underground, and mandatory fire drills. Thirteen health and safety standards were proposed during the year and to date all but three have been published in the Federal Register as mandatory regulations. Other campaigns to reduce injury and death in coal mines include making daily inspections of mines having the greatest potential for accident occurrences and hiring experienced surface mine personnel to inspect surface mines. Efforts will be made to accelerate the use of cabs and canopies underground, which should appreciably reduce not only fatal accidents from falls of roof and ribs but also from crushing injuries. Further inroads into the fatal accidents will be achieved by regulations, such as requirements for panic bars on face equipment. Also, since the accident reporting system in technical support is now operational, analyses of accidents and injuries will be possible affording us the opportunity to take action in those areas pinpointed.

It is recognized that although improvements have been made in the number of fatality occurrences in the past 2 years the record is still unacceptable. Therefore, the objective in all these coordinated attacks on accident generating conditions and practices is to lower to the very minimum the annual toll of casualties in the mines.

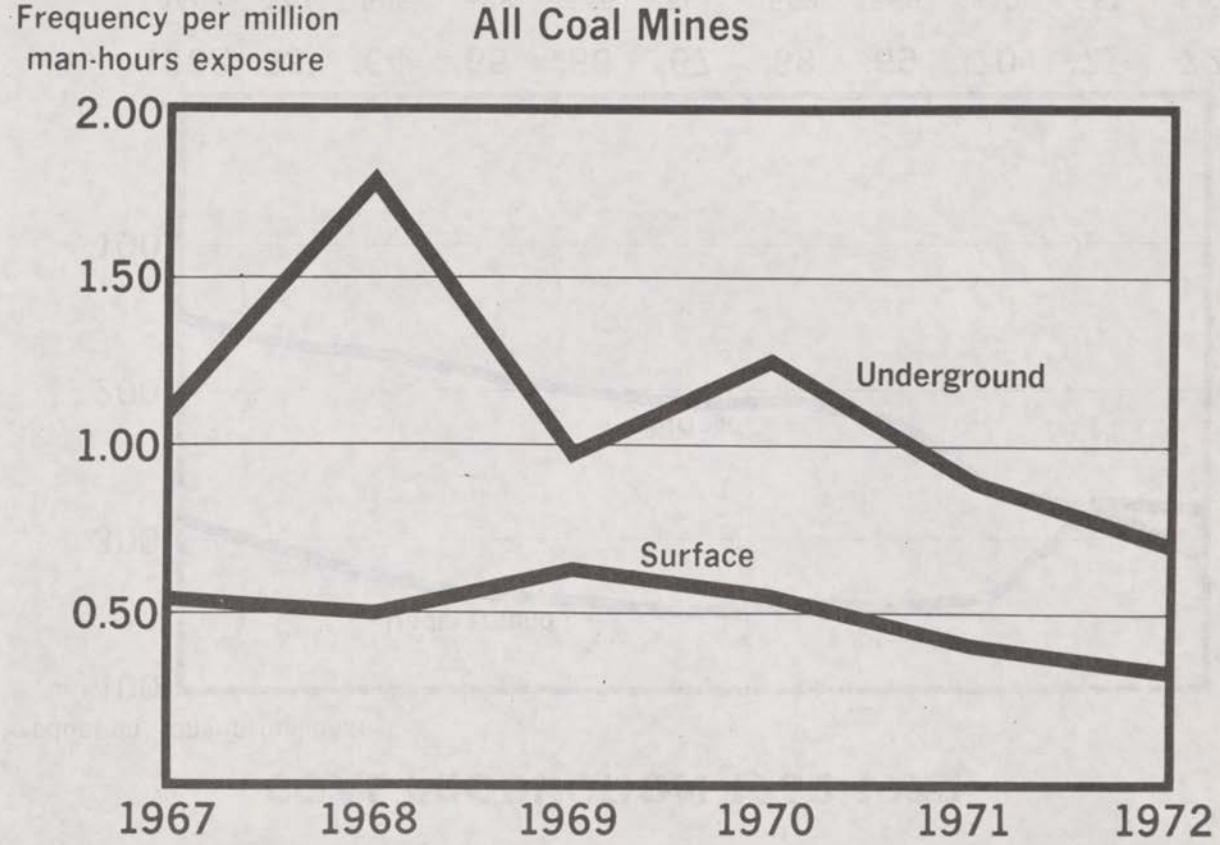

COAL MINE FATALITIES - CUMULATIVE BY MONTH
NUMBER OF FATALITIES
300
250
200
150
100
50
1970
1971
1972
1973
J F M A M J J A S O N D

94-250 O - 73 - 27

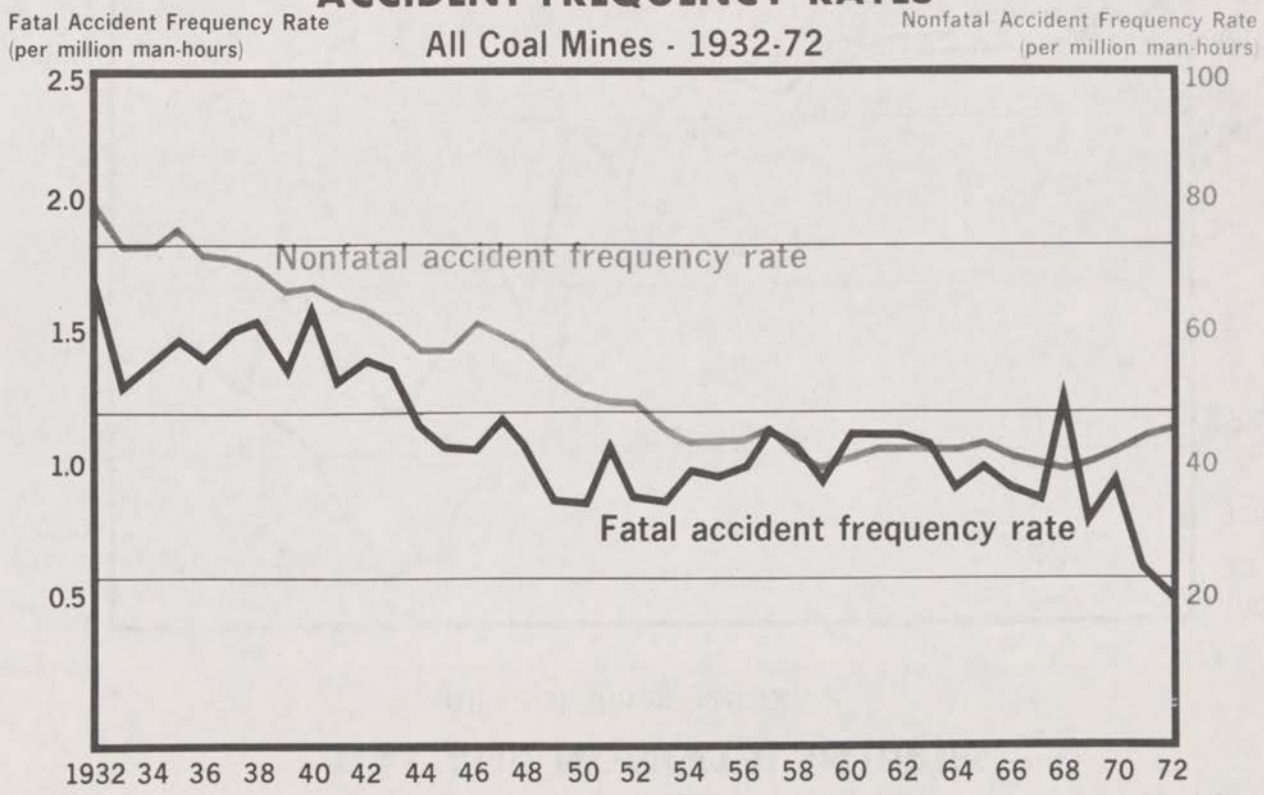
COAL PRODUCTION 1962-1972



FATAL ACCIDENT FREQUENCY RATE 1967-1972

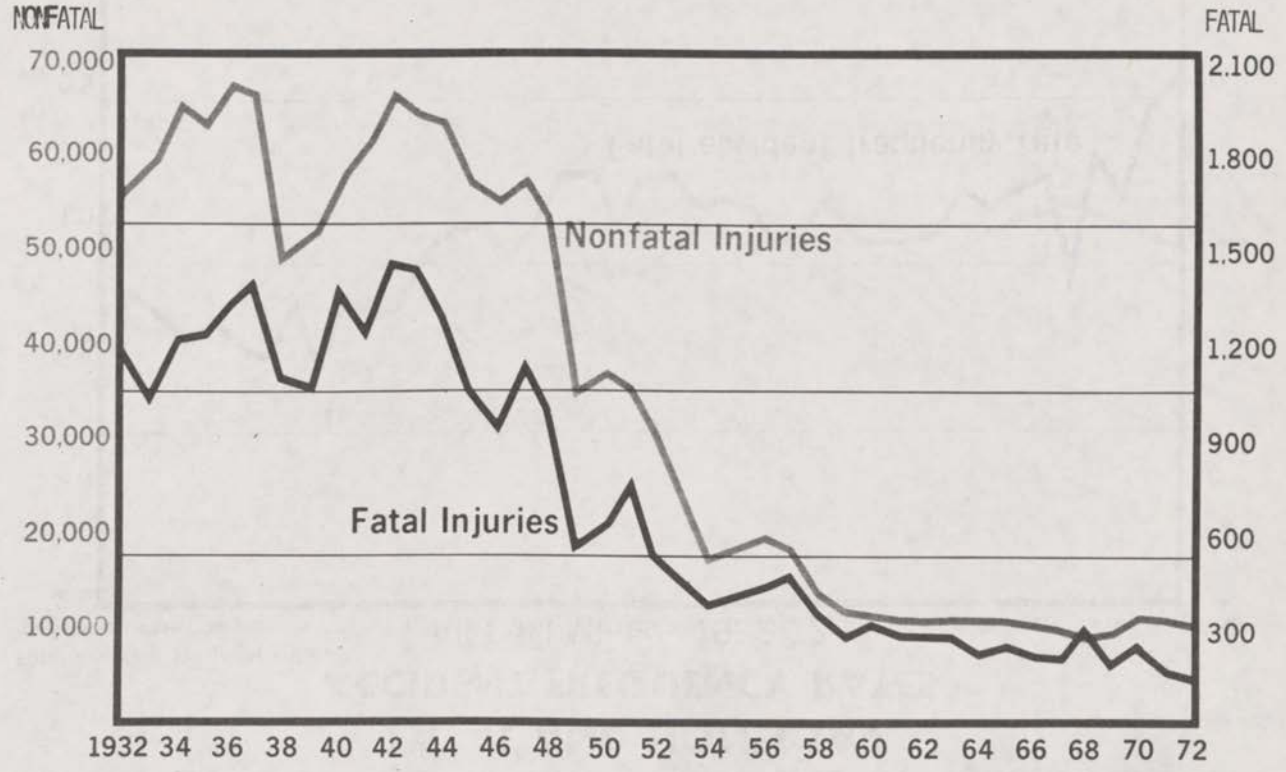


FATAL AND NONFATAL ACCIDENT FREQUENCY RATES

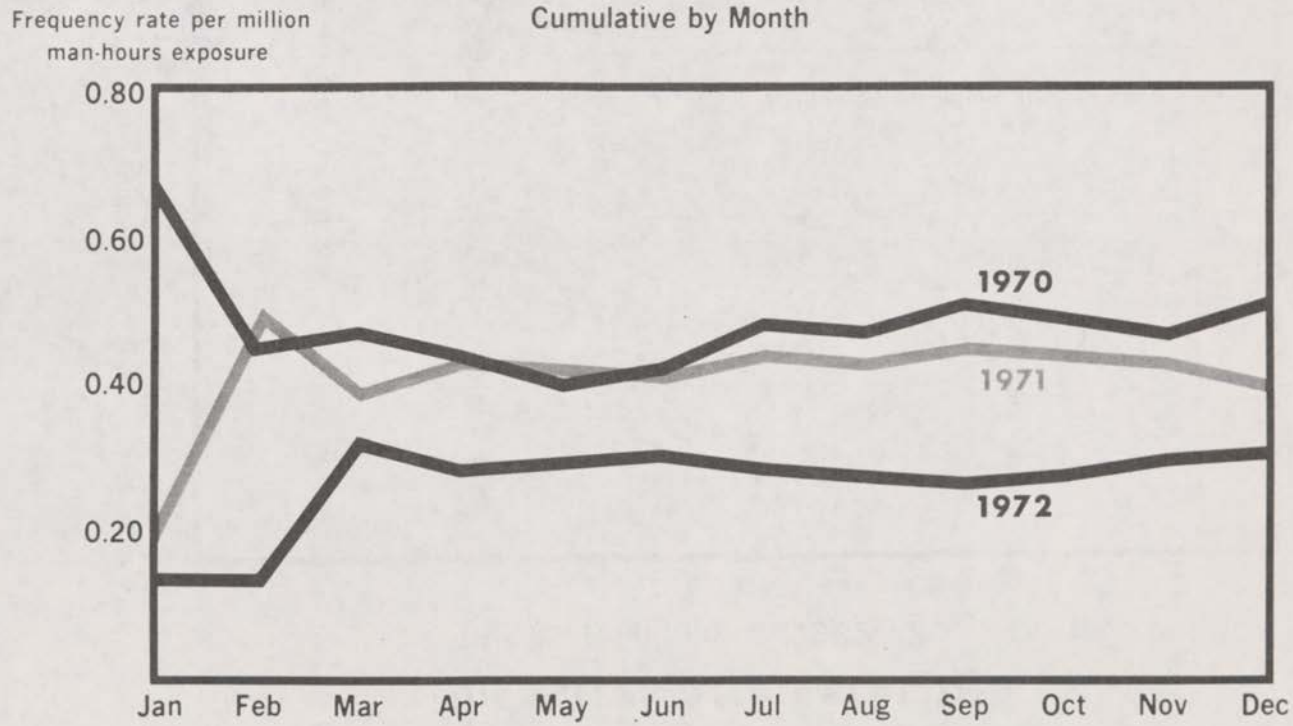


FATAL AND NONFATAL INJURIES

All Coal Mines - 1932-72

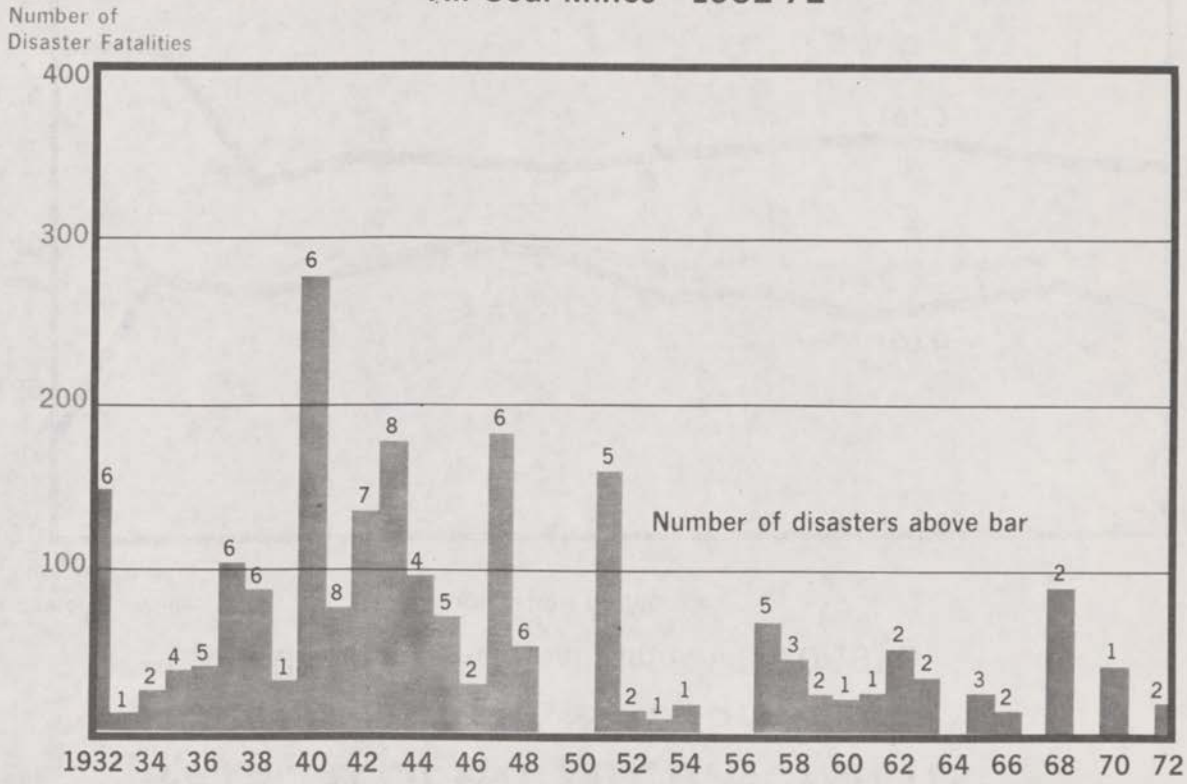


FATAL ACCIDENT FREQUENCY RATES
Falls of Roof, Face, and Rib
All Underground Coal Mines - 1970-1972

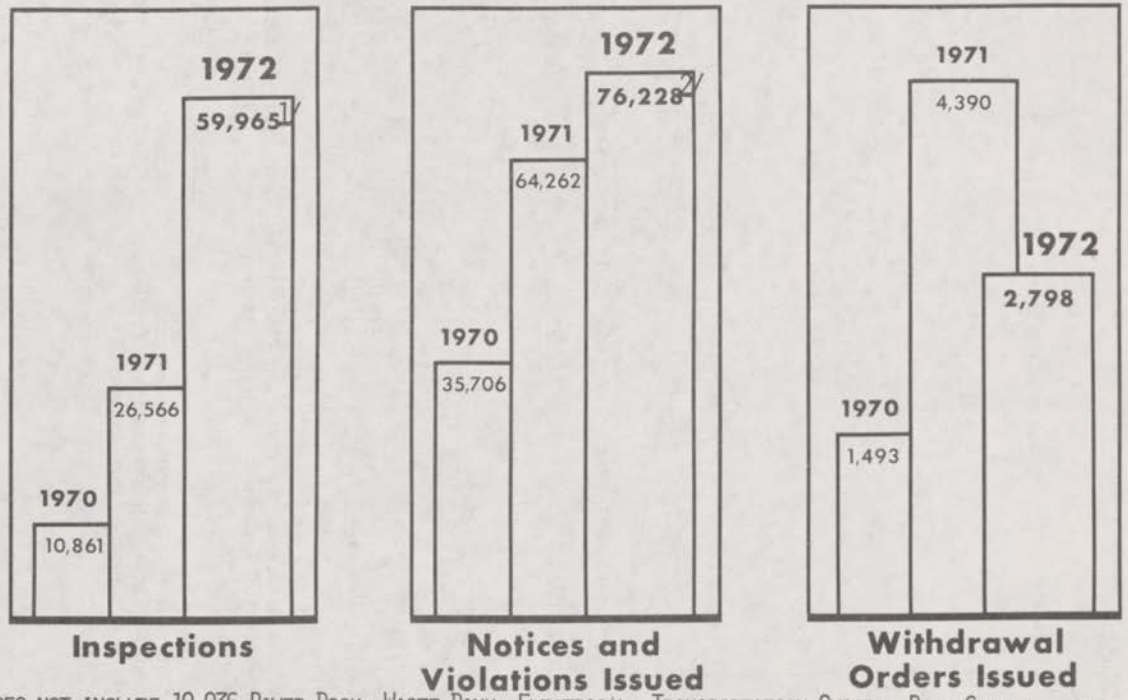


DISASTERS AND FATALITIES

All Coal Mines - 1932-72



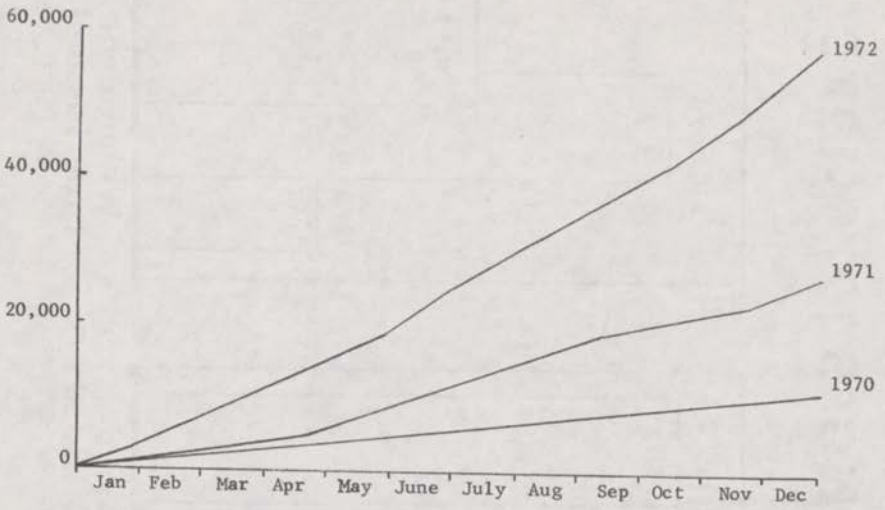
SIGNIFICANT CHANGES 1970-1972



1/ Does not include 10,936 River Dock, Waste Bank, Electrical, Transportation System, Roof Control, and Ventilation Surveys and Inspections.

2/ Preliminary estimate; later revised to 76,001.

Health and Safety Inspections



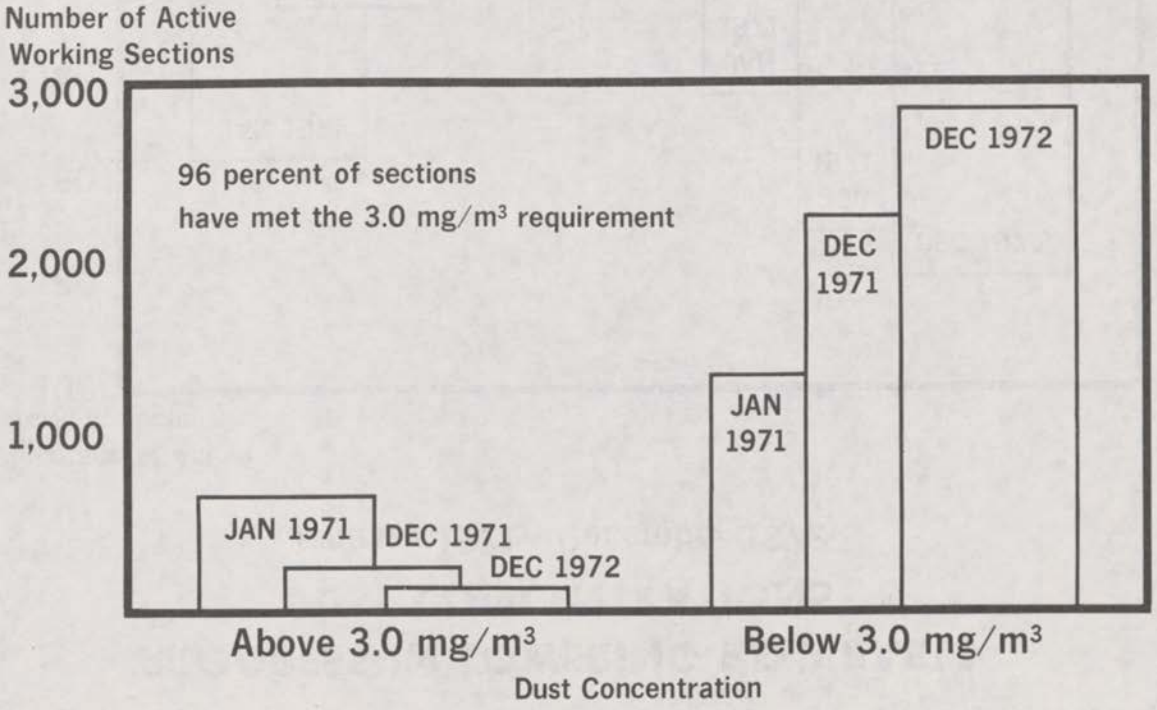
Type of Inspection	Surface	Underground
Regular Safety	3,148	4,125
Regular Health	74	1,668
Regular Health and Safety	519	2,802
Spot Safety	4,948	29,952
Spot Health	306	3,750
Spot Health and Safety	158	1,811
Safety (Other) 1/	1,697	5,982
Spot Safety (Other) 1/	541	3,646
Total	11,391	53,736

1/ Includes Electrical, Preparation Plant, River Dock, Roof Control, Transporation System, and Ventilation Inspections and Surveys

	Complete	103(i)
Number of required Underground inspections	13,304	9,360
Number of required Underground inspections made	11,397	10,184
Percentage of required inspections	85.6%	108.8%

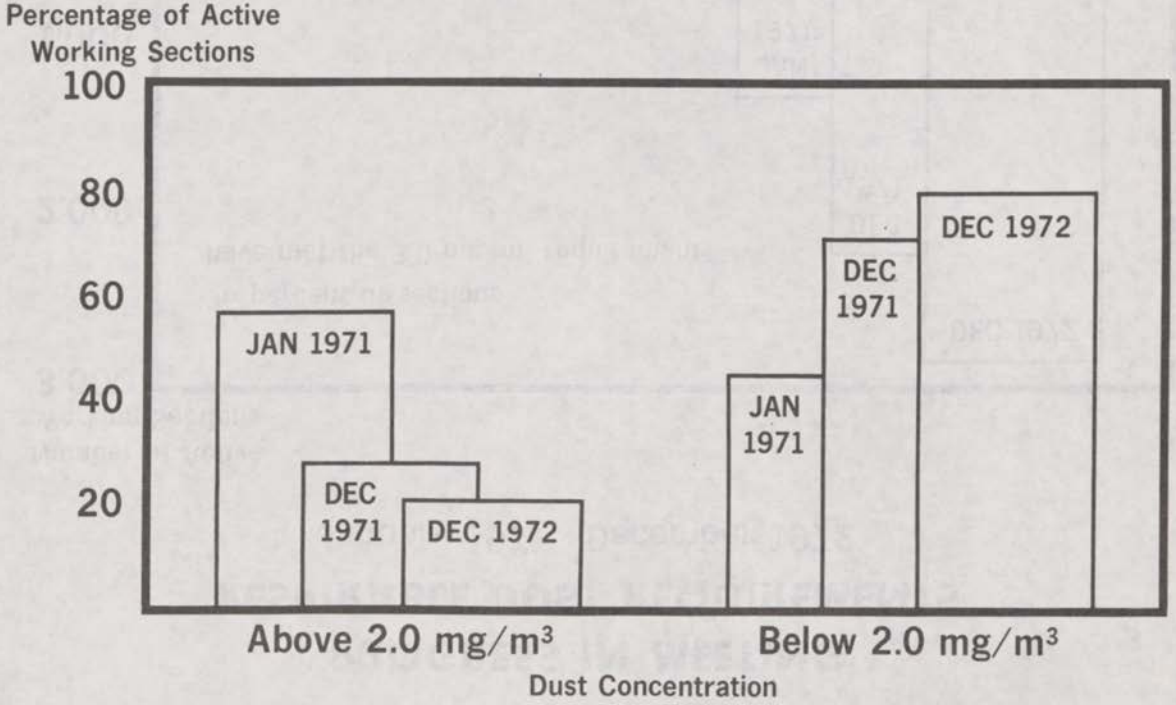
PROGRESS IN MEETING RESPIRABLE DUST REQUIREMENTS

January 1971 - December 1972



PROGRESS IN LOWERING RESPIRABLE DUST CONCENTRATIONS

January 1971 - December 1972



COMPARISON OF MEAN DUST EXPOSURES, SELECTED OCCUPATIONS

Occupation	Survey Data 1968-69 29 mines	Dust Program 7-'70 to 6-'71 29 mines	Dust Program 7-'71 to 6-'72 29 mines	Dust Program 1-'72 to 7-'72 all mines
Continuous miner operator	6.5	3.1	2.6	2.1
Loading machine operator	6.0	2.7	2.2	1.7
Cutting machine operator	5.9	2.9	2.2	1.7
Shuttle car operator	2.3	1.6	1.5	1.4
Laborer	10.4	2.9	1.2	1.7
Timberman	3.9	1.7	1.7	2.2
Roof bolter	3.9	2.3	1.9	2.1

COAL MINE FATALITIES - 1968-1972

	1968	1969	1970	1971	1972
Total fatalities	311	203	260	181	157 1/
Surface operations	43	54	54	40	35 1/
Day-to-day UNDERGROUND fatalities					
Roof-falls	99	78	84	61	51
Haulage	31	33	37	35	37
Machinery	15	18	26	21	13
Electricity	17	7	11	13	2
Other	19	13	10	11	5
Total day-to-day fatalities	181	149	168	141	108
DISASTER fatalities	87	-	38	-	14
Total underground fatalities	268	149	206	141	122

1/ PRELIMINARY FIGURES LATER REVISED TO 156 AND 34.

KBKD

Mrs. HANSEN. There is also a GAO report on this subject which you have probably seen.

Mr. OSBORN. Yes.

Mrs. HANSEN. Will you make a comment on the entire matter?

COAL MINE PENALTY ASSESSMENTS

Mr. OSBORN. Yes.

Mr. Long is here to help out, if we need him. He is the associate solicitor having to do with this. The law became effective on March 30, 1970, and with guidelines that the department had already developed our inspectors immediately began assessing penalties, following these guidelines on the basis of the law, for the violations that were being cited in the coal mines. In April of that year, 1970, the department was enjoined from continuing this by a court, on the basis that the assessments were not being properly made. Not all of the six criteria were being considered. It just happens that I arrived in October and really was not very well acquainted with this—not at all in fact when I arrived—but by the next January 1971, we had new guidelines from the department and the Bureau of Mines was asked to administer the program under these new guidelines.

By then there were 39,000 violations piled up. The law requires that a separate assessment be made for every violation. We are now doing this at the rate of 1,300 a week. Each assessment has to be made by a careful examination of six criteria: Severity of the violation, the past history of the mine with respect to violations, the ability of the mine to pay, the attitude of the operator, and so on. This was a tremendous job, trying to catch up with this backlog. We have made progress, and I think tremendous progress, to the extent that now, up to March 21 of this year, proposed assessments have been made for 12,800 cases—those are mining companies—consisting of over 140,000 violations, representing $24.5 million. Mine operators paid approximately $5 million in fines, for 49,200 violations. These figures represent 20 percent of the money and 35 percent of the violations.

GAO CRITICISM OF ASSESSMENT PROCEDURES

There are over 2,700 violations awaiting formal adjudication in the Office of Hearings and Appeals, which is in the Department of the Interior but not the Bureau of Mines. Approximately 2,200 violations are pending collection action by the Justice Department in the district court. At the same time, or let us say last summer, the GAO report on examination of the Bureau of Mines or Department of the Interior's assessment procedure, criticized the asessment procedure—and you are referring to one of those GAO reports, I think—on assessment delays.

Mrs. HANSEN. The GAO report was dated July 5, 1972.

Mr. OSBORN. That is it. It criticized us on the basis of assessment delays, but we have caught up on the backlog there. The need for adequate management control system, and we have now we think an adequate control system. Also, a recommendation was made that we issue new and better guidelines to involve each of these six factors.

We took their recommendations very seriously, and on August 31 we set out for new rulemaking, proposed new guidelines. We got back, naturally, a lot of criticism. We took that into consideration, modified our glidelines and on November 22, again went out for rulemaking on new guidelines. We got back the criticisms from that.

In the meantime another GAO report, with suggestions, of December 22, and a letter or two from Congressman Reuss with suggestions, and we are now preparing final guidelines that we believe will meet most of these objections, although it may cost a couple of million dollars or more to do the assessment job. In the meantime the independent operators have requested an injunction against the whole business of assessments on the basis that the Bureau of Mines has not been, in its assessment procedures, giving proper information or justification along the lines of these six guidelines in the case of each one of these violations.

RECENT COURT ENJOINMENT OF ASSESSMENT ORDERS

On March 9, U.S. District Court Judge Aubery Robinson declared unlawful the assessment procedures of the Bureau of Mines enjoined us from continuing to utilize or enforce such assessment procedures, but gave us a 30-day stay from March 15. I would like Mr. Long to comment after I say another sentence or two.

In the Bureau of Mines, we feel that we have followed the guidelines that we had from the Department, have caught up on the backlog, and are moving these assessments along the way we had hoped to be able to a year ago. In other words, we have made real progress.

At the moment, we are stopped from sending assessments for fines out to the operators under the present procedures. That does not mean that we will stop our machinery. We will keep that going. There are about 1,300 violations a week coming in, which will be handled, checked out, all the information that goes with making the assessments being compiled. So we will keep going full force. But we will not be able to assess any fines under the present procedures. We wait on something that happens next in the court system. I believe Mr. Long can comment on that.

Mrs. HANSEN. Before Mr. Long comments, this clipping says:

> Judge Robinson held that the Bureau of Mines failed to follow the Mine Safety Law * * * with penalties up to $10,000 for each mine safety infraction and to make the assessment final unless the mine owner requested an administrative appeal.

Mr. OSBORN. Our solicitors have maintained that the procedure we are following is appropriate under the law.

Judge Robinson disagrees. The Justice Department, we believe, is appealing. We have asked them to. In the meantime, we have this other machinery going for new guidelines that we think will meet all the objections anyhow. We think it unwise to issue these new guidelines with this court case going.

Mrs. HANSEN. Mr. Long, do you want to speak to that?

PUBLIC HEARINGS ON PENALTY ASSESSMENTS

Mr. R. LONG. The section that is involved in the statute is 109(a)(3) and it reads that a "civil penalty shall be assessed by the Secretary

only after the person charged with the violation under this act has been given an opportunity for a public hearing."

It doesn't say he has to have a hearing. The volume of violations here is a tremendous volume. The Bureau of Mines is turning out about 75,000 violations a year—75,000 to 80,000 violations. The statute is mandatory in that a penalty be assessed for each violation. The Department has always been of the opinion that with such a volume of violations, you have to have some system other than going straight to a hearing on everyone of these cases to assess the penalty.

Mrs. HANSEN. If you went straight to a hearing——

Mr. R. LONG. That would be 75,000 cases a year.

Mrs. HANSEN. Would they be appealable?

Mr. R. LONG. Yes. Under this statute, this operator does not have to come to the hearing. He does not have to pay us a cent. We could go through all the administrative sections of this statute and we get down to the last part in 10984 and it says, "If he doesn't pay, then the Secretary must go into the U.S. District Court where the operator is entitled to a de novo trial by jury on the whole issue."

I talked to this on the last appropriation hearing. This is ridiculous.

Mr. MCDADE. It is unreal.

Mr. R. LONG. He can forestall us all along the line.

Mr. OSBORN. The wonder is that we collected anything.

Mr. R. LONG. Quite a few cases have gone to hearings. As a matter of fact, since the judge's order, we have received 145 petitions for hearings from the operators. That part of the work is still going on, where the operator wants his day in the hearings.

Mrs. HANSEN. How many have never asked for a hearing?

Mr. R. LONG. The great majority. Why should he? He can sit there. He has no interest charges running against him. He can keep the money in the business, and he can let Uncle Sam come after him in the last analysis. We have over 2,000 cases in the district courts right now trying to get this money. What we need is an amendment to this statute which will provide for the administrative imposition of penalties. The court in issuing the injunction recognizes and has given us a scheme which is reasonably close to what we proposed in the last notice of rulemaking for an informal procedure to collect these penalties. The court has recognized that you may have an informal procedure. It is not required that hearings be held in each instance. We do not want to have the Bureau hold a mini-type hearing at the Bureau level for every one of these assessments and then have the operator appeal that assessment to the Office of Hearings Appeals and then to the Mine Operations Board of Appeals, and then in the end be forced to go to court. That is what we are trying to avoid. That is it in a nutshell.

SAFETY OF MINES

Mrs. HANSEN. Without adequate assessments will you be able to keep the mines safe?

Mr. R. LONG. Yes; we would have the safety. The Bureau can always issue the closure order and close the mine if the operator doesn't abate the violation, which is the real big safety tool in the act.

If he cannot work he has no income, and the statute does require that he pay the miners wages.

Mrs. HANSEN. How many times have you used that procedure?

Mr. R. LONG. Every time he does not abate the violation the inspector will close a portion or the entire mine.

Mr. OSBORN. We have those figures in these sheets we gave you.

Mr. SCHLICK. Four thousand last year.

Mr. R. LONG. He has no production for the day. The statute does require him to pay his miners wages for the day he is down. That is the real enforcement tool under this whole statute. These civil penalties, we are spending an awful lot of money to collect them.

Mr. OSBORN. At the moment what is the status?

Mr. R. LONG. We have a 30-day stay. We could go on doing what we have been doing, but we would be flying in the face of the judge's order if he is upheld on the appeal. Then we would be in the position of having to refund. In the interim we could take everything to hearing, which is a slow laborious expensive way.

COST PER HEARING

Mrs. HANSEN. What is the cost per hearing?

Mr. R. LONG. That depends. Every hearing varies. You may have five violations in one hearing and you may have 150 in another hearing. The Bureau has the burden of proof in the hearing of establishing the occurrence of the violation and on the six criteria. If you cannot get a lot of stipulations out of the other side and cut through some of that you can drag it out for days. Since we do have the burden of proof, they can put us to all of that if they won't stipulate.

Mr. OSBORN. As far as I am concerned, it is not a question of the law. It is just a question of how to administer it. In order to abide by the ruling, if it holds up, this may cost us a great deal more money, in which case we will have to come back to you for an amended budget. We will need money even before we could get a supplemental, which is next December, probably.

COAL MINE INJURY RATE

Mrs. HANSEN. I have another news clipping entitled, "Coal Mine Study Shows Record Can Be Improved When Firms Really Try."

Do you have any comments on this article?

Mr. OSBORN. I do not remember that particular clipping.

Mr. SCHLICK. That was an article by John Conte in the Wall Street Journal. I think he was trying to prove that some coal companies do better in the injury frequency rate than others.

His point was that certain companies have an average injury frequency rate of about 45. That is the number of injuries per million man-hours of exposure. A few companies have injury frequency rates of 2, 3, 5, and 10, and many have injury frequency rates above 100.

Mr. Conte was trying to point out, why do some companies have a better injury frequency rate than others?

His article is pretty true. I would have to concur with his findings there, particularly in the case of some of the basic steel companies, who have been concerned with reducing injury frequency rates for many, many years on the surface and they translate this to their underground operations.

They just have a better injury frequency rate. He was just pointing that out. In 1973 we are going to move very strongly. We feel that education and training is the long-term tool to get the injury frequency rate down. We hope this year to promulgate regulations that will require mandatory training for workers before they go underground—that is new workers—and we hope to promulgate regulations to train people before they change from one job to another, and we hope to promulgate regulations where we have periodic training for all workers. Our end result here is to try to get the injury frequency rate down.

INSPECTION OF HAZARDOUS MINES

Mrs. HANSEN. I have another article from the Washington Post of December 21, 1972, "Mine Inspector Off on Day of Fatal Blast." This was a mine at Mullins, W. Va. Where was he?

Mr. SCHLICK. There are 122 mines in the country that we inspect daily, and that mine was in the category. This is way above and beyond the minimum requirements of the act. I have so many resources to do my inspections with. We picked 122 of the potentially worse mines in the country, where a potential disaster may happen. I put inspectors in those mines daily.

That program applies daily—Monday through Friday—so if a mine works on Saturday, we wouldn't have made an inspection. My whole point is that the act requires us to make four inspections a year. Some of our most potentially disastrous mines are inspected every day because we have the facilities to determine which mines are more potentially hazardous. We are inspecting those at a rate much greater than called for by the act. So we missed one day at this particular mine.

Mrs. HANSEN. Is your budget sufficient to adequately inspect the particularly hazardous mines?

Mr. SCHLICK. We just started this program this year. Before we inspected all mines the same amount. It was our idea that there are mines that are obviously potentially worse than other mines.

WINTER ALERT PROGRAM

We developed several management tools for our field managers to determine the most hazardous mines. That program, which we call the "winter alert," stops, incidentally, at the end of this month. The mines are more susceptible to explosions and major fires during the winter months from October through March 31. It might be interesting to note that because of our winter alert program we are getting at these most hazardous mines right now—Dr. Osborn told you that in 1971 we had the best year in recorded history of coal mining with a fatality frequency of 0.72. Last year the fatality rate went down to 0.56, the lowest ever recorded. The fatality rate hovered at about one for many, many years before the Federal Coal Mine Health and Safety Act was enacted.

We are very happy with this. Although we have to do better, we are still happy. A very important thing is that so far in 1973 there were 24 men killed in our coal mining industry, whereas there were 49 killed in a similar period last year. So far this year there has been half as many people killed in our coal mining industry as last year.

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Mrs. HANSEN. You attribute this to your winter alert and your general safety program?

Mr. SCHLICK. I attribute this to several things. I attribute it to the fact that Congress has granted us a big inflow of inspection people. They are in the mines every day. They are in there getting health and safety.

We issued 76,000 notices of violation last year. That is up from the year before. We do not hesitate to use our power to close mines on any infractions of the law. I think we are getting compliances because clearly we have policemen on the beat every day.

[Discussion off the record.]

METAL AND NONMETAL MINE INSPECTIONS

Mrs. HANSEN. You are requesting an increase of $1.5 million and 83 positions for metal and nonmetal mine inspections. Give us the details of this request.

Mr. OSBORN. May I again, Madam Chairman, call your attention to the fact that we have just a short summary of the operation of the metal and nonmetal, this abstract with two or three tables and two or three charts. Might we put this in the record?

Mrs. HANSEN. Please do.

Mr. OSBORN. I think it will answer almost all of your questions.

[The information follows:]

ABSTRACT OF 1972 METAL AND NONMETAL HEALTH AND SAFETY ACTIVITY

The Federal Metal and Nonmetallic Mine Safety Act of 1966 (Public Law 89-577) provides authority for the Bureau of Mines to conduct mine health and safety inspections, mine disaster investigations, fatal and nonfatal accident investigations, and special investigations and surveys. Also, the Bureau inspects explosive storage facilities on mining properties under an agreement with the Treasury Department's Bureau of Alcohol, Tobacco, and Firearms.

There are approximately 17,000 operations covered by the Metal and Nonmetallic Mine Safety Act, of which an estimated 4,000 are inactive and/or temporarily closed operations at this time.

SUNSHINE MINE FIRE DISASTER

The Bureau's response to the first news of the Sunshine Mine fire was immediate and substantial. Essential rescue equipment, instrumentation, and other materials were dispatched to the mine along with a large number of inspectors, engineers, and other Bureau personnel, to advise and assist in the rescue and recovery operations.

Eventually, though the dedicated efforts of mine rescue teams from the United States and Canada, Bureau of Mines, and the Sunshine Mine, two miners were found alive and rescued from the underground workings. Ninety-one other men died from carbon monoxide poisoning.

A constant around-the-clock surveillance of recovery and rehabilitation efforts was maintained by the Bureau of Mines until December 8, 1972.

The company completed the remedial work recommended by the Bureau of Mines for reopening, the mine closure order was withdrawn, and the company is now in the process of resuming production.

The Bureau's final report on this disaster was issued on February 14, 1973.

Prompted by the Sunshine Mine disaster, the Secretary of the Interior announced a number of initiatives to prevent repetition of such a catastrophe. These included a demand for drastic increase in the number of inspections, more stringent mine health and safety standards.

A total of 13,021 health and safety inspections, including 6,700 regular and 6,321 spot inspections, were conducted in calendar year 1972. This 54-percent increase in the number of inspections made in calendar year 1972 over calendar

year 1971 was due in part through increased time available for mine inspection through expanded use of field offices to reduce inspector traveltime and through changes in administrative procedures.

Also, in calendar year 1972, a total of 54,800 notices were issued and 50,200 notices were abated compared with 45,600 and 27,800 respectively, in calendar year 1971.

A total of 208 closure orders were issued during calendar year 1972, nearly 4 times more than the 56 orders issued in calendar year 1971.

Increases in issuance of both notices and closure orders, and their abatement through compliance is indicative of increased mine inspection frequency and more stringent policies.

Requests for variance from the provision of mandatory standards in calendar year 1972 decreased 43 percent from calendar year 1971.

HEALTH AND SAFETY STANDARDS

Following the Sunshine Mine disaster, the Deputy Director—Health and Safety appointed a Bureau Standards Development Committee to translate the Secretary's initiatives into suggested mandatory standards. The committee was also charged with reviewing all of the existing standards for clarity, sufficiency, and enforceability.

Bureau-suggested safety standards based on the Secretary's initiatives were considered at the July and September 1972 meetings of the Federal Metal and Nonmetal Mine Safety Advisory Committee. After consideration of the advisory committee's recommendations thereon, the Secretary caused such standards to be published as proposed rulemaking in the December 9, 1972, issue of the Federal Register. A total of 21 standards actions was proposed. In accordance with statutory provisions, a hearing was requested on four of the proposed mandatory standards that, in the form proposed, could not be designated as recommended by the advisory committee.

Other actions recommended by the advisory committee at its November 1971, March 1972, and July 1972 meetings were prepared in form for publication as proposed rulemaking. These consisted of proposal of 15 new standards, revision of 27, and the revocation of 4 existing standards, and revision of 1 definition.

The Bureau's Standards Development Committee completed its preliminary review of the existing promulgated standards. Groups of new and revised standards suggested by the committee have been reviewed in the field at district headquarters and by the mine health and safety agencies of State plan States. These groups of standards dealt with ground control; fire prevention and control; loading, hauling, dumping; and explosives.

Meanwhile, based on actions proposed in the Federal Register on December 17, 1971, and the consideration of comments and objections received thereon, there were promulgated by publication in the Federal Register on July 19, 1972, 39 new standards and 43 revisions and 15 revocations of existing standards.

HEALTH ACTIVITY

Industrial hygiene laboratories have been installed in 12 of the 14 subdistrict offices. These laboratories are equipped to determine from field samples, the concentrations of dusts, toxic gases, radiation, and noise found in mining and milling operations.

At the end of calendar year 1972, approximately one-half of the inspection force had been trained to perform health inspections. A program to survey all underground mines for radiation was initiated in 1972.

A program was initiated with technical support assistance to investigate dust conditions in all asbestos mines and mills. Adverse asbestos dust conditions were not too common; however, dust control systems must be improved or installed in all the mills as a result of these studies.

INJURY EXPERIENCE

The fatality frequency rate in the metal and nonmetal industries decreased slightly from 0.41 in 1967 down to 0.31 in 1971. A total of 223 fatalities were reported in 1972, including 91 deaths resulting from the Sunshine Mine fire disaster, compared to 163 deaths in 1971. As of March 26, 37 fatalities have already been recorded in 1973, compared with 29 by this date in 1972. The increase in fatalities at surface mining operations indicates the need for greater concentration of enforcement effort in these operations.

Recent studies have indicated an adverse upward trend in the number of nonfatal accidents.

Part 58 requiring the mandatory reporting by the mine operators of accident and injury information to the Bureau of Mines was promulgated and became effective January 1, 1973. This information will bring a new dimension to metal and nonmetal enforcement activity by pinpointing those specific mining tasks where accidents and injuries are occurring.

The number of fatal and nonfatal accidents occurring each year in the noncoal mineral industries has brought into sharp focus the need for additional personnel and expanded Bureau of Mines health and safety enforcement programs.

STATE PLAN

The Federal Metal and Nonmetallic Mine Safety Act provides for State participation in the promotion of health and safety in the mineral industries.

Five State plan agreements (Arizona, California, Colorado, New Mexico, and New York) have been approved and signed to date, with three others (Virginia, Washington, and Utah) in the final stages of preparation. An additional 11 States were well along with achieving full compliance with the requirements of section 16 of the act but are not in a position to consummate an agreement without funding by the Government. Preliminary correspondence has been exchanged with an additional nine States.

PROGRAM THRUSTS IN FISCAL YEAR 1974

1. Strive to reduce the nondisabling, disabling, and fatality rates throughout the noncoal mining industry.
2. Increase the inspection activity and known presence of mine inspectors at all mines.
3. Increase health inspection activities and broaden the scope of health inspections to cover all known mining health hazards.
4. Establish a program for upgrading on a continuing basis the health and safety inspection capability of our inspection personnel.

TOTAL METAL AND NONMETAL
MINE HEALTH AND SAFETY
ACTIVITY
1971 AND 1972

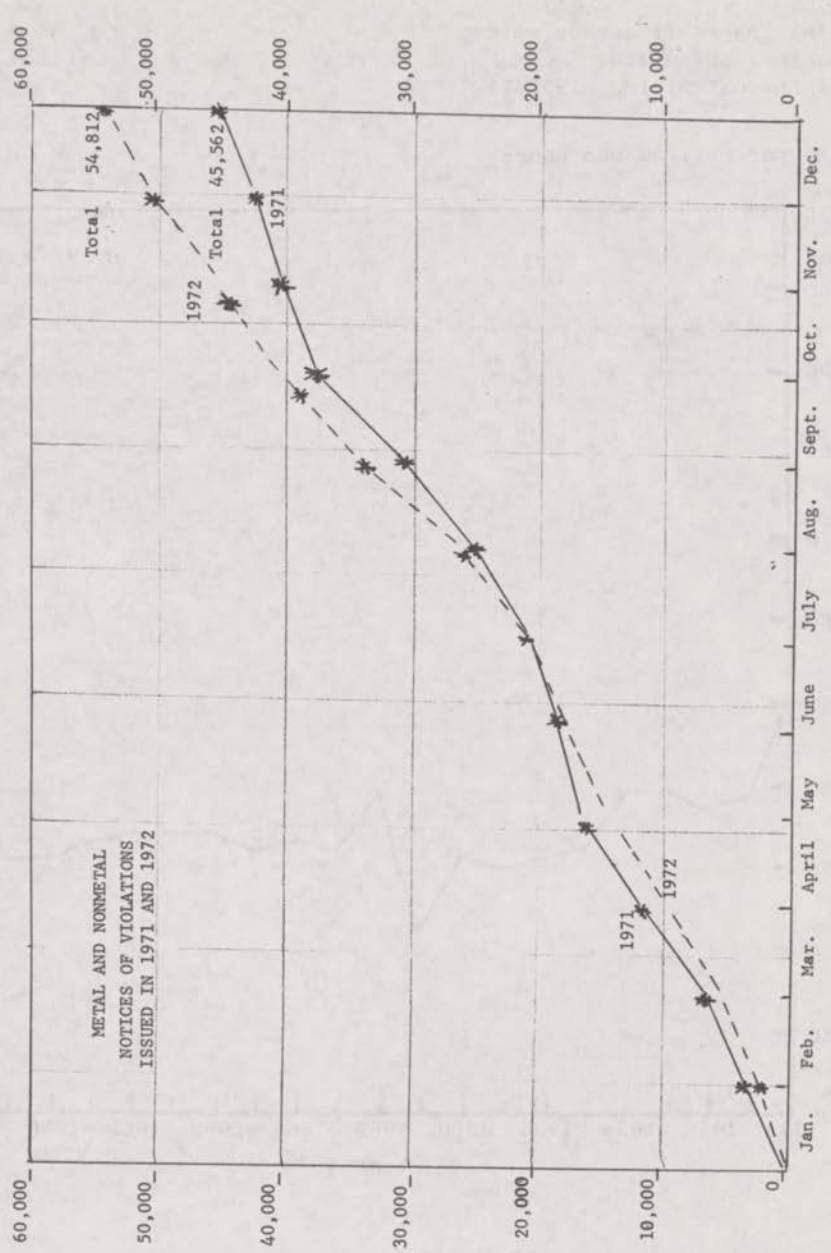
AUTHORITY	1971	1972
PL 89-577:		
MINE INSPECTIONS	8,457	13,021
FATAL INVESTIGATIONS	180	183
NONFATAL INVESTIGATIONS	45	73
BASIC ORGANIC ACT OF 1910:		
SPECIAL INSPECTIONS INVESTIGATIONS AND SURVEY	168	225
SECRETARY ORDER 1940:		
INSPECTIONS	5	12
A.T.F. CONTRACT:		
TO INSPECT EXPLOSIVE STORAGE AND APPLICATIONS	124	1,973
TOTAL FIELD ACTIVITY	8,979	15,487

NUMBER AND TYPES
OF
OPERATIONS
FOR
METAL AND NONMETAL MINE HEALTH
AND SAFETY ACTIVITIES

ACTIVE MINES IN 1972

	Current Five State Plan Situation	Non-State Plans	Total
UNDERGROUND	238	562	800
OPEN PITS AND QUARRIES	682	3,518	4,200
SAND AND GRAVEL AND CRUSHED STONE OPERATIONS	942	6,258	7,200
ASSOCIATED MILLS	200	600	800
TOTAL	2,062	10,938	13,000

There are an additional 4,000 inactive and/or temporarily closed operations some of which may operate at some future date.


METAL AND NONMETAL
NOTICES OF VIOLATIONS
ISSUED IN 1971 AND 1972
Total 54,812
1972
Total 45,562
1971
1971
1972
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan.
Feb.
Mar.
April
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.

- Figure 7 -

Fatal injury-frequency rates
at mines and mills,
all noncoal mining, 1952-71

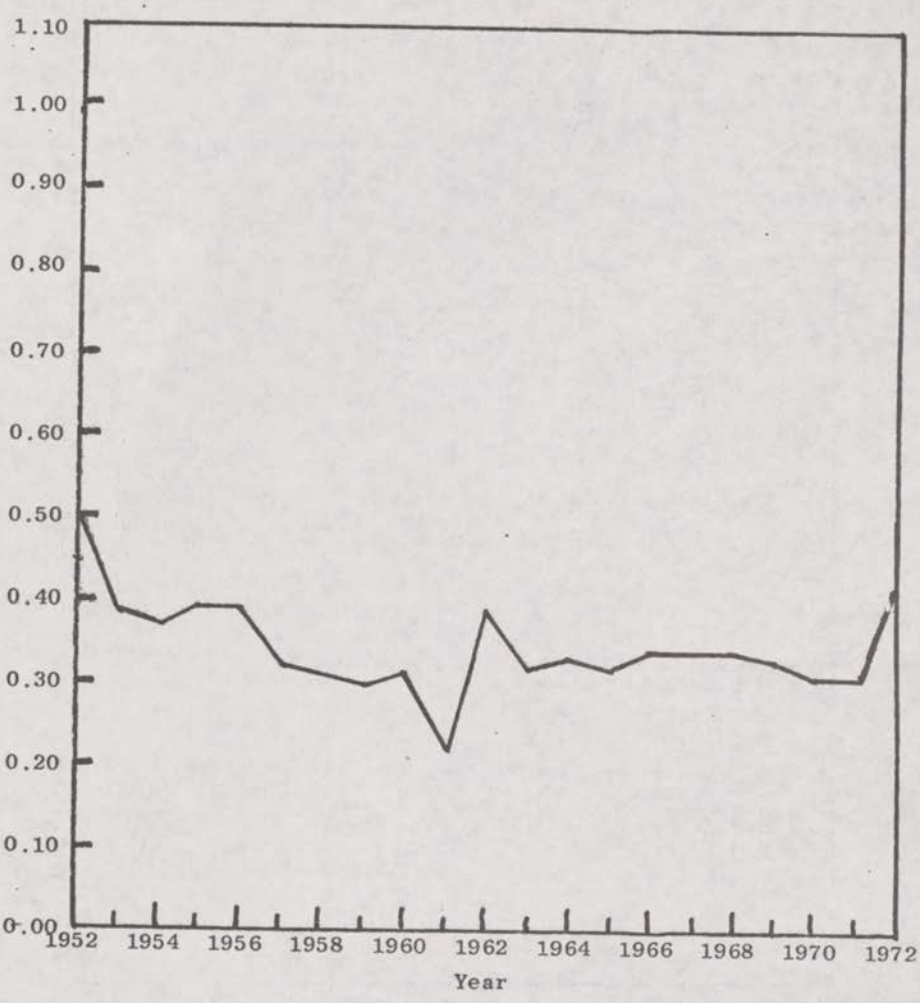


Figure 12

Nonfatal injury-frequency rates
at mines and mills,
all noncoal mining, 1952-71

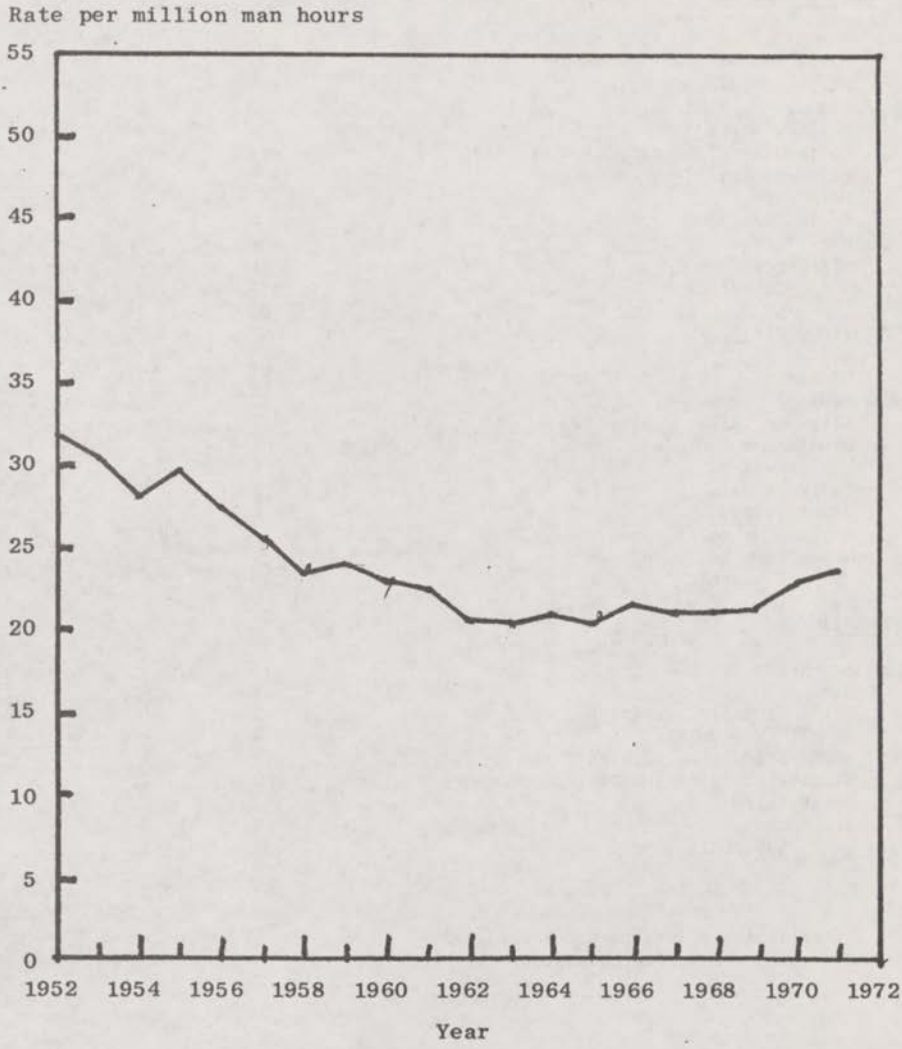


Figure 15

Fatalities at Metal, Nonmetal, Stone, and Sand and Gravel Operations, by Cause 1971, 1972, to March 26, 1973

Underground Mines	1971	1972[2/]	1973[1/]
Mine fire	- -	91	- -
Fall of roof, face or back	20	19	6
Slips of falls of persons	5	8	- -
Haulage	3	5	2
Falling cages	4	- -	- -
Suffocation from natural mine gases	9	- -	- -
Sliding or falling materials	- -	4	1
Machinery	2	3	- -
Explosives	6	4	- -
Electricity	- -	1	1
All other	6	- -	- -
Subtotals	55	135	10
Surface Mines			
Machinery	27	24	7
Haulage	20	21	7
Slips or falls of persons	10	4	4
Handling materials	4	1	1
Explosives	4	- -	- -
Falls of face	2	3	2
Electricity	2	2	3
Sliding or falling materials	- -	2	1
Miscellaneous (Burns)	- -	- -	1
Subtotals	69	57	26
Mills			
Machinery	16	14	- -
Haulage	8	4	- -
Slips or falls of persons	5	6	- -
Handling materials	2	4	1
Suffocation from foreign gases	3	- -	- -
Sliding or falling materials or objects	3	2	- -
Electricity	- -	1	- -
All other	2	- -	- -
Subtotals	39	31	1
Totals	163	223	37

1/ Preliminary data to March 26, 1973.
2/ Sunshine Mine Fire Disaster.

IMPROVED PROCEDURES RESULTING FROM KELLOGG MINE DISASTER

Mrs. HANSEN. What has been done to improve procedures in this program as a result of the Kellogg mine disaster?

Mr. OSBORN. Do you want to go at that briefly. Don?

Mr. SCHLICK. Since the Kellogg mine disaster, quite a few things have happened. If you recall, the Secretary of the Interior, Rogers C. B. Morton, announced some initiatives that he was hoping to take, and one of those was increasing our inspection force by 150 people, if I recall correctly, and you recall then in our appropriation that we are asking for 75 that we need to have on board.

He also announced about 10 new standards that hopefully will prevent a similar type of fire in other mines. Those standards are ongoing through the proper rulemaking procedures now.

Also since that time, we have probably trained every underground metal and nonmetal mineworker in using a self-rescuer, which wasn't done before. We have increased our education and training in the metal and nonmetallic mining districts.

We have nine education and training centers throughout the country and we have largely worked on coal. Nowadays we are working on both, metal and coal.

Finally, we have developed a committee that is now going through all of our metal and nonmetallic mining standards in an effort to upgrade them.

Mrs. HANSEN. Please insert in the record a list showing the number of various types of mines and the amount of inspections which will be made in fiscal years 1972, 1973, and 1974 under your proposals.

[The information follows:]

METAL AND NONMETAL MINE HEALTH AND SAFETY

NUMBER AND TYPES OF ACTIVE OPERATIONS

	Current Five State Plan Situation	Non-State Plans	Total
UNDERGROUND	238	562	800
OPEN PITS AND QUARRIES	682	3,518	4,200
SAND AND GRAVEL AND CRUSHED STONE OPERATIONS	942	6,258	7,200
ASSOCIATED MILLS	200	600	800
TOTAL	2,062	10,938	13,000 1/

1/ There are an additional 4,000 inactive and/or temporarily closed operations, some of which may resume operations in the future.

METAL AND NONMETAL MINE HEALTH AND SAFETY
ACTUAL AND PLANNED MINE INSPECTIONS
FY 72, FY 73, AND FY 74

	REGULAR			SPOT			TOTAL		
	FY 72[1]	FY 73[2]	FY 74[3]	FY 72[1]	FY 73[2]	FY 74[3]	FY 72[1]	FY 73[2]	FY 74[3]
OPEN PITS	1,296	1,200	1,500	679	900	1,100	1,975	2,100	2,600
STONE QUARRIES	1,760	1,800	2,200	1,617	2,100	2,600	3,377	3,900	4,800
SAND AND GRAVEL	1,804	2,800	3,400	1,508	2,400	3,000	3,312	5,200	6,400
UNDERGROUND	903	1,500	1,700	657	1,300	1,500	1,560	2,800	3,200
TOTAL	5,763	7,300	8,800	4,461	6,700	8,200	10,224	14,000	17,000

1/ Actual FY 72.

2/ Projection of first 9 months.

3/ Estimated. Full impact of planned increased inspection force will not be fully evident until FY 75 because of time required in FY 74 for training.

Mrs. HANSEN. The committee will adjourn until 10 o'clock tomorrow morning.

Mr. OSBORN. Thank you.

Mrs. HANSEN. Thank you very much.

THURSDAY, MARCH 29, 1973.

Mrs. HANSEN. The committee will come to order.

DISPOSAL PROBLEMS OF SEWER SLUDGE AND OTHER WASTES

We return to the Bureau of Mines. In this morning's paper there was a long article on sewer sludge and the problems of burning.

Dr. Osborn, are you working in this field?

Mr. OSBORN. Mrs. Hansen, I didn't see this article but I think I know what you mean, this very serious problem of disposal of the sludge.

Mrs. HANSEN. That is correct.

Mr. OSBORN. The city of Chicago, for example, is carting it out to some of the strip mine pits and this is worrying us, so we do have a concern about where it is being put if it is connected with any of the mining operations and this is certainly a problem.

As Congressman McDade knows, it was not sewage sludge from Philadelphia but it was garbage and trash that was going to be baled and dumped in the pits out there in the anthracite region. This is a concern to us because it opens possibilities of fires, spontaneous combustion, which can cause the coal at the bottom of the pits in these deep strip pits to catch on fire. Sludge is the same sort of a problem. What are you going to do with it? People right away think, well, we will put it in some of those old strip mine pits.

Second, another connection we have with the sludge problem is that it is an organic waste and thus amenable to being transformed into oil. Our people have worked on that at our Pittsburgh laboratories.

In fact, they have been working on the problem of conversion of coal to oil and gas for decades, and when this rather neat system of converting cellulose to this low sulphur oil was being developed they also tried various materials, you know, the sawdust that I mentioned, the agricultural wastes, and this therefore is a natural.

So our people have worked on the sewage sludge and it can be processed very well this way. We don't get quite the number of barrels of oil per ton of this as you do for the animal wastes because it doesn't have as much cellulose in it but this is entirely feasible and possibly practical from the standpoint we were talking of yesterday, if you apply enough credit for disposal, because you have to put it somewhere.

In other words, if getting rid of this sewage sludge is going to run in very high costs, then it is certainly going to be practical to process it into low sulphur fuel oil.

SEALING OF STRIP PITS BEFORE DUMPING

Mr. MCDADE. Doctor, that cut that we talked about yesterday, that $800,000 cut, is specifically earmarked to seal up the strip pits, isn't it?

Mr. OSBORN. Yes, sir.

Mr. McDade. That money is now taken out and you have actually got the problem of some of these fires that have occurred the way we discussed yesterday threatening to get into the coal seams and there is no way to seal them; isn't that right?

Mr. Osborn. Yes, sir, that is correct. The dumping of materials in these strip pits, and it is common practice all over—I know the problem in Pennsylvania and I know the problem in Illinois and those working on these problems. But the towns are getting so desperate for a place to put their waste, as the Congressman from Maryland was mentioning yesterday about Baltimore's problems, right away they think why not put it in these holes. The Bureau's attitude is, it should not go in these holes until we have the bottom sealed in such a way that the leachate from this material can be positively controlled. In many cases the pit bottom will have to not only be sealed but be provided with a drain system. Rain water which gradually seeps through this material and picks up the poisons and so on that are in there should be drained out in a manner where it can be analyzed regularly and controlled. This is the research that Congressman McDade was just referring to. We think a lot of work has to be done yet on sealing and proper precautions taken before we do a lot of this dumping.

Mr. Evans. Madam Chairman, may I ask one question?

Mrs. Hansen. Yes.

POWER TO PROHIBIT DUMPING

Mr. Evans. Do you have power now to prohibit such dumping?

Mr. Osborn. We don't have, but what happened in Pennsylvania was this: The city of Philadelphia went so far—I think this was in 1969—as to make at least tentative arrangements, and I think actually a contract, with the railroad for hauling and with companies to bale their trash and they selected even the pits out near Pottsville, I believe it was in that case, to dump it. But they forgot to ask the people out there about it.

The people then took it to the State government and the State health department stopped it, just stopped it cold. In January 1970 a State law became effective that provided that there could be no dumping in strip mine pits unless it was approved by the health department. The health department, under its own rules, requires that a professional geologist approve it before they will approve it. So in Pennsylvania this is under control, but it is just a stalemate because we don't have the techniques for doing this sealing. To answer your question, no, we don't have the authority but at least one State is preventing it.

Mrs. Hansen. This is what disturbs the committee. In almost all instances research funds are cut and the cuts made today may be reflected in disastrous problems in 10 years. Your solid waste disposal program has proved effective. You have developed the techniques.

But if these programs are persistently cut year after year, then there is going to be increasing amounts of problems.

Mr. Osborn. That is correct.

EXTRACTING CHEMICALS FROM WASTE MATERIALS

Mr. McKay. In your research dealing with the sludges, waste materials, I assume that the properties of all the chemical compounds are

there. Are you working on some extractable recycling process to where they can go back through the market situation, or is that a probability?

Mr. OSBORN. This is a very good question, yes. In the case of the raw refuse, this is exactly what we have been doing, you see, both the incinerated part of the refuse and the raw refuse.

In the case of sewage sludge we haven't gotten that far with respect to separating out the chemicals. We have only so far applied our techniques for making oil out of organic material, and, of course, with a shortage of fuel oil this is a pretty good way to go.

Mr. MCKAY. You do have then research to move in that direction; is that true?

Mr. OSBORN. Yes, sir. And also Mr. Zinner reminds me that experiments up at our Twin City Laboratory have been going on using sewage sludge as a reducing material for the iron ore.

In other words, it is organic material so, therefore, it can be used directly as a reductant for iron ore. But the actual recovery of chemicals is down the road as far as we are concerned.

At the moment we think that the simplest way to get the values is to convert it to oil.

EFFECT OF BUREAU REORGANIZATION ON STATE LIAISON OFFICERS

Mrs. HANSEN. Yesterday, you will remember, we discussed public relations. I had a wire from the Division of Mines and Geology in my own State:

> I understand that the Congress in considering the Bureau of Mines reorganization intends to replace their liaison men with public relations people.

As you are well aware, this isn't a congressional proposal.

> I think this would be a mistake. The present liaison men with the Bureau are technical people who are able to understand our problems and give good counsel in solving them and know where to go and what to do to get technical information we might need. This is one of the best programs ever developed by the Government. It is very successful. Why change it to a lesser advisable one?

I would be interested in a comment.

Mr. OSBORN. I can only comment this way: We also think that the Bureau of Mines State liaison system has worked out to be a very effective program in helping the States with their mineral resource problems. We get compliments continually and it probably could be shown that the various suggestions we have made and help we have given have paid for the whole thing in savings to the States but, by any measure, it is a good program.

Now, somebody is surmising what may happen and I really can't comment on that. I don't know.

ADDITIONAL HEALTH AND SAFETY INSTRUCTORS

Mrs. HANSEN. You are requesting an increase of $200,000 for teachers' health and safety in metal and nonmetal mines. What is the justification for this request?

Mr. OSBORN. Don, would you like to talk to that first?

Mr. SCHLICK. Yes, I would like to very much. Our education and training program is really one of the two major things that we in the enforcement activity look to to get health and safety.

The first one obviously is our enforcement program. Second, and more long term, we think the education and training of the miner and of the mine operator is going to get us health and safety in years to come, in the long term, a couple years, in 3 years.

Our education and training program has inevitably been oriented toward coal minng. In the wake of the Sunshine disaster——

Mrs. HANSEN. I was going to mention the Kellogg mine disaster.

Mr. SCHLICK. Many of us think and say now we have to orient ourselves differently and we must emphasize our coal as usual, as usual business, but we also now must move into the metal and nonmetallic mining side, so as part of this the Secretary of the Interior, Secretary Morton, asked for more funds to do things in metal mining.

Our request for more education and training people will be for education and training specialists who will be located in the various education and training centers located around the country. Their job will be solely to teach education and training in health and safety to the metal and nonmetallic miners.

Mrs. HANSEN. How many instructors will the $200,000 provide?

Mr. SCHLICK. I believe it is 11.

Mr. OSBORN. Mrs. Hansen, we have a diagram here—this is just a poor copy of it—which shows the progress that is being made in transferring the instructional work from the Bureau's personnel to the mining company employees, which is, of course, what we want to do.

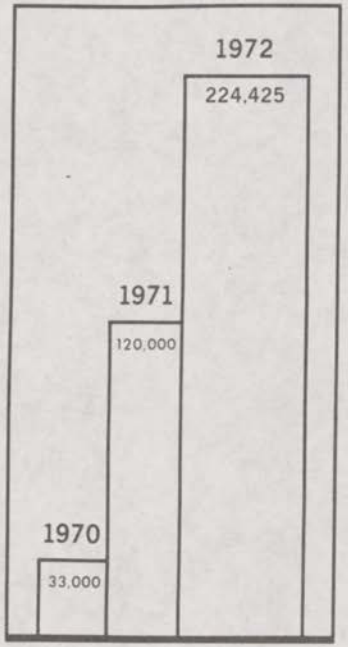
In other words, we are training teachers who then do the teaching, and I would like to suggest that this might go in the record, at least this one.

Mrs. HANSEN. We will be pleased to insert it in the record at this point.

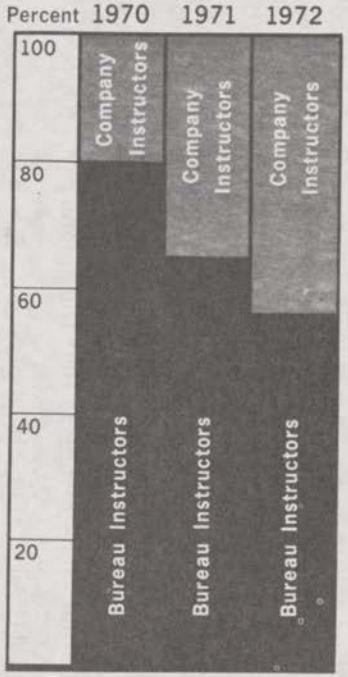
[The information follows:]

SIGNIFICANT CHANGES IN EDUCATION AND TRAINING

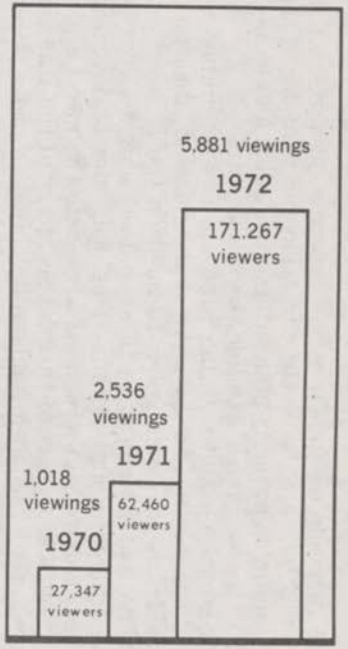
1970-1972



Personnel attending training classes



Percent of training by Company Instructors and Bureau Instructors



Motion pictures exhibited and viewers attending

Mrs. HANSEN. Also insert in the record a list of your manpower training programs indicating the funding for each.

[The information follows:]

MANPOWER TRAINING PROGRAMS

Institution	Funding	Started
1. Butte Vocational Technical School, Butte, Mont	$224,000	February 1971.
2. Do	40,000	Do.
3. Colorado Mountain College, Leadville, Colo	153,481	June 1971.
4. Southwest Virginia Community College, Richlands, Va	98,504	September 1971.
5. College of Eastern Utah, Price, Utah	43,165	June 1972.
6. Western Wyoming College, Rock Springs, Wyo	47,324	January 1971.

INCREASED TEACHING OF BUREAU EDUCATION AND TRAINING COURSES

Mr. SCHLICK. It might be prudent to mention that in the year 1970 there were 33,000 Bureau of Mines approved education and training courses taught to the mining industry. In 1971 this was increased to 122,000 education and training courses and last year we reached an unprecedented high of 235,000 courses taught to the mining industry.

These are Bureau of Mines approved courses. At first we did all the training. Now we are training instructors from coast to coast to do the training. Heretofore, we did about 95 percent of the training ourselves. Now we are doing about 40 percent of the actual training and the company instructors that we certify are doing the training, so it is a grassroots project really.

MINE INSPECTOR PROBLEMS

Mrs. HANSEN. Dr. Osborn, last year we discussed your problem in hiring inspectors. You were having some difficulties with the Civil Service Commission. Has that problem been entirely overcome?

Mr. OSBORN. I think so. Wouldn't you say, Don?

Mr. SCHLICK. Yes.

Mr. MCDADE. Have you got the full complement of inspectors on board?

Mr. OSBORN. Yes, sir.

MANPOWER DEVELOPMENT TRAINING PROGRAM

Mr. MCKAY. Madam Chairman, in connection with these, I note in your chart here some of the schooling is attached to universities or colleges. Is that a continuing program, or are you dropping that?

Mr. SCHLICK. We have a manpower development training program where we sort of fit in. I believe the money is funded through the Department of HEW to the Department of Labor and they give the money to the local jurisdictional area but the Bureau of Mines comes in and we set up the training program for them and work with them on this thing.

We don't do the actual training.

Mr. MCKAY. You are advisory?

Mr. OSBORN. We manage it.

Mr. SCHLICK. We do the managing of it. The money goes through a circuitous route. I don't know what it is.

Mrs. HANSEN. Please insert in the record what kind of a route it takes?

Mr. SCHLICK. Right. I certainly will.

[The information follows:]

The manpower development training program was financed by transfer of funds from the Department of Labor to the Department of Health, Education, and Welfare and advanced as a working fund to the Bureau of Mines.

Mr. SCHLICK. We have about five or six or seven programs there and I have a staff of four people who work on this in my education and training office and they set up the programs, they manage the programs. There have been some very successful programs, particularly in the West. The one at Leadville, Colo., has been successful.

One in Butte, Mont., has been very successful. It is a real good program.

Mr. OSBORN. You understand that our authority is only health and safety?

Mr. MCKAY. Yes.

Mr. OSBORN. Not training people to work in the mines.

Mr. MCKAY. Of course that is interrelated.

Mr. OSBORN. Yes, they are interrelated, but inasmuch as this is training of workers it, therefore, comes under the Labor Department or HEW from the standpoint of funding. But it is certainly very important to us. We stimulate this and then actually do the managing.

STATUS OF BECKLEY TRAINING ACADEMY

Mrs. HANSEN. You are requesting a decrease of $13 million for the Beckley Academy. How much of the $13 million provided in 1973 has been obligated. How much will be unobligated on June 30, 1973?

Mr. OSBORN. The contracts have not been let but we expect that they will be before the end of this year and we will use essentially all of these funds before June 30.

Mrs. HANSEN. You plan to obligate the funds before June 30, 1972?

Mr. OSBORN. Yes.

Mrs. HANSEN. Last year you said the Academy would be completed in the summer of 1975. Now you say it will be early 1976. Why the delay?

Mr. OSBORN. I can't explain the delay except that there has not been any particular event that has delayed it.

Mrs. HANSEN. Have your funds been held back?

Mr. OSBORN. No, not at all. It is just slippage on the part of the architects, GSA, and so on. It is not slippage on our part.

Mrs. HANSEN. The plans were not ready?

Mr. OSBORN. It just takes longer. I don't know why it will take 2½ years to construct this. You can construct a big building in 6 months.

Mrs. HANSEN. That is why I am asking these questions. Every Government facility that we are constructing seems to take longer to construct than planned and there is always a cost overrun.

Mr. OSBORN. This is being managed by the General Services Administration.

Mrs. HANSEN. I know. That doesn't mean you won't have difficulties.

Mr. OSBORN. I didn't mean to imply that.

Mrs. HANSEN. What cost overruns have you experienced thus far?
Mr. OSBORN. On the Academy?
Mrs. HANSEN. Yes.
Mr. OSBORN. None.
Mrs. HANSEN. What are the total estimated construction costs?
Mr. OSBORN. About $13 million.
Mrs. HANSEN. You hope.
Mr. OSBORN. Yes. That is the architects' and GSA's estimate.
It does not include the planning money, which will run the total cost up to about $14 million.
Mrs. HANSEN. I never will understand why every building requires such large amounts of planning money.
Mr. OSBORN. Ten percent is about normal.
Mrs. HANSEN. How much money is in the 1974 budget for Beckley, construction and nonconstruction?
Mr. OSBORN. Zero.

TECHNICAL SUPPORT ACADEMY

Mrs. HANSEN. You are requesting an increase of $300,000 for technical support for work relating to metal-nonmetal mines.
Will you give us the details of this request?
Mr. OSBORN. I would certainly be glad to. I would like to call on Mr. Schlick to discuss it but I have another of these short abstracts with a few diagrams and tables that I would hope you might put in the record.
Mrs. HANSEN. We will insert the material in the record.
[The information follows:]

ABSTRACT

TECHNICAL SUPPORT

The primary mission of technical support, organized into a separate activity under health and safety in 1972, is to provide engineering and consulting service and assistance to enforcement personnel and mine operators, as well as miing equipment manufacturers, in solving compliance problems relative to the Coal Act and the Metal and Nonmetal Act. The health and safety analysis center has the important mission of collecting and disseminating accident information and of conducting special studies initiated as a result of the analysis of accident and injury data. The mine rescue responsibility of technical support is limited to providing hardware and expertise in drilling probe and rescue holes, in logistics and communication backup, and in locating trapped miners.

Technical support also has a technology evaluation function in support of the enforcement groups. It is called upon to act as a judge in terms of new technology which is proposed for use in mining. Another major and related responsibility is research coordination. To meet this responsibility, technical support, as a group, must stay abreast of technologic advances in research and development and, conversely, delineate areas for research where adequate technology is lacking to solve day-to-day mining problems.

A significant portion of technical support's work has to do with providing technical backup in the preparation of rules and regulations under both acts. As has been the case for many years, the Bureau has an approval and testing function. As now structured, this has also become an important function of technical support.

Organizationally, combining eight previously existing and separate groups, technical support now consists of a Washington staff and three operating field centers—the Pittsburgh Technical Support Center, the Denver Technical Support Center, and the health and safety analysis center, also located in Denver.

Each center is organized into highly specialized groups, essentially all oriented to problem solving or applied engineering objectives.

Approximately one-half of technical support's personnel (240 totoal positions) are engineers and scientists in many specialized fields, and 25 are technicians, many of whom are also highly specialized in areas such as roof control, ventilation, etc. The remainder consists of coding, statistical, administrative and clerical personnel.

Activities during 1972 of the two technical support centers relative to direct engineering assistance to mine operators are summarized in Figure 1. Direct engineering assistance, as used in this tabulation, is limited to work that was either requested by Bureau enforcement personnel or mine operators themselves. All of this work has to do with compliance problems of one type or another. It does not include field or laboratory work which was conducted for the industry as a whole. Nor does it include training, field investigations on coal and metal waste embankments, or the direct support provided in connection with three mine fires last year, namely, Sunshine in Idaho, Somerset in Colorado, and Blacksville in West Virginia. The industrial safety category listed includes work in the electrical and mechanical areas as well as hoisting, explosives and several others.

DIRECT ENGINEERING ASSISTANCE TO MINE OPERATORS IN 1972

Area of work	Number of operators		Total man-days of work	
	Coal	Noncoal	Coal	Noncoal
Roof and ground control	44	25	818	707
Ventilation	27	23	1,094	741
Industrial safety	49	27	421	216
Industrial hygiene:				
Dust	38	13	361	396
Noise	6	18	100	247
Radiation		10		127
Other		13		196
Approval and testing	4		8	
Subtotal	168	129	2,802	2,630
Total	297		5,432	

As can be seen, assistance was provided to 297 mines—168 coal and 129 metal and nonmetal—expending over 5,400 man-days of work. This constituted about 26 men, full time, for the entire year and is even more significant considering that half of the total work force do not have field oriented responsibilities. Among others, the Health and Safety Analysis Center, most of the Approval and Testing Group, the dust weighing laboratory, and staff personnel fall into this category. Thus, over a fifth of the technical support personnel with field work responsibilities were engaged *all of the time* in providing direct assistance to individual mine operators.

As part of technical support's ongoing activities, about 500,000 respirable coal dust samples were weighed and results coded, and 2,500 of these samples were analyzed for their quartz content. In addition, about 3,100 actions were taken by the Approval and Testing Group at the Pittsburgh Technical Support Center, the details of which are listed, with comparative data for 1971, in Figure 2.

Technical support was also engaged in many other activities of major importance in 1972, vital to the improvement of health and safety in the mines. A state-of-the-art study on the underground use of protective cabs and canopies was conducted, their mandatory design specification developed, computer programs for analyzing their static and dynamic loading were written, and assistance was provided in the writing of final rules and regulations governing their underground use.

A survey was conducted on 95 percent of the Nation's asbestos mines and mills. All the mines were found to meet the five fiber standard but none of the mills did. A noise dosimeter was developed with the cooperation of Mining Research after a noise survey was conducted in 31 coal mines. This work has resulted in the development of similar dosimeters by the industry, all of which, including the Bureau's, have been tested successfully.

APPROVAL AND TESTING ACTIONS

Action	Number	
	1971	1972
Approvals	209	276
Certifications	89	191
Formal extensions	628	727
Informal extensions	967	1,166
Experimental permits	49	65
Extension of experimental permits	11	36
Field changes	257	318
Flame tests	125	151
Inspections and explosion tests	73	98
Thermal shock and impact	0	24
Field and laboratory inspections	38	41
Total	2,446	3,093

Technical support and, indeed, all of the Bureau, was caught up in the aftermath of the coal waste dam failure at Saunders, W. Va., on February 26, 1972. Technical support was charged with coordinating the high-level of activity involving a detailed engineering study of the Saunders Dam and the emergency study conducted during June and early July on nearly 140 other coal waste embankments. The final report on the Saunders Dam study was released recently. An interim report on the emergency study was released on July 31, 1972, and the final report is scheduled for release some time this summer.

Other major engineering and related activities in 1972 included an extensive investigation of the use of integral machine-mounted dust collectors on continuous mining machines, indepth studies on deep metal mine ventilation problems, testing and mine application of resin grouted bolts for improved ground support, rescue support for the three mine disasters which occurred during the year, and the development of schedules for the use of diesel equipment in underground coal mines.

The newly established Health and Safety Analysis Center was not staffed to near the present level of operation until mid-1972. Aside from the initial work of planning and staffing, new coal mine and metal and nonmetal mine reporting systems were developed and implemented accompanied by the issuance of new identification numbers for the mines, 57,000 report forms were processed, over 25,000 corrections were made in the records, seven information circulars were completed, and a comprehensive microfilm system of record-keeping was developed. In addition, a number of special studies were initiated and about 500 special requests for accident and injury data were precossed, ranging from simple ones requiring little time to those which were complex and time consuming.

In fiscal year 1974, technical support will continue to support the enforcement organizations and the industry in engineering assistance. Similarly, it will continue to work with the Bureau's Mining Research organization through direct contact at all levels and, more particularly, by continuing its health and safety research task forces to provide input to research planners and programers.

As in the past, a major effort in engineering assistance will be in roof control. However, emphasis will be to initiate indepth studies on failures at roadway intersections, a serious problem common to many mines.

Standards or regulations will be proposed covering the use of dust collectors mounted on continuous mining machines. These regulations will have great potential for dust reduction in face areas and studies are in progress to evaluate the efficiency of this application and the resulting airflow patterns, methane concentration, and noise generation.

New rules and regulations for diesels, electrical equipment, and mechanical safeguards will be proposed. Rules and regulations will aso be proposed on various classes of permanent and temporary fireproof stoppings, including the development of tests to determine their acceptability. In order to place this and other fire toxicity tests on a more rational and controllable basis, a fire esting gallery will be constructed and placed in operation.

To deal with the mine waste problem more efficiently and economically, a minimum level of in-house technical capability will be estabished. In the mean-

time, work initiated in coal wastes as a result of the Saunders Dam failure will be completed.

In accident and injury statistics, a major effort will be devoted to solving problems associated with coding, quality control of data, computerization, and generating accurate and timely reports for both coal and metal and nonmetal mine accident and injury reporting.

Mr. OSBORN. Do you want to talk to that, Don?

Mr. SCHLICK. Our technical support activity is really the enforcement activity's arm to get engineering ways of complying with health and safety requirements. Again our technical support activity, like most of our enforcement activities, has been coal-oriented in the past. Also in the wake of the Sunshine disaster Secretary Morton asked for more people to do technical support work solely in the metal and nonmetallic mining industry.

We have a center at Pittsburgh that does work largely in coal. We established a while back a center in Denver, Colo., that does work largely in metal and nonmetallic mining. The 15 positions, I believe, that we are requesting funds for here will result in people to do work solely in the Denver area for the metal and nonmetallic mining area.

They will be involved with things like doing indepth ventilation studies in the metal mining industry. They will be involved with doing roof and ground control work, again to help the operators comply with Federal regulations, and they will be in the West.

In the West, our Denver center is probably 90 percent metal and nonmetallic operations and 10 percent coal. In the East, it is the reverse due to the geographic location.

PROBLEMS IN ASBESTOS MINES

Mrs. HANSEN. Who is performing the work on the problems in asbestos mines?

Mr. SCHLICK. From the compliance standpoint, our people have, and it is in our report here, in the green-covered report here. I believe we made a survey of all of the asbestos plants.

Now, our job from the asbestos standpoint, of course, is in the mines and the mills. When it gets out of our jurisdiction into the occupational health and safety jurisdiction, we have no authority there.

Mrs. HANSEN. Is HEW working on this problem?

Mr. SCHLICK. HEW is working with the Department of Labor. HEW would come up with the standards, so many fibers per milliliter. Then it would be up to us in the mining area and to the Department of Labor in the other industry areas to enforce that particular standard.

There are very few asbestos mines and mills in our country. A lot of it is imported, and the problem that we seem to hear about in the public is generated from the people that spray the buildings, let us say, so it is a Department of Labor enforcement situation and not particularly ours in the Bureau of Mines.

We have made in-depth asbestos surveys at all of the mines and mills in our country, that it is our responsibility to enforce.

METAL AND NONMETAL MINE RESEARCH

Mrs. HANSEN. Justify your requested increase of $1 million for the metal-nonmetal safety research.

Mr. OSBORN. Yes. Dr. Henrie, do you want to comment on the details of that additional $1 million?

Mr. HENRIE. I think this is essentially the same as Don Schlick mentioned earlier. As a result of this disaster in Idaho, much of our work on health and safety research was changed, although it was inherent that a lot of it would apply to metal and nonmetal mines. The changes in our program were made so it would be clearly identifiable. We did take $1 million out of our coal mine health and safety, and put that much increased effort into the metal and nonmetal research. More emphasis and more programs were assigned to fire research. Some of this work will now be carried out at Denver and Spokane.

Mrs. HANSEN. Was the Bureau of Mines aware of the problems in the metal-nonmetal mines, similar to those that occasioned the Kellogg disaster?

Mr. HENRIE. We were doing lots of research in this area, but nearly all of it had to do with rock mechanics and ground control. One of our most outstanding achievements is sensing rock mechanics problems. We have a lot of good work on this so that we can detect beforehand where a rock burst would occur so that corrective action can be taken.

Now, as to the fire situation that resulted, I wasn't in on the investigation and I don't know really the cause, but I think that the severity of the problems caught our research people a little bit by surprise.

NUMBER OF METAL AND NONMETAL MINES

Mrs. HANSEN. How many metal-nonmetal mines do we have in the West?

Mr. SCHLICK. Madam Chairman, there are about 17,000 metal and nonmetallic mining operations that we have to enforce regulations on. About 4,000 of that 17,000 are intermittent sand and gravel operations that are in today and out tomorrow and maybe perhaps a quarter in the summer season.

There are less than a thousand, probably about 800, underground metal and nonmetallic mines in our country, and quite a few of those are in the West. The deeper ones, of course, are in Idaho, in that Coeur d'Alene area, and each day they get a little bit deeper. Each day they get more difficult to manage.

EMPLOYMENT IN METAL AND NONMETAL MINES

Mrs. HANSEN. What is the average employment in these mines?

Mr. SCHLICK. I would be guessing, but I would probably think each of those mines up there has 300 or 400 people working in them. There are many mines up in that area.

Mrs. HANSEN. So you really have a large inspection job to do.

INSPECTION REQUIREMENTS

Mr. SCHLICK. Very much so. Our metal and nonmetallic mine law calls for us to make one underground inspection a year.

Mrs. HANSEN. Do you think that is adequate?

Mr. SCHLICK. No, I believe we should make four, and we have said this, and we are trying to parcel our number of metal mine inspectors

that we hope to get through this appropriation that will let us get on that road to making that many inspections a year, and we have statistics that I hope can back this up.

We think our people have to be getting into each mine at least once every 3 months in order to maintain health and safety.

Mrs. HANSEN. Do you have an adequate number of inspectors?

Mr. SCHLICK. We originally had thought we needed 150 inspectors to do this, and this is what I believe Secretary Morton in his press statement, subsequent to the Sunshine disaster, asked for, and we ended up getting 75.

METAL AND NONMETAL RESEARCH FINDINGS

Mrs. HANSEN. What specific metal and nonmetal research findings have been utilized by the mining industry in the past year?

Mr. HENRIE. I think most of that would be contained in the little booklet we gave you yesterday.

Mrs. HANSEN. Would you highlight a couple of the findings for us that have been utilized? We can't insert the book in the record.

Mr. HENRIE. We have an active technology transfer program going on, that identifies for industry our significant research results. Methane drainage is a good example of coal research that industry has adopted. In metal mining, the rock mechanics work that we are doing is a prime example of important research findings. I don't know whether I spelled out clearly enough earlier, but Coeur d'Alene mines are very deep. There are tremendous pressures, and if you are underground you observe that there is constant movement. In other words, the openings are closing in.

Mr. SCHLICK. I was at the Sunshine Mine disaster as well as Dr. Osborn. While I was there, I went into an adjacent mine, which was the Galena Mine, and I went down to the 5,000-foot level, 5,000 foot deep, and it was shocking for me to go back and see one of these rockbursts.

There are deep pressures there, and at 5,000 feet all of a sudden the whole place would fall down for maybe 100 feet, just one rubble of rock, no advance warning, goes boom.

This is frightening, I think, because there is no advance warning, and luckily when it happens, most times, there is no one there and it is just scary.

Mrs. HANSEN. Are these occurrences predictable?

Mr. HENRIE. They are now.

Mr. SCHLICK. They weren't before, and this is what scares you, because I am a miner and you can tell when things are going to fall, and you mine with your eyes and your ears and your sight and your feel, but on this particular thing there is no way. It just comes on you and you have had it, and if you are there you are dead, and so our research people in Spokane and Denver have been trying to instrument these things for us and let us know when they are falling.

I think we are a long way along the road now. We are trying to take the scientific and translate it into a pragmatic mining situation.

EFFECT OF EARTHQUAKES AND ROCKBURSTS ON MINES

Mrs. HANSEN. Are not some of your mines located in earthquake-prone areas?

Mr. SCHLICK. Yes.

Mrs. HANSEN. Suppose an earthquake occurs?

Mr. HENRIE. I have asked questions of my mining people on this.

Mrs. HANSEN. Are you performing any work in this regard with the Geological Survey? They are performing a great deal of earthquake work, as you are well aware.

Mr. HENRIE. It is not quite a similar problem. These rockbursts are detected—I don't know if you have ever taken a piece of tin and bent it and heard it crack.

Mrs. HANSEN. Yes.

Mr. HENRIE. This is actually what is happening down there. Stresses due to pressure are causing slight noises, so they have little devices that hear these little sounds that is input to a small computer in the mine, and this locates where these highly stressed areas are.

Then they drill into these high-stress areas and set off an explosive charge. The stress is thereby relieved. After the stresses are relieved, the area is safe. It isn't quite the same as earthquakes, and the detection system is not the same as for earthquakes. However, we are working with Geological Survey and exchanging information.

Mrs. HANSEN. What I am talking about is the interplay of an earthquake at the same time you are having difficulties in a mine.

Mr. HENRIE. I am not a miner myself but I have talked to them. I have said, "What does it feel like to be in a mine when there is an earthquake?" They shrug their shoulders and indicate there are more things happening there than an earthquake and the earthquake's influence would be fairly minor compared to the overall normal movements in a deep mine.

Mr. ZINNER. I happen to have had this experience. I was working in a mine in Montana a number of years ago when they had a very serious series of earthquakes at Helena and it was virtually undetectable and there was no effect that we could detect in the mine, yet there was very serious damage on the surface.

I can't explain the phenomena but apparently the workers underground probably feel less effect than you would on the surface. I say I can't explain it but I had the experience.

Mrs. HANSEN. It is a very interesting comment.

Mr. HENRIE. I think it is the same thing as in the ocean. The ocean is fairly quiet underneath but you have wave action on the surface.

Mrs. HANSEN. I understand.

Mr. HENRIE. These tremendous pressures must be much greater than problems developed by the earthquake.

Mr. VEYSEY. Could I ask a question on this point?

Mrs. HANSEN. Yes.

MINE FATALITIES FROM ROCK BURSTS

Mr. VEYSEY. Could you give us for the record the figures on how many fatalities resulted from rock bursts in the past year or two or three or four?

Mr. SCHLICK. Yes, sir.

[The information follows:]

FATALITIES ATTRIBUTABLE TO ROCK BURSTS IN METAL AND NONMETAL MINES

August 9, 1968.—Galena Mine, Wallace, Idaho, one man killed, long section of ground along stope came out at once due to rock burst. Stope was nearly complete.

October 21, 1969.—Lucky Friday Mine, Mullen, Shoshone County, Idaho, one man killed, another injured, rock burst in stope.
March 15, 1970.—Urad Mine, Urad, Colo., two men killed by air blast when bridged ground in caving area collapsed suddenly. Victims blown down drift.
1971, 1972, 1973 to date.—No fatalities directly attributable to rock bursts.

Mr. VEYSEY. Do you know them offhand?

Mr. SCHLICK. I don't know them offhand.

Mr. VEYSEY. What percentage of the total fatalities in mines would be the result of rock bursts?

Mr. SCHLICK. I would think about probably 40 or 50 percent of the fatalities are due to falls of roof and rib.

Mr. VEYSEY. I see that figure in the testimony but that is a little different.

Mr. SCHLICK. On the paper that we handed out to you yesterday that Madam Chairman says she will put in the record, on the last page it gives an outline of fatalities per cause.

Because of falls of roof and rib there were 19 in 1972, and I would think that a portion of these 19, maybe a fourth of them, would probably be due to this outburst you are talking about.

Mr. VEYSEY. So perhaps four or five fatalities in that year?

Mr. SCHLICK. I would think so.

SUNSHINE MINE DISASTER

Mr. VEYSEY. How many men were lost in the Sunshine mine?

Mr. SCHLICK. Ninety-one, I believe.

Mr. VEYSEY. Yes. I wonder if we are directing our research at really the most critical point? I agree rock burst is a hazard, something that needs to be researched, but might it not well be that there are other areas on which we could spend the money that would save more lives, produce more real results, than that?

I am asking that question for your comment. I was a member last year of the Education and Labor Committee. We had several hearings in the wake of the Sunshine disaster. You people may have participated in some of those and the information that came before the committee from union representatives, and employees, and management people, and even Government people was most distressing as to the state of inspection, the state of safety in that particular mine.

Indeed, I think it was outrageous. We have to direct a lot more attention right there than doing some research involving possibility of saving 4 or 5 lives, if that is the possibility, where we lost 91 lives in that disaster.

Mr. HENRIE. Mr. Congressman, we are doing a lot of work to detect poisonous gases.

MINE INSPECTION RESPONSIBILITY OF STATE OF IDAHO

Mrs. HANSEN. What responsibility does the State of Idaho have?

Mr. SCHLICK. The State of Idaho, like all States, has an inspection agency and they have State laws, and similarly in a vein that we do also.

Mrs. HANSEN. Do they do an adequate job of inspection?

Mr. OSBORN. In most States they have a very small force and their

inspectors are not nearly as completely trained or as numerous as those of the U.S. Bureau of Mines.

May I speak to your question, Congressman Veysey?

Mr. VEYSEY. I would certainly like to get an answer.

INCREASED FIRE AND EXPLOSION PREVENTION RESEARCH

Mr. OSBORN. I would like to point out that on page 54 of our report we show that of this $1 million for new research in the metal and nonmetal mines, $500,000 is precisely in the area you are talking about.

In other words, half of this is going into it because we, too, think this is extremely important. This is on fire and explosion prevention methods.

Mr. VEYSEY. If I heard the testimony correctly no research was needed as to the troubles in the Sunshine mine. Any inspector, any management person, any miner, I think, could well identify what the troubles were.

They had dragged old timbering off into abandoned runs and some way some of this caught on fire and smoldered. That was the cause.

Now, you don't need a lot of research on poisonous gases or anything else in that case. What we needed was some real inspection. The State of Idaho did not furnish it. The U.S. Government did not furnish it adequately, and these problems had gone on for some time.

Now, some very condemning things were said about the inspection in that situation and I do hope, instead of directing our effort at some research that is related to things that could help somewhere, that we are really getting on the problem of inspection, which is what was wrong there.

Mr. HENRIE. Mr. Congressman, we do need to have better sensing devices so these gases can be monitored.

Mr. VEYSEY. They had sensing devices and they failed.

Mr. HENRIE. Well, we need better ones and this is what a lot of our research is on. We do have some devices, and we hope to get them cheaper and more effective. Devices that will record 10 or 12 things at a time and these happenings monitored from the surface.

I think this is one of the paths that our research is taking to solve that particular problem.

Mr. VEYSEY. I would like to get back to the important aspect of inspection which I think was the inadequacy in that situation.

Mr. OSBORN. I hope you are separating these two things. We were just talking about research at the moment.

Mr. VEYSEY. I understand.

Mr. OSBORN. I concur, if you would like to talk about inspection——

Mr. VEYSEY. I want to talk about two things.

I want to see that our research is directed to the areas where the fatalities are occurring, and clearly numerous fatalities occurred there, not related to a rock burst. I want to see that our research goes where lives can be saved, but, second, I want to be sure that the inspection inadequacies are corrected.

INSPECTION REQUIREMENTS AND THE SUNSHINE MINE DISASTER

By the way, were any of the Federal inspectors discharged, replaced, or whatever as a result of the——

Mr. SCHLICK. No, sir.

Mr. VEYSEY. They were not?

Mr. SCHLICK. No. With all due respect to you and your committee, I would have to defend my inspectors. I think you have to realize that on a national scope our country looks to the coal mining as the big problem. I mean you look at the budget and you look at the people allocated in both forms, you look at the fatalities we have in our metal mines and fatalities in our coal mines, and it has always been coal that the emphasis has been on.

Mr. VEYSEY. It wasn't last year.

Mr. SCHLICK. In the wake of the Sunshine disaster I think we all now are going to put more emphasis on the——

Mr. VEYSEY. You told us yesterday that you had this winter alert system in which you had a daily inspection.

Mr. SCHLICK. 122 mines.

Mr. VEYSEY. In certain mines. And yet I guess the requirement, as you say, the minimum requirement by law is once a year.

Mr. SCHLICK. Four.

Mr. VEYSEY. Four times a year. But I guess inspections have been very periodic, to say the least, at the Sunshine mine.

Mr. SCHLICK. At the Sunshine mine we probably made two or three times what is required by the law.

Mr. VEYSEY. And they never observed the hazards. They never observed the inadequacies and lack of training of personnel. They never observed that the safety evacuation equipment was locked in such a way that the employees could not get at it. They never observed these facts.

Mr. SCHLICK. There were no regulations for everyone to have self-rescuers on, let us say. In the regulations now everyone should have the self-rescuer.

Mr. VEYSEY. Whose regulations?

Mr. SCHLICK. There has been no Federal regulations that everyone should wear a self-rescuer in the metal mines. Since the Sunshine disaster, though, with the cooperation of the miner himself and the mining companies, and they are helping out a lot, now, I believe, everyone has been trained in the use of a self-rescuer in our country.

Mr. VEYSEY. You reported that to us earlier. I am glad for that.

Mr. SCHLICK. That is a major thing. It takes people. It takes the desire of the worker and management as well as the Federal Government or the States to do this.

Mr. VEYSEY. What does it take on the part of the inspector? Should he not know the facts; that the men had no training, that the self-rescue equipment was locked up in such a way that they could not get it? Should he not have known these facts? Should he not have known that the debris had accumulated in these runs and could be the cause of a fire——

Mr. SCHLICK. These so-called runs are all sealed off and no one goes into those areas. These are abandoned workings that have been made since a mine was first started, many, many, many years ago. We don't inspect old workings like that. That is not part of the inspection.

I think that everyone, I think the State, I think the company, I

think the union, and I think the Federal Bureau of Mines must do a better job of this.

Mr. VEYSEY. I agree with you they were all involved and probably any one could have prevented that disaster. But we are talking to you about your budget and how you are spending Federal money to try to prevent just that sort of thing.

I want to be sure that we are using our dollars to save lives. We didn't do it in that case. We used dollars but we did not save lives at the Sunshine mine. The Federal inspector could have prevented that.

NEED FOR MORE INSPECTIONS

Mr. SCHLICK. I hope we will be able to make more inspections at these mines. I just don't think one inspection a year is enough.

Mr. VEYSEY. I don't either especially in view of the one per day inspection that you have implemented in other areas. Is the hazard in the ratio of 365 to 1?

Mr. SCHLICK. I would be the first to say technically that there are underground metal mines that have the same potential disaster conditions as some of our coal mines do and I would like to get into those more than four times a year. Hopefully we will be able to pinpoint some of these places and be able to do this.

Mr. VEYSEY. Getting into them is one thing. You have to do that, I agree. But when the inspector gets in there and does not take any action with respect to any of the several deficiencies that caused that loss of life——

Mr. SCHLICK. The inspector cannot issue a violation if there was nothing to issue a violation against. We have issued hundreds of violations against Sunshine Mine.

CITATIONS ISSUED

Mrs. HANSEN. You testified yesterday on other mines that you issued citations for.

Mr. SCHLICK. Yes. In the metal mining industry last year we issued 54,812 violations across the country. In coal mining we issued 77,000 violations across the country. So we are issuing violations.

Mr. VEYSEY. You are telling me that those conditions in the Sunshine Mine would not have been a violation of any regulation?

Mr. SCHLICK. When the Sunshine Mine was last inspected they cleared up all their violations, I believe, in the subsequent inspection. Any time you go into the mine because a mine is a moving type thing——

Mr. VEYSEY. This relates to training personnel? No regulations covering that?

Mr. SCHLICK. There is a regulation—I can get it exactly for you but there is a very minimum amount of training that has to be done.

Mr. VEYSEY. None was done. The testimony was, "None was done."

Mr. SCHLICK. I think they comply with the law with a certain amount of training. It is very small.

Mr. VEYSEY. Has that been changed?

Mr. SCHLICK. Some of the regulations that we are promulgating now—in fact they are up for public hearing—are to get more train-

ing. We think everyone should wear a self-rescuer. We think everyone should be trained in the use of the self-rescuer.

Mr. VEYSEY. Is there a regualtion against locking the self-rescue equipment away so no employees can get into it?

Mr. SCHLICK. No, there was no regulation that says anything about the self-rescuer.

Mr. VEYSEY. Nothing at all?

Mr. SCHLICK. No. The regulatitons that we are promulgating now, and are up for a public hearing, say that each man must wear a self-rescuer and be trained in a self-rescuer once a year.

Mr. VEYSEY. It is in effect?

Mr. SCHLICK. It is up for public hearing. The American Mining Congress, I believe, asked us for a public hearing on several regulations and that is one of them.

Mr. VEYSEY. What about timber fires in the mines?

COMMITTEE ON REGULATIONS

Mr. SCHLICK. I have started a 24-man committee. I have three men in each area and three men working on roof support. One of the regulations I think that we are going to try and advance in the near future is, timber should not be stored or left in a mine. It should be taken out. That is going through the rulemaking process.

I think it is a very good regulation.

Mr. VEYSEY. I would think so but there hasn't been anything on the books?

Mr. SCHLICK. No, sir.

Mr. VEYSEY. It just occurs to me that that deficiency in promulgating appropriate regulations cost a lot of lives.

Mr. SCHLICK. The regulations are promulgated differently in the mental mining business than they are in the coal mines.

Mr. VEYSEY. I don't know how they are promulgated but they weren't effective.

Mrs. HANSEN. Will you give us the details of the rulemaking procedures.

Mr. SCHLICK. Yes.

In the metal mining business the act established a committee that has equal members of labor, equal members of industry, and equal numbers of the State. It is a nine-member committee now and they are the Secretary's advisory committee on regulations. Some of the most eminent people in the country are on this committee and they advise the Secretary on regulations that he should promulgate. In the past the Secretary has taken their advice because it is really good advice in developing the regulations that he has promulgated.

In the coal mining area it is different. In the Bureau of Mines, in the enforcement activity, below my level, at the assistant director level, they will start the promulgation rules.

For instance, after the Blacksville mine fire recently we found our rules should be tightened up in moving the equipment so we developed a new regulation and we must take that regulation in the early stages to interested parties and discuss it with them.

Then we get their feedback, we develop a regulation that is published in the Federal Register as proposed rulemaking, and it stays

there for 45 days and then after that if there is no comment it becomes a regulation and that is the two different ways of doing it.

STATE REGULATIONS

Mrs. HANSEN. I think this is the problem with the new federalism in placing a lot of responsibility on States. Many States have limited capabilities to enforce regulation. I think Dr. Osborn would agree with me.

Most State legislatures faced with funding problems are prone to put aside some of the more expensive regulatory safety programs. I think this is one of the problems in this "new federalism."

Mr. OSBORN. Mrs. Hansen, may I just remark for perhaps some of the new members of the committee that the law provides for State inspection with Federal surveillance, and there are five States now that have adopted this—Colorado, Arizona, New Mexico, California, and New York.

In each of those States the State regulations have to be at least as strict and of the same nature as the Federal and they have to show a plan of training for their inspectors and that they will have enough inspectors to do the job.

Then they can make the additional inspections that our people aren't making. Under these plans we will make, let us say, one inspection a year and we will be checking on them and the States then will make, let us say, three to bring it up to the level of four inspections, as it is in coal.

This is quite different from the coal mining. Under the Coal Mine Health and Safety Act the States have no status with respect to our law.

Mrs. HANSEN. But that is only five States out of a large number.

Mr. OSBORN. Well, there are about 20 or so that are important in metal and nonmetal mining. I mean in the underground metal mining. Of course, every State has gravel quarries, or almost every State.

Mrs. HANSEN. Idaho has not adopted them nor has Montana?

Mr. OSBORN. Right.

Mrs. HANSEN. Has Nevada?

Mr. OSBORN. No.

Mrs. HANSEN. Montana, Idaho, Nevada, Arizona have not adopted regulations.

Mr. OSBORN. That is right. Arizona, but not Nevada.

Mr. SCHLICK. In Colorado also.

Mrs. HANSEN. Is such a plan before the legislatures in these other States?

Mr. OSBORN. The root of the problem is money.

Mrs. HANSEN. I understand.

Mr. OSBORN. The inspection cost is covered entirely by Federal money if we do it. If the States do it they have to pay for it.

Mrs. HANSEN. I understand.

MATCHING FUNDS FOR STATE INSPECTION PROGRAMS

Mr. OSBORN. So the legislators are saying, "Why should we pay for it? The Federal Government will do it."

Now, an amendment to the Metal and Nonmetallic Mine Safety Act was actually introduced in the Senate last year under which the Federal Government could match up to half of the cost of these State programs. That matching provision was to be contingent on other requirements with respect to the facilities the States would have to have and so on, so that with the Federal money there would be another lever still to upgrade these State inspection groups.

I think that this is an excellent idea; in other words, to encourage the States. Missouri, for example, which has a large number of deep mines, lead, zinc, iron mines, and so on, is stalling on this because they figure the Federal inspectors will do it. It is a money problem.

Mrs. HANSEN. I understand because I served a long time in the State legislature. If a State feels the Federal Government will pay for a program they will not delve into their limited resources.

Mr. OSBORN. A matching basis in my opinion would be a very good idea. It would save the Federal Government money to have them do it and pay for only half of it. Now we are paying for all of it.

LIVES SAVED AS A RESULT OF INCREASED INSPECTIONS

Mrs. HANSEN. Is it possible to estimate how many lives may be saved as a result of your increased level of work in this area?

Mr. OSBORN. In the metal and nonmetal mines?

Mrs. HANSEN. Yes.

Mr. OSBORN. I don't know. I was thinking of this when Congressman Veysey was saying that the Federal inspection was not saving lives as demonstrated by Sunshine or something to the effect.

We don't know how many lives have been saved as a result of our inspection. There might have been another disaster, equivalent to the Sunshine, that was prevented.

Mr. VEYSEY. Let me just clarify my statement. That came through to you a little differently than I think I said it.

What I think I said was that that disaster could have been prevented by the action of any of several different groups, including the Federal inspector. The Federal inspector could have blown the whistle but did not. The State inspector could have but did not. The union people could have but did not. Management people could have but did not.

Maybe some individual employee could have, but in none of these cases did it happen.

Mr. OSBORN. My point was that it could well have been, but we are just hypothesizing, another disaster that would have occurred in other mines if there had not been inspection, and Mrs. Hansen's question was, well, how many lives might we be saving if we did this.

Let me just give an analogy with coal. With this stepped-up intensive program in coal, far more intensive than the metal and nonmetal mines, the fatalities have just been coming down in an amazing way.

Mr. VEYSEY. The statistics are impressive.

Mr. OSBORN. We are keeping our fingers crossed that something bad may not happen tonight. The number of coal mine fatalities dropped from 260 in 1970 to 181 in 1971, to 156 in 1972, and right now there are half as many as last year in the same period. You could say that the Coal Mine Health and Safety Act, on the basis of these numbers, is saving about a hundred lives this year. You could come to that conclusion, you see.

On the other hand, statistics have a way of fluctuating and I don't want to draw that conclusion. Similarly, you might say, Mrs. Hansen, if we had as strict a law as we have for coal, the number of fatalities might be cut in half.

DECREASE IN FATALITIES

Mr. SCHLICK. Madam Chairman, may I add just a comment to that? Yesterday we said the fatality rate in the coal mining business has been one fatality per million man-hours; in the last 2 years it has been cut in half. You can say there has been so much of the enforcement activity and program that you people have funded has caused that. We had 260 people killed in 1970. We had 181 killed in 1971. There were 157 killed last year. So far this year in the first quarter it happens that half as many people were killed this year as last year. So it keeps on coming down. I can point to the two disasters we had last year. One killed five people and one nine. I think in my experience in labor and management in mining if those two disasters had happened 10 years ago instead of killing 5 people they would have killed 100 people.

How do you say what you have done? I am convinced that the two disasters we had last year because of the things that we required the mining companies to do and they are doing is causing less people to be killed. Disasters are localized in one spot.

Mr. OSBORN. I would like to add the caviat that we could have a disaster anytime. Disasters are not outlawed yet.

Mr. YATES. That is the question I want to ask. Could you avoid the prospective disaster that you just testified to if there were more money available to you?

LAG IN METAL AND NONMETAL MINE SAFETY PROGRAMS

Mr. OSBORN. I think in the case of metal and nonmetal mines we could develop programs which could have a similar effect as with coal.

The metal and nonmetal mine safety program has lagged behind the coal one, because the coal one is where the big disasters in the past occurred. They have to be treated differently. Coal is pretty much the same wherever you find it. These are horizontal beds and the same type of problems. Each of the metal mines is different in many respects from the next one, and each is really a problem to itself. I think the approach here has got to be one of a study of each mine. Blanket regulations for metal mines, will be only partially effective. We have regulations and then there is an accident and we discover we ought to have a regulation for that. We cannot anticipate them the way we can in coal mines, because in coal mines we know what the problem is, and it is a matter of just how strict we want to make regulations and enforce them.

Mr. YATES. I'm not sure you are giving me the answer to my question.

Mr. OSBORN. The answer is yes.

Mr. YATES. How much money did you ask from OMB for this purpose?

Mr. OSBORN. The Secretary asked for $10 million.

INJURY AND FATALITY RATE FOR METALLIC MINES

Mr. VEYSEY. I wanted to get the comparable figure for the fatalities in the metallic mines. You gave the one for coal as being one per million man-hours.

Mr. SCHLICK. Yes.

In metal mining the injury rate in 1970 was 23.21. The fatality rate in 1970 again for metal mining was 0.31. In 1971, the injury rate in metal mining was 23.81, and the fatality rate remained the same at 0.31. In 1972 our injury rate is not available yet, but the fatality rate is 0.44. In coal mining the injury rate in 1970 was 44.40, and the fatality rate was 1.0. In 1971 the injury rate in coal mining was 45.85 and the fatality rate was 0.72. In 1972, the injury rate in coal mining was 47.43 and the fatality rate was 0.56.

You see the fatality rate in coal mining coming down rather markedly and in metal mining going pretty much the same, except it went up last year because of the Sunshine disaster.

Mr. VEYSEY. They are not that far apart.

Mr. SCHLICK. Traditionally the metal mining fatality rates and injury rates have been much less.

In coal mining they have been almost double in the fatality rate. In 1973—we may want to knock on wood—we may have the first time when the coal mining fatalities are less than the metal mining fatalies.

Mr. VEYSEY. That leads me to ask whether we are placing our emphasis where the returns will be the greatest for the dollar.

Mr. OSBORN. Mr. Veysey, you will notice that $1 million in research was taken from the coal and put to metal. So we have made that shift.

Mr. VEYSEY. I am thinking of the inspection aspect. It seems to me we have a much higher level, and a more intensive level of inspection, under a different law, in coal mining than we do in metallic mines.

Mr. OSBORN. There is no question about it.

Mr. VEYSEY. Maybe we will have to take a new look at that and reassess our programs.

Mr. OSBORN. I think you are right.

Mr. SCHLICK. It takes time to implement these programs and your committee has been very gracious with their time and giving us all the money.

PROBLEMS IN HIRING MINE INSPECTORS

You remember all the trouble we had in hiring inspectors.

Mrs. HANSEN. Mr. Veysey the hiring of inspectors presented some particular problems because of the Civil Service Commission rules and regulations.

Mr. SCHLICK. I think the program is now a hard, viable program and the metal mining program is following in its wake. Sometime in the near future it will be just as viable and hard-hitting. It takes two things, people and money.

Mr. VEYSEY. It takes good regulations. Apparently we have been rather late in getting appropriate regulations in the metallic mine field.

SAFE MINING PRACTICES

Mr. OSBORN. May I make one further comment that is pertinent here before we get off the subject of disasters. It is good to distinguish between a safe mine physically and safe mining practices.

In the case of the Blacksville Mine where the nine men were killed, that mine had been inspected and it was a safe mine. With ordinary accepted safety practices in mining, that disaster should not have occurred. That was a human error that was beyond our control in making the mine safe. This is where education and training come in. These companies must train their people and impress on them the various practices we know are safe. So we can get a mine safe, we think, but if the practices are improper, we can have a bad disaster.

[Discussion off the record.]

Mr. MCKAY. You recited the reduction in fatalities. Could you add to that the figure in the reduction or addition of the number of people working in mines?

Mr. SCHLICK. The fatality rate I quoted you is the number of people killed per million man-hours of working. You can also correlate that on the number of people killed per million tons produced which gives you some kind of common denominator, but that does not take into effect the productivity. The 100 million man-hours is pretty much the common denominator. I think the mining industry in the last 3 or 4 years peoplewise has stayed pretty constant. We quoted 100,000 people working in the coal mining industry and 250,000 in the metal and nonmetallic mining industry. That has not changed much.

Mr. MCKAY. 350,000 or 400,000 people total.

Mr. SCHLICK. Yes.

HIGHWAY DISASTERS IN THE UNITED STATES

Mrs. HANSEN. The committee is always troubled about a mine disaster but there is a daily disaster occurring on the highways of the United States; 56,000 people are killed every year. I think the State of California, Mr. Veysey, leads the Nation in fatalities.

Mr. VEYSEY. Unfortunately.

Mrs. HANSEN. These are not the fatalities that make the headlines. There has been a lot of conversation about the safety of a vehicle. A vehicle is no safer than its driver. This is one of the real shocking statistics and it seems as if nothing is being accomplished. We have to in the United States bring the death rate down.

Mr. VEYSEY. I can report we have made improvement in California. We may still be the highest but our rate has gone down in the past 2 or 3 years and is continuing down.

Mrs. HANSEN. It is still a shocking rate across the United States.

Mr. OSBORN. Are you suggesting that the Bureau of Mines should start enforcing highway safety?

COAL HEALTH AND SAFETY RESEARCH

Mrs. HANSEN. I am saying that somebody should. You are requesting a reduction of $3,868,000 for "Coal health and safety research". Why the decrease and what specific projects are affected?

Mr. OSBORN. I covered that fairly well yesterday, I believe, in referring to page 9 of this booklet.

Mrs. HANSEN. Will you supplement your previous statement?

Mr. OSBORN. What we have done is shown on page 9. We have reduced 7 of the 10 major categories of research projects. Those other three are slightly increased for 1974 over 1973. First, we are increasing the funds put into noise research. This is one of the areas that we are moving into just as hard as we can. It tends to be the last one, I think, in most industrial safety programs. We have a long way to go, especially in surface mining, to get the noise down.

Our research involves research on machinery, on the one hand, and on protecting the man on the other, if there is noise above the limits.

Second, there is a slight increase over last year in the postdisaster survival and rescue program. Third, there is a slight increase in the systems engineering research. All the other seven have decreases. These are ground control, fire and explosions prevention, industrial-type hazards, methane control, respirable dust, advanced mining systems, and industrial hygiene.

As I said yesterday, the funds that go into research are bound to pay off. So if more funds are put into research, it can be accelerated, and we will more rapidly complete the circle which is drawn on each of these 10 pages, indicating our present estimate of the amount of research that needs to be done in that particular area.

With the boundary conditions that we have had in making up our budget, we have placed the cuts where we think it will do the least harm.

Mrs. HANSEN. But it will still do some harm.

Mr. OSBORN. Yes.

Mr. VEYSEY. May I ask a question at this point?

Mrs. HANSEN. Yes.

SHIFT FROM UNDERGROUND TO SURFACE MINING

Mr. VEYSEY. I don't have clearly in my mind what the extent of the shift is from underground coal mining to surface mining. I think there is a shift over the past several years; is that right?

Mr. OSBORN. Yes, sir. In the last 10 years for coal mining, the percent of coal mined has gone from about 35 percent by surface methods to 52 percent last year.

Mr. VEYSEY. Surface mining is less hazardous and less dangerous from the health point of view, am I correct?

Mr. OSBORN. That is correct, from the standpoint of the number of people killed, to be sure. But in certain areas it is more dangerous. Noise is one. The noise problem with the surface machinery is more serious than underground. Certainly the health and general fatality hazards are less. The fatality rate, the number of men killed per million man-hours, is less than 0.3 for surface mining of coal, whereas it has been around 1.0 for underground mining; and it is above 0.5 still. So it is about double.

Mr. VEYSEY. That change has to be read into the declining overall statistics.

Mr. OSBORN. Yes. We have that separated in our curves. Both have decreased the fatality rate and both for surface mining and underground mining.

Mr. VEYSEY. I suppose in the direction of resources in terms of safety and health research.

Mr. OSBORN. Yes, sir, that is true.

Mr. SCHLICK. I believe that the fatality rate in underground mining of coal has decreased markedly where the fatality rate on surface mining went down just a little bit in this trend. I don't think you can say the move from underground to surface coal mining, productivitywise, has had a marginal effect if any on the lowering of the fatality rate.

PROPOSED BAN ON ALL STRIP MINING

Mr. OSBORN. There is one further point I missed, though. Although the trend has been strongly toward an increased ratio of surface to underground, there is at least one bill in Congress now which would ban all strip mining of coal. So it is a little hard to predict where the trend will be.

Mrs. HANSEN. If that bill were enacted, what would be the effect for the future as far as coal potential is concerned?

Mr. OSBORN. If you think of the long future, Mrs. Hansen, for several hundred years there is enough coal deeper than we could strip to take care of this country. In other words, we have plenty of coal. We are not using it because we are importing oil. But we have the coal if we want to use it.

However, any sudden change eliminating strip mining would be a disaster economically.

Mrs. HANSEN. For how long?

Mr. OSBORN. Unless there was a leadtime of several years, I don't think we could recover from it. To open up a new mine would take at least 5 years because of the training of people and so on. This for underground coal mines. Strip mines can be brought into production faster. This would have to be phased over a period of time, if we were eliminating all strip mining. If we are eliminating part of it, we ought to have some leadtime to make this up with underground sources.

Mrs. HANSEN. Has anyone ever consulted you about leadtime for closing certain areas to strip mining?

Mr. OSBORN. Let me say nobody has ever consulted me. I don't think the Bureau of Mines has been consulted. In the case of new underground mining equipment, there is a delay of approximately 18 months now for just the equipment alone. The obtaining and training of underground miners is a very serious problem.

LABOR FORCE FOR DEEP MINING

Mrs. HANSEN. I believe it was 3 or 4 years ago when we discussed the diminution in the number of the labor force and the potential labor force for deep mining. Is this still the situation?

Mr. OSBORN. Yes, we think so. We think also that the drop in productivity which is so evident for underground mining is related to the fact that the desire and motivation to mine coal is not quite the same as it used to be. This is a related part of this problem. What the labor market is in coal mining is very difficult to get at. We have some studies going on now by outside experts in these fields, studying the areas of the United States area by area, because one area is so different from others with respect to the requirements of industry and the possibility of available people.

The first part of that is one of the tough things, that is, predicting the requirements of the industry.

If we look at the present trend, we would say that the requirements don't look so bad. The amount of coal being mined underground is decreasing. What are we worrying about labor for? There is a lot of talk about how we are going to mine more coal underground, but we are not, not this year at least. The coal mining industry has had a lot of problems in the past where they thought maybe something was going to happen that would be good with respect to increased production and then it didn't.

Mrs. HANSEN. This is why the committee in its report last year asked for a national coal policy. You cannot greatly expand the coal research program predicated upon a continuing use of coal if you have not geared up in the way of labor potential and marketability.

PLANNED COAL OPERATIONS IN GERMANY

Mr. OSBORN. Yes. I was in Germany last summer for just a day, actually at the Big Brown coal operations near Cologne. They have these operations planned for a hundred years. As they move across the country, the coalbeds are 200 feet thick and mined by surface mining, they plan the town that will have to be eliminated and therefore another town built to take care of those people. This is planned well ahead of time. The towns agree to that and the people get new homes. As the mining goes through there will be a lake here and forest here and so on. This is planned for 100 years. It produces about 25 percent of the power in Germany.

Mrs. HANSEN. The United States doesn't seem to plan anything in advance even for 10 years.

Mr. OSBORN. In a case like that you can do something.

Our people making studies on manpower in coal are stuck with what is the future of coal.

Mrs. HANSEN. This is why the committee is deeply concerned.

COAL HEALTH AND SAFETY RESEARCH PROGRAM AND ACCOMPLISHMENTS

Will you provide for the record a listing of the various components of your coal health and safety research program and show the funding provisions for each of these for fiscal 1969–74. Also provide for the record a complete listing of the accomplishments of your research program.

[The information follows:]

COAL MINE HEALTH & SAFETY RESEARCH
ALLOCATION OF RESEARCH FUNDS
($ in thousands)

Research areas	FY 69	FY 70	FY 71	FY 72	Planned FY 73	Proposed FY 74
Coal Mine Health						
Respirable dust	150	2,030.9	2,967.1	2,905.9	3,569.7	2,084
Noise		45.0	113.5	509.8	556.9	549
Other industrial hygiene problems	50	98.0	605.1	894.6	907.4	695
Health totals	200	2,173.9	3,685.7	4,310.3	5,034.0	3,328
Coal Mine Safety						
Methane control	392[1/]	1,851.1[2/]	4,719.8[3/]	3,668.7	3,900.3	2,956
Fire and explosion prevention	1,097	1,222.9	3,177.7	4,816.7	4,261.9	3,598
Ground control	1,000	2,516.1	4,308.8	5,341.0	5,847.4	5,452
Industrial-type hazards	100	296.7	3,663.1	7,338.3	4,114.2	3,526
Advanced mining systems and systems engineering		379.1	2,008.6	1,689.8	4,082.8	4,354
Survival and rescue		3,623.3	1,925.3	2,947.2	1,133.4	1,140
Safety totals	2,589[1/]	9,889.2[2/]	19,803.3[3/]	25,801.7	23,340.0	21,026
Program totals	2,789[1/]	12,063.1[2/]	23,489.0[3/]	30,112.0	28,374.0	24,354

1/Methane control in FY 69 was all funded under Conservation and Development
2/Methane control in FY 70 included $1,528.0 thousand from Conservation and Development funds.
3/Methane control in FY 71 included $3,055 thousand from Conservation and Development funds.

Coal Mine Health and Safety Research Major Achievement Since 1969

GROUND CONTROL

1971: Horizontal roof strain indicator to detect unstable roof conditions demonstrated at United States Steel, Robena No. 2 and Concorde mines; Consolidation Coal Co.': Renton mine and others.
1972: Microseismic fracture warning system operational at Greenwich Collieries mine.

RESPIRABLE DUST

1971–72: Water infusion of coal beds for control of respirable dust demonstrated underground at Eastern Associated Coal Corp.'s Federal No. 2 mine.
1972: Water-based high-expansion foaming system used with a continuous miner to reduce dust at face in Pittsburgh Coal Co.'s Mathies mine.
1972: Foam system for dust suppression on conveyors and transfer points demonstrated at Hanna Coal Co.'s Rose Valley mine.
1972: Prototype dust meters used at Bethlehem Steel Co.'s Cambria Slope No. 33 mine.

SYSTEMS ENGINEERING

1972: Underground mine haulage simulator program used by Barnes & Tucker Co.

FIRE AND EXPLOSION PREVENTION

1971–72: Explosion-proof bulkheads, based on Bureau design, constructed in United States Steel Somerset mine and Duquesne Power and Light Warwick operation.
1972: Federal standard on portable coal dust-rock dust analyzers promulgated
1973: Ignition suppression devices developed for face equipment to be used in Consolidation Coal Co.'s Loveridge, Itmann, Mathies, and Kepler Mines, and Youngstown Sheet & Tube's Olga Coal mine.
1973–74: Prototype coal dust-rock analyzer developed and to be demonstrated underground.

INDUSTRIAL-TYPE HAZARDS

1972: Mine surveillance system installed in Eastern Associated Coal Co.'s Federal No. 2 mine.
1972: Portable area illumination system installed and demonstrated at Hanna Coal Co.'s Franklin No. 25 mine to assure availability of technology for proposed illumination standard.
1972: Trolley phone/wireless system demonstrated at the Bureau's research coal mine and at Consolidation Coal Co.'s Montour No. 4 mine.
1973: Advanced remote surveillance and communication system installed for demonstration at Bureau's safety research coal mine.

METHANE CONTROL

1971: Oil well, which penetrated Pittsburgh coalbed, safely plugged and mined through in cooperation with Christopher Coal Co.
1972: Water infusion techniques used to reduce methane in face area at Eastern Associated Coal Co.'s Federal No. 2 mine; Consolidation Coal Co.'s Loveridge mine, and Island Creek Coal Co.'s Beatrice mine.
1972: Degasification through vertical boreholes demonstrated at 10 locations in 8 coalbeds.

POST DISASTER SURVIVAL AND RESCUE

1971: 8¾'' probe and 28½'' rescue drills tested at United States Steel No. 14 mine and used at Nemacolin mine fire.
1972: Survey probes used at Blacksville and Sunshine disasters.
1972: Wireless rescue team communications used at Sunshine mine disaster and presently in use at United States Steel Somerset mine.
1972–73: Location of trapped miners using electromagnetic techniques developed and to be demonstrated at Union Carbide Leon mine and at Robins mine.

INDUSTRIAL HYGIENE

1972: Studies on diesel engine emission and ventilation requirements for use of diesels underground have resulted in the preparation of new Federal standard on "diesel emission control technique."

1972–73: Investigations on generation of toxic products from combustible materials resulted in development of an adopted test procedure and basis for proposed standard limiting the amount of combustible materials underground.
1973: Improved laboratory analysis techniques and in-mine sample surveys to result in Federal standard defining maximum levels of toxic gases underground.

NOISE

1972–73: Audio dosimeter, as replacement for sound level meter, demonstrated at United States Steel Robena mine; use underground to be required through promulgation of alternate interim standard.
1972: Discriminating earmuffs demonstrated to be effective for reducing excessive personnel noise level exposure at United States Steel Robena mine.
1972: Noise control muffler system reduced pneumatic drill noise to allowable levels at United States Steel's Robena mine.

Mrs. HANSEN. Mr. McKay.

PUBLIC LAND POLICY FOR MINING

Mr. MCKAY. The BLM, Forest, and other managers of public lands are making policy for areas nonminable. Are you ever consulted about any of the policy about what should be mined and should not be mined in relation to what you were talking about earlier about strip mining, deep mining, and potential mining?

Mr. OSBORN. We work on the public lands that are classified under the Wilderness Act to develop knowledge of the resources there. However, I believe what you are referring to is public lands where there is leasing for mining?

Mr. MCKAY. Yes.

Mr. OSBORN. I would say in general that our input is very little or none.

Mrs. HANSEN. Should you not have more input? Wouldn't it provide for an improved leasing policy?

Mr. OSBORN. I feel that the Bureau of Mines has experts in these fields. Our activity has been mostly on private land.

Mrs. HANSEN. These leases are going to become more and more valuable depending upon a coal policy. It seems to me if the Government is going to receive the maximum amount of benefit from our leases you should at least be consulted as to the kind and depth of the coal policy.

Mr. OSBORN. Of course, we have the health and safety responsibility wherever it is. On these other problems, this was within the jurisdiction of the Buerau of Mines, if I recall the history, up until about 1923 or 1924 when the Bureau of Mines was transferred to the Department of Commerce. At that time its jurisdiction over this was transferred to the Geological Survey and it became the Conservation Division of the Geological Survey. When the Bureau of Mines returned to Interior about 1934 that remained in the Geological Survey. So it is the Geological Survey along with the Bureau of Land Management that has this surveillance and regulatory authority of coal mining on Federal lands. We do not have it.

Mrs. HANSEN. It seems to me the Bureau of Mines, the Geological Survey, and the Bureau of Land Management should be working jointly in this area because of the very nature of the leases.

Mr. OSBORN. Let me say our relations are very friendly. There are no personality problems or anything like that. But the other bureaus have the responsibility.

COAL POLICY ESTABLISHMENT BY OTHER AGENCIES

Mr. McKay. My concern here is that we have the Forest Service and the BLM and other Federal agencies who are establishing policy on coal or other minerals and they are doing it arbitrarily, without the knowledge you have about what is minable and nonminable, and what ecological problems you will have in the engineering of that mining, so that we may be locking up some of our resources that may be opened with the knowledge you have along with what they are trying to do.

Mrs. Hansen. The Geological Survey determines what land has geological potential. But beyond that you have to determine the quality and scope of the coal itself. Also the types of mining appropriate to that terrain. The committee is of the opinion that there should be some exploration in the Department of Interior so you have a combined summation of the knowledge.

Mr. Osborn. I think your observation is very good, Mrs. Hansen. I agree.

Administrative Provisions

Mrs. Hansen. Please insert justification page 69 in the record at this point.

[The page follows:]

Bureau of Mines

EXPLANATION OF ADMINISTRATIVE PROVISIONS

Contributions.—Various industrial organizations have expressed interest in many phases of the Bureau's activities and are at times willing to contribute funds, experienced personnel, special equipment, and so forth toward accomplishing certain objectives useful to industrial purposes. The Bureau endeavors to cooperate with industry whenever possible and authorization to accept such contributions is a distinct aid in furthering such cooperation.

Sale of metals and mineral products.—In some of the metallurgical pilot plants of the Bureau, quantities of special metals may be manufactured which might be of value to industrial concerns. Funds received from the sale of such products would be covered into miscellaneous receipts.

Helium Fund

Mrs. Hansen. Also insert justification pages 70 and 71 in the record at this point.

[The pages follow:]

BUREAU OF MINES

HELIUM FUND

(in thousands of dollars)

Estimated income, 1973:	
Operations	$ 7,611
Anticipated supplemental borrowing authority	34,000
Estimated income, 1974:	
Operations	7,605

Financial Summary

	Actual 1972	Estimate 1973	Estimate 1974
Income and expenses (funded):			
Income:			
Sales of helium	$5,801	$6,300	$6,300
Other income	2,049	1,311	1,305
Total income	7,850	7,611	7,605
Expenses:			
Production and sales	2,987	2,454	2,495
Research	32	- -	- -
Administrative and other expenses	499	468	475
Total expense	3,518	2,922	2,970
Net income (funded)	4,332	4,689	4,635
Unobligated balance, start of year	3,700	5,706	6,506
Borrowing authority	45,300	- -	- -
Anticipated supplemental borrowing authority	- -	34,000	- -
Change in selected resources	95	- -	- -
Total funds available	53,428	44,395	11,141
Capital outlay:			
Crude helium for underground storage	47,639	36,721	2,743
Land, structures, and equipment	83	1,168	400
Total capital outlay	47,722	37,889	3,143
Unobligated balance, end of year	5,706	6,506	7,998

Helium Fund.—Fiscal year 1973, $34 million (proposed supplemental); fiscal year 1974, none; decrease, $34 million.

On January 26, 1971, the Under Secretary of the Interior issued a determination to terminate four helium conservation contracts. Thereafter, the U.S. District Court in Kansas enjoined the Government from taking any action leading to the termination of three of those contracts on the ground that the requirements of NEPA had not been met. Pursuant to that ruling, the Bureau of Mines has prepared and disseminated a final environmental statement. On January 12, 1973, the court issued an oral ruling denying the Government's motion to dissolve the injunction, but interpreted the injunction as allowing the Secretary to proceed anew to determine whether or not to terminate the three conservation contracts. Resolution of this matter will undoubtedly take most, if not all, of the remainder of fiscal year 1973. In the circumstances, a supplemental appropriation to the helium fund is required to permit the liquidation of obligations that have been or may be incurred under the three contracts during the period June 30, 1972, through June 30, 1973. The matter of damages owing a fourth contractor is in litigation in the Court of Claims. No helium is being received from the fourth contractor.

Under authority of the Helium Act Amendments of 1960 (Public Law 86–777). the Bureau of Mines will continue helium production and sales during 1973 from its production plant at Keyes, Okla. Shipments of helium in small cylinders will continue from the Bureau's Amarillo, Tex., shipping terminal. All shipments of helium in trailers and tank cars will be from the Keyes plant. The Exell Tex. plant will operate to accommodate helium storage operations. Helium produced by the plant in excess of market requirements will be added to underground storage.

Total helium production by the Bureau of Mines during fiscal year 1973 is expected to be about 380 million cubic feet. Sales for fiscal year 1973 are estimated to be 180 million cubic feet.

As of June 30, 1972, the Government had $465.4 million invested in the helium program. Of this amount, $349 million is owed to the U.S. Treasury in accordance with the Helium Act, leaving a net investment of $116.4 million. The investment at June 30, 1972, was about 12 percent in helium plants and facilities and about 88 percent in helium stored underground (33.5 billion cubic feet as of June 30, 1972).

On June 30, 1974, the Government's investment is estimated to be $507.8 million, of which $390.7 million will be owed to the U.S. Treasury, leaving a net investment balance of $117.1 million. The estimated increase from June 30, 1972, of $0.7 million in net Government investment (equity) results from an increase in retained earnings accrued during fiscal years 1973 and 1974.

Mrs. HANSEN. We discussed helium yesterday afternoon. Insert justification pages 72 through 75 in the record.

[The information follows:]

OBLIGATIONS INCURRED BY THE BUREAU OF MINES BY ACTIVITY AND SOURCE OF FUNDS, FISCAL YEARS 1972, 1973, AND 1974

	1972	1973	1974
ENERGY:			
Bureau of Mines Appropriation	$14,847,832	$19,821,000	$18,096,000
Reimbursements	79,839	100,000	100,000
Department of the Army	152,792	150,000	150,000
Department of the Air Force	189,748	200,000	200,000
Department of the Interior	95,730	100,000	100,000
Department of Justice	8,500	10,000	10,000
Department of the Navy	94,350	100,000	100,000
Department of Transportation	125,312	125,000	125,000
Atomic Energy Commission	30,500	20,000	20,000
Environmental Protection Agency	1,027,715	1,000,000	1,000,000
National Aeronautics & Space Administration	27,652	30,000	30,000
Veterans Administration	50,000	50,000	50,000
Other Agencies	2,000	---	---
Contributed Funds	420,877	425,000	420,000
Total	17,152,847	22,131,000	20,401,000
METALLURGY:			
Bureau of Mines Appropriation	13,863,335	15,393,000	14,393,000
Reimbursements	82,764	100,000	100,000
Department of the Air Force	53,671	70,000	70,000
Atomic Energy Commission	57,000	50,000	50,000
Environmental Protection Agency	875	---	---
Contributed Funds	15,106	15,000	15,000
Total	14,072,751	15,628,000	14,628,000

	1972	1973	1974
MINING:			
Bureau of Mines Appropriation	$ 5,762,498	$ 5,733,000	$ 5,033,000
Reimbursements	265	---	---
Department of the Air Force	70,981	50,000	50,000
Department of the Army	3,467,083	3,800,000	3,800,000
Department of the Interior	42,524	50,000	50,000
Atomic Energy Commission	24,192	5,000	5,000
National Aeronautics & Space Administration	239,141	150,000	150,000
U. S. Coast Guard	59,888	---	---
Other Agencies	4,822	5,000	5,000
Contributed Funds	76,023	20,000	20,000
Total	9,747,417	9,813,000	9,113,000
DATA COLLECTION AND ANALYSIS:			
Bureau of Mines Appropriation	9,398,241	9,563,000	9,263,000
Reimbursements	151,346	170,000	170,000
Department of the Interior	48,191	50,000	50,000
Contributed Funds	4,657	5,000	5,000
Total	9,602,435	9,788,000	9,488,000
ENGINEERING EVALUATION AND DEMONSTRATION:			
Bureau of Mines Appropriation	6,064,938	9,896,000	7,296,000
Department of the Army	50,322	50,000	50,000
Atomic Energy Commission	16,884	---	---
Office of Emergency Preparedness	88,499	50,000	50,000
Appalachian Regional Commission	1,867,077	5,850,000	7,400,000
Contributed Funds	803,060	840,000	840,000
Total	8,890,780	16,686,000	15,636,000

	1972	1973	1974
COAL MINE INSPECTIONS:			
Bureau of Mines Appropriation	$30,001,969	$31,734,000	$31,734,000
Reimbursements	4,905	10,000	10,000
Total	30,006,874	31,744,000	31,744,000
METAL AND NONMETAL MINE INSPECTION:			
Bureau of Mines Appropriation	5,830,000	6,074,000	7,574,000
EDUCATION AND TRAINING:			
Bureau of Mines Appropriation	5,138,000	18,121,000	5,321,000
Department of Health, Education and Welfare	263,406	1,000,000	1,000,000
Total	5,401,406	19,121,000	6,321,000
TECHNICAL SUPPORT:			
Bureau of Mines Appropriation	6,780,000	6,894,000	7,194,000
Department of the Navy	12,890	---	---
Total	6,792,890	6,894,000	7,194,000
RESEARCH:			
Bureau of Mines Appropriation	32,780,559	31,185,000	28,317,000
MINED AREA PROTECTION (Proposed Legislation)	---	---	7,000,000

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	1972	1973	1974
PROGRAM ADMINISTRATION:			
Bureau of Mines Appropriation	$ 2,370,036	$ 2,427,000	$ 2,603,000
Reimbursements	14,230	20,000	20,000
Department of the Interior	237,774	300,000	300,000
Contributed Funds	592	---	---
Total	2,622,632	2,747,000	2,923,000
DRAINAGE OF ANTHRACITE MINES:			
Bureau of Mines Appropriation	246	200,000	200,000
DEMONSTRATION GRANTS:			
Bureau of Mines Appropriation	21,582	---	---
HELIUM PRODUCTION			
Federal and Non-Federal Sources	51,144,598	40,811,000	6,113,000
SUMMARY:			
Bureau of Mines Appropriation	132,859,236	157,041,000	144,024,000
Reimbursements	333,349	400,000	400,000
Other Agencies	8,409,519	13,265,000	14,815,000
Contributed Funds	1,320,315	1,305,000	1,300,000
Helium Production	51,144,598	40,811,000	6,113,000
Total	194,067,017	212,822,000	166,652,000

Mrs. HANSEN. Does any member of the committee have a question at this point?

SALE OF MINERALS AND METALS

Mr. VEYSEY. On the administrative matter, you report you have certain sales of minerals and metals included in miscellaneous receipts. Is that unappropriated funding for you? Does that go back to the Treasury?

Mr. OSBORN. It all goes to the Treasury. Anything we collect goes to the Treasury. We have to justify here the use of all the funds we get.

Mr. MCDADE. I understand that your laboratory at College Park, Md., has been transfered to the University of Maryland. What was the authority for this and what is the status of the transfer?

Mr. OSBORN. Public Law 89–227 provided for this conveyance. The transfer papers were signed on June 10, 1968.

Mr. MCDADE. How come you are still occupying the facility?

Mr. OSBORN. The terms of the transfer provide that the Bureau could continue to occupy the laboratories for a period of up to 10 years under a rent-free lease.

Mr. MCDADE. Does that mean that you have to vacate the facility on or before June 1978?

Mr. OSBORN. Yes.

Mr. MCDADE. Does this mean you are going to abolish the laboratory, transfer it, replace it, or what?

Mr. OSBORN. In all of the testimony leading up to the passage of this authority (Public Law 89–227) the justification was based upon replacement. The Department reported favorably on the bill with that understanding. The legislative history is extensive in this instance. The bill was considered by three Congresses before passage.

Mr. MCDADE. What action have you taken to provide for replacement?

Mr. OSBORN. Well, we try each year to have funding for replacement, or at least initial plannnig, included in the budget estimates. But, there is always something that seems more urgent and it has never been included in any justification submitted to the Congress.

Mr. MCDADE. Do you have authority to replace the laboratory?

Mr. OSBORN. I think so. Aside from the fact that the Congress clearly anticipated that replacement was to be the consequence of this conveyance, the specific authorities included in Public Law 63–283 (Foster Act) are adequate.

Mr. MCDADE. As I read it—that authority provides for 10 locations. Don't you already have more than that?

Mr. OSBORN. Yes, but many of these were established by other specific authorities and therefore would not be counted. Reno and Grand Forks are examples. Also, Pittsburgh was established before the passage of this authority.

Also, let me read a statement from the committee report on this authority:

> The exact location and the question of their (these facilities) being removed from time to time from one point to another is wisely left to the discretion of the Secretary of the Interior in order that the work of the several stations may be carried on at such places and in such manner as will best facilitate the metal mining resources of the country.

Thus, the transfer of a facility from one location to another is provided for and is pertinent in this case.

Mr. McDade. What is the nature of the program at College Park?

Mr. Osborn. The programs at all of our laboratories are constantly changing and at any time these are oriented to current problems. All of the laboratories must have this built-in flexibility, and College Park is no exception. Recently, College Park has been deeply involved with secondary metals recovery among other things. But, as you see from the budget justifications before you, this process of continuous reorientation is apparent.

Mr. McDade. Please give me some examples.

Mr. Osborn. Certainly. Mindful of the emerging energy crisis, and the fact that the production of minerals, and the mineral substances claim a very large share of our energy supply, much of our research is aimed at reducing such energy requirements. This orientation is explained, in part, on page 20 of our justification.

Similarly, many of the problems in advancing new energy processes are material problems, and our research is oriented to that too.

Mr. McDade. So you relate some of your program at College Park to the energy problem?

Mr. Osborn. Most certainly, and a large part.

Mr. McDade. And now this will be interrupted, if the laboratory is abandoned, at the very time these efforts should be strengthened.

Mr. Osborn. Loss of this facility would reduce the Government's in-house research capabilities.

Mr. McDade. Has a site been selected or acquired in anticipation of this relocation?

Mr. Osborn. No. As I am certain you know, at least one bill has been introduced in this Congress authorizing the replacement and the appropriation of necessary funds. I don't know what the Department's position will be on the bill. It has not been reported upon or heard.

Mr. McDade. In light of your observation regarding existing authority, why would such legislation be considered?

Mr. Osborn. Well, for one thing it would fix the matter of location.

Mr. McDade. How would the relocation site be fixed otherwise?

Mr. Osborn. It would be our option, subject to the appropriation of funds, which means the concurrence of the Congress.

Mr. McDade. What would constitute an acceptable site?

Mr. Osborn. Because the level of scientific and technologic competence attracted to and retained at any laboratory determines its productivity, the siting is very important. The basic authority (Foster Act) I mentioned, correctly anticipated that these laboratories should be convenient to educational institutions with strong mineral engineering departments. I think that is more important now than ever. Then, of course, the offer of an acceptable parcel of land (20–40 acres) would be a factor. The basic authority also provides for acceptance of such donations.

Mr. McDade. Would you consider that a location at some school or university would be mandatory?

Mr. Osborn. No; it would be preferrable and would offer important advantages. Most of our laboratories are sited this way—all that have been built in the last 30 years are.

Mr. McDade. What are some of these advantages?

Mr. OSBORN. Nowadays there are not enough fully trained people to meet the needs and this kind of arrangement facilitates recruitment. Moreover, it provides a means for supporting a fellowship and graduate student program—a program that the Bureau of Mines has employed successfully for many years. Similarly, the Bureau gains immediate access to the library, laboratory, and related supporting functions already established. Also, once the Bureau facilities are established, major benefits accrue to the school, too.

Mr. MCDADE. What is this relocation going to cost?

Mr. OSBORN. About 85,000 square feet of laboratory space is required. We expect that it would cost about $6 million not including equipment. Of course, until we have architectural plans and specifications the cost can only be estimated.

Mr. MCDADE. What do you need for planning costs and what would be the timetable?

Mr. OSBORN. We would need $600,000 to acquire the plans and specification necessary to permit letting a construction contract.

As to time. Assuming a suitable site were acquired promptly, the planning would take at least a year—perhaps 18 months. Assuming further that construction funds were provided at that time another 18 months would pass before the facility might be available for occupancy. We are talking about 3 or 4 years, at least.

Mr. LONG. What is the average amount of money spent on reclaiming strip mined areas per ton of coal mined?

Mr. OSBORN. Reclamation costs are affected by the type of strip mining, type of deposit mined, type of use for which the mined area is reclaimed, and State reclamation requirement as well as geologic, topographic, and climatic conditions. Coalbed thickness in relation to thickness and type of overburden in addition to these factors influence the per ton costs of reclamation. Estimates on a regional basis indicate that at a cost of $1,000 to reclaim an acre of mined land, the average cost per ton of coal mined would be about 20 cents in the Appalachian region, 14 cents in the Mid-Continent region, and 4 cents in the Western region. Should costs of reclaiming strip mined land be lower or higher than $1,000 per acre at particular mine sites, these per ton costs would of course be affected accordingly.

Mr. LONG. How much do you estimate would need to be spent to adequately reclaim the land?

Mr. OSBORN. To provide basic reclamation for the 2.2 million acres requiring reclamation would require an expenditure of approximately $1 billion. Such basic reclamation would include planting, grading, drainage control, slide damage repair, haul road repair, stream drainage repair, pond stabilization, providing access to high walls, and eliminating selected hazardous conditions. Improving this unreclaimed land beyond this basic level for selected land use consistent with adjacent land use patterns would require an expenditure of approximately $1.5 billion.

Mr. LONG. If the cost of adequate reclamation was added to the cost of strip mining, would it still be cheaper to strip mine coal than to deep mine it?

Mr. OSBORN. The average f.o.b. mine value of surface mined bituminous coal was $5.28 per ton in 1971 while that for underground mined coal was $8.87 per ton, or 68 percent greater. On the basis of the $3.59 difference, it would be cheaper to strip mine coal than to deep mine it

even if the cost of adequate reclamation were added to strip mined coal.

Mr. LONG. How much land do you estimate has been strip mined in the United States? How much of that land has been reclaimed?

Mr. OSBORN. Approximately 4 million acres have been surface mined with some 2.2 million of these acres requiring reclamation, the balance, 1.8 million acres, has been reclaimed by man and nature.

Mr. LONG. Is strip mining being done more now than in the past relative to deep mining? What do you think would be the effect on the amount of coal mined if strip mining was abolished?

Mr. OSBORN. Surface mining has increased over the years to the point that 94 percent of crude metallic and nonmetallic ores and 50 percent of the coal mined in 1971 were produced by this method. Coal strip mines produced on estimated 52 percent of the coal mined in 1972 whereas only 9 percent was mined by this method in 1940.

The immediate effect of abolishing strip mining of coal would be a serious disruption in our energy supply. Slightly over half of our coal production in 1971 was extracted by surface mines—strip and auger. In other words, some 281 million tons of the national total of 561 million tons produced would have to be replaced by other fuels which are presently in short supply.

Mr. LONG. There is a decrease of $1,725,000 in your request for energy under the category of Mineral Resources Development. In this time of grave concern about the adequacy of our energy supply, how do you explain this decrease?

Mr. OSBORN. The decrease will be accomplished by terminating our programs on converting wood and other organic wastes to oil, on the underground disposal of liquid wastes and, on environmental problems associated with processing of oil shale. We will also reduce large-scale experimentation on in situ retorting of oil shale.

Subsurface disposal of liquid waste does not have important application in trying to solve our energy problems; while environmental problems associated with oil shale processing will receive increased attention in a 2-year joint study by the Department of the Interior, EPA, the State of Colorado, industry, and local Colorado jurisdictions.

Reduced funding for in situ retorting of oil shale will still permit investigation of some important operating problems delineated in earlier studies.

While we found our programs on converting wastes to low-sulfur oil a useful addition to our coal conversion studies, the work is being phased out in order to concentrate on other research dealing with technology to provide clean energy.

Mrs. HANSEN. Dr. Osborn, I want to express my own and the committee's appreciation for an excellent presentation. I would also like to compliment your staff.

Will you please tell Mr. Lipper what an excellent job he did on helium. We are very grateful.

Mr. OSBORN. Thank you.

Mr. MCDADE. I want to offer my commendations to Dr. Osborn and the members of the Bureau of Mines for a fine presentation justification.

Mr. OSBORN. Thank you.

THURSDAY, MARCH 29, 1973.

OFFICE OF COAL RESEARCH

WITNESSES

GEORGE R. HILL, DIRECTOR, OFFICE OF COAL RESEARCH
G. EDWARD LARSON, CHIEF, DIVISION OF CONTRACTS AND ADMINISTRATION
NEAL P. COCHRAN, CHIEF, DIVISION OF RESEARCH AND DEVELOPMENT
FRANCIS M. WILES, DIRECTOR OF BUDGET, OFFICE OF THE SECRETARY

Mrs. HANSEN. We now have the Office of Coal Research and our principal witness is Dr. George R. Hill, the Director.

We want to welcome you to the committee, Dr. Hill. I believe this is the first time you have appeared before the committee.

Mr. HILL. That is correct.

BIOGRAPHY OF DR. HILL

Mrs. HANSEN. Please insert your biography in the record at this point.

Mr. HILL. I would be happy to do it.

[The biography follows:]

Name.—George Richard Hill III.

Born.—Ogden, Utah, November 24, 1921.

Home address.—1101 Delf Drive, McLean, Va. 22101.

Phone.—(703) 356-6513.

Schooling.—East High (Salt Lake City) June 1938; Brigham Young University, A.B. chemistry, June 1942; Cornell University, Ph. D. inorganic and physical chemistry, minor in plant physiology, June 1946; International School of Nuclear Science and Engineering, Argonne National Laboratory, summer 1956.

Present employment.—Director, Office of Coal Research, U.S. Department of the Interior.

Professional career.—1937–42, summer and Saturdays—chemist, American Smelting and Refining Co., Agricultural Research Department. 1942–46, employment at Cornell University: Assistant 1942–43; part-time instructor 1943–46; acting assistant professor, summer 1946.

University of Utah appoitments.—1946, instructor of chemistry, 1946, assistant professor, 1950, associate professor, 1951, organizer and chairman, Department of Fuels Engineering, 1956, professor, 1965–66, acting dean, College of Mines and Mineral Industries. 1966–72, dean, College of Mines and Mineral Industries. 1952–57, project director, Air Force Combustion Research. 1951–62, Light Atom Research and Surface Chemistry Research. 1956–72, project director, U.S. Department of the Interior, Office of Coal Research on Western Coals. 1961, project director, equity oil shale research.

Other.—Consultant for several coal, petroleum, mining, and metallurgical companies. 1972, Director, Office of Coal Research, U.S. Department of the Interior.

STATEMENT OF THE DIRECTOR

Mrs. HANSEN. I am sure you have a general statement. You may summarize it or read it, as you wish.

Mr. HILL. I prefer to summarize it and put it in the record.

Mrs. HANSEN. Your statement will be inserted in the record.
[The statement follows:]

Madam Chairman, we are pleased to be here today.

The people of the United States are feeling the effects of shortages in natural gas and fuel oil. These shortages can be alleviated by the increased use of domestically produced coal—cleaned of its sulfur and ash and converted to more convenient gaseous and liquid forms. The Office of Coal Research is the contracting agency set up by the Congress to develop the essential conversion processes. Rapid development of economic processes will reduce the extent and shorten the time of reliance on overseas supplies of essential oil and gas, reducing the balance-of-payments deficit and insuring the independence of our energy-dependent economy.

The left-hand two bar graphs in figure 1 show clearly the relative supplies of energy resources in the United States and the relative consumption pattern at the present time. Coal which represents over 80 percent of our fossil fuel reserve is used to furnish less than 20 percent of our energy needs. It is available in adequate amounts to furnish all of our energy needs for hundreds of years if converted to environmentally acceptable forms.

The fourth bar in figure 1 represents the relative distribution of energy according to end-use in the United States. Note that by far the largest portion of our energy is used for transportation, and for space, steam, and process heating.

Only 8 percent of the energy purchased by consumers is electricity. An additional 4 percent of energy finally utilized as electricity is generated by the consumer. However, the fossil fuel and nuclear energy input into that electricity represents 36 percent of our annual fuel demand. Clearly, conversion of coal into clean forms for power generation in more efficient power generation systems will free major quanties of natural gas and oil to alleviate the current shortage.

NEED FOR NEW TECHNOLOGY

Estimates of the base cost of liquefied natural gas delivered into U.S. pipelines generally range upward from $1.25 per million Btu's. Wellhead prices of natural gas in many parts of the United States have been averaging about 25¢ per million Btu's. For the first time in my recollection the U.S. consumer is faced with a quantum jump in the value of a major essential commodity. There does exist a technology for making gas and oil from coal dating from the 1920's. Supplemental natural gas produced at low pressure in fixed-bed gasifiers of that era is estimated to cost in the range of $1.25 per million Btu's.

The high pressure processes being developed under contract with OCR suggest savings to the American consumer of 15 to 20 percent of that cost. The lower price of this high quality, clean gas will tend to serve as a ceiling above which future supplies of natural gas are unlikely to rise.

NEED FOR ALTERNATIVE SOURCES OF LIQUID FUELS AND PIPELINE GAS

An increasing proportion of U.S. energy consumption is in the form of oil and gas. We see that each year's usage of oil and gas has been increasingly steadily.

"SHARE OF ENERGY SUPPLY"

Figure 2 shows the proportional decline of energy supply in solid form, and the proportional increase in supply in oil and gas forms.

"U.S. NATURAL GAS RESERVES"

Additions to U.S. natural gas reserves have not been keeping pace with gas consumption since 1968, so that natural gas reserves have been declining since that year, as shown in figure 3.

"CRUDE OIL AND GAS FOUND"

Additions to natural gas reserves show a decline, and the same is true for additions to petroleum reserves, as shown on figure 4.

"CHANGING PATTERN IN OIL SUPPLY/DEMAND"

The increasing application of pollution control has intensified a tight fuel supply situation, and this is reflected in an acceleration of demand for oil, as shown on figure 5–A.

You will note that the domestic production of oil began leveling off in 1971, while the demand for oil increased by almost 30 percent since 1968, or an annual increase of 6 percent. The gap between demand for oil and domestic product is increasing at a geometric rate, as shown on figure 5–A. In a recent review published by the Department of the Interior, entitled "U.S. Energy Through the Year 2000," it is estimated that by 1985 about 53 percent of the oil consumed in the United States may be imported or synthetic. The same report estimates that by 1985 about 25 percent of pipeline gas consumed in the United States may be imported or synthetic.

As you will observe on figure 5–B, not only is the prospective impact of these galloping energy imports significant with regard to balance of payments problems, but the Western sources of oil and gas are far from adequate to supply the United States, so that the United States will be increasingly dependent on North African and Middle Eastern sources. These sources of oil and gas are less secure than domestic sources and the emerging security problems are lending added urgency to development of alternative domestic sources of oil and gas from coal.

A POTENTIAL SOURCE OF OIL AND GAS ENERGY

The widespread distribution of coal (1½ trillion tons reserve) is shown on figure 6.

Most of the coal, particularly that coal of low sulfur content, lies west of the Mississippi. Figure 7 shows the thickness of a typical seam of low-sulfur subbituminous coal in Wyoming.

OFFICE OF COAL RESEARCH PROGRAM

The contracting program of the Office of Coal Research involves the selection after careful evaluation by impartial, mainly non-Government experts, of promising R. & D. proposals in seven major areas. Figure 8 lists these areas.

Cosponsoring of projects by industry and Government has now become the general practice. For example, the Office of Coal Research has contracted with the American Gas Association to fund jointly the $30 million total annual cost of the pipeline gas projects over a 4-year development period. Three basically different chemical process designs are being developed to the pilot plant stage in this one-third–two-thirds cost-sharing program. From these, the most successful elements will be combined into the best overall plant design. Development of new techniques for methanation and for sulfur and particulate removal from the gas are being developed within the program. The technology developed on all of the projects will be available royalty-free for development by any company, large or small, desiring to utilize the process in a competitive commercial venture. Cofunding provides the bridge for rapid transfer of the technology to the private sector.

The remaining major categories as shown in figure 8 are:

1. The production of low-Btu fuel gas for power generation;
2. MHD electric power generation;
3. Fluidized-bed combustion for power generation;
4. Supporting projects, electric power generation;
5. Low-sulfur liquid fuels; and
6. Other supporting research projects.

OCR projects for conversion of coal to electricity not only offer clean methods of conversion, but are based on use of substantially less coal per kilowatt-hour generated.

The potential efficiencies, shown on figure 9, of 50 to 60 percent for conversion compare with the 35 to 40 percent for the best conventional boiler-generator plants. The high efficiency of conversion means less heat to be dissipated and, therefore, a lessened water requirement. It may provide methods of generating electric power in arid areas of the United States where there is little water and an abundance of coal.

Figure 10 gives a typical time schedule for the development of a process from the laboratory experiment to the operation of a viable, economic demonstration plant.

In this program there are many decision points for evaluation of a process before it moves to the next larger (and more costly) phase.

In industry only 1 in 10 projects which develops to the pilot plant level proves technically sound and economically successful. So far the OCR batting average is much higher. Of nearly 700 proposals evaluated for possible support some 120

have been funded, 40 are currently being supported, and 6 are at or in the pilot plant stage.

Figure 11.—OCR's HYGAS Pilot Plant, at IGT, Chicago, Ill.
Figure 12—OCR Pilot Plant, Rapid City, S. Dak.
Figure 13.—OCR's Pilot Plant, Homer City, Pa., featuring the BI–GAS Process.
Figure 14.—OCR's Solvent Refined Coal Process, Fort Lewis, (Tacoma), Wash.
Figure 15.—OCR's Pilot Plant, Cresap, W. Va.
Figure 16.—OCR's COED Pilot Plant, at FMC, Princeton, N.J.

Several R. & D. objectives are still in prepilot plant stages under OCR projects: low-B.t.u. gas for electric power and clean industrial fuel; magneto-hydrodynamic (MHD) for electric power; fluidized-bed boiler project for electric power; and projects for liquid fuels, and several projects for multiple-product purposes.

Let us look at the consequences of a regional energy resource development plant, figure 17.

"OCR BUDGET"

Figure 18 shows the OCR budget request for fiscal year 1974. It totals $52,500,000. This is an increase of $9,010,000 over the amount appropriated for fiscal year 1973. The contract research program will require $51,300,000 compared with $42,605,000 for an increase of $8,695,000. The amount requested for administration and supervision of the entire program for fiscal year 1974 is $1.2 million. This also includes the cost of administration and supervision of the Federally funded portion of the total program as well as the $15 million of contributed funds. Included in this amount for administration and supervision is a request for 18 additional full-time positions, an increase from 37 positions in fiscal year 1973 to 55 positions in fiscal year 1974.

We are prepared to respond to questions or provide further information as the committee may desire.

Thank you, Madam Chairman.

Mr. HILL. I have a series of transparencies which I would like to incorporate in the statement.

Mrs. HANSEN. That is excellent.

Mr. HILL. We are very pleased, Madam Chairman, to have the opportunity to talk with you and the others of your committee regarding the role and mission of the Office of Coal Research, which since I came aboard in July, I have been honestly pleased with. The basic operational elements that we have in the OCR structure as given to us by congressional action make possible, in my opinion, the kind of effort that needs to be mounted now to solve our energy problem, to avoid the long term dependence on the Mideast for crude oil and liquefied natural gas with its attendant energy uncertainties and dollar balance-of-payments problem.

FUEL SHORTAGES

The people of the United States are now very keenly aware of the real shortage in natural gas. Due to the moving away from burning high sulfur coal in powerplants the utilities have shifted to a swing fuel oil, which has created an unanticipated but nonetheless real shortage in that portion of the oil barrel which will be reflected this

summer in a shortage of gasoline. The heating oil that fuel cut is further refined in an oil refinery to produce the gasoline.

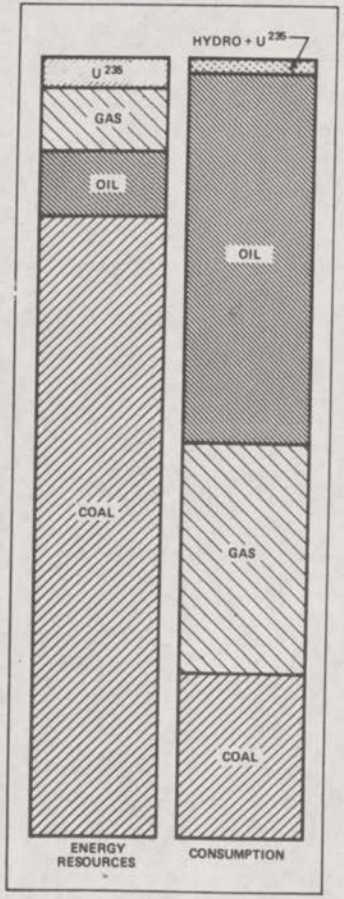
Mrs. HANSEN. You are also faced with other energy problems. If the rivers in the west are down won't this result in a reduction of hydroelectric power?

Mr. HILL. Yes; this is an additional problem.

Mrs. HANSEN. Suppose this situation continues into the fall, you will have a decrease in hydro at a time, when you are carrying peak loads.

Mr. HILL. That is correct. The shift from coal to oil and the attendant shift now from gas to oil is in a real sense robbing Peter to pay Paul. We are creating or compounding a felony, if you like, necessarily so, but I do think we need to address some real attention to it. If we could have the first slide.

[The slide follows:]



ENERGY RESOURCES, CONSUMPTION, AND END USES

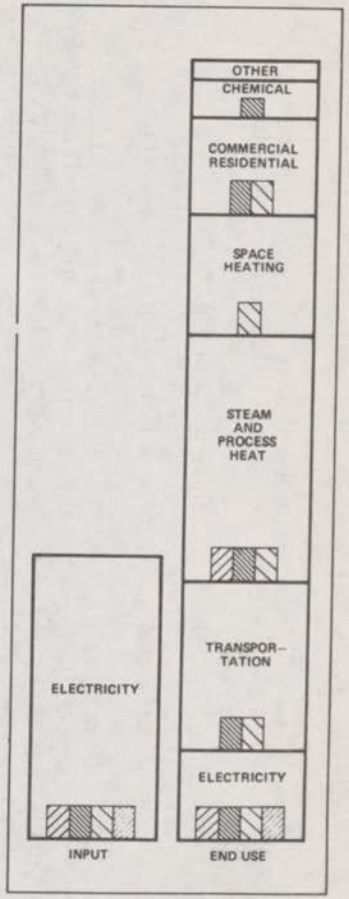


Figure 1

Mr. HILL. The left-hand two bars in this bar diagram, Madam Chairman, shows what our energy resource pattern is in the United States.

ENERGY RESOURCES, CONSUMPTION, AND END USES

Our fossil fuel and nuclear fuel reserves are shown on the far left diagram, coal representing 80 percent to 88 percent of our total fuel energy reserve. Oil and gas—and this segment includes oil from the oil shale—represents a very small part relatively, less than 20 percent. U–235 available at up to twice present costs is represented by that narrow band at the top.

Our consumption pattern on the other hand—you have a question?

COAL RESERVES

Mrs. HANSEN. Yes.

How long will our coal reserves last?

Mr. HILL. This amount of coal would last the United States, if it is used not only for its present purposes but liquid and gaseous needs, about 200 years.

Mrs. HANSEN. Is that predicated on a growth in the use of coal?

Mr. HILL. Yes, that includes the growth element. We are in good shape. We have enough energy to meet our needs. We have an imbalance. The imblance is shown on the consumption side in that oil is used way out of proportion to its availability, as is gas.

OIL RESERVES

Mrs. HANSEN. What is our proved reserve of oil?

Mr. HILL. The proved reserve of oil available in the United States I believe is 11 years' supply.

Mrs. HANSEN. Does this take into account Alaska and the Outer Continental Shelf oil?

Mr. HILL. It includes Alaska. We have not drilled the Outer Continental Shelf.

There is probably twice as much oil as we have in our proven reserve.

Mrs. HANSEN. So the supply of oil could last as long as 22 or 25 years.

Mr. HILL. Yes.

As a matter of fact, we will never run out of oil. Let me explain that. The availability of oil depends on the price we are willing to pay to hunt for it. The fact of life is that we have discovered and developed all of the obvious reservoirs, and now we are using tougher techniques, geophysical techniques, to find smaller reservoirs. We are having to drill twice as deep and the reservoirs we find are smaller. We have a factor of four in the cost of discovering new oil.

ENVIRONMENTAL CONSIDERATIONS IN ENERGY

Mrs. HANSEN. You have another factor built in and that is the current environmental considerations.

Mr. HILL. That is right.

Mrs. HANSEN. I refer to such things as the controversy over the permafrost in Alaska.

Mr. HILL. These are going to have to be resolved. There is the same problem on coal. We must resolve the difference in opinion on strip mining, in my opinion. This can be resolved, and I think most States are now moving in that direction.

I participated on a committee in the State of Utah before I came to OCR to write strip mine legislation. The mood of that committee was such that we drafted a bill that required an approved plan for restoration of the ground to equivalent or better status before mining could be initiated.

Technically we know how to do it. The Germans have been doing it for years.

This is really no problem if we are willing to add that cost to the price of coal.

GAS RESERVES

Mrs. HANSEN. What are the known gas reserves?

Mr. HILL. The known gas reserve has dropped from 25 years proved supply, some 6 years ago, to less than 13 at the present time.

Mrs. HANSEN. What is the potential for new gas discoveries?

Mr. HILL. Probably in the long pull we will discover twice as much or three times as much as we now have discovered and utilized.

Mrs. HANSEN. That could provide a supply of somewhat under 50 years?

Mr. HILL. That is right.

That will take a real investment, because the same logic applies as I mentioned on oil. We are having to drill deeper. We are finding gas in stratigraphic traps now. Earlier large anticlinal reservoirs were the source of gas.

Mrs. HANSEN. All these factors add to the cost of production.

Mr. HILL. You bet it does. This is correct.

Mr. VEYSEY. May I ask a question before we leave that chart? I am trying to understand this. On the left-hand side you have two bar charts for comparison but they are really quite different. The first one is total U.S. energy resources.

Mr. HILL. That is right.

Mr. VEYSEY. Is that total or is that economically available?

Mr. HILL. This is the total reserve available at up to twice present costs of production.

That is the total proved reserve at up to twice present cost of development. The second bar is how we are using it.

Mr. VEYSEY. This is annual consumption.

Mr. HILL. That shows the pattern of use in the United States.

Mr. VEYSEY. This is in percentages.

Mr. HILL. That is right.

Mr. VEYSEY. So they do not relate to all?

Mr. HILL. You are right.

Thank you for bringing that point out. To make them exactly comparable we are using one-twentieth of our proved reserves of oil each year, so that the right-hand bar would shrink—I am sorry, one-thirteenth—so the right-hand bar, the oil segment, would be one-thirteenth the height of the left-hand oil bar.

ENERGY FUEL CONSUMPTION

Mrs. HANSEN. Give us the consumption on each of these fuels, in barrels, cubic feet, and tons.

Mr. HILL. I am not sure I have those data with me.

Mrs. HANSEN. With respect to your oil, how many barrels a year are we currently consuming?

Mr. HILL. Sixteen million barrels a day, 5,840 million barrels annually.

Mrs. HANSEN. Give us the total cubic feet for gas.

Mr. HILL. Twenty-three trillion cubic feet on a yearly basis.

Mrs. HANSEN. Coal.

Mr. HILL. 550 million tons a year.

So we ought to multiply the first figure by 365.

HYDROPOWER COMPONENT OF ENERGY SUPPLY

Mr. VEYSEY. One other question, Madam Chairman, if I may. Under the energy resources you do not show hydroelectric.

Mr. HILL. No.

The energy bar is the fossil fuel and the nuclear fuel. We put U^{235} and hydro together which are only a small segment. Most of that is hydro at the present time. We are just getting into U^{235} use.

GEOTHERMAL RESOURCES

Mr. VEYSEY. I learned on the "Today" show that geothermal is an enormous potential energy source.

Mr. HILL. I am talking about fuel. The Office of Coal Research is a fuel utilizer. We will add to our electricity production by utilizing geothermal power where it will turn out to be economically feasible. It is going to be a boost. I had several professors in our College of Mines at the University of Utah, who were interested in this, who showed me a map of Utah and Nevada, where hotspots are.

Mrs. HANSEN. Dr. Hill, the Geological Survey testified that geothermal energy is limited because of location. Is this correct?

SOURCES OF ENERGY

Mr. HILL. Yes. Let me add one other thing, lest we not get this in perspective. We are going to have to develop and use every source of energy we can put our hands on, and still we are going to be short. It is not a question of oil, shale, or coal, as it used to be, or nuclear or fossil fuel for power. This is not the question. We have to gear up and develop every one as hard as we can.

Mrs. HANSEN. Isn't it also true that hydroelectric power has about reached its potential because of the limiting factor inherent in the rivers, dams, and number of power stations?

Mr. HILL. And our desire to retain some canyons unimpaired. If you put that in, we have about reached the limit of hydro development.

Mrs. HANSEN. What portion of our total energy need is supplied by nuclear energy?

Mr. HILL. Hydro and nuclear together are less than 5 percent.

Mrs. HANSEN. What portion of that 5 percent is nuclear?

Mr. HILL. I would guess one-fifth. I think that about 1 percent of our total power production is nuclear.

Mrs. HANSEN. We are asking these questions so the committee can orient itself to the total energy problem. Preliminary to your appearance, the committee has heard testimony from the Bureau of Land Management, the Geological Survey, and the Bureau of Mines so that we will have a complete picture on what our energy needs are.

Mr. HILL. I appreciate this. Again don't any of you hesitate to come in with questions.

Mrs. HANSEN. We are a very inquisitive committee.

ENERGY INPUT AND END USE

Mr. HILL. If we could move to the two right-hand bars on figure 1, there is an element in the far right-hand one that people do not generally understand. In terms of end use, the very short bar at the bottom represents the electricity segment of our energy end-use pattern. This is half again as long as it should be in one sense. Actually, 8 percent of the energy that is sold to customers is electricity. The other 92 percent is gasoline, diesel oil, fuel oil for all the purposes you see in the column—for transportation, steam and process heat, space heating, and commercial and residential use. The electricity about which we are concerned and on which the discussion has been on up to this point, is represented by a bar that is only 8 percent of the length of this whole thing. There is an additional 4 percent in this particular one because the data that OST developed showed that some companies generate electricity which they use in-house, and that is 50 percent more. That means that 12 percent of our energy consumption is as electricity, and 88 percent is for other purposes—transportation, space heating, and the like.

FUTURE ELECTRIC POWER USES AND EFFICIENCY

Mrs. HANSEN. How much increase in research is needed to expand our use of electricity?

Mr. HILL. If we go to electrically driven motor cars, for which we do not have the technology yet, if we go to electrcially heated homes, we could move that up to 25 or 30 percent, but there is a cost. I hope we can be in agreement on that.

The left hand of these two bars, the input bar, shows how much energy goes into the production of that electricity. This is why we are really concerned about it, because there is a thermodynamic limit to the efficiency of conversion of fuel to electricity. The best fossil fuel plants, the best nuclear plants, are coming out with about 35-percent efficiency. In some instances by raising the temperature in the cycle, you can get up to near 40. So the input into the electricity component means that you throw away two-thirds as waste heat with present technology. In the OCR program, we are not only trying to convert coal to clean environmentally suitable fuels, but we are also coupling that with the development of combined cycles that will increase the efficiency of the production of electricity and maybe from 40 to 50 percent. We have some slides that will illustrate that. Why are we paying so much attention to the electricity part then? This is quite simple. Any saving we can make in gas or oil consumed, transfers back into our transportation and space heating supply.

POSSIBLE FUEL SAVINGS

In my opinion, we should quickly require that all the gas now being burned in boilers for generating power be diverted to higher value use—home consumption and small business. Again I may be speaking out of order, but I feel it quite strongly. I think we ought to require the utilities to burn coal, cleaned up as quickly as we can develop the technology—environmentally clean coal—so we do not force ourselves into the bind of importing too much from the Middle East and becoming too dependent on that area. I would hope that this kind of reasoning will prevail. We have a real critical situation, in my opinion. I have some students who got their doctorates from Egypt and Libya. I spent a week at their invitation giving some lectures in Egypt a couple of years ago. In my opinion—I don't want to be offensive to anybody—the temperatment of the people in the Mideast is such that for the United States to become 20 or 30 percent dependent on its supplies, could be catastrophic.

Mrs. HANSEN. The United States has a great deal of competition in the Mideast market from Japan and other nations of the world who have to purchase their energy.

Mr. HILL. That is right. The OPEC group is smart. I do not want to intimate that they are not smart. They may be too smart. They catch on to our way of doing things awfully fast and they have brought the price of oil up so it is equivalent to internally produced crude. With us moving into the market and competing with Europe, the sky is the limit.

SETTING A CEILING ON IMPORTED CRUDE

Again one of the features that has made me pleased about the OCR efforts that the team has already contracted for, is that we are developing techniques and are well on the road now to producing oil from coal—a high melting oil in the case of the prime product at the SRC plant—oil from coal at a price that will set the ceiling above which imported crude will not be able to rise. The savings to the American taxpayer, if that happens, will be tremendous.

That very phenomenon explains in large measure why the oil companies don't come in and do it themselves. Anytime you have a process that simply sets a ceiling to which your competitor can rise does not have a chance of making a good return on your investment.

Mrs. HANSEN. The committee will adjourn until 1 p.m.

AFTERNOON SESSION

Mrs. HANSEN. The committee will come to order.

SHARE OF U.S. ENERGY SUPPLY BY VARIOUS FUEL SOURCES

Mr. HILL. If you don't have questions on chart 1 I would like to move ahead, Madam Chairman, to the next chart.

[The chart follows:]

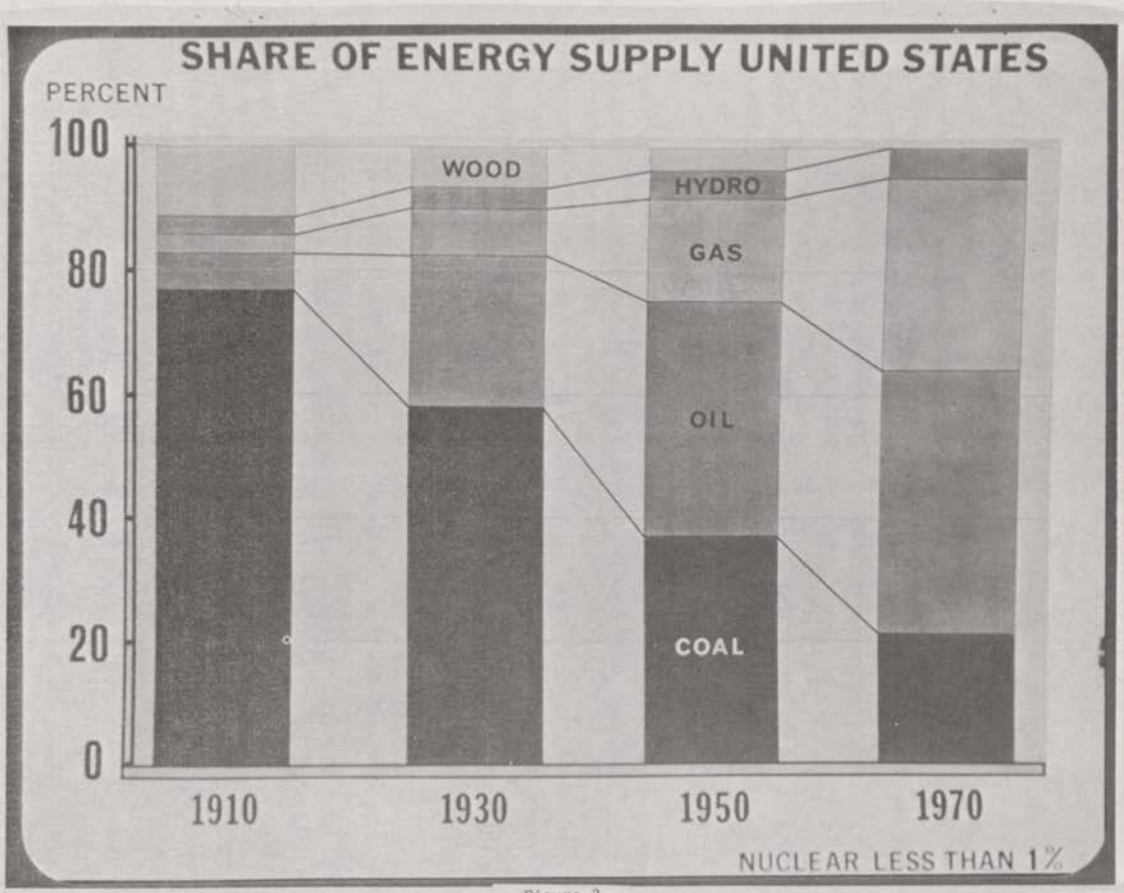

SHARE OF ENERGY SUPPLY UNITED STATES
PERCENT
100
80
60
40
20
0
WOOD
HYDRO
GAS
OIL
COAL
1910
1930
1950
1970
NUCLEAR LESS THAN 1%

Figure 2

This chart, of course, shows how we have changed the percentage of consumption over the years from 1910 to 1970 from wood and coal to oil and gas. The bottom part in each instance shows the relative amount.

Mrs. HANSEN. Wood, as a share of the energy supply, is almost nonexistent.

Mr. HILL. Yes; just wiped right out. I would like to add though—and again this is something that the Representative from California pointed out earlier—this is deceptive in that the 1970 quantity of coal is about what it was in 1910.

The consumption has increased that damatically. So if we made these proportional we would extend the 1970 bar up through the ceiling a bit.

NATURAL GAS RESERVES

You asked a question in this next transparency, Madam Chairman, about the natural gas situation.

[The chart follows:]

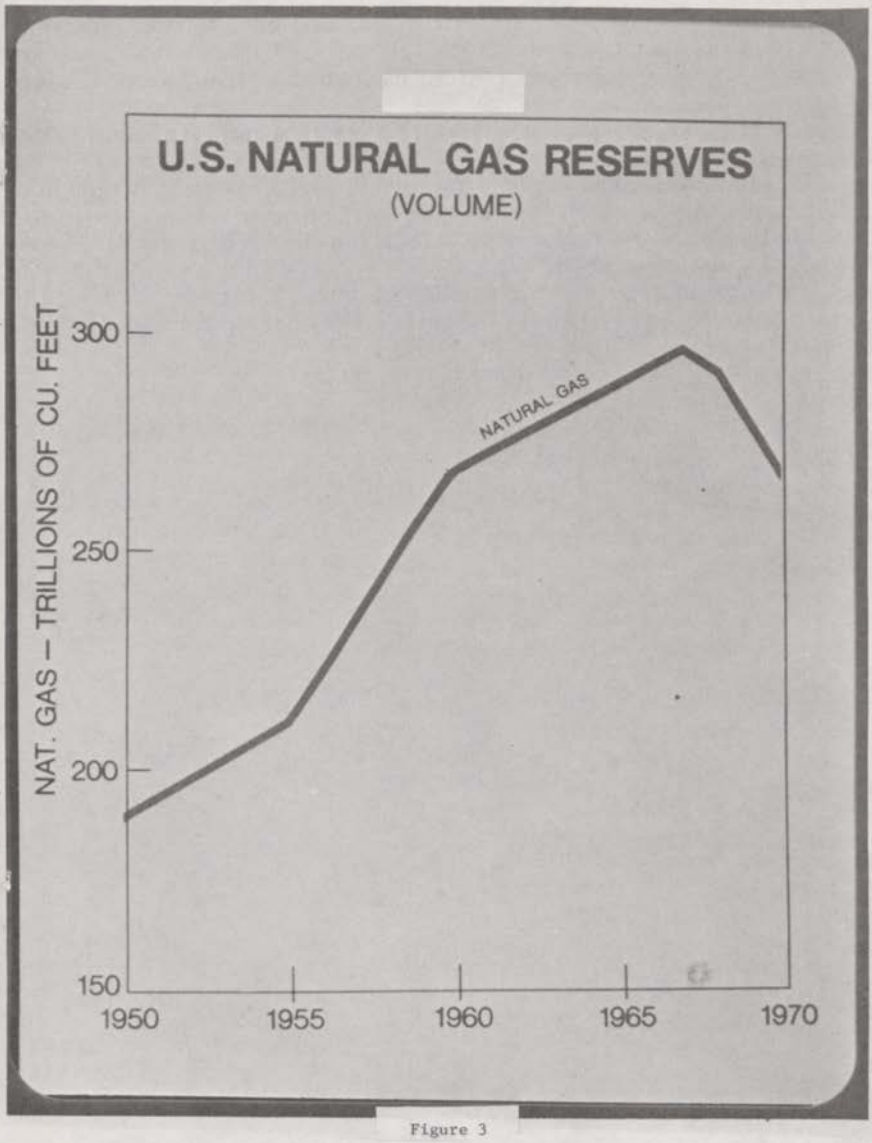

U.S. NATURAL GAS RESERVES
(VOLUME)
NAT. GAS — TRILLIONS OF CU. FEET
300
250
200
150
NATURAL GAS
1950
1955
1960
1965
1970

Figure 3

Mr. HILL. We were finding gas as fast as we were using it until about 1968. Our consumption has been increasing at 5 or 6 percent a year.

Mrs. HANSEN. To what do you attribute that?

Mr. HILL. The demand for gas was met by the new discoveries until that time. The demand curve however has been an exponentially increasing one. The number of new drilling rigs to find the gas didn't increase exponentially to match the demand because there was inadequate incentive.

The economic incentive just isn't there because the price ceiling on gas at the well head (for interstate use) didn't give an incentive to multiply the number of drilling rigs. It would have had to be multiplied in order to keep up the discovery rate.

It would have had to go up even more than that again because we are not finding big pools, big reservoirs, any more. We are finding gas in stratographic traps more frequently than we discover large anticlynal structures.

Mrs. HANSEN. So the cost of removing the gas is——

Mr. HILL. Is increased again by a factor of four, roughly, because of the increased cost of drilling, and the smaller reserves found per well.

CRUDE OIL AND GAS FOUND PER BARREL/CUBIC FOOT PRODUCED

The next transparency shows this isn't an instant phenomenon.

[The chart follows:]

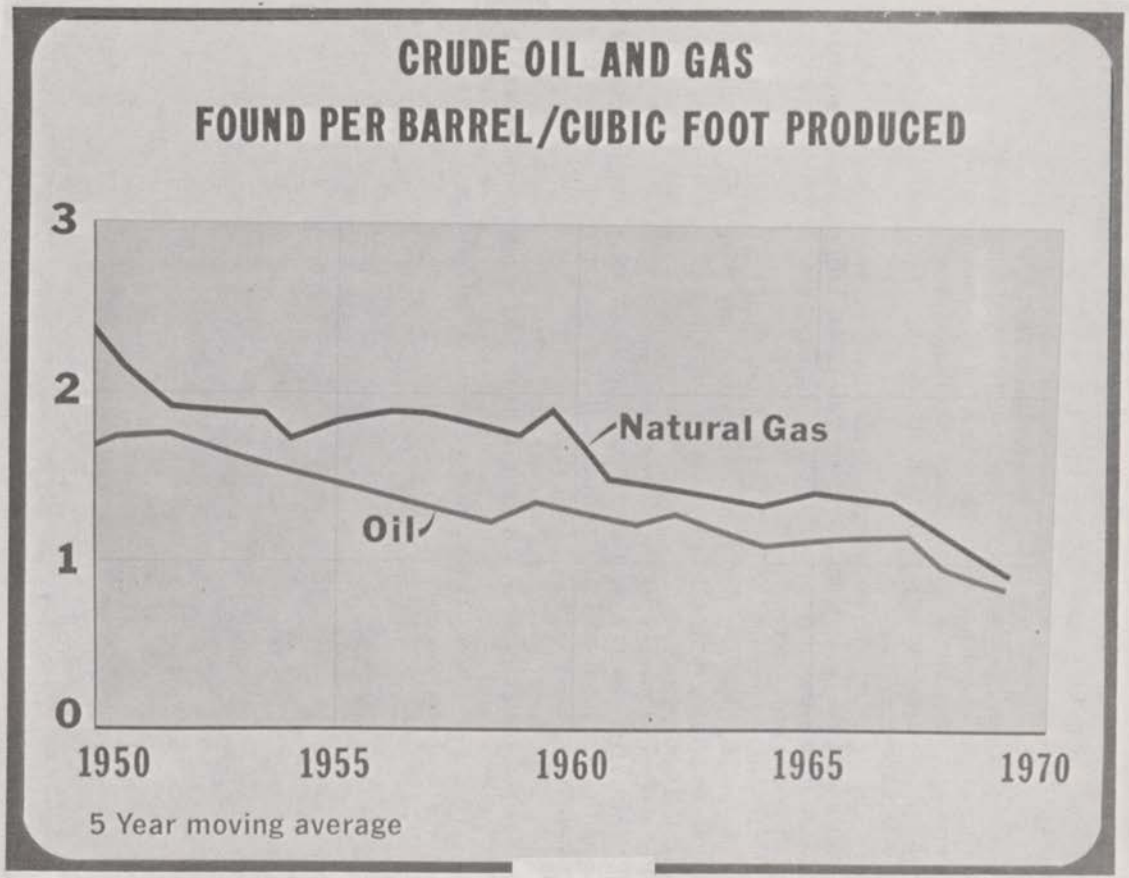

CRUDE OIL AND GAS
FOUND PER BARREL/CUBIC FOOT PRODUCED
3
2
1
0
Natural Gas
Oil
1950
1955
1960
1965
1970
5 Year moving average

Figure 4

Mr. HILL. This has really been going on since before 1950. At that time the crude oil found per barrel of oil produced was 1.7 relative to now, a value less than 1.0. It is almost cut in half. This is a running average showing the oil found per barrel used and the natural gas found per cubic foot produced. Both have gone down by a factor of two at a steady rate.

Simultaneously we have been having this exponential increase in demand and the consumption curve just smacked into the supply ceiling. That is all, we are simply not finding enough to meet our needs.

We are not finding enough new gas or new oil to meet our needs and so we are net importers now. About 25 percent of our crude oil requirements at the present time are coming from imports.

CHANGING PATTERN IN U.S. OIL SUPPLY/DEMAND

The next transparency, I think, may show that particular phenomenon as far as oil is concerned.

[The chart follows:]

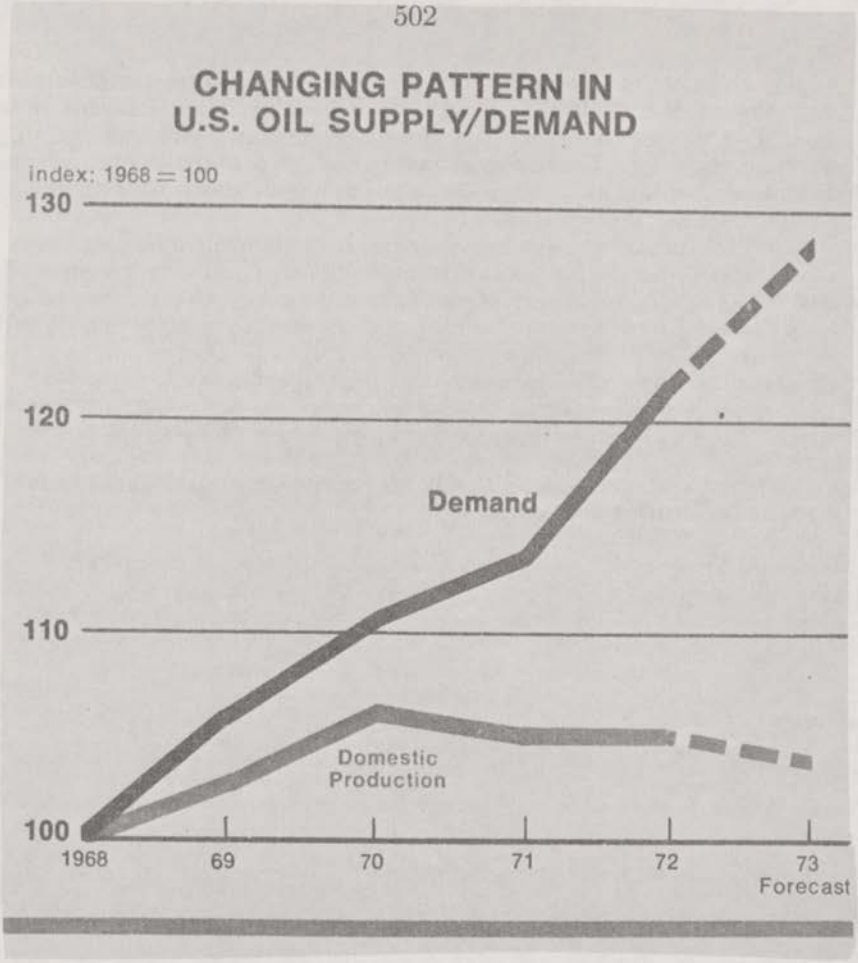

CHANGING PATTERN IN
U.S. OIL SUPPLY/DEMAND
index: 1968 = 100
130
120
110
100
Demand
Domestic
Production
1968
69
70
71
72
73
Forecast

Figure 5-A

Mr. HILL. The lower curve shows the domestic production of oil in the lower 48 States, and you notice it peaked in 1970 and since then the domestic production has remained essentially constant, dropped off a bit, but not significantly.

But the demand curve had a fairly steep slope up to 1971 and then you notice a break there and it increased. Now, that is due to two things: One, the shift of the utilities from coal to oil has increased the demand for oil. Two, the normal increase in demand, this exponential increase in demand, the upward curve kind, as consumption increased. There has now been created a disparity between our domestic production and demand of nearly 30 percent.

And there is nowhere for that to go except up unless we develop alternate sources of oil, or unless somehow we dramatically decrease the consumption.

Mrs. HANSEN. Is there any possibility of dramatically decreasing the consumption without altering the entire economic structure of the United States?

Mr. HILL. No; and with your permission if I could show two slides that aren't a part of the handout materials we will have reproductions made that will illustrate this——

INCREASE IN ENERGY CONSUMPTION

Mrs. HANSEN. The other day there was a great deal of discussion in the Transportation Subcommittee about mass transit and its requirement for energy. At the same time I also see an ever-rising demand curve for energy as a result of pollution devices.

Mr. HILL. You are putting your finger right on a very critical point that people aren't realizing. What we have done so far, for example, in cleaning up our automobile exhaust is to decrease the compression ratio. The net result of that, plus the air pollution devices we have under the hood, is a 20- to 25-percent increase in the consumption of gasoline.

Mrs. HANSEN. You don't have to tell me, I just bought a new automobile.

Mr. HILL. You had the same experience I did. I bought an Opel 2 years ago when they were just starting this program. We need to reduce exhaust emissions but not this way.

[Discussion off the record.]

Mrs. HANSEN. Dr. Hill, I think you also have to consider the fact that formerly city after city was dumping their sewage in the rivers and into the ocean and now they are treating this sewage which increases the consumption of fuels.

The lighting of our cities is increasing as a deterrent to crime. This is also increasing energy consumption.

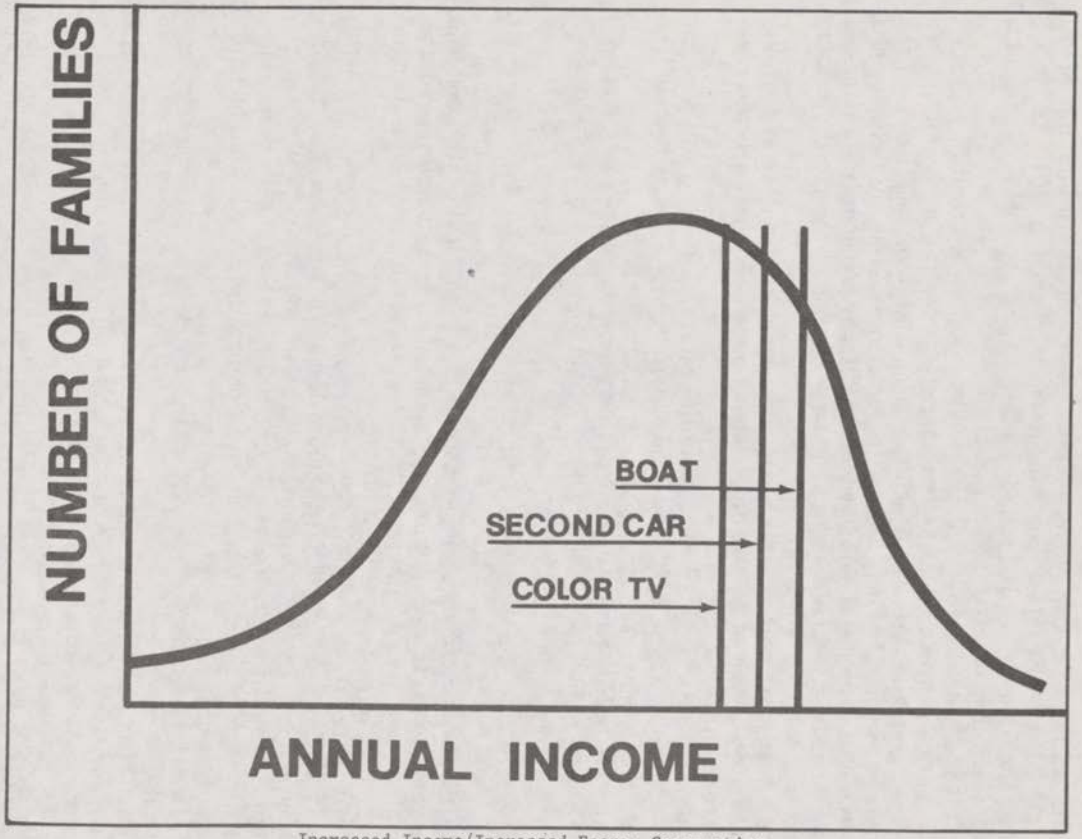
Mr. HILL. That is right. Everything we are doing is requiring an increase in consumption of fuel.

Mrs. HANSEN. This is correct.

INCREASED INCOME/INCREASED ENERGY CONSUMPTION

Mr. HILL. The distribution pattern of family income for people in the United States is something like this bell curve.

[The chart follows:]



Increased Income/Increased Energy Consumption
Figure 5-B

Mr. HILL. This end represents low salary, here high salary, and we have a typical bell shape distribution curve of income. People who think they are going to be able to tell others not to buy a second car and the like are kidding themselves. This first vertical line represents enough income to buy a television set, a color TV.

The second vertical line is the salary needed to buy a second car. As our income in the United States increases that translates this distribution curve to the right you see. More and more people have higher income and so each time the average income of the families in the United States goes up just a little bit, we increase enormously, because of the steepness of this curve, the number of people who now can buy a second car.

The only way to turn that around is to tell these people, "No; you cannot."

Mrs. HANSEN. This creates another problem because some men and their wives have jobs in different locations.

Mr. HILL. Sure.

Mrs. HANSEN. You are automatically telling them they have to disband their own family economy.

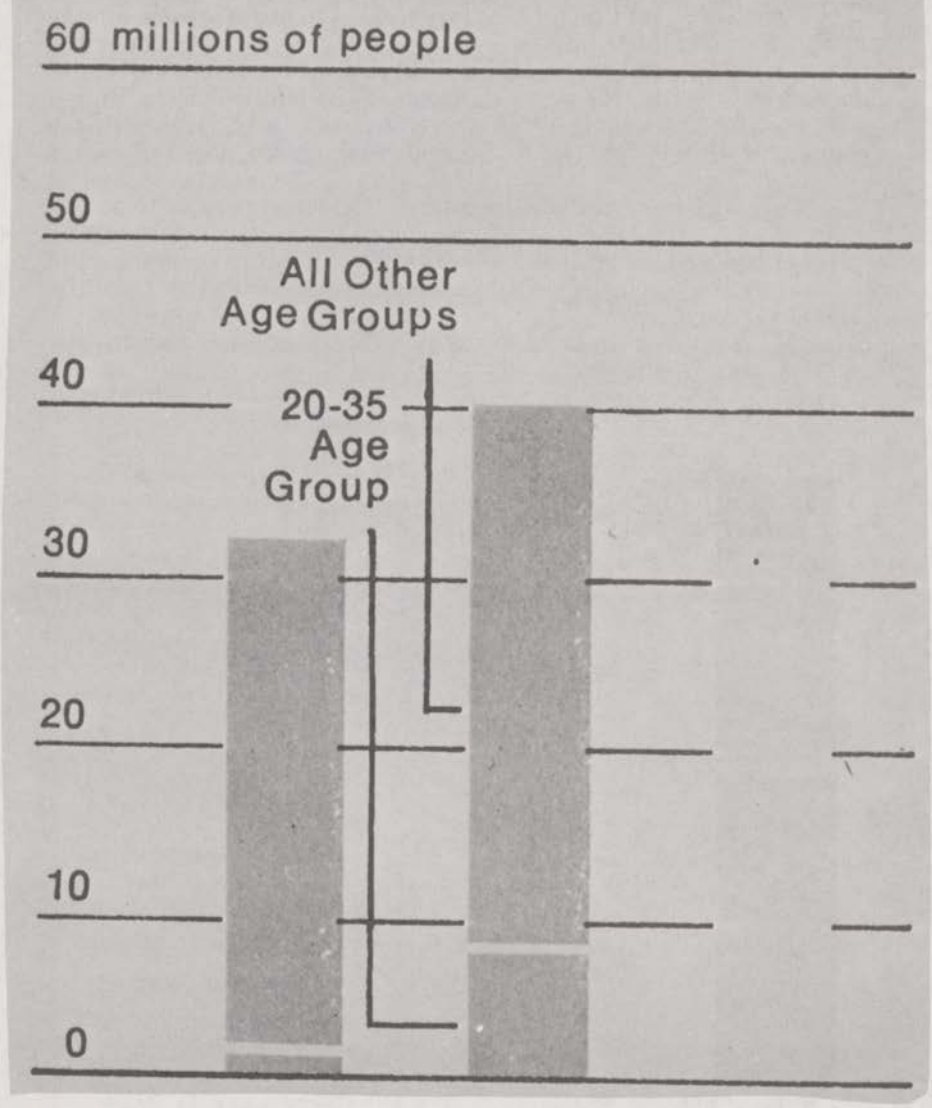
POPULATION GROWTH AND ENERGY

Mr. HILL. Yes; and there is just no way to turn that around.

I wanted to add this chart to show another reason why we are not going to be able practically to turn the demand around.

[The chart follows:]

POPULATION GROWTH



Mr. HILL. These data show the percentage of the U.S. population in the age group 20 to 35. The percentage of the population in the 1940 to 1955 period, is on the first column.

In the 1970 to 1985 period the population fraction in the home buying consuming stage is twice as great as it has been in the immediate past. Well, there is just no way to stop a family from buying a refrigerator and other things they need, so we are whistling in the dark, I really believe, if we figure we are going to somehow decrease our energy consumption. Don't misunderstand me. We need to insulate our homes better, and we can turn lights out and do all these other things to reduce consumption, but the impact of these increased forces is going to more than offset what we can do. Let us go to the next chart.

[The chart follows:]

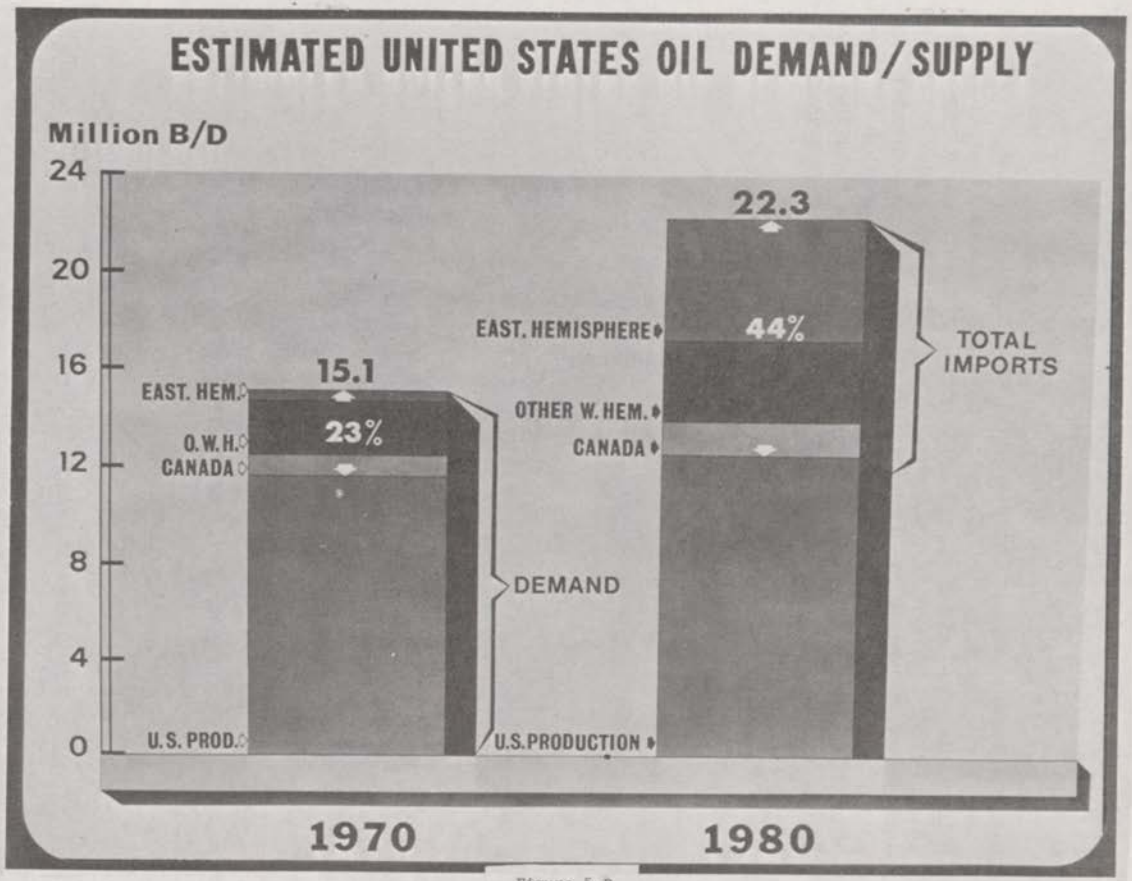

ESTIMATED UNITED STATES OIL DEMAND/SUPPLY
Million B/D
24
20
16
12
8
4
0
15.1
EAST. HEM.
23%
O.W.H.
CANADA
U.S. PROD.
DEMAND
22.3
EAST. HEMISPHERE
44%
OTHER W. HEM.
CANADA
U.S. PRODUCTION
TOTAL IMPORTS
1970
1980

Figure 5-D

ESTIMATED U.S. OIL DEMAND/SUPPLY

Mr. HILL. Our consumption pattern now, 1970, is shown in the left-hand bar and then the column on the right, 1980, shows that we will require something like 44 percent net importation of crude, of which more than half will be from the Eastern Hemisphere.

In my opinion, that will be decreased by however much crude we can make from coal, and from oil shale. I think we need to do both things.

NUCLEAR POWER

Mrs. HANSEN. What input do you give to the development of nuclear energy?

Mr. HILL. Nuclear can only be used for electricity.

Mrs. HANSEN. So it is only a portion of electrical use?

Mr. HILL. Yes. Our big demand is for transportation and space heating.

Mrs. HANSEN. I understand.

Mr. HILL. So we keep saying, well, we are going to solve our problems when we get a breeder reactor. Or surely we are going to get a fusion reactor. If we do that is going to require some 50 percent conversion of current liquid fuel powered operation to electrical operation.

And we don't have the technical know-how yet to build a satisfactory electrical powered automobile.

Mrs. HANSEN. I hear many comments to the effect "Just develop nuclear energy and our problems are solved." So nuclear energy only meets a proportionate share of electrical use?

Mr. HILL. We will double or triple the fraction we are using of electricity. However, we can't build nuclear plants fast enough to keep even that part going. We still are going to have to have this quantity of oil and gas.

Mr. EVANS. Madam Chairman, may I pose a question?

Mrs. HANSEN. Yes.

ACCELERATED PROGRAM FOR COAL CONVERSION

Mr. EVANS. Under the circumstances it would seem to me that what you are saying amounts to a description of a crash program we ought to be undertaking in these new processes for developing oil both from coal and from shale. Would that be a fair description of how to do it?

Mr. HILL. This is certainly an item that is under discussion and needs to be looked at awfully hard, this is correct. We are pleased with the foundation that has been laid in the Office of Coal Research program for meeting the challenge. We have a good program funded within the present budget constraints to do the job we are now doing.

It could be increased in rate. This is certainly under discussion at present time.

Mrs. HANSEN. Dr. Hill, isn't it also true, and I know Mr. Fumich will agree, that in the years when we should have been moving ahead we had budgetary restrictions? The research has been very meager and very limited.

Mr. HILL. This is right.

Mrs. HANSEN. The committee saw this coming and has mentioned it for the past 7 years. To my knowledge there was no cognizance taken at OMB. The budget has always been under restraints.

"STATE OF THE ART" IN COAL CONVERSION

Mr. EVANS. Madam Chairman, are we in a situation where the state of the art is such in both areas, of oil shale and conversion of coal, so that if we made the decision to go ahead on a crash program, the technology is there and we can produce?

Mrs. HANSEN. We are developing the state of the art but we are late in doing it.

Mr. EVANS. So it is not here yet?

Mr. MCKAY. Would you respond to that state of the art on this sort of thing?

Mr. HILL. Actually I think it will flow out of the other charts I have and probably explain it more adequately.

Mr. EVANS. All right.

Mr. HILL. There are steps that have to be gone through, laboratory, process development unit, pilot plant, and then demonstration plant.

Mrs. HANSEN. You couldn't develop the state of the art without adequate funding. That was the problem.

Mr. HILL. Here is what the budget of OCR has been: 1961, $1 million; 1962, $1 million; 1963, $3.4 million; then $5 million, $6 million, $7 million, $8 million, and $10 million, just increasing slowly.

When I look at the Defense budget I wonder how this coal research budget just didn't fall through the cracks. But in 1971 it has grown to $17 million, through your efforts, then $25 million in 1972, $43.9 million in 1973, and recommended a 20-percent increase this year. A realization of what you have been saying over the years really, has finally dawned.

Mrs. HANSEN. OMB for years has paid little attention to this problem. I think you can place a lot of the crisis in this country upon their shoulders. Let there be no mistake this committee does not share the viewpoint of OMB.

COAL PRODUCING AREAS IN THE UNITED STATES

Mr. HILL. Let us look at what we can do about it now if we could. This chart shows the coal-producing areas in the United States showing how widely distributed coal is.

[The chart follows:]

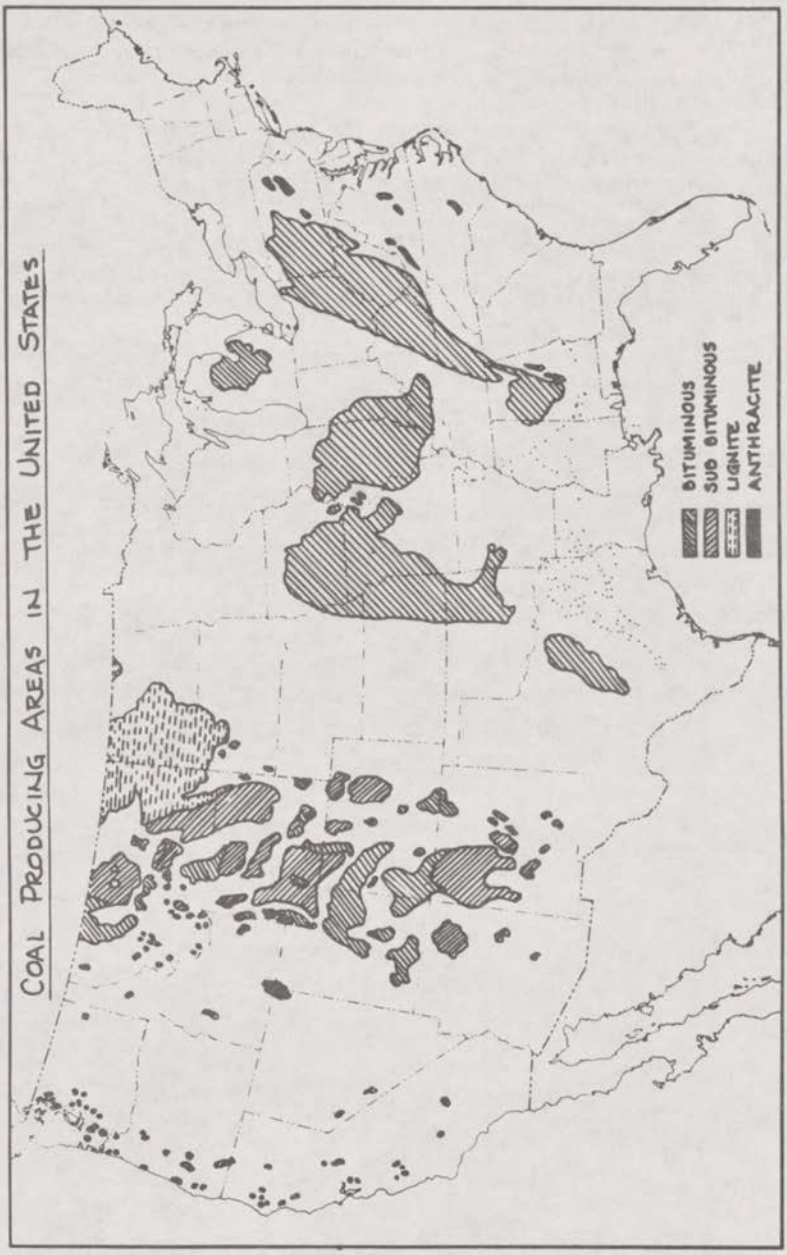


Figure 6

94-250 O - 73 - 33

Mr. HILL. All of you know I am sure that in the eastern province, and in the midwest province, we have large supplies of coal which are, unfortunately, relatively high in sulfur, so that this coal is being backed away from in its use in powerplants.

In the western province we have tremendous quantities of coal in much thicker seams. Coal is widely enough distributed and adequate in amount to meet our needs.

COAL RESERVES IN THE WEST

The next slide shows one of these western seams.

[The slide follows:]



Figure 7

Mr. HILL. This is a subbituminous coal seam near Gillette, Wyo. This isn't as thick as a lot of them, but you get the perspective there of what coal seams out there are like.

Mrs. HANSEN Is this low-sulfur coal?

Mr. HILL. Yes. This is not lignite. This is subbituminous, so it lends itself to making liquids, not as high in yield as bituminous coal but higher than the lignite.

OFFICE OF COAL RESEARCH PROGRAMS

The next chart.

[The chart follows:]

OFFICE OF COAL RESEARCH PROGRAMS

PIPELINE QUALITY GAS

LOW BTU FUEL GAS AND ELECTRIC POWER GENERATION

- CLEAN FUEL GAS
  - for Power Generation
- MHD
  - Electric Power Generation
- FLUIDIZED BED COMBUSTION
  - for Power Generation
- SUPPORTING PROJECTS
  - for Electric Power Generation

LOW-SULFUR LIQUID FUELS

OTHER SUPPORTING RESEARCH PROJECTS

Figure 8

Mr. HILL. The Office of Coal Research Programs which you have had a big hand in developing over the years are basically four. If you look at the items, we have pipeline quality gas, low Btu for electric power generation, and then dropping down to the next to the bottom line, low-sulfur liquid fuels—the SRC program fits here—and then the other supporting research projects that are critically needed.

In the low Btu fuel gas area we are talking with the Electric Power Research Institute about a funding program from industry to carry their share of the load. We have a partnership with the American Gas Association, they putting in one-third, $10 million a year, over a 4-year period to fund the pipeline quality gas program.

We are well along now in our discussion with Mr. Starr and the EPRI to get some industry funding.

In the low Btu fuel gas as it relates to power generation, we have clean fuel gas, the MHD program which you are acquainted with, and fluidized bed combustion. This process in terms of efficiency is one that really appeals to me.

FLUIDIZED BED COMBUSTION

We now know that we can burn directly in a fluidized bed any range of coal from anthracite on down, filter the product gases through a channel filter that Dr. Art Squires has invented and end up with a product the particles of which are below five microns in size. It can go right into a gas turbine, and from that into a steam turbine, resulting in increased power production efficiency. The fluidized bed system allows you to burn anthracite, bituminous, subbituminous, or lignite coals.

You trap the sulphur dioxide in the fluidized bed by putting dolomite or limestone in there taking it out as part of the slag which can be made into bricks or safely stored. Ash is a product we are used to taking care of, anyway.

I am sorry again for spending so much time on that but to me that represents great efficiency of conversion because you are not converting coal to another form but are burning it directly.

Mr. MCKAY. What is the position of this you are talking about now?

Mr. HILL. In the budget this year we are getting an increase to authorize the design and building of a large enough fluidized bed boiler to give us the design parameters so that the major companies can design one to sell to the power companies.

This isn't a retrofit process. This is what the new powerplants, the new peak load powerplants, would be using.

FUTURE FUNDING FOR FLUIDIZED BED COMBUSTION

Mr. MCKAY. Is that sufficient to accomplish your need there and move it along at a pace necessary?

Mr. HILL. Within the framework of the present program it is enough. We pressed hard to fit the program to that figure. That is what Pope, Evans, and Robbins can utilize. I feel good about that.

Mr. MCKAY. They can utilize it, that is true, but to what state of efficiency could they accelerate it a year or 2 years if they had more funds to do it?

Mr. HILL. Really that one company, I think , will be able to operate, going at its optimum rate. If we were asked with approved budgeting to move more in that direction there are other companies with expertise that could be brought aboard. We have other proposals.

Mr. MCKAY. It would be necessary for the final bringing of this on line?

Mr. HILL. Yes. The Pope, Evans, and Robbins is tied pretty closely to conventional technology. The one I mentioned to you came in in a proposal that we are not funding this year. It proposes a fluidized bed combuster to a gas turbine-steam turbine system.

Mr. EVANS. Would the gentleman yield?

Mr. MCKAY. Yes.

Mr. EVANS. If you have the money would you do it?

Mr. HILL. If we were requested we have the capability of expanding in that direction.

Mr. EVANS. And what would this do in terms of the time frame we are thinking about that would give you the plant capacity to use this method? How much would this shorten the time?

Mr. HILL. It is a different kind of fluidized bed combustion. I think we are in good shape on the standard boiler kind. This parallel approach might lend itself to converting the diesel engine operation on railroads to coal operation on railroads again. They can build with existing technology, existing turbine technology, a 50-megawatt unit which I think is about the size of a railroad diesel system, if you please.

I have to admit I am intrigued with the possibility that that can go ahead. This would also, if the turbine people would come aboard and expand the size of their turbines, allow us to build a lot of relatively small peak load plants over the country.

Mr. EVANS. How much more money could you use in the fiscal year for those purposes?

Mr. HILL. This is under serious discussion. I think all of us recognize it. That particular contract proposal is nominal, the order of $1 million or $2 million for the first couple of years to get the concept tested.

Mr. EVANS. If you add an extra $2 million this year could you enter into such a contract? Would that be sufficient for such a contract?

Mr. HILL. That would be sufficient for that contract.

Mr. EVANS. Thank you, Madam Chairman.

COMBINED SYSTEM EFFICIENCY

Mr. HILL. I want to get something on the record here. I came aboard in July. I have learned many things but not all the things I need to know about the operations in Washington, so that if I say things wrong I apologize; my error.

Mrs. HANSEN. No, no. All we are interested in are facts.

Mr. HILL. I am trying my level best to give them to you.

Mrs. HANSEN. You wouldn't even be where you are today if this committee had not prodded OMB.

Mr. HILL. This I understand.

Mr. MCKAY. You are not going to get your hand slapped here.

Mr. HILL. I know, but I will get them slapped.

Mr. EVANS. Madam Chairman, if there is any hand-slapping for a witness testifying of his knowledge in regard to questions we ask

him, I would sure like to know about it because I think this committee has a right to have this frank information.

Mr. HILL. Let me qualify that.

Mrs. HANSEN. To my knowledge the people who have testified before this committee have always given us frank evaluations of the facts. I have never known of any repercussions in any administration.

Mr. HILL. This is true. I wanted to add my affirmation to that.

I want to reaffirm that because the hand-slapping that I have encountered has not been at all based on any testimony given before a House or a Senate committee.

Mrs. HANSEN. You know what would happen if it was. The person that slapped the hand would have his budget cut.

POWER PRODUCTION EFFICIENCY RATIOS

Mr. HILL. I appreciate that, Madam Chairman.

We are trying very hard for the reasons we have indicated already to increase the efficiency of power production as indicated in this chart.

[The chart follows:]

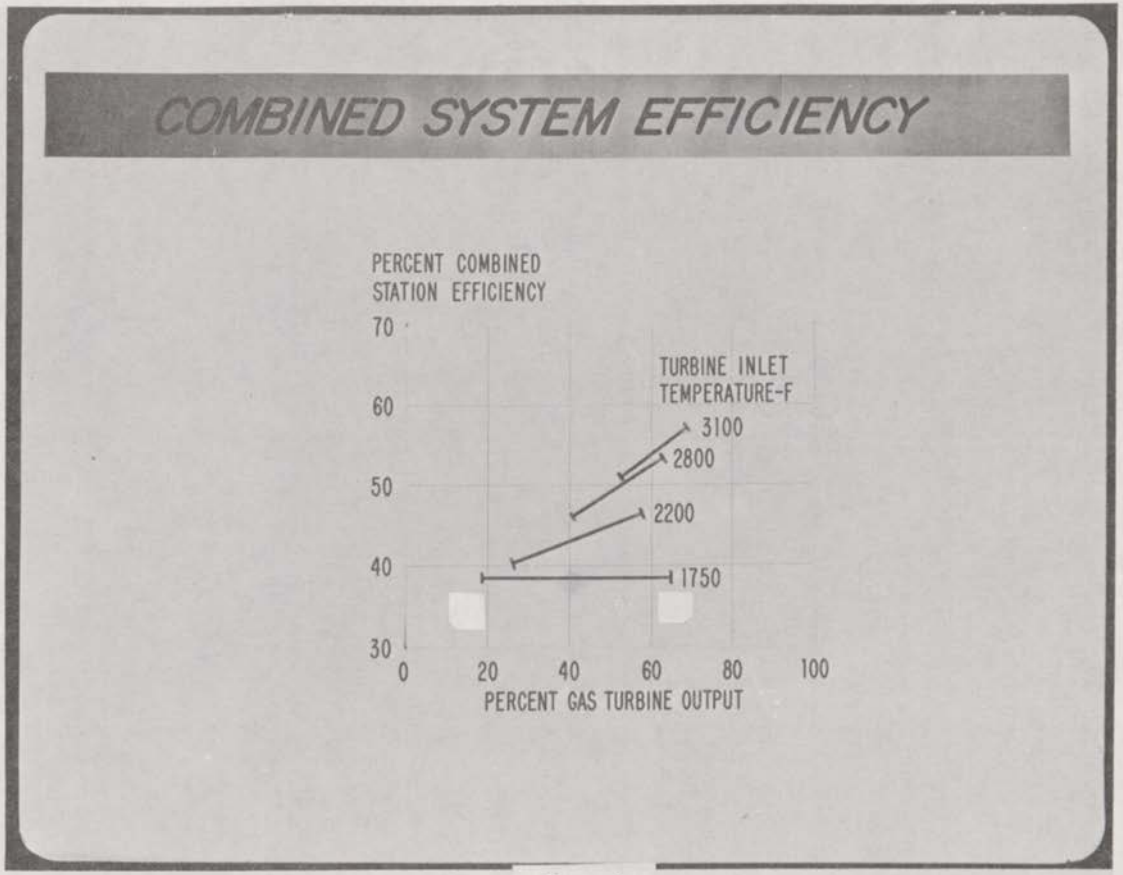

COMBINED SYSTEM EFFICIENCY
PERCENT COMBINED
STATION EFFICIENCY
70
60
50
40
30
TURBINE INLET
TEMPERATURE-F
3100
2800
2200
1750
0
20
40
60
80
100
PERCENT GAS TURBINE OUTPUT

Figure 9

Mr. HILL. The company that I mentioned that has this capability on the fluidized bed has given us some calculations of the increase in efficiency we could expect in a combined gas turbine-steam turbine combination by increasing the temperature.

The present efficiency is around 36 or 37 percent. Going up to 2,200° we got up to 45-percent efficiency. Well above 50-percent efficiency would be achieved at 2,800, and nearly 60-percent efficiency at 3,100°. This is 60 percent more than we are currently getting, which is a goal toward which we must move.

Mr. MCKAY. Out of this same volume of coal?

Mr. HILL. That is correct. The thermodynamic efficiency is determined by the maximum temperature in your system minus the exhaust temperature, divided by the maximum temperature, so anything you can do to crowd the highest temperature up and to have a system in a combined cycle that exhausts the product at as low a temperature, as possible, that increases your efficiency and this kind of combined cycle works toward that end.

Out of the same amount of coal you can increase the power output by the kinds of devices we are currently investigating.

Mr. MCKAY. This seems to be a very needed thing, Madam Chairman, because they are building a new plant in a section of my district and I was amazed at the amount of heat energy that was flowing out through the stacks unused, unable to be trapped, for the thing we are after.

Mrs. HANSEN. This is one of the problems at Four Corners.

Mr. HILL. Right, yes.

Mr. MCKAY. Fantastic amounts.

Mr. HILL. We are really addressing a lot of attention to it. This will come out, I think, in some of the later slides, if we could move on to the next chart.

[The chart follows:]

TYPICAL TIME SCHEDULE AND PROGRAM COSTS FOR R&D CULMINATING IN THE OPERATION OF FIRST GENERATION COMMERCIAL PLANTS TO PRODUCE SYNTHETIC PIPELINE GAS FROM COAL GASIFICATION PROCESSES

ITEM	SMALL PROCESS TEST UNIT	LARGE PILOT PLANT	DEMONSTRATION PLANT	FIRST GENERATION COMMERCIAL PLANT
PLANT OPERATIONS: • DESIGN • CONSTRUCTION & START-UP • OPERATION	TYPICAL TIME SCHEDULE —— YEARS 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16			
GASIFICATION CAPACITY (MMCF/DAY)	VARIABLE	1.0–2.5	50–100	250 +
COAL FEED: • TONS PER DAY • TONS PER YEAR	1–3 50–150	50–125 15,000–50,000	2,500–5,000 1,000,000–2,500,000	12,500 + 5,000,0000 +
PLANT CAPITAL INVESTMENT ($ MILLION)	$0.5–1.5	$5.0–15.0	$100–150	$150–250 (OR EXPAND DEMO. PLANT AT A COST OF $100–150)
OPERATING COSTS ($ MILLION / YR.)	$0.5	$2.5–4.5	$20–35 (WITHOUT CREDIT FOR GAS SALES)	$50 +
APPROXIMATE TOTAL PROGRAM COSTS ($ MILLION)	$2–5	$15–35	$150–300 +	OFFSETTING REVENUES & VARIABLE

Figure 10

TIME SCHEDULE FROM INITIATION OF R. & D. PROJECT TO COMPLETION AND COMMERCIALIZATION

Mr. HILL. This answers your question, or will lead into the answer, Mr. Evans, as I go through it systematically.

On this very complicated chart we have reading from left to right, the cost and process flow chart for a typical coal conversion scheme—in this instance gasification. In the first column of items we have the plant operations. These include design, construction, and start-up, and operation. This is in that upper left-hand corner. In any new technology you begin with an idea in the mind of a real bright guy in a laboratory and you test it out. The initial contracts that we let through the Office of Coal Research are pretty much laboratory scale. You can see the design of a plant in the laboratory, build it and test it. Then you come to a decision point.

If the process is technically viable, you move into a process development unit and this costs you more dollars than the laboratory scale does.

OCR R. & D. PROPOSALS

Mrs. HANSEN. How many proposals do you receive and how many are funded?

Mr. HILL. In total nearly 700 proposals have been received by the Office since the beginning of the program. Of these 700, 120 have been funded.

Now, the mechanism of that reduction is important. Each time a proposal comes in we send it out to experts all over the country, out of Government as well as in Government, mostly outside for the initial evaluation. They come back with their evaluation of the value of the proposal. Based on that evaluation, plus our General Technical Advisory Commitee's evaluation of the proposals, plus the Bureau of Mines screening of the proposals, we have come up with 120 that have stood muster, if you please, and that have merited funding from available funds.

Of those 120, 80 now have either been completed or have fallen by the wayside because they didn't prove out technically or economically.

There are now 40 that are being funded by the Office. Of the 40, only 6 have survived into the pilot plant stage. That is the kind of flow you get and the dollar flow is awfully important.

In the initial phases, in the laboratory you are talking about a $1 million to $3 million investment in the program. You move into the pilot plant and you go up to $15, to $25, or $30 million, depending on the kind of activity you are doing.

If it survives the pilot plant test, and we have none that has gone beyond that yet into the demonstration plant, then you go up to $100 or $150 million or even $200 million.

DEMONSTRATION PLANTS

Mrs. HANSEN. Have any projects reached the demonstration stage?

Mr. HILL. Not yet, no; we are close. We think that as to the SRC plant, for example, we have enough information from what Willard Bull and his team at P. & M. have done, and with what they will now learn, that we can begin design of a large scale operation.

This is one of the ways you could cut the time down between now and building a demonstration plant.

Mr. McKay. You need the funds to cut that time down. Could you be ready for that phase in another year if you had the funds?

Mr. Hill. I think we would be kidding ourselves if I didn't answer this frankly.

Additional funds would enable us to bring closer together, to have some overlap in some of the programs. There would be a calculated risk. It wouldn't be as efficient as we are now moving. There is a built-in hazard here.

To accelerate you don't learn all the things you would like to before you go to the next stage. But some of the design could be started sooner if we were directed to do it.

Mrs. Hansen. You know enough currently to move into the design stage?

Mr. Hill. Oh, yes, we could move into the design stage on one or two of the kinds of operations if we were requested to do so.

Mr. McKay. The state of the art is that completed to where you could move on?

Mr. Hill. Yes, but you have to recognize that there is a dollar risk here. Let me say one other thing on this point. There has been an assumption, I think maybe oversold in the past, that every process that reaches a pilot plant stage will be successful.

In industry only 1 in 10 turns out to be economically and technically successful.

Now, in the OCR program one plant, the FMC plant, has been successful. It has met all the design characteristics. The next phase of the program is now moving ahead with industry picking up the ball. Any company could have done it. A consortium of companies has elected now to move ahead with the next phase at no expense to the Government so it will get into the market place quite fast.

CRESAP, W. VA., PILOT PLANT

Another one, the Cresap, W. Va., plant, was not eminently successful in making gasoline, which was the initial——

Mrs. Hansen. Do you want additional funding for Cresap?

Mr. Hill. Wait a minute; not for that operation. I think we need to understand that. Maybe I am diving in where I shouldn't. Let me finish the statement.

In the facilities at Cresap, there are something like $8 million in plant facilities. The hardware I think is an $8 million figure, and I am not saying the full amount can be used, but that amount of hardware, equipment facilities, are available for use. The thing that I think hasn't been clear in the past is that to make gasoline you dissolve the coal, you hydrogenate it, you go through a low sulfur oil stage, and then you upgrade it, and it was this last element at Cresap that fell on its face.

At that facility the first three phases of the program were demonstrated and were successful. Those facilities or equivalent facilities built somewhere else at additional expense will need to be put together to test the different concepts, the Bureau of Mines concept, the Gulf Oil concept, the Exxon concept, for making low sulfur oil out of coal.

I am a taxpayer and I would hate to have to start from scratch if we have an $8 million head start on a program.

Aside from that, I think if we look at this figure 10 chart, we are really 3 to 6 years down the road already, if we can utilize those facilities.

[A picture of the Cresap plant follows:]

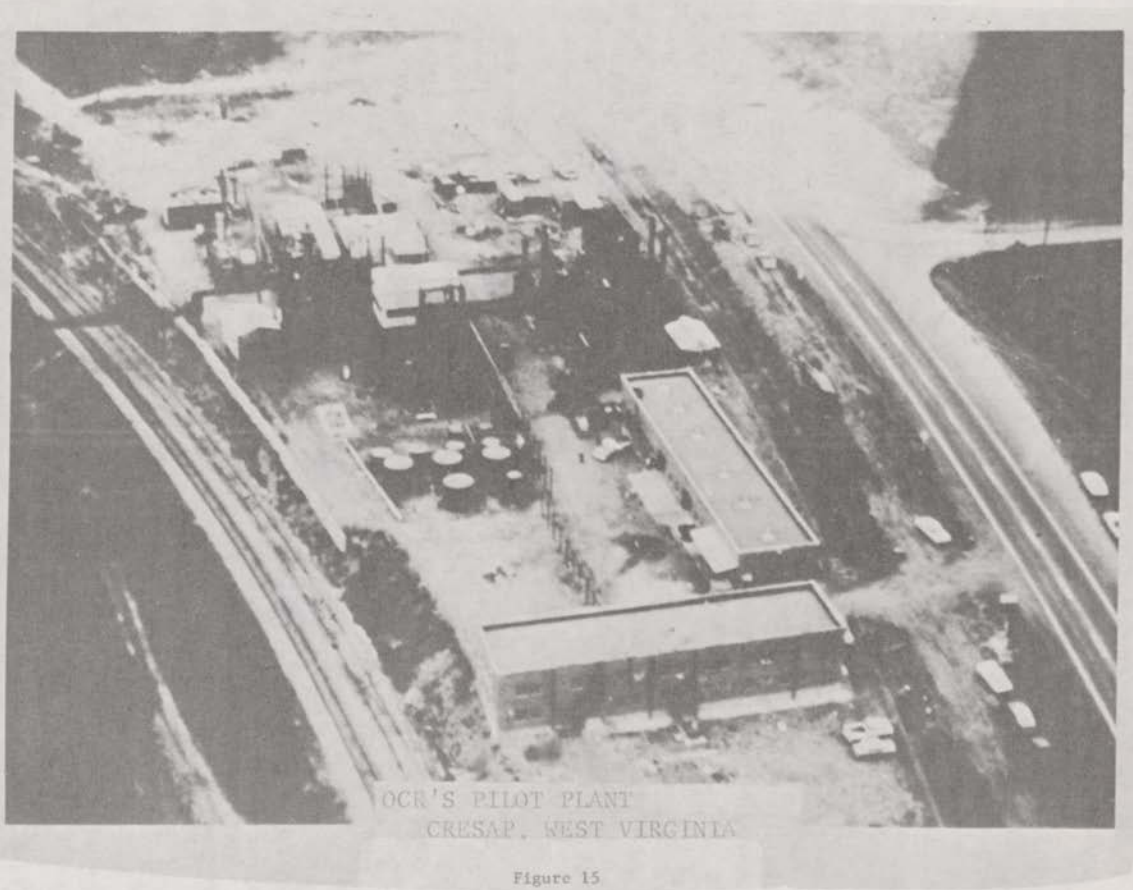


Figure 15

Mr. HILL. In order to meet the request you made that I received in writing when I got aboard, we have sent out requests for proposals for the best way to utilize that facility to make low sulphur oil and then do the one other thing that I think we desperately need to do in the program, that is to develop the unit chemical engineering operations, the pumping systems, the filtering system, the valving systems that are causing grief in every one of our plants, liquefaction as well as gasification. That has been added on.

We have kind of had a naive expectation that companies that are developing these new processes, the high Btu gas program, the solvent refined coal program, would incidentally somehow develop the hardware that you cannot buy off the shelf, to make the process successful.

That is an unconscionable burden. We have been too naive. We need to direct attention to these things, and that facility will have side streams on it that would be used. What we now have is a series of four proposals that have come in to do that double job.

There are groups of companies, including equipment companies as well as oil and construction companies. These four proposals have been evaluated and two stood out far above the rest. Neither of them had in its group the company that had performed initially at Cresap, for whatever that is worth.

I am glad it turned out that way.

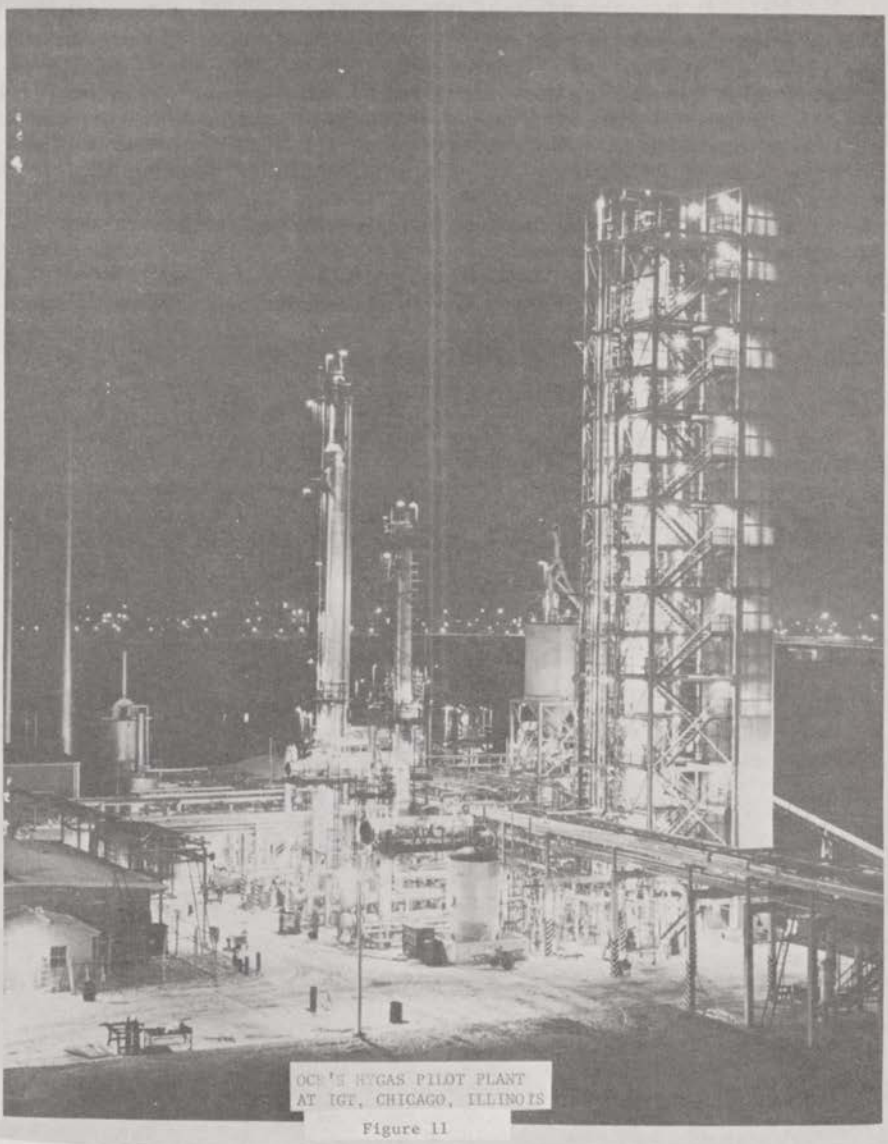
[Discussion off the record.]

HYGAS PILOT PLANT

Mr. HILL. Let us move ahead so we can get your next team in here.

Here we have some pictures of the systems that have come to pilot plant stage.

[The picture follows:]



OCR'S H-GAS PILOT PLANT
AT IGT, CHICAGO, ILLINOIS

Figure 11

Mr. HILL. This is the high Btu gas program we are cofunding with the American Gas Association. This plant is now in final proof stages, if you like. All of the elements, save the methanation unit, have been run over a period of a day or two without having to close down. We are very optimistic about it.

CO_2 ACCEPTOR PILOT PLANT

The next slide is the Rapid City, S. Dak., CO_2 acceptor process, again high Btu gas.

[The picture follows:]

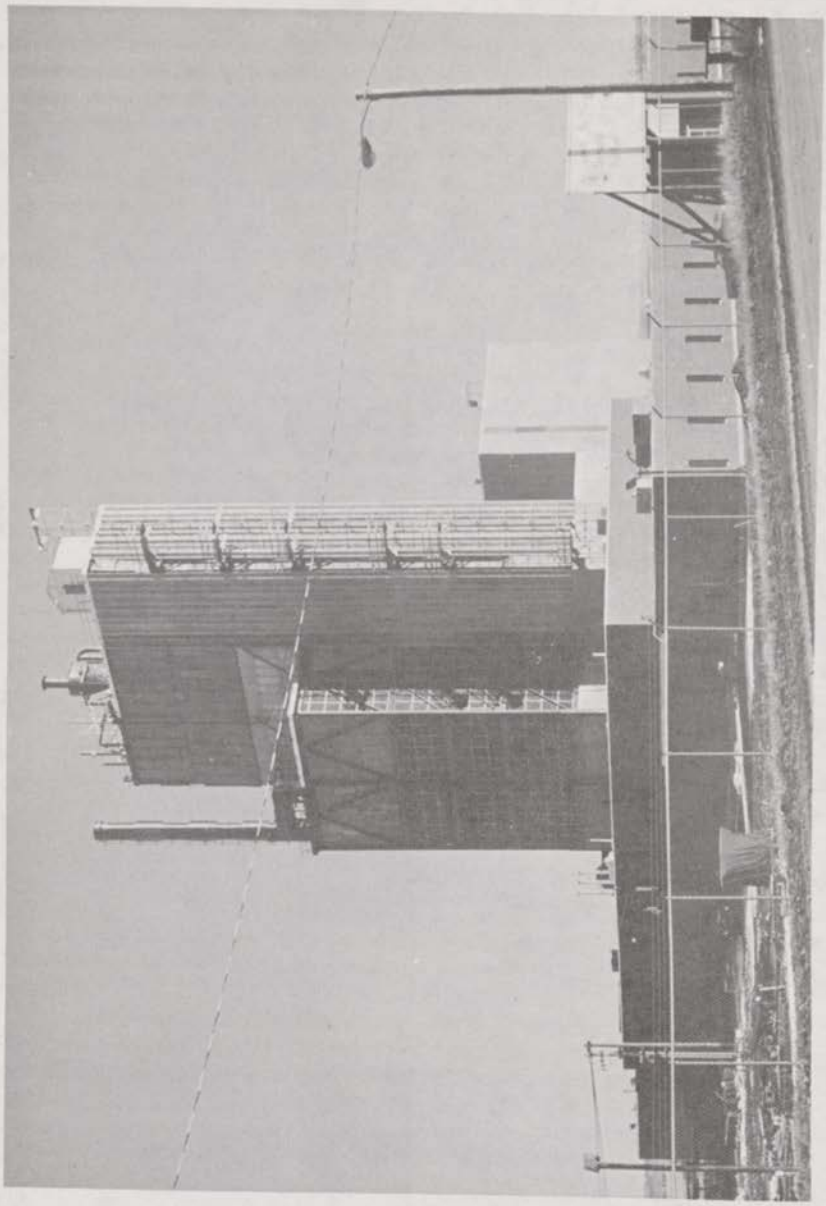


Figure 12

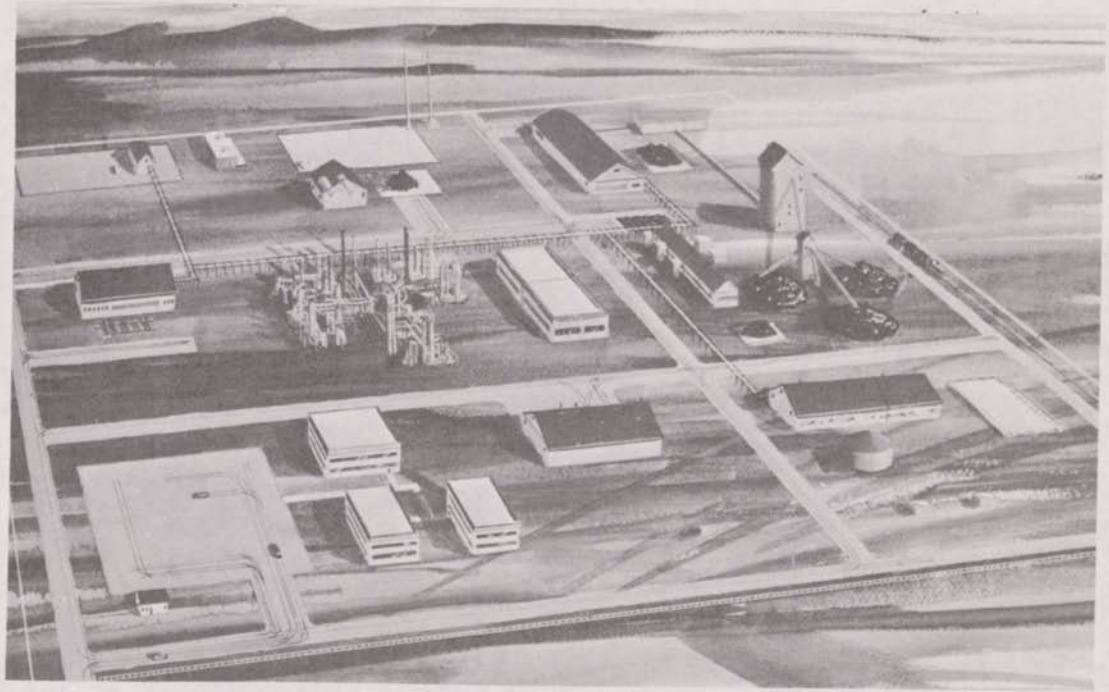
Mr. HILL. The dedication of that pilot plant occurred last fall and it is being tested. It is being fired up again now. This plant includes an extremely complicated mechanical operation and I just feel elated that they have actually gotten the two types of solids to go the right direction.

You have some black balls, coal, and white balls, dolomite, and who tells the white ones to go one way and the black another. I don't know, but they are actually following the designed course. It looks good. If this comes off it is going to mean a whole new era in chemical engineering plant design.

BI-GAS PROJECT PILOT PLANT

The next slide is a schematic diagram of the Homer City, Pa., plant. Groundbreaking occurred for that last summer. And these are the three high Btu gas programs.

[The slide follows:]



ARTIST'S SKETCH OF OCR'S PILOT PLANT
HOMER CITY, PA., FEATURING
THE BI-GAS PROCESS

Figure 13

Mr. HILL. A fourth high Btu gas program that is really a part of the set is totally funded by the Bureau of Mines. It is the synthane plant, for which the groundbreaking occurred last fall also. In order to monitor these adequately, rather than increase our in-house staff, we have hired a competent engineering organization, the C. F. Braun Co., that sends to the sites the proper engineers to look over the operators' shoulder and to keep us apprised of the developments. They let us know when things go wrong, give the operators input on how to modify the operation, and, even more importantly, when they see something develop in one of these plants that is applicable in another they transfer the information instantly and we don't have to reinvent the wheel a lot of times. It is working out very nicely.

SOLVENT REFINED COAL (SRC) PILOT PLANT

The next transparency is a picture of the SRC plant being constructed in Tacoma. There was a groundbreaking ceremony this past fall, and it is moving ahead in fast time, I might add.

[The picture follows:]

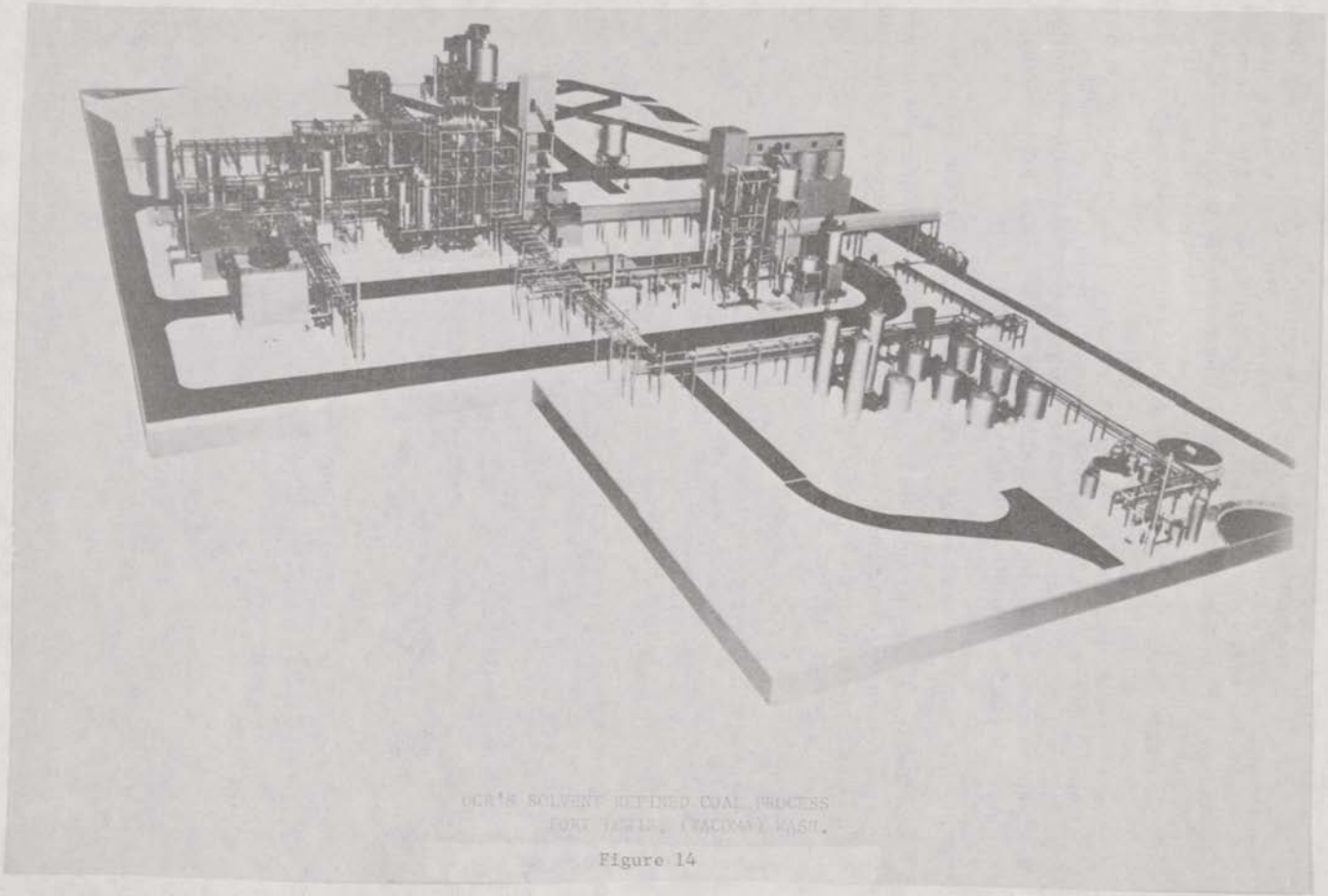


Figure 14

Mrs. HANSEN. Have there been any slowdowns at Tacoma due to lack of funding?

Mr. HILL. Not yet and we are having a dialog about it right now. The company, Rust Engineering, that is building this plant, believes they can complete it well ahead of schedule. If they do there will be a fund shortage. If it runs the course of the normal plants, we think we can make it.

Mrs. HANSEN. What would be the completion date under your normal plan?

Mr. HILL. The normal plan would be in April 1974, and they are thinking of November 1973. November is the schedule and from the experience we have had in the past on pilot plant building this one is going much faster than we would have guessed.

Mrs. HANSEN. Supposing it is completed and you run out of funds. What happens?

Mr. HILL. We will have to come back for additional funds.

Mrs. HANSEN. For a supplemental?

Mr. HILL. Some mechanism. I don't know. Again I am learning.

Mrs. HANSEN. Or reprograming?

Mr. HILL. Yes; one or the other. I suppose those are the two options.

COED PROCESS PILOT PLANT

Here is a picture of the COED pilot plant, the one that I indicated has proven out, up to specifications.

[The picture follows:]

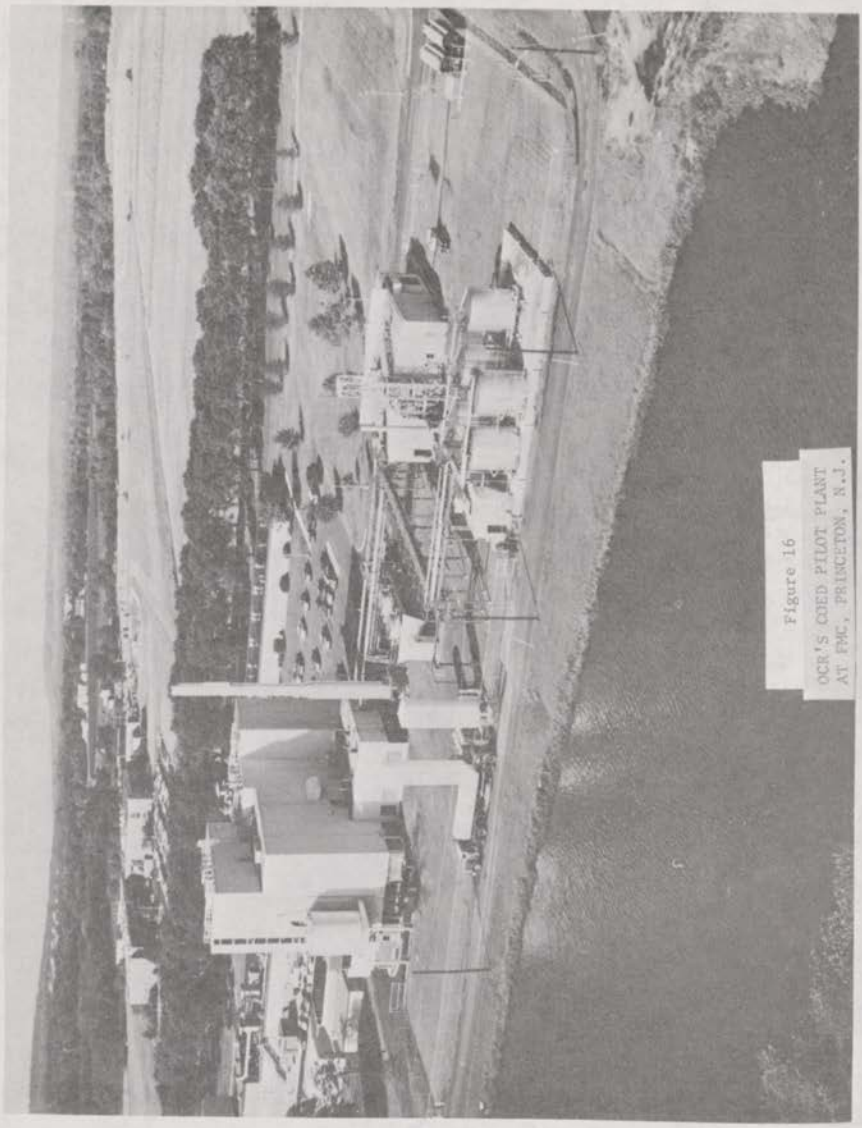


Figure 16

OCR'S COED PILOT PLANT
AT FMC, PRINCETON, N.J.

Mr. HILL. Many coals from all over the country have been tested. This is a carbonization plant that produces a liquid, gas, and char. The char is now being studied under nongovernmental funding to convert to hydrogen, to make hydrogen from the char so we can make high Btu gas with the basic concept that was developed under total Government funding at the FMC plant.

REGIONAL ENERGY RESOURCE DEVELOPMENT PLANTS

The next transparency shows the result of a study we made.
[The chart follows:]

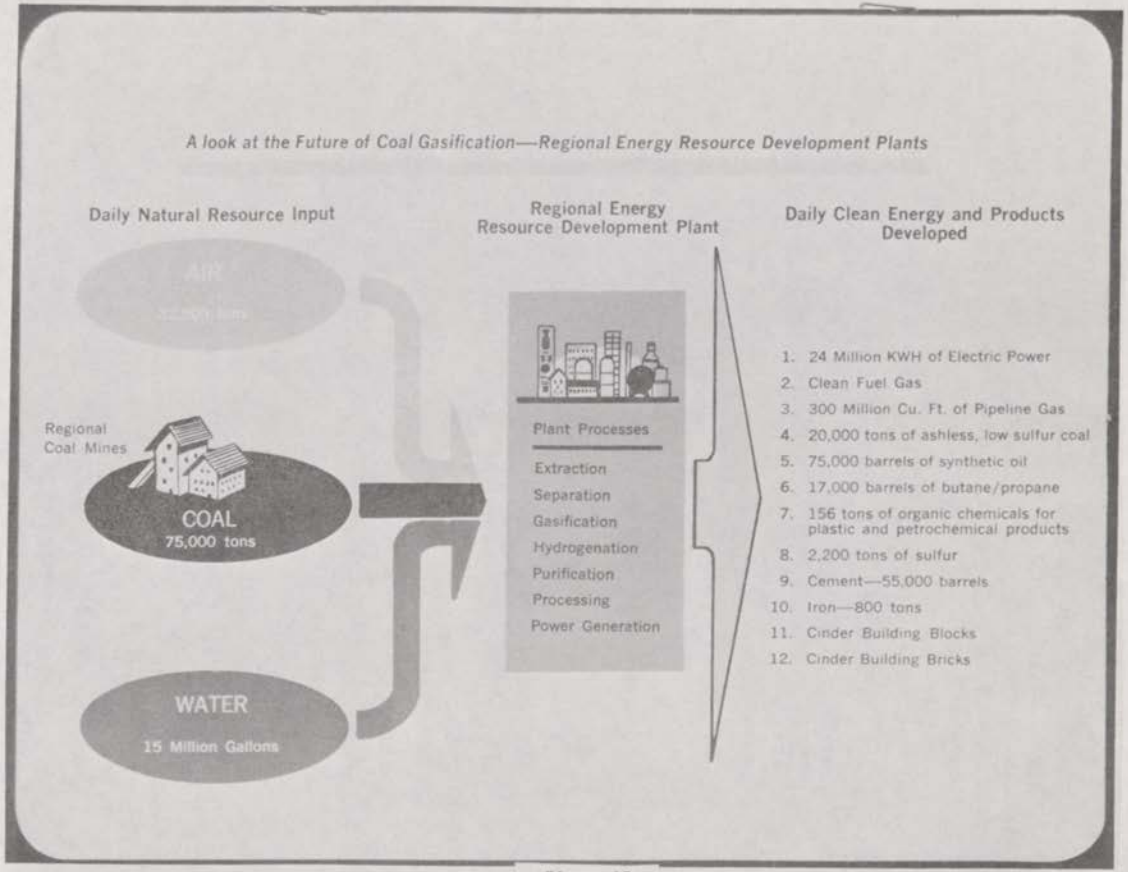

A look at the Future of Coal Gasification—Regional Energy Resource Development Plants
Daily Natural Resource Input
Regional Energy Resource Development Plant
Daily Clean Energy and Products Developed
AIR
Regional Coal Mines
COAL
75,000 tons
WATER
15 Million Gallons
Plant Processes
Extraction
Separation
Gasification
Hydrogenation
Purification
Processing
Power Generation
1. 24 Million KWH of Electric Power
2. Clean Fuel Gas
3. 300 Million Cu. Ft. of Pipeline Gas
4. 20,000 tons of ashless, low sulfur coal
5. 75,000 barrels of synthetic oil
6. 17,000 barrels of butane/propane
7. 156 tons of organic chemicals for plastic and petrochemical products
8. 2,200 tons of sulfur
9. Cement—55,000 barrels
10. Iron—800 tons
11. Cinder Building Blocks
12. Cinder Building Bricks

Figure 17

Mr. HILL. We are very concerned about the environmental, sociological, and economic impact of each of these processes. We need to know what is going to happen to the involved population in an area, what kind of things are going to be available and this diagrams it very well, I think.

It shows that a major plant of commercial size would require 75,000 tons of coal as input, plus 15 million gallons a day of water, plus air, which still, fortunately, is not a cost to the operation. You would have a series of plant processes, including extraction, separation, all of those on that list, and a series of 12 products, power, high Btu gas in large quantity, oil, and so forth.

The whole set of things would be produced. We are also having some studies made as to the impact that would have in the Fort Union area in the West, and two or three other places, to see just how this can be implemented practically and what has to be done now in order that the programs can go ahead.

Mrs. HANSEN. You have a problem in certain areas of the West with water shortage.

Mr. HILL. Yes. I am keenly aware of this and I was really heartened when Doug King, vice president of the American Gas Association, told me that they had made a study and had found that in the United States there are 176 sites with enough coal and enough water to support a plant of this type.

So this may mean a transfer of water perhaps from irrigation purposes. I don't know all the parameters that went into the study. But it turns out you can really stretch water when you have to and according to the data they have, there are 176 such sites. I feel comfortable again.

Mrs. HANSEN. Unless you have difficulties with reclamation programs.

Mr. HILL. Okay, I admit there are problems.

Let me just give you an anecdote. I was involved in a hearing by the Utah Power & Light Co., in Utah. They wanted to build a plant for generating power at Huntington. This is in a low population area in the southern part of the State.

I was asked to put a team together to make a preliminary survey of the sulfur dioxide, the ozone, the vegetation, the animal life in the area, to give them input as to what they would need to do to make that an environmentally sound plant.

We got our study going. Then we held our first hearing. I got to the hearing and I was aghast. There were 23 separate interest groups, every one of which had to have its demands met before permission could be granted for that plant to go ahead. So we have problems, real problems.

Mrs. HANSEN. I understand. Before you drive one piling on the Columbia River you have to have the approval of 21 agencies.

Mr. HILL. Utah is behind that because these 23 represented the whole spectrum of things. It wasn't just the piling.

Mrs. HANSEN. The reason that the committee is concerned is because there are so many of these water areas where the people can't agree on who should use the water. There are also problems of the Indian water rights which have never been fully adjudicated as I understand.

Mr. HILL. I think the law describes how much water can go to each area and each group.

Mrs. HANSEN. Some of them don't agree with the law.

Mr. HILL. OK.

Mrs. HANSEN. That is the problem.

OCR FISCAL 1974 BUDGET REQUEST

Mr. HILL. The final slide shows, our budget request in dollars.

[The slide follows:]

OCR BUDGET REQUEST FOR FY-1974

I. PILOT PLANT PROJECTS:		
A. LIQUEFACTION	$ 9,000,000	
B. HIGH-BTU GASIFICATION	20,000,000	
PILOT PLANT SUBTOTAL		$ 29,000,000
II. NONPILOT PLANT PROJECTS:		
A. LOW-BTU GAS	11,500,000	
B. MHD	3,750,000	
C. FLUIDIZED-BED BOILER	2,700,000	
D. SUPPORTING RESEARCH PROJECTS	4,350,000	
NONPILOT PLANT SUBTOTAL		22,300,000
III. SUPERVISION AND ADMINISTRATION		1,200,000
TOTAL BUDGET REQUEST		$ 52,500,000

Figure 18

Mr. HILL. For liquefication pilot plant projects, $9 million; for high Btu gasification, $20 million; in the nonpilot plant project areas, $11.5 million for low Btu gas—that is an increase of a little over $8 million this year for that item—MHD $3.75 million, and for the fluidized-bed boiler $2.7 million. That is the one you were mentioning, Mr. McKay, that I think is funded adequately for that one fluidized-bed boiler operation.

Part of that money is being contracted for research in England with the British Coal Utilization Research Association. They have expertise. They have equipment there that we are utilizing awfully cheaply to test high pressure fluidized-bed boiler technology, so that that includes not only Pope, Evans, and Robbins, but also the British effort at Leatherhead, Surrey.

MHD PROJECTS IN TENNESSEE

Mrs. HANSEN. Chairman Evins of Tennessee is deeply interested in this subject.

He asks if there is any of the money for the MHD proposal going to Tullahoma, Tenn., to the Arnold Engineering Development Center.

Mr. HILL. There are two programs at Tullahoma. There is Professor Dick's program at the University of Tennessee that is funded at the level they can carry it. We are just about complete on the design phase which we have funded with the Arnold Engineering Center. They have a proposal for a $1½ million test to determine whether we can get a 20-percent enthalpy extraction from that operation, for which there is no money in the budget. I am conferring with Dr. Chaunchey Starr of EPRI to get some funding forthcoming, but it is not in the budget.

There is a question in the minds of our MHD experts whether that should be the next step tested or not. I don't find agreement. AVCO and MIT think that should be deferred in favor of some other things we are funding this year. The Tullahoma programs would be desirable but timewise it could be deferred without seriously hurting the program. That is the last slide, Madam Chairman.

OFFICE OF COAL RESEARCH ORGANIZATION

Mrs. HANSEN. Dr. Hill, have there been any significant program or management changes in your office since you have become Director?

Mr. HILL. Immediately prior to my coming aboard, at the time you held the hearings last year, the office structure was changed to provide for an Associate Director and to provide staff for the Director. We have brought in a long-range planner. We have brought in a communications expert who is helping us a great deal.

We have brought in additional accountant and engineering staff. In addition, we have had a careful study by Leadership Systems, Inc., of our internal operation. As the Office has grown from $1 million a year to $43 million a year, the methods of operation have not been internally reorganized. We have made such a study now and are going to improve our communications system. We are going to get the right kind of card record typewriters that will allow us to increase our efficiency here considerably. It is likely because of the tremendous load that Mr. Cochran and his shop are carrying that we may need to divide the research and development unit into two divisions. It is an

unconscionable burden that Mr. Cochran and his staff are carrying. We have a request for additional personnel. We are finding that as we form coupling contracts, as with the American Gas Association, the dual system of negotiation and approving contracts and the like, requires more time than when we did it alone. As we move into the same kind of pattern with EPRI and other industry groups we will need additional staff. Within the budget there is a request to increase by 18 people. I have no intention of going that far if we can do it with fewer people.

I still feel like a taxpayer and will continue so to feel. I am stingy, if you please, about the rate of increase of the personnel. We are making that request so that we can add the necessary staff if we find we are not riding herd closely enough on the programs.

MONITORING OF OCR PROJECTS

Mrs. HANSEN. Does OCR monitor its own contracts using its own personnel or does it have help from some other agency or source outside of the Government?

Mr. HILL. We assign an individual on Cochran's staff, staff responsibility for a group of programs. Rather than allow our staff to become a bureau we have elected to hire expert engineering help. The C. F. Braun Co., Parsons Co., and Gilbert Associates have been hired to provide us on-the-site expert help in each major area. They have a stable of engineers, maybe 500 engineers, available as needed. They can send the exact man they need for a particular time on an electrical engineering problem, for example, have him there, get the report back to us, without our having to hire an electrical engineer full time for an occasional function.

ROLE OF EVALUATION, ENGINEERING, AND REVIEW CONTRACTORS

Mrs. HANSEN. How does OCR define the duties of industrial firms used for this purpose?

Mr. HILL. We constrain them by contract from entering, during the period of their relationship with us into any development that would be competitive with what we have them provide surveillance on. So they are not competitive. They are not learning things that they will capitalize on ahead of time.

Mrs. HANSEN. What about after the project has been completed?

Mr. HILL. Everything that is done in the OCR program is published. Any company, large or small, can pick it up and move ahead with it royalty free. The contract monitors have the advantage of intimate knowledge, the same as the company that built the plant has the advantage of intimate knowledge. But it costs them something. We are on a cost-sharing basis. For that privilege they are not charging overhead in some instances. They are even carrying 20 percent of the overall cost of that service.

Mrs. HANSEN. Have you ever had any charges leveled at OCR that they are using industrial engineering firms or engineers who may be in a competitive situation?

Mr. HILL. Not to my knowledge, Madam Chairman. I think we would hear awfully quickly if such were the case.

PUBLICATION OF CONTRACT RESULTS

Mrs. HANSEN. Are the reports of these technical evaluation contractors made public?

Mr. HILL. The reports on each process are published periodically. We get quarterly reports, we get interim reports, and final reports. They are made available to the public simultaneously. Included in those reports will be the input from the contract monitors, if you please. We do not publish as a routine fashion their comments, such as how the IGT plant went today. No, we don't do that. Their input becomes part of the record that is published as a final report and as interim reports.

Mrs. HANSEN. These technical evaluation contractors have the right to use the information contained in the reports for their own purposes.

Mr. HILL. Subsequently, that is correct.

EVALUATION CONTRACTORS

Mrs. HANSEN. What is the approximate number of contractor personnel working for OCR on the special technical evaluation contracts during fiscal year 1973?

Mr. HILL. On a day-by-day basis what would C. F. Braun average?

Mr. COCHRAN. We are running on the order of $100,000 to $125,000 a month, which is on the order of two man-years per month.

Mrs. HANSEN. Please insert a complete summary in the record.

Mr. HILL. Yes, we would like to do that.

[The information follows:]

The approximate number of contractor personnel working for OCR on OCR's technical evaluation contracts during fiscal year 1973 can be summarized as follows:

	Man-years
Power systems	2.5
Liquid fuels	11.0
Pipeline gas	25.0
	38.5

Mrs. HANSEN. What is the estimate for fiscal year 1974—in terms of dollars and people?

Mr. HILL. Could we give that on the record?

[The information follows:]

The estimate of contractor personnel working on OCR's technical evaluation contracts during fiscal year 1974 can be summarized as follows:

	Estimated man-years	Estimated total cost (including overhead)
Power systems	7	$190,000
Liquid fuels	30	1,220,000
Pipeline gas	44	1,700,000
Total	81	3,110,000

To provide equivalent coverage, using in-house personnel most effectively, OCR would need approximately 60 full-time positions augmented by outside consultant assistance totalling 10 man-years, with an additional job contract cost for 15 man years of work, at a total estimated cost of $3,830,000. The use of the evaluation contractors represents an estimated saving of $720,000; in addition it provides the additional advantage of flexibility inherent in the contract system, which is a real future saving.

CONTRACTOR EVALUATIONS AND OCR STAFF

Mrs. HANSEN. How did the expenditure for these special contracts and the number of contractor personnel involved compare with the administrative expenses for, and the same number of actual Government employees used by OCR for this same purpose?

Mr. HILL. We have a staff that now numbers 33. Correction. We have a staff of 32 people now aboard. The number of people available to us by this other route is three or four times as great as that.

Again there are specific experts in a number of areas. To duplicate what we get in this way would cost us four or five times as much money as we are spending, in my opinion.

Mrs. HANSEN. You have told us that the contracts of the industrial engineering firms used for privileged evaluations specifically forbid them to participate in any way on a project which they have evaluated.

Mr. HILL. It is true for all three companies while the contract work is going on. However, after they complete the contract work on some project they have evaluated, then they are just as free as any other organization to perform further work for someone else, since the results will be made public by OCR as soon as the contractor completes his work for OCR.

OCR/AGA COAL GASIFICATION PROGRAM

Mrs. HANSEN. A large part of your budget is devoted to the joint Government-industry coal gasification program.

Mr. HILL. Yes.

Mrs. HANSEN. Will you please summarize the status of that program? Is the program on schedule? When do you anticipate the first demonstration plant will be built?

PROGRAM SCHEDULE PROBLEMS

Mr. HILL. The program, in my opinion, is remarkably close to being on schedule. By that I am admitting that we have slipped.

Mrs. HANSEN. To what extent?

Mr. HILL. We have a 3-month slippage.

Mrs. HANSEN. Why?

BI-GAS PILOT PLANT PROJECT

Mr. HILL. We had a rainstorm at the time the groundbreaking was scheduled in Pennsylvania that washed it out. That was Hurricane Agnes. It is these kinds of things, among others, that cause slippage. There is another element. Our contract negotiations did not permit the signing of the contract as early as we thought. The groundbreaking ended up being in July, as I recall. It had been scheduled for June, or whenever Agnes came through.

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SUBCONTRACT DELAYS

There was another problem that caused the slippage. The subcontractor for building the big gasifier, the heart of the unit, is going to be Babcock and Wilcox. At about the time they were submitting the bid there had been an explosion in the Linden, N.J. oil refinery that was demonstrated to be centered in a new unit. They analyzed that the new unit involved an ebullating bed system where the heat localized. The heat did not distribute itself through the body of the bed and there was a tremendous explosion, as you may recall from the press releases. The company that built that boiler in addition to the oil company and in addition to the other contractors ended up in a lawsuit. Babcock and Wilcox said:

If we are going to have this kind of liability, we want some protection. We want the liability written off. We don't want any responsibility.

It was necessary to negotiate with them for a couple of months until we finally worked out a mechanism, with the Solicitor's Office, their attorneys and ours, in order that we could come up with a mechanism that we could live with in Government. We cannot legally free them from any responsibility on construction and materials. These are the kinds of things that caused a 3- or 4-month slippage in that program.

DELAYS RESULTING FROM THE NATURE OF R&D WORK

There is another element that is real. We showed on that chart how long it would take to carry through each phase. What you always write is what the time schedule will be if everything goes well. Nature is perverse. It turns out that you guessed wrong and it involves stopping work for a day or a week.

CO_2 ACCEPTOR PROJECT

At the CO_2 acceptor plant they had elected to put in insulating material that turned out to be too soft for the surface and overheating blew out a pipe connection between two units.

When they went back in they found out that the insulation had broken away. They had to shut down, tear out all the insulation and go in with another set of insulation. It cost a month or longer. We learned something. We know now how to put the insulation together for all the rest of the plants. The time lost is not totally down the drain because you are learning something you have to know, each time. That system has now slipped 2 or 3 months.

IGT PROJECT AND PROJECT FUNDING

The IGT plant is behind where we would have hoped it would be. I would like to have seen it fully operational by now. Each unit in it except the methanation unit has been demonstrated. Here is the reason: In my opinion we may be underfunding. We may not be wise, I went to Russia in the fall to look at the MHD program for our mutual benefit and subsequently the U.S. Government signed an agreement to exchange information and technical personnel with them to learn what they have done. Over there I found that somehow when

they build a plant they overfund it by a factor of two. They really build two plants. They do their testing in one. As it undergoes development, there is an up-and-down operation and things wear out awfully fast. When they work out all of the bugs they fire up the brandnew one and they get beautiful results. In all our contracts we pound on the contractor so hard that there is no redundancy at all. So when a plant heats up and goes down 20 times, the deterioration is much greater than it would be if you heated it once and ran at a steady state. So during the course of operation, valves will go out, pipes will rust through and this costs you in time and dollars. We don't have the built-in redundancy that would allow us to go forward at the desired rate. We underfund and pay that penalty in time and dollars.

ESTIMATE OF GAS FROM COAL BY 1985

Mrs. HANSEN. What is your estimate of the portion of the total energy supply in the year 1985 that will come from the gasified coal?

Mr. HILL. If we do not have any further slowdowns, by 1985, if industry and/or Government, probably in combination, decided, we could, I think, build enough plants by 1985 probably to meet 10 percent of our gas requirements that year. It will take an enormous amount of capital. For 250 million cubic feet a day plant, you are talking roughly $300 million.

Ten percent of the present consumption of gas per day would require on the order of 30 plants at $300 million each. The technology will be ready. I am convinced we will have the technology in good shape. The question is whether you can afford 30 plants at $300 million each.

REASON FOR GOVERNMENT INVOLVEMENT IN COAL GASIFICATION

Mrs. HANSEN. We have several news clippings which indicate the direction of private industry.

Why is it necessary for the Government to be involved in this program when all these companies have indicated that they intend to proceed on their own. The Pacific Light Transmission Co., Texas Eastern, and FMC plan to turn coal into gas, for example.

Mr. HILL. I have conferred with potential plant managers and with the president of El Paso Natural Gas Co., and asked them the same question. Their answer is this: We are going ahead with a plant using a 40-year-old technology developed in Germany, recognizing full well that the cost of that plant will be probably 25 percent greater than a plant we will build down the road using the technology you are developing.

Mrs. HANSEN. So the customer will pay for the increased costs?

Mr. HILL. Yes. The reason is to protect us consumers by saving up to 20 to 25 percent in the cost of gas. That is the reason for the Government being in. We can do it with that technology. The main difference is that instead of having 30 of the Lurgi gasifies which will be required in northwest New Mexico to provide the gas for that plant, I understand that one gasifier of the type that is under development now will do the same job. It is a high-pressure gasifier, and uses better heat exchange systems and all the new engineering techniques. That is a major difference in cost. The unit is a lot more complicated. The

total plant will cost 25 percent less overall, we estimate. There is a real incentive for developing the technology so that we can come up with the least expensive gas for the consumer in this country.

USE OF TECHNOLOGY DEVELOPED BY OCR CONTRACTORS

Mr. McKay. Along with that business of getting the technology, would the industry pull off that building procedure and move with your technology sooner?

Mr. Hill. Yes, I have been told that they will probably even scrap their gasifiers and put one of these in if they can work out the economics.

Mr. McKay. What do you need to do to get on line to do that?

Mr. Hill. Follow the program we are following. We have a good program.

OCR FUTURE FUNDING WITH AGA

Mr. McKay. Do you have sufficient funds to meet that deadline?

Mr. Hill. Yes, for this year. We are doing some sweating down the road. In 2 years we may have to negotiate again with AGA for both of us to come up with more money. This is going to be difficult, because we have a 4-year program. The escalation was not built in. For this year we are in good shape. For 1974 we are in good shape for the high Btu gas program.

We are locked in by contract. Congress helped a great deal here in giving a 20 million per year commitment on the high Btu program for 4 years. We are in better shape on that than any others. We have the partnership working out very well, with industry putting up a third of the money. We will have a major question down the road when it comes to the design of the first demonstration plant. I hoped basically that industry would be in a position to pick up the full cost of the demonstration or commercial plant. This may have to be negotiated. There may have to be some changes in tax structure to help out. I do not know. We have not come to grips with that yet. When that time comes, I am sure there will be quite a dialog.

Mrs. Hansen. Texas Eastern Gas Transmission and Pacific Light Transmission of Los Angeles have applied to the FPC to build a coal gasification plant. What is your comment in this regard?

Mr. Hill. That is the same type of plant.

In talking with the president of El Paso Natural he said, "Dr. Hill, I am decreasing a billion cubic feet of gas every year. The wells are being used up. I have to do everything." He has contracts to import liquefied natural gas. He is going this route, as well. He said he is doing everything he can to come up with enough gas to keep the customers in California onstream.

Mr. McKay. He is in a panic stage and if your technology does not bring this in line he will double the cost in arriving at his consumer needs.

Mr. Hill. Let us talk about cost of gas. There is the other element, why the Government has to be in it.

REDUCTION IN CONSUMER COST OF ENERGY AS A RESULT OF R. & D.

Mrs. HANSEN. If the Federal Government was not involved in this area private industry would not have accomplished anything. Isn't that correct?

Mr. HILL. Yes, for this reason: Until 3 years ago gas was priced at around 25 cents. The new gas imported from Algeria is going to cost upward of a dollar and a quarter for the same quantity of gas we are paying 25 cents at the wellhead. Gas from the North Slope, if it costs nothing to produce, would have an addon for the cost of pipelining the 3,000 miles to Chicago. The gasline people tell me that to pay for the pipe they are going to have to put in to meet the environmental constraints there will have to be a charge of 3 cents per thousand cubic feet of gas per hundred miles. That is a 90-cent addon to whatever the value of the gas is declared to be at the wellhead to pay for the cost of exploration and development, plus whatever the distribution cost is going to be.

We have a quantum jump in the value of gas. At 25 cents it made no sense to try to convert coal to gas. You cannot begin to do it. At $1.25 you can do it. We think we can do it for a dollar with the new techniques we are trying to develop. First, there was no economic incentive, but people need it. Now the economic incentive is there. We are in the business to try to get the price as low as we can so that the consumer will be protected as much as possible.

Mrs. HANSEN. In spite of all the developments over the widespread private utility field?

Mr. HILL. Yes.

The same logic applies to liquefaction and to low Btu gas for power production.

CRESAP, W. VA., PILOT PLANT MODIFICATION

Mrs. HANSEN. No money was provided in 1973 and none has been requested in 1974 for the OCR plant at Cresap, W. Va. Our report last year directed that you provide the committee with an evaluation report on this project. A letter was sent to the committee on February 9, 1973. You have summarized part of the plan, but please complete it. We will place your letter in the record at this point.

[The letter follows:]

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF COAL RESEARCH,
Washington, D.C., February 9, 1973.

Hon. JULIA BUTLER HANSEN,
Chairman, Subcommittee on Interior and Related Agencies Appropriations, House of Representatives, Washington, D.C.

DEAR MRS. HANSEN: Last year when your subcommittee acted on the Office of Coal Research appropriation request for fiscal year 1973 the subcommittee report at that time indicated:

"At the time of the hearings, studies were being conducted to determine the feasibility of plant modifications to permit research on the liquefaction of coal. The committee directs that no action be taken in this connection until the committee has had an opportunity to review the evaluation report and has had discussion of the merits of the program in a hearing. In the event the committee is favorably impressed, funds can be appropriated at a later date for the program."

In part I, page 924 of the hearing relative to the Cresap project, Assistant Secretary Dole in response to a question from the chairman relative to the project said:

"We feel, Madam Chairman, that our needs for a fuel oil type material is so great because of our dependence upon overseas sources for oil and especially for a residual type oil that this could be best used as a test facility for programs which are still under review at the present time. In other words, we think it would be a large saving to the Government to go ahead and utilize this as a multiple test facility under projects which we do not have firmed up at the present. But I promise you before we do that I will come before you and your committee and tell you why we want to operate in this fashion."

The Senate subcommittee said: "The committee directs that the Office of Coal Research determine at an early date the exact future use of the Cresap facility, and request any additional funds necessary for conversion of this plant in the next supplemental appropriations bill."

The evaluation reports which were prepared for the Office of Coal Research by the Foster-Wheeler Corp. and the Ralph M. Parsons Co. are both affirmative in their recommendations regarding having the Office of Coal Research proceed with necessary modifications regarding start-up of this facility. A report prepared for the Office of Coal Research by the National Academy of Science's National Academy of Engineering was also affirmative.

As your committee is aware from its long and detailed reviews of this project on a continuing basis from year to year, the need for the kind of process data and the kind of end product that would emerge from the project in the form of a clean liquid product would be ideally suitable for use by utilities and other industrial users, as well as contribute to a cleaner environment. Such a product would materially reduce our Nation's dependence upon foreign sources as mentioned in Assistant Secretary Dole's testimony as quoted above.

The Office of Coal Research solicited proposals on a competitive basis from 18 qualified engineering organizations to handle the projected work. We received six responses and the proposed future work, schedule for completion, and cost indicated that the Fluor Corp.'s proposal was best from every standpoint. We propose to enter into negotiations promptly with the Fluor Corp., and upon approval from your committee would execute a letter contract to begin work while the formal contract is being finalized.

We are appending hereto copies of the various reports received, and have appropriately marked the pertinent comments. Also appended is a brief description of the proposed program for reactivation of the Cresap pilot plant.

It is currently estimated that the total cost of modifying the pilot plant and reactivating the project as well as operating and maintenance funds for approximately 2 years would be $8,700,000. Since the Office of Coal Research has approximately $2 million as a residual balance of funds previously appropriated for the Cresap project, but unexpended when the project expired last fall, these funds could be allocated for the project to get started on the work of modification and reactivation. An additional sum estimated at $6,700,000 would be required to complete the project. However, approximately $825,000 of non-Federal funding will be made available by the proposed contractor, reducing the total Government funds required to $7,875,000. The Office of Coal Research is seeking, and hopes to attract, additional funds from the private sector which would further reduce future year Government funding.

We stand ready to provide additional details, or any other supporting information that you may desire, or to meet with you or your committee for this purpose.

An identical letter is being sent to Hon. Alan Bible, chairman, Subcommittee on Interior and Related Agencies Appropriations, U.S. Senate.

Sincerely yours,

GEORGE R. HILL,
Director, Office of Coal Research.

Enclosures.

PROGRAM FOR REACTIVATION OF CRESAP PILOT PLANT

INTRODUCTION

The primary objective of this program is to establish at the earliest practical date the most advantageous process system for producing clean fuels from sulfur-bearing coal. The ultimate determinant for this selection will be in the overall economics of the process system, including: (1) capital investment, (2) operating costs, and (3) demonstrated operating reliability.

We propose to convert the Cresap plant into a multipurpose test and demonstration facility so that it can be used to promote the development of both public and proprietary processes for coal conversion.

As such, it can: (1) save costs associated with duplication of effort, (2) encourage private participation, and (3) be used to obtain engineering information for the definitive evaluation of a commercial-size installation.

The program is divided into four phases of work. The first phase is designed to demonstrate the operating feasibility of the pilot plant. Each successive phase is designed to extend the scope of investigations to areas which require more extensive time for development and hardware modifications. We plan to dovetail activities so that work is started on all phases early in the program. This will allow ample time to complete modifications and ready the plant for testing when needed for each phase.

PROGRAM SCHEDULE

Introduction

This schedule is based on our current evaluation of program planning. It shows major activities of the four work phases in relation to the Government's fiscal calendar.

Program planning

The program is planned so that initial activities for all four phases have an early starting date with ample time allowed so that plant modifications can be completed, checked out, and ready for testing when needed.

Plant modifications will require careful planning and controls. Although only a few activities are represented on this displayed schedule, large number of detailed steps are involved, such as: Development studies, process design, equipment specifications, supplier quotations, bid analysis and equipment selection, detailed engineering design (project, mechanical, piping, structural, electrical, and instrumentation), purchasing of material and equipment, expediting, field construction, and mechanical testing and checkout.

Program Costs

The total cost of the work to be performed in fiscal year 1973 is estimated to be $2,890,000 of which $2,550,000 is the expected cost to the Office of Coal Research. Estimated costs for work in subsequent years will be developed later in fiscal year 1973 from the scope of work agreed to between Fluor and the Office of Coal Research.

PHASE I—DEMONSTRATE OPERATING FEASIBILITY OF PILOT PLANT

Plan design modificatons to the pilot plant (1) to correct present deficiencies and (2) to meet current environmental requirements of EPA regulations.

Execute plan for modifications to plant (1) review and analyze operating history and reports relative to the pilot plant design deficiencies, (2) prepare detailed specifications for all design changes, (3) procure materials, and (4) construct—make all plant changes.

Hire operating staff: (1) Hire present plant personnel if qualified and (2) hire additional personnel to complete complement for plant operation.

Train operating staff: (1) Classroom instruction and (2) in-plant training.

Mechanical checkout of equipment.

Start-up and operating shakedown of plant.

Operate plant to demonstrate feasibility for converting coal to a clean liquid fuel.

PHASE II—INVESTIGATE OPERATING VARIABLES

After operating feasibility demonstration tests on the plant, we will conduct a testing program to determine optimum operating conditions.

Establish if the following will have significant effect for extending life of the hydrogenation catalyst (1) solvent washing the oil feed, (2) catalyst attrition in the reactors, and (3) use of an alternate catalyst system.

Also determine the effects of (4) hydrogenation reaction severity on conversion, (5) reactor space velocity on conversion and selectivity, and (6) Solvent to coal ratios on product yield (a) total solvent to coal ratio, and (b) donor solvent to coal ratio.

PHASE III—TEST ALTERNATE EQUIPMENT

Identify where alternate equipment is needed.

This includes two types of improvements:

First type.—Those which may improve the process. For example: (1) Determine if catalyst life in hydrogenation unit can be extended significantly with equipment additions to residue separation unit. (a) filtration, (b) centrifugation, and (c) precipitation.

(2) Improve hydrogenation reaction step with: (a) other fluid bed reactor designs and (b) fixed bed reactor design.

Second type.—Those required for more reliable plant operation. Involves improved equipment designs for either residual items not identified in phase I, or those which require additional design changes.

Survey manufacturers for suitable existing designs.

Where necessary, select manufacturers with demonstrated innovative capabilities to develop advanced designs.

Modify plant to incorporate new equipment.

Conduct performance tests.

Phase IV—Test To Demonstrate Alternate Processes

Process development: (1) survey existing applicable processes, (2) investigate alternate product slates—including gaseous and solid fuels, (3) screen out economically unattractive processes, (4) select most promising candidate processes for pilot plant evaluation, and (5) establish mutually acceptable use arrangement between the OCR and licensors of selected processes.

Process Design: (1) obtain licensors' engineering design packages, and (2) integrate added units into pilot plant.

Execute pilot plant modifications.

Operating program for added process units: (1) demonstrate operating feasibility, (2) test process variables, and (3) determine engineering design parameters for commercial-size plant.

Program for Reactivation of Cresap Pilot Plant

Justification

The program for reactivation of facilities at Cresap, W. Va., is intended to convert the existing pilot unit to a multiple test and demonstration unit. The primary objective is to establish as rapidly as feasible the optimum combination of processes for conversion of coal to a low sulfur liquid fuel for economical power generation and industrial use. Priority will be given to investigation of relatively simple processes initially with the degree of sophistication increasing as development proceeds. In this way, the most progress can be attained in minimum time.

After basic process operability has been proven, investigations will be conducted to establish optimum operating conditions for production of clean liquid fuel products meeting requirements for both large utility plant and industrial fuel applications.

The first phase of the program involves rehabilitation of the existing plant incorporating modifications to quickly achieve reliable mechanical operation of the basic extraction and hydrogenation operations. The changes incorporated will be those found necessary to correct deficiencies evidenced in past operations through a detailed study of the plant and previous operations and recommendations. Modifications will include those needed to meet current EPA regulations. (A final environmental impact for the modified plant is ready to go forward at this time.)

Following operator training, run-in of each plant section, with shakedown to dependable operation the conversion of coal to fuel oil will be demonstrated over sufficient length of operation to indicate process unit on-stream factors and produce enough product to be tested in various combustion systems to determine that fuel quality is satisfactory. Testing will include sulfur and nitrogen levels adequate to meet environmental protection standards.

Operation will begin with Pittsburgh seam coal to prove that the solvent generated from operation at equilibrium is adequate and satisfactory for coal solution, that normal deviation of operating conditions from the optimum will not upset plant operation and that hydrogenation of the extract will yield a clean fuel meeting required future specifications. After conditions have been selected and basic characteristics have been proved by limited operation, extended plant runs will be carried out to demonstrate commercial reliability. Other operating variables will be investigated including the effect of various

methods of operation on the rate of activity decrease for the extract hydrogenation catalyst and the effect of hydrogenation reaction severity on the conversion of various product fractions.

Following demonstration of the process with Pittsburgh seam coal, MidContinent and Western coal will be tested and the processing scheme optimized and evaluated for these coal sources.

Investigations will be made to develop and evaluate improvements in unit operations including alternate methods of solids separation such as filtration, centrifugation, and precipitation. The efforts will be directed by the improvement in results obtained. Unit operation studies can be applied to other coal processing investigations and eliminate the necessity for similar test facilities at other locations.

Alternate unit processes will also be tested. Improved catalysts for extract hydrogenation and various fixed bed processes will be tested.

The next phase will include testing of other processes. This will involve a thorough engineering analysis of various process system combinations and applicable process ideas. Some alternates for consideration in integrated operation for coal conversion are the Bureau of Mines fixed bed turbulent flow solution process and the H-Coal process. Potential ways to utilize char will be considered. It may be converted to a clean fuel gas or hydrogen or burned in an electric power generation uit. Selection of alternates will be based on a comparative analysis of the total conversion plant.

There are tentative plans to install a large fixed bed coal gasifier operating at a pressure of 300 p.s.i. It would be designed and fabricated by McDowell-Wellman Engineering Co.

This program will provide OCR with a versatile facility for piloting several different processes and developing the technical information needed for design and prediction of the economics of commercial-scale coal plants expeditiously and economically.

This program is scheduled to cover a 3-year period and estimated costs are as follows:

	1st year	2d year	3d year	Total
OCR cost	$2,550,000	$2,700,000	$2,625,000	$7,875,000
Contractor contribution	340,000	210,000	275,000	825,000
Total program cost	2,890,000	2,910,000	2,900,000	8,700,000

Mrs. HANSEN. What is the current status of the facility?

Mr. HILL. We are using some of the unexpended funds you mentioned earlier to maintain it in a standby condition——

CRESAP PILOT PLANT MAINTENANCE AND GUARD COSTS

Mrs. HANSEN. What are the maintenance costs?

Mr. HILL. $8,000 a month.

This is so it doesn't deteriorate, rust, and so on.

Mrs. HANSEN. When was the last time this facility was operated?

Mr. HILL. April, 1970.

Mrs. HANSEN. Place in the record the total funds appropriated for this project to date. Also indicate how much of this money is presently unobligated.

[The information follows:]

Congress appropriated $23,337,000, but $3 million was withdrawn from this project in fiscal year 1973 by Congress, leaving a net appropriation to date of $20,337,000. The entire sum has been obligated. OCR was directed to use the $3 million that was withdrawn from this project for its other projects in fiscal year 1973.

PROPOSAL TO REACTIVATE AND MODIFY CRESAP FACILITY

Mrs. HANSEN. Please summarize the proposal for the committee.

Mr. HILL. The proposal is simply this. We have had evaluated proposals from four groups of companies to modify and reactivate the Cresap facility not for its initial purpose but to make low-sulfur oil and to develop the other multiprocess equipment that we need for SRC and other programs.

The cost of the program over a 3-year period, we estimate at $8.7 million. To do the same job starting from scratch would cost that much plus $12 million for duplicating the units that are built and operable at Cresap. This kind of work of making low-sulfur oil from coal is critically needed. It would be in my opinion very much to the advantage of the country and to the taxpayer to save that $12 million in current money and utilize those facilities for the purposes that we outlined in that report.

Mrs. HANSEN. You have an additional sum estimated at $6.7 million that would be required to complete the project.

Mr. HILL. That is correct. I am assuming permission would be granted for us to use the $2 million unencumbered. That gives the $8.7 million total. However, we estimate that non-Federal contributed funds would reduce the $6.7 million to about $4.0 million new funds needed.

BENEFITS ATTAINED AT CRESAP PILOT PLANT

Mrs. HANSEN. What has been learned from this project thus far? What has been the longest run of the process?

Mr. HILL. I will have to defer to Neal on that.

Mr. COCHRAN. The longest period of operation was on the order of 10 days under conditions for which the plant was initially designed. Individual sections of the plant ran for periods ranging from 15 to 25 days.

Mr. HILL. It is those individual sections again, involving the dissolution of the coal, the hydrogenation to a low-sulfur liquid, that did operate satisfactorily. The bugs were worked out of that part. It was the last phase that we are not going to reactivate. We are not going to make gasoline.

Mrs. HANSEN. You will be able to use the first three steps?

Mr. HILL. That is correct. We found out how to operate a new technology in those three different areas during the initial part of the operation of the plant.

FUNDS FOR FISCAL YEAR 1974 NOT REQUESTED FOR CRESAP

Mrs. HANSEN. Since there are no funds in the 1974 budget for your proposed program for reactivation of the Cresap pilot plant, am I correct in assuming that the OMB has not approved this proposal, and if not, why not?

Mr. HILL. Here I have to admit my naivete, Madam Chairman. Being new aboard, I didn't know all the steps you have to take, and I did get the request too late to OMB for it to be included in our budget.

Mrs. HANSEN. I have news for you. Almost all the committee's add-ons were impounded.

Mr. HILL. I'm learning awfully fast. Then again, for the record, the same question was asked in the Senate hearings and I received direction to work with Frank Wiles to have it reconsidered.

It is being reconsidered by management in the Interior Department.

Mr. WILES. When we finish with it in the Department we will have to send over to OMB and request a budget amendment be sent up.

It has not gone to the OMB yet and it has not been approved by the Department.

USE OF CRESAP EQUIPMENT IN OTHER PILOT PLANTS

Mrs. HANSEN. Could some or all of the equipment in this plant be used in other OCR pilot plants currently under construction?

Mr. HILL. I suppose some could be redesigned to allow, for example, some of the pumps to be used.

Mrs. HANSEN. What would be the cost?

Mr. HILL. It would be pretty heavy to do the redesigning of the plant, because they would be different sizes.

Mrs. HANSEN. Please insert a cost estimate in the record and indicate what uses could be made of the equipment and where the equipment could be utilized.

Mr. HILL. There would also be a redesign cost of the place to which it would go because the size of the units don't correspond necessarily. It would be strictly an accident if it did.

Mr. COCHRAN. You would have to redesign the other facility.

Mrs. HANSEN. Give us the costs associated with this.

Mr. HILL. We will be glad to furnish those figures.

[The information follows:]

It would cost at least $5 million to remove all equipment from the Cresap plant; rehabilitate, ship, and reinstall usable equipment elsewhere; and dispose of the unused equipment. If equipment of this capacity were consistent with design requirements elsewhere, the major equipment items (such as reactors, compressors, hydrogen generation equipment, and centrifuge) are of sufficient value to justify the cost of dismantling, removal, and reinstallation. Other items (such as buildings, site improvements, service and process piping, and minor equipment items) would have no value or nominal value elsewhere under the OCR program and would result in a net cost for removal and disposal.

Thus, by using the equipment at Cresap, W. Va., rather than elsewhere, there is a saving of $5 million for removal and reinstallation, and an additional saving by avoiding the loss for unused items.

SALARIES AND EXPENSES

Mrs. HANSEN. We will insert justification pages 1 through 29 in the record at this point.

[The pages follow:]

DEPARTMENT OF THE INTERIOR
OFFICE OF COAL RESEARCH
SALARIES AND EXPENSES

Appropriation, 1972	$ 25,530,000		
Supplemental appropriation, 1972.....	5,120,000		
Total appropriation, 1972.....		$ 30,650,000	
Unobligated balance from prior year.....		437,000	
Total available, 1972.....			$31,087,000
Appropriation, 1973		43,490,000	
Unobligated balance from prior year.....		804,000	
Total available 1973.....			44,294,000

SUMMARY OF INCREASES AND DECREASES, 1974

	Base for 1974	Increase 1974	
Increase to provide necessary staff to administer and monitor expanded contract research program--both Federally and non-governmentally funded portions.....	$ 885,000	315,000	
Increase in contract research program...	43,409,000	7,891,000	
Net increase, 1974.....			$ 8,206,000
Budget estimate, 1974.....			52,500,000

DEPARTMENT OF THE INTERIOR
OFFICE OF COAL RESEARCH
SALARIES AND EXPENSES

Analysis by Activity

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Total Appropriation	F.Y. 1973 Unobligated Balance	F.Y. 1973 Adjusted Amount Available
Administration and Contract Supervision	$ 615,000	$ 885,000	$ -	$ 885,000
Contract Research	30,035,000	42,605,000	804,000	43,409,000
Unobligated balance	437,000	-	-	-
Total	31,087,000	43,490,000	804,000	44,294,000

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Amount Available	F.Y. 1974 Estimate	Increase (+) Decrease (-) 1974 comp. with 1973
Administration and Contract Supervision	$ 615,000	$ 885,000	$ 1,200,000	$ +315,000
Contract Research	30,035,000	43,409,000	51,300,000	+7,891,000
Unobligated balance	437,000	-	-	-
Total	31,087,000	44,294,000	52,500,000	+8,206,000

PROGRAM JUSTIFICATION

DEPARTMENT OF THE INTERIOR

OFFICE OF COAL RESEARCH

Fiscal Year 1974

Salaries and Expenses: Fiscal Year 1973, $43,490,000; Fiscal Year 1974, $52,500,000; increase, $9,010,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanations
(1)$ +315,000	+18	$ 1,200,000	55	To provide necessary staff to administer and monitor contract research program.
(2) +8,695,000	--	51,300,000	--	Increase in contract research program for ongoing projects and new projects.
$ +9,010,000	+18			

Cost Factors Involved in Increase

(1) The increase of $315,000 requested for administration and supervision involves an increase of eighteen employees. This will increase the total staff to fifty-five (55) employees. These additional employees are the minimum number necessary to meet the requirements of the greatly expanded technical and administrative program. It is estimated that this increased staff will enable proper monitoring of contractors' performance and activities. The increase is also required for the extensive additional workload entailed in coordinating the expanded program of multi-million cosponsored funding of OCR projects by non-Federal sources. The pilot plant projects will be in critical stages of construction and operation, making it vital to perform adequate monitoring of contract work. There will be additional travel required by OCR technical employees in the performance of these duties, necessitating an increase in the travel budget, and for supporting staff cost requirements.

The $1,200,000 funding proposed for Fiscal Year 1974 for administration and supervision represents 1.7 percent of the total projected contract research program (Government and private contribution), and covers total salaries, personnel benefits, travel, and all miscellaneous items as broken out in the object classification.

	Appropriation for FY-1973	Estimate for FY-1974
Administration and Supervision	885,000	1,200,000

(2) The requested increase of $8,695,000 for the contract research program involves increases for coal liquefaction pilot plants ($2,643,000) and non-pilot plant research ($11,212,000); and a decrease for high-B.t.u. coal gasification ($5,160,000). The OCR program comprises research and development projects in the conversion of coal to clean gaseous fuels, liquid fuels, and electric power; projects for clean coking and coal mining and preparation. Pilot-plant level projects follow the successful achievements in bench-scale and process development stages; and non-pilot plant research includes support-type project efforts that increase the potential for success of pilot plant projects.

Pilot Plant Projects	Appropriation for FY-1973	Estimate for FY-1974
A. Liquefaction		
1. FMC Corporation - Project COED (Char-Oil-Energy-Development) Contract No. 14-32-0001-1212 (operation and maintenance funds for pilot plant)	$ 3,250,000	$ 1,000,000
2. Pittsburg & Midway Coal Mining Co. - Low-Sulfur, Low-Ash Solvent Refined Coal - Contract No. 14-01-0001-495 (continue construction of pilot plant and additional process development)	$ 6,107,000	$ 8,000,000
Liquefaction Totals:	$ 9,357,000	$ 9,000,000
B. Cresap Pilot Plant		
In accordance with the appropriation for FY-1973, the $3.0 million appropriated for use on this project in FY-1972 shall be applied toward other projects in amounts requested for FY-1973	- 3,000,000	--

Pilot Plant Projects (cont.)	Appropriation for FY-1973	Estimate for FY-1974

C. Gasification (high-B.t.u.): Department of the Interior and the American Gas Association (A.G.A.) have entered into an agreement (August 3, 1971) for joint funding, based on the following OCR projects:

1.	Institute of Gas Technology - Contract No. 14-01-0001-381 (operation and maintenance funds for pilot plant--basic construction completed)	$ 4,000,000 (+2,000,000)	4,670,000 (+2,330,000)
2.	Consol - Lignite Gasification Project - Contract No. 14-01-0001-415 (operation and maintenance funds for pilot plant--basic construction completed)	2,730,000 (+1,370,000)	4,670,000 (+2,330,000)
3.	Bituminous Coal Research, Inc. - "Two-Stage, Super-Pressure" Process - Contract No. 14-32-0001-1207 (continuation of construction of pilot plant)	6,400,000 (+3,200,000)	1,330,000 (+ 670,000)
* 4.	Institute of Gas Technology - Steam-Iron Process	5,180,000 (+2,560,000)	4,670,000 (+2,330,000)
* 5.	Chem Systems, Inc. - Liquid Phase Methanation	1,010,000 (+ 490,000)	340,000 (+ 160,000)
* 6.	Lurgi Gasifier Project	1,600,000 (+ 800,000)	--
* 7.	Battelle Memorial Institute, Inc. - Hydrogen/Synthesis Gas	1,670,000 (+ 830,000)	670,000 (+ 330,000)
* 8.	Applied Technology, Inc. - Molten Iron Process	1,670,000 (+ 830,000)	2,320,000 (+1,180,000)
* 9.	Process Selection, Evaluation, Preliminary Designs and Engineering Assessments	900,000 (+ 440,000)	1,330,000 (+ 670,000)
	Gasification Totals:	25,160,000 (+12,520,000)	20,000,000 (+10,000,000)
	Pilot Plant Subtotal:	34,517,000 (+12,520,000)	29,000,000 (+10,000,000)

* Each one is at the non-pilot plant level; the work performed will, if successful, be incorporated into existing pilot plant projects.

(+ Estimated industry contribution).

Non-Pilot Plant Projects	Appropriation for FY-1973	Estimate for FY-1974
A. Funds are requested by the Office of Coal Research for FY-1974 for research on eleven (11) non-pilot plant projects as follows:		
1. Pennsylvania State University	$ 400,000 (+ 40,000)	300,000 (+ 30,000)
2. University of North Dakota	-- *	200,000
3. University of Utah	360,000 (+ 45,000)	250,000 (+ 35,000)
4. Magnetohydrodynamic (MHD) Coal/Power Research	3,500,000 (+ 530,000)	3,750,000 (+ 650,000)
5. Evaluation for Liquefaction Projects ...	650,000	1,000,000
6. Fluidized-Bed Boiler Project	500,000	2,700,000
7. Clean Coke and Fuels Project	1,000,000 (+ 450,000)	1,500,000 (+ 645,000)
8. Colorado School of Mines (Desulfurizing Coal)	100,000 (+ 28,000)	100,000 (--)
9. Low-B.t.u. Fuel Gas/Power Cycles Research	3,000,000 (+1,000,000)	11,500,000 (+4,000,000)
10. "COG" Multiprocess Research Project	500,00	500,000
11. Coal Mining Systems Project	--	500,000
B. No funds are requested for FY-1974 for the following:		
1. Iowa State University - Contract No. 14-01-0001-479	200,000	--
2. Virginia Polytechnic Institute - Contract No. 14-01-0001-410	200,000	--
3. West Virginia University (Waste Utilization) Contract No. 14-01-0001-488	478,000 (+ 10,000)	-- (--)
4. University of Wyoming - Contract No. 14-01-0001-1196	200,000	--
Non-Pilot Plant Subtotal	11,088,000 (+ 2,103,000)	22,300,000 (+ 5,360,000)

+ Estimated industry contribution.
* Ongoing in FY-1973 with funds previously appropriated.

A summary of OCR's programs for Fiscal Year 1973 and 1974 is as follows:

Activity	FY-1973	Requested Increase	FY-1974	Estimated Industry Contribution
Pilot Plant Projects..	$31,517,000*	($ 2,517,000)*	$29,000,000	$ 10,000,000
Non-Pilot Plant Proj..	11,088,000	11,212,000	22,300,000	5,360,000
Administration and Supervision.....	885,000	315,000	1,200,000	--
Total:	$ 43,490,000	$ 9,010,000	$ 52,500,000	$ 15,360,000

The Office of Coal Research continues to work closely with its General Technical Advisory Committee (GTAC), a distinguished, able, and technically qualified group of advisers drawn from industry, science, education, and labor, and appointed by the Secretary of the Interior. This group, as well as other non-Governmental technical consultants, assists in the review of ongoing work and new work. The budget for FY-1974 reflects detailed discussions with the GTAC relative to individual projects as well as areas of research effort for the proposed areas of work to be covered.

* Reflects adjustment of $3 million appropriated in FY-1972 for use on Cresap Pilot Plant project.

NATIONAL NEED FOR OCR RESEARCH PROJECTS

The Coal Research Act requires the Office of Coal Research to contract for research and development of new and more efficient methods of mining, preparing, and utilizing coal, and to sponsor and cosponsor such research.

The Office devotes its best efforts to the development of new technologies and processes which will enable the Nation's abundant coal resources to be secure, dependable sources of pipeline gas, clean liquid fuels, and clean and efficient generation of electric power, and related clean energy purposes.

The aspects of insuring a clean environment while using coal as a source of energy in those various forms, is an important consideration in all of the research projects.

Recent projections of energy demand (Table 1) indicate that the total demand for energy in the United States is expected to increase to 116,630 trillion B.t.u.'s by 1985, compared with 68,989 trillion in 1971, an increase of almost 70 percent.

Projected demand for pipeline gas indicates an increase by 1985 of 25 percent, and a petroleum demand increase of 66 percent. Demand for electric power supplied by utilities is estimated to increase by 156 percent.

The increasing dependency of the United States on less secure sources (see Excerpt) and the increasing balance of payments problems have greatly enhanced the national need of R & D for conversion of coal to pipeline (high-B.t.u.) gas, low-B.t.u. fuel gas, clean liquid fuels, and clean electric generation:

a. By 1985, about 25 percent of pipeline gas consumed in the United States may be imported unless a significant proportion can be met by synthetic gas from coal. Annual additions to natural gas reserves have not kept pace with increasing demand for several years.

b. It is estimated that by 1985, domestic petroleum would supply only about 47 percent of the total U.S. petroleum demand, compared with 74 percent in 1971. Thus, 53 percent would be imported or synthetic. This also assumes that domestic petroleum supply will increase by about 5 percent, whereas there is considerable opinion that domestic supply may decline by 1985.

Clean methods of generating electricity are important for curtailing the demand for imported low-sulfur fuel oils, since environmental controls are barring the use of higher sulfur coals for electric generation, and the substitution of low-sulfur oils is accelerating.

TABLE 1

United States consumption for energy resources by major sources, 1971, actual, with projections to the year 2000

	1971	1975	1980	1985	2000
Petroleum (includes natural gas liquids)					
Million barrels	5,523	6,340	7,615	9,140	12,985
Million barrels per day	15.1	17.4	20.9	25.0	35.6
Trillion B.t.u.'s	30,492	35,090	42,190	50,700	71,380
Percent of gross energy inputs	44.1	43.8	43.9	43.5	37.2
Natural Gas					
Billion cubic feet	22,050	24,462	26,169	27,537	32,959
Trillion B.t.u.'s	22,734	25,220	26,980	28,390	33,980
Percent of gross energy inputs	33.0	31.4	28.1	24.3	17.7
Coal (bituminous, anthracite, lignite)					
Thousand short tons	510,800	565,000	665,000	893,000	1,310,000
Trillion B.t.u.'s	12,560	13,825	16,140	21,470	31,360
Percent of gross energy inputs	18.2	17.2	16.8	18.4	16.3
Hydropower					
Billion kilowatt-hours	266.3	350	420	470	700
Trillion B.t.u.'s	2,798	3,570	3,990	4,320	5,950
Percent of gross energy inputs	4.1	4.4	4.2	3.7	3.1
Nuclear power					
Billion kilowatt-hours	37.9	240	630	1,130	5,470
Trillion B.t.u.'s	405	2,560	6,720	11,750	49,230
Percent of gross energy inputs	.6	3.2	7.0	10.1	25.7
Total Gross Energy Inputs					
Trillion B.t.u.'s	68,989	80,265	96,020	116,630	191,900

Source: "U.S. Energy Through the Year 2000," U.S. Department of the Interior, December 1972, p.23

EXCERPT: "U.S. ENERGY THROUGH THE YEAR 2000," DECEMBER 1972, pp. 10 and 11:

"In discussing the adequacy of resources it appears that, for hydropower, (which includes pumped storage) there is some finite limit to development which cannot be exceeded. The above forecasts are based on limits set by the availability of sites, and by environmental and economic considerations. If the scenario developed by the Atomic Energy Commission (AEC) for the introduction of better reactors (both the High Temperature Gas Reactor and the Liquid Metal Fast Breeder Reactor) is realized then the above outputs of nuclear power will be attained. Any significant problems encountered in construction of nuclear powerplants and in supply supporting services will require that fossil fuels take up the slack. This would mean a corresponding increase in consumption of fossil fuels.

"It is in the fossil fuel area that problems develop. Coal resources appear adequate for the time period contemplated although problems do exist vis-a-vis environmental and capital considerations, but these can be overcome. Domestic natural gas and petroleum will, however, have to be supplemented. For natural gas the supply and necessary supplementations are as follows (all figures in trillions of Btu):

	1971 1/	1975	1980	1985	2000
Domestic supply	21,810	22,640	22,960	22,510	22,850
Percent of total	96.0	89.8	82.9	74.1	57.9
Synthetic gas	-	-	700	2,000	5,500
Percent of total	-	-	2.6	6.6	13.9
Gas Imports 2/	924	2,580	4,020	5,880	11,130
Percent of total	4.0	10.2	14.5	19.3	28.2
Total	22,734	25,220	27,680	30,390	39,480

1/ Actual
2/ Includes LNG & pipeline imports (principally from Canada)

"To achieve production of the synthetic gas forecasted will require considerable effort. Further research and development will be necessary, capital necessary for construction of plants must be forthcoming, and the environmental problems associated with coal mining must be solved. Failure to do so implies a shortfall in the gaseous fuels necessary in the future.

"The problem is more acute for petroleum. The domestic supply envisaged and the supplementations necessary are spelled out in the following table (all figures in trillions of Btu):

	1971	1975	1980	1985	2000
Domestic supply	22,569	22,130	23,770	23,600	21,220
Percent of total	74.0	63.1	56.3	46.6	29.7
Supplemental supplies	7,923	12,960	18,420	27,100	50,160
Percent of total	26.0	36.9	43.7	53.4	70.3
Total	30,492	35,090	42,190	50,700	71,380

I. Pilot Plant Projects

Pilot plants do not represent a difficult environmental problem because of their relatively small size, limited operating life, and close control. Nevertheless, such plants comply with all pertinent Federal, State, and local environmental regulations. Eventual full-scale coal gasification plants will be required to comply with rigorous environmental regulations. Pilot plant emissions (thermal and chemical) are closely monitored, studied, and controlled. The objective is to establish practical methods which minimize the use of cooling water (through the use of evaporative cooling) and keep all emissions to negligible levels that are compatible with environmental requirements. The only discharges to the atmosphere are harmless water vapor, carbon dioxide, and a minimal amount of heat. The environmental needs of the country are doubly served through the greater availability of clean fuel, cleanly produced.

A. Coal Gasification (High-B.t.u.)

Pipeline gas from coal contributes to cleaner air, conservation of chemicals in coal prior to combustion, meeting the increasing demand for pipeline quality gas at reasonable prices, and helps avoid undue reliance on less secure sources of oil and liquefied natural gas (LNG) from foreign lands, with incidental foreign exchange benefits as well.

New discoveries of natural gas are not keeping pace with rising demand. Pollution controls are intensifying demand for gas as a clean fuel for electric generation and industrial use--as a substitute for high-sulfur coals. The shortage of domestic low-sulfur fuels is causing added importation of low-sulfur oils.

In 1971, OCR and the American Gas Association entered into four-year agreement covering three coal gasification pilot plant projects and six supporting projects to jointly provide funding (two-thirds by Government and one-third by industry) of $30 million annually beginning with FY-1972. The objective: the completion of this pilot plant program by FY-1975 to permit the early design of a demonstration plant based on the best results of the pilot plant program. It is estimated that this research program should be able to demonstrate the commercial feasibility of coal gasification by the end of FY-1979.

During the pilot plant phase of this jointly-funded coal gasification research program, OCR's three ongoing pilot plant projects will be pursued, and successful results from at least six supporting research projects will be incorporated into these three pilot plants. The six supporting projects are intended to increase the technological feasibility of coal gasification, as well as to reduce the unit cost for increased economic feasibility.

The budget proposed for FY-1974 for high-B.t.u. coal gasification is $20 million, compared with $25,160,000 appropriated for FY-1973. This conforms with the four-year OCR/A.G.A. agreement, the appropriations for the first two years (FY-1972 and FY-1973) averaging $20 million each. FY-1974 is the third year covered by the agreement.

In addition to providing for one-third funding by A.G.A., the agreement states that ownership of all patents and equipment, such as that contained in pilot plants, remain in the Government. The agreement establishes an organization and procedures for overseeing the joint program by an Operating Committee and a Steering Committee.

A survey by the American Gas Association has shown that there are 176 potential sites in the United States which could accommodate plants capable of producing 250 million cubic feet of gas per day.

	FY-1973	FY-1974	
	($ thousands)		
1. Hydrogasification Process	4,000	4,670	
(Institute of Gas Technology)	(+2,000)	(+2,330)	A.G.A.

The HYGAS pilot plant for converting coal to pipeline-quality gas is located in Chicago, Illinois. It is designed to convert 75 tons of coal per day to 1.5 million cubic feet of high-B.t.u. gas. Construction of the pilot plant was initiated in August, 1969; the plant was dedicated on October 29, 1970. Construction was completed by Procon Incorporated early in 1971. The pilot plant is being tested in sections. The principal part of the pilot plant, the hydrogasifier, has already operated successfully.

The FY-1974 funding request, coupled with funds from A.G.A. will permit continuation of the research and development program already underway.

The HYGAS gasifier produces the largest fraction of methane in its synthetic gas compared with other processes, but requires a separate outside source of hydrogen. Among the objectives of the pilot plant program are the elimination of pretreatment and the perfection of the internal coal cycling system through the beds. At the HYGAS pilot plant, at least three different hydrogen supply systems will be investigated and all hydrogenmaking systems that are tested will use coal, or partially gasified coal (char), plus water in the form of steam, as raw materials.

The integration of all sections of the HYGAS process will be accomplished in two phases. First, hydrogen for the hydrogasifier will be supplied from a commercial natural gas reformer; during this phase, the 2-MW electrothermal gasifier will undergo testing. Second, the electrothermal gasifier will be integrated with the hydrogasifier, and the hydrogen plant retired; during this phase the HYGAS process will be completely coal-based, except for the generation of electric power from the electrothermal gasifier char.

2. CO_2 Acceptor Process	2,730	4,670	
(Consolidation Coal Company)	(+1,370)	(+2,330)	A.G.A.

The pilot plant for the CO_2 Acceptor Process for conversion of lignite to pipeline quality gas, located at Rapid City, South Dakota, is being tested in sections. The pilot plant has operated in sections and as an integrated whole in a test operational mode on an intermittent basis during the last several months. Regular operation with collection of data should begin within the near future.

The FY-1974 funding estimate will, together with A.G.A. funds, permit continuation of the research and development program underway and planned for the next fiscal year.

The scope of the initial pilot operations is limited to the processing of lignite into raw synthesis gas. Provision is made for the subsequent addition of gas purification and methanation facilities.

The $9 million pilot plant at Rapid City, South Dakota, was dedicated in August 1972. Break-in operations are underway. The pilot plant was constructed by Stearns-Roger Corporation, and they are operating it under a subcontract to Consolidation Coal Company.

In the CO_2 Acceptor Process calcined dolomite is circulated through a fluidized bed of lignite char operating under gasification conditions. The reaction of dolomite with carbon dioxide, one of the gasification reaction products, liberates heat sufficient to sustain the endothermic carbon-steam reaction, and also results in a product gas enriched in methane and hydrogen. Spent dolomite from the gasification zone is calcined in a separate regenerator using air and high-ash char from gasification as the source of fuel, thus avoiding the need for an expensive oxygen plant.

	FY-1973	FY-1974	
	($ thousands)		

The pilot plant is designed to operate at pressures of 150 to 300 p.s.i.g. and temperatures up to 1,800° F. The initial phases of the pilot plant program will be devoted to the development of operating skills in solids and gas flow control under nongasifying conditions.

Because of temperature conditions of the process, it appears that the CO_2 Acceptor Process is best suited to the more reactive coals, such as lignite and subbituminous, although further development is expected to adapt the process to higher ranks of coal.

3. BI-GAS Process	6,400	1,330	
(Bituminous Coal Research, Inc.)	(+3,200)	(+ 670)	A.G.A.

Construction is about to begin near Homer City, Pennsylvania, on a pilot plant based on the BI-GAS Process. The design of a fully integrated 5-ton-per-hour plant was completed in December 1971.

The BI-GAS gasifier does not require pretreatment and operates at the highest temperature of any gasifier, in that the ash must be melted and removed as molten slag from the bottom. Pilot plant operation is required to resolve the associated problems. The gasifier requires pure oxygen to produce a nitrogen-free synthesis gas, but because of its two-stage nature it produces a higher percentage of methane than other directly blown gasifiers. Bench-scale experiments indicate that BI-GAS has the potential for high-volume yield--more gas per unit of gasifier volume--which is to be investigated during pilot plant operation.

The initial phase of the project was a survey of available and proposed coal gasification processes; this survey resulted in the conceptual design of a two-stage, superpressure, oxygen-blown system for producing high-B.t.u. pipeline gas from coal.

Development work proceeded to successful operation of a process and equipment development unit (PEDU) using about 100 pounds of coal per hour. The installation, built during 1969, was operated through September 1971, using coals ranging in rank from lignite to high-volatile "A" bituminous coal to obtain performance and engineering data for further scaleup. Yields of methane in excess of those anticipated have been obtained without associated caking or agglomeration problems. The results from the experimental program have confirmed that methane could be produced in high yield directly from coal in an entrained gasifier.

With the completion of the 100-pound-per-hour PEDU test program, sufficient information is available for the initial design and construction of a fully integrated gasifier.

Concurrently, laboratory work continues in support of the total program. Methods are being investigated for catalytic methanation of the product gas to raise the heat value to that of pipeline gas.

The design of a process and development unit for studying fluidized-bed catalytic methanation was completed in 1971. The unit may be operational early in 1973. Process and equipment development also was initiated on the fluidized-bed gasification of char and coal to explore the use of fluidized-bed techniques for using chars produced in other coal conversion processes. The design of a 100-pound-per-hour fluidized-bed gasification unit was completed, and the unit is expected to be placed in operation early in 1973.

	FY-1973	FY-1974	
	($ thousands)		

4. Additional Projects Essential for Technological and Economic Feasibility of Coal Gasification Processes

Because of interdependency, the six additional selected projects are vital. They add comparatively little to the total cost of the program, and yet their potential contribution to technological and economic feasibility is critical.

a. Steam-Iron Process	5,180	4,670	
(Institute of Gas Technology)	(+2,560)	(+2,330)	A.G.A.

The evaluation contractor (C F Braun) has completed an engineering evaluation of this process, and has recommended that this research should be undertaken. This is a unique process in that a pure hydrogen-steam mixture is produced for the HYGAS hydrogasifier. Combining these processes theoretically produces the lowest cost synthetic gas.

Hydrogen supply is one of the keys to successful development of the HYGAS process (as well as for processes that yield synthetic liquid fuels). The steam-iron system represents an approach to the reduction of a hydrogen steam mixture as an alternate (in the HYGAS process) to the electrothermal reactor and oxygen system. The IGT had developed this process to the pilot plant stage (under sponsorship of the Fuel Gas Associates) and has expended approximately $1 million, including preliminary design studies.

b. Liquid Phase Methanation	1,010	340	
(Chem Systems, Inc.)	(+ 490)	(+160)	A.G.A.

This research is now being pursued under contract. It is a unique process to accomplish the methanation step in the liquid phase, which, if successful, would greatly enhance the required heat transfer.

The "methanation" step is another key to all pipeline gas processes. In methanation, hydrogen and carbon monoxide are converted to methane, the desired end product. This project for "liquid phase" methanation system, will first be tested on bench scale to determine if it should be incorporated into the pilot plant work.

No commercial methanation system is now designed specifically for methanating gas produced from coal. Today's processes are designed for methanating gas made from petroleum and the like which contains less than 4 percent carbon monoxide. The large volumes of carbon monoxide and hydrogen produced in the coal gasifiers release huge quantities of heat which require further development of existing processes or new processes to cope with the problem.

To achieve this goal, several different processes will be piloted at existing plant sites. The HYGAS process will pilot a cold gas recycle process. The CO_2 Acceptor Process will pilot a packed tube process. The BI-GAS project will pilot a fluid bed process. All of these processes involve methanation in the vapor phase.

c. Lurgi Gasifier Project	1,600	-	
	(+ 800)	(-)	A.G.A.

Carryover funds from FY-1973 are sufficient to complete this project. No FY-1974 funds are required.

The Lurgi gasifier is the only commercially available gasifier suitable for the first step in producing pipeline-quality gas from coal, but it has limited applicability due to the problems of scaling up and preparing the

	FY-1973	FY-1974	
	($ thousands)		

proper size of coal required. Under this project an existing Lurgi gasifier will be optimized for U.S. coals.

The fixed bed design of this gasifier results in reactors of small size and low coal throughput which in turn results in expensive gas. The process appears good for producing a low-B.t.u. gas from subbituminous coal. It is doubtful whether other coal types can be used at this time. If a modification of this design was successful, it would enable private interests to build commercial Lurgi plants anywhere in the country to meet the demand for additional gas sooner--even though it would be more expensive.

The Bureau of Mines has tested a "rabble-arm" concept which appears promising for use in the Lurgi gasifier to increase the range of types of coals it would gasify and also increase the percentage of coal fines allowable in the gasifier. Thus, there is an immediate need to demonstrate the rabble-arm concept on a commercial scale and so establish the range of U.S. coals that Lurgi is capable of gasifying.

d.	Hydrogen/Synthesis Gas (Battelle Memorial Institute)	1,670 (+ 830)	670 (+330)	A.G.A.

This project is proceeding to contract, after favorable evaluation by the evaluation-contractor, C F Braun & Co.

The project is important to all other gasification projects. It is based on prior work done by Battelle Memorial Institute for Union Carbide Corporation, and uses a unique fluidized bed to produce a partially clean gas, thus reducing the cost and effort of the gas cleanup step. Either hydrogen or synthesis gas can be produced and delivered at gasifier pressure.

This project is unique in that an agglomerated ash formed in an air-blown reactor produces heat for the gasifier. Moreover, the agglomerating tendency of the ash leaves the off-gas from the air-blown reactor clean enough to drive a gas turbine directly to produce shaft horsepower which compresses air for the process and pressurizes the product gas. This process can produce hydrogen or a hydrogen-carbon monoxide mixture for methanation.

e.	Molten-Iron Process (Applied Technology, Inc.)	1,670 (+ 830)	2,320 (+1,180)	A.G.A.

This project has been favorably evaluated by evaluation-contractor C F Braun & Co. and is proceeding to contract.

The project is for development of a combustor capable of gasifying coal without generating a sulfur oxide pollution problem, by utilizing a molten-iron bath with air or oxygen. (Small pilot work was done on this process for another purpose--elimination of sulfur from coal for power generation--and was sponsored by the Department of Health, Education and Welfare.)

This process is uniquely different from all others in the program in that the gasifier is a bath of molten iron. Coal is dissolved in the molten iron. Steam and oxygen are introduced in the iron. Iron has a strong affinity for both carbon and sulfur; the dissolved sulfur migrates from the iron to a molten slag layer floating on top of the iron bath, where the sulfur reacts with the slag to produce calcium sulfide. The calcium sulfide is removed, and elemental sulfur is recovered from it. The carbon dissolved in the molten iron is oxidized to carbon monoxide with the blown-in air or oxygen.

	FY-1973	FY-1974	
	($ thousands)		

Product gases are essentially methane, carbon monoxide and hydrogen. With a minimum of gas cleanup, the product gas is methanated to pipeline-quality gas. Byproducts are iron and slag for roadbed material, either with or without processing for chemicals. This is the only process suitable for all coals including anthracite and lignite.

f.	Process Selection, Evaluations, Designs, and Engineering Assessments (C F Braun & Co)	900 (+440)	1,330 (+ 670)	A.G.A.

This contractor is evaluating proposed research, and assists in the continuous evaluations of all phases of the high-B.t.u. coal gasification program.

It is essential that independent engineering evaluations be made as each process or process-step is developed. The contractor will prepare engineering designs and cost estimates for processes and process-variations, projecting from these figures a final cost figure for the product-gas. (Additionally, this work will facilitate termination of projects if they do not meet the technical and economic yardsticks established among the alternates.)

A highly qualified, unbiased engineering firm is vital to the program for evaluation of the various processes and components of processes and to assist in the decision-making procedure to insure that the best results of the program are selected for commercialization in order to produce pipeline-quality gas at the lowest possible cost.

Total for high-B.t.u. gasification	25,160	20,000	
	(+12,520)	(+10,000)	A.G.A.

B. Coal Liquefaction

Coal liquefaction will make major contributions to cleaner air, conserve chemicals prior to combustion, and help meet the increasing demand for petroleum and liquid fuels with reduced reliance on imported oil. Such research is a vital part of meeting the Nation's total energy needs for the future.

Coal is abundant in the Eastern States and in the Western States, and high-sulfur coals will be increasingly available for liquefaction as their use for electric generation is limited by pollution controls.

Pollution controls are intensifying demand for clean imported oil, because domestic supplies of low-sulfur fuels are inadequate to substitute for barred high-sulfur fuels.

By 1985 imported oil may represent about 53 percent of total consumed in the "lower 48 States" compared with 26 percent in 1971. (By 1980 the United States is expected to import as much as 8 million barrels of oil per day, compared with 3.4 million barrels in 1970.) An accelerating proportion of oil imports will be supplied from North Africa and the Middle East. Eastern States are already overdependent on foreign oil sources. Each year's delay in developing a domestic coal liquefaction alternative is expensive (in terms of bargaining for foreign oil supplies).

The increasing reliance on imported oil makes domestic alternatives of synthetic oils from coal urgent to avoid excessive balance of payments problems and undue reliance on less secure sources. The President's "Clean Energy" message of

June 4, 1971, made favorable mention of coal liquefaction research.

The major elements for OCR's coal liquefaction program comprise three pilot plants, which may be modified on the basis of supporting research projects, with several support research projects to improve the technology and further reduce unit-costs. The COED pilot plant (based on successful bench-scale research, and process development) is in continuous operation providing engineering data for scaleup, which is expected to be completed in FY-1974. A pilot plant for solvent refining (low-ash, low-sulfur) will begin construction shortly at Fort Lewis (Tacoma), Washington, (based on successful bench-scale research and process development). Several support research projects are included in the program to improve the economics of the processes and to bring about economic feasibility of coal liquefaction at an earlier date.

The OCR program is beginning to include a "COG" concept that will reduce the unit-costs for producing liquids, gas, and solid fuel by combining into a single process several separate projects which have complementary characteristics. At the outset a combination of the Solvent Refining Coal Project and the BI-GAS project is expected to reduce the need for hydrogen in coal processing.

The time frame for the coal liquefaction program, assuming timely funding, is based on completion of the construction and operation of the Solvent Refined Coal pilot plant about the same time as the BI-GAS pilot plant, so as to permit the design of a "COG" plant 1/ based on the engineering data from these two pilot plants in combinations, as well as additional COG-support research.

Given coordination of the liquefaction program and the gasification program, it is hoped that the design stage for the "COG" demonstration plant can take place in 1976.

Pursuit of the "COG" concept may provide the technology for commercial liquefaction by 1980.

	FY-1973	FY-1974
	($ thousands)	
1. Char-Oil-Energy-Development Pilot Plant (FMC Corporation)	3,250	1,000

OCR's Project COED pilot plant at Princeton, New Jersey, is in continuous operation, and is providing engineering data for scaleup purposes. The process consists of heating coal in a series of vessels to a top temperature of about 1500° F. In the process, the coal is volatilized, producing a tar-like "oil," a gas with a heating value in the range of 500 B.t.u.'s per cubic foot after cleanup, and a residual char (that can be gasified to produce additional gas, or burned, or used to produce hydrogen for hydrogenating the oil).

Project COED has been under development at Princeton, New Jersey, since 1962. The pyrolysis-derived oil is also hydrotreated to produce a valuable synthetic crude oil.

The pilot plant is designed to process 36 tons of coal per day and hydrotreat 30 barrels of coal-derived oil per day. The plant is fully operational at the throughput capacities of coal and oil for which it was designed. Experimental programs in process variables, process equipment modifications, and coal evaluations are now underway.

1/ For further explanation of the "COG" concept see description of the "COG multi-process research" project.

	FY-1973	FY-1974
	($ thousands)	

In the COED process, coal is upgraded to three useful products by heating in multistage fluidized beds. In these stages, dried and crushed coal is shock heated to successively higher temperatures until a major fraction of the volatile matter of the coal is evolved. The optimum temperatures and the number of stages vary with the types of coal.

After pyrolysis, the char from the fourth stage can be cooled and collected as a product or it can be gasified. The volatiles and vapors from the first and second stages are condensed and recovered. The oil product is collected and sent to the hydrotreater for conversion to a high-quality synthetic crude oil. In a commercial plant, the gas would be collected and subjected to further processing to produce a salable product. Hydrogen for the oil hydrotreating could be produced from this gas or from the char. The residual char would be used as a powerplant fuel or, preferably, be gasified.

Projected economics for a commercial COED plant are encouraging for certain geographic areas.

FMC Corporation is engaged in continuation of the development of this process. As part of the additional work, selected coals will be processed, and equipment changes made to improve operability and to lower the projected costs.

2.	Solvent Refined Coal Pilot Plant (Pittsburg & Midway Coal Mining Co.)	6,107	8,000

Solvent refined coal (low-ash and low-sulfur) can be used in either liquid or solid form, the form depending on the amount of solvent left in the product. Accordingly, this product is a major part of OCR's liquefaction research program, as well as a potential source of low-sulfur, low-ash solid fuel for existing powerplants and industrial installations.

The national need for a clean solid fuel for existing powerplants is increasingly apparent as pollution controls are applied more stringently. Powerplants are being compelled either to bring low-sulfur coals very long distances or to import low-sulfur oils. When only a few miles away vast high-sulfur coal reserves are available for processing. (Imported oil for about 75 cents per million B.t.u.'s is being substituted for 22-cent coal in Chicago, with consequent reflection on cost of electric power to the consumer.)

A process for solvent refining of coal has been ready for pilot plant stage for several years. The process was developed under an OCR contract with Spencer Chemical Company. Ground-breaking for the pilot plant took place at Fort Lewis (Tacoma), Washington, in October 1972.

In the solvent refining process, coal is dissolved in a heavy aromatic solvent under moderate hydrogen pressure. The solution is filtered (to remove ash and insoluble organic material) and fractionated to recover the solvent. Smal quantities of hydrocarbon gases and light liquids are produced, along with heavy organic material. Solvent Refined Coal has a melting point of about 350° F. and contains about 0.1 percent ash and less than 1 percent sulfur. Its heating value is about 16,000 B.t.u.'s per pound regardless of the quality of the coal feedstock. The solvent refining process removes all of the inorganic sulfur and 60 to 70 percent of the organic sulfur in the coal.

Bench-scale development work is continuing to determine the effect of operating conditions on the solution of various coals, from lignites to high-volatile bituminous in rank. The objective of this work is to determine favorable operating conditions for initial pilot plant runs and to develop analytical techniques for process control. Additional work is being carried out through several subcon-

	FY-1973	FY-1974
	($ thousands)	

tracts to study subjects related to the Solvent Refined Coal process.

In preparation for use of solvent refined coal for coal liquefaction, under a subcontract an economic evaluation has been completed for a conceptual refinery that is a combination of the Solvent Refined Coal process and the Bituminous Coal Research BI-GAS process. The combined process includes hydrocracking and hydrotreating of the solvent refined coal to yield a light refinery liquid. This conceptual refinery is called COG (Coal-Oil-Gas) refinery. The first phase of the evaluation was to find the optimum combination of processes to make 100,000 barrels per day of light refinery liquids and at least 250 million cubic feet per day of synthetic high-B.t.u. gas from a bituminous coal. The second phase of the study included a detailed design and economic evaluation of the COG refinery.

Total liquefaction pilot plant research	9,357	9,000

II. Non-Pilot Plant Projects

OCR's program includes projects which are not at the pilot plant level of research either (a) because they have not reached pilot plant stage, or (b) because they will not require pilot plant level of expenditure before they can be beneficially applied. These include support research which may improve the economics of ongoing pilot plant projects, whether by improving the process or by providing opportunities for byproduct credits. Through such projects, major gains in technological and economic feasibility may be achieved for relatively small expenditures.

A. Support for Coal Liquefaction	400	-

1. Two projects for support of liquefaction are being completed in FY-1973, or are being suspended at this time: (a) Multicatalyst Research (University of Wyoming); and (b) Electrothermal Processing (Iowa State University). These were funded in FY-1973 for a total of $400,000.

2. Western Coals Adaptation (University of Utah)	360 (+ 45)	250 (+ 35)

The process being developed by this project indicates a potential short residence time and a corresponding high efficiency in utilizing capacity for clean liquefaction and gasification. High conversion yields are also indicated. Lower capacity costs can be a major contribution to lower unit costs for products of coal conversion. This project originally emphasized coal liquefaction, but in view of the supply situation of natural gas the objective has been broadened to include coal gasification problems.

A second generation hydrogenation reactor is nearing completion of construction. It is based on a fully turbulent-flow, replacing movement of catalyst-treated coal by a medium-pressure hydrogen stream; this improvement is based on results of preliminary studies. This new reactor is also designed for temperatures high enough to obtain improved gas yields. Both reactors will be in use, and by the end of FY-1973 it is anticipated that studies involving reactor tubes of less than 1/2" diameter should be completed. Studies for the 1/2" reactor tube will be pursued in FY-1974.

Studies supporting coal conversion are in progress and include application of the catalyst, recovery of the catalyst, basic related analysis, and studies for up-

	FY-1973	FY-1974
	($ thousands)	

grading the product. These studies will keep pace with development of the main hydrogenation reactor. Engineering data will be developed during FY-1973 for use in designing more advanced stages of research.

Research utilizing Western U.S. coals in a direct first-stage hydrogenation process to yield synthetic crude oil, solid char fuel and fuel gases is the main objective of this project. Certain properties of this raw synthetic crude (such as low hydrogen content, high oxygen content, sulfur content, etc.) would prohibit feeding this material into a conventional oil refinery. A second stage, therefore, involves hydrotreating to yield a synthetic crude oil which could serve as a feedstock for a modern conventional refinery. Current investigations are also being conducted relative to the production of high-quality gasoline in substantial yields from Western coals.

It is necessary to utilize a proper balance of coal feed-rate, hydrogen feed-rate, tube diameter and reaction temperature in order to avoid char buildup. The specific effect of each of these variables has not been fully investigated; however, results to date are encouraging.

At present, the choice of catalysts is limited by available techniques for impregnating the catalyst on the coal and by catalyst loss. Investigations are being conducted to find additional and improved techniques for establishing intimate contact between catalyst and reactants.

A coal hydrogenation reactor has been designed to operate in the desired range of hydrogen pressure and temperature.

Work on the development of dual functional catalysts for hydrocracking of coal oils is being done. The object: to develop catalysts having appropriate activity and selectivity necessary for the treatment of coal oils. This work is now being directed toward development of more efficient reactor systems, more active and selective catalysts, and the production of high-octane gasoline of moderate aromatic content, low-sulfur fuel oils, and aromatic chemicals.

Supporting work is being conducted in the areas of reaction kinetics and mechanisms of the processes involved in conversion of coal to liquid fuels, chemicals, and gaseous fuels.

3.	"COG" Multiprocess Research	500	500

Engineering studies are needed as to yield and economics for combinations of complementary processes, as well as for individual processes, in accordance with the "COG" concept.

The "COG" concept for coal liquefaction is aimed at further reducing the unit costs by incorporating complementary gasification and electric generation processes into a "COG" complex, with end-products to include: (1) low-sulfur, low-ash solid fuel for powerplants; (2) oil; and (3) pipeline gas.[1/] To further enhance the economics, special coal preparation studies are proposed. To reduce costs and avoid environmental impediments to commercial application, research for related methods of large-scale mining and preparation is required, taking into consideration all environmental factors. In the "COG" concept the ash, removed by filtration in the Solvent Refined Coal process, is introduced into the BI-GAS process which serves as a source of hydrogen for the Solvent Refined Coal process and subsequent hydrogenation. The result is high-B.t.u. pipeline gas without the

1/ A "COG" type plant consuming 10,000 tons of coal daily will produce approximately 17,500 barrels of oil daily, 60 million cubic feet of high-B.t.u. pipeline gas (at 1,065 B.t.u.'s per cubic foot) as well as a substantial volume of low-sulfur low-ash solid fuel, at reasonably competitive cost.

	FY-1973	FY-1974
	($ thousands)	

normally difficult and expensive methanation stage, and the net hydrogen requirement of the combined (COG) process is substantially reduced. The liquid product would be about 60 percent of the output in B.t.u.'s. Other economies may be achieved by interrelating other complementary processes.

The possibility of designing a commercial-size "COG" plant directly from pilot plant engineering data is under consideration.

Further development of the "COG" concept involves incorporating results from the COED project and use of a char-gasifier for clean power, based on acceleration on the molten-salt (Kellogg) project (for which successful bench-scale research was performed under a previous OCR contract).

4.	Lignite Resource Development (University of North Dakota)	--- 1/	200

This project is directed toward development of processes for upgrading lignite into fuel gas, liquid fuels, chemicals, and related products. This requires R&D to determine technologically obtainable economic yields of useful products from lignite. Four types of research are contemplated: (1) studies of methods of dissolving lignite in the presence of hydrogen, carbon monoxide, and mixtures of carbon monoxide and steam; (2) carbonization studies to determine yields and methods of upgrading products; (3) hydrogenation-distillation studies on extracts using various catalysts; and (4) studies on continuous low pressure hydrogenation of lignite under a range of operating conditions. The products will be determined, using typical identification techniques, and typical results will be analyzed for possible development of an integrated process development and possible pilot plant application.

Bench-scale work in support of a solvation process should be about 75 percent completed by the end of FY-1973. Detailed design of the solvation unit will be virtually completed, and acquisition of equipment for the unit will be underway. Preliminary economic evaluations will also be made. Bench-scale work on carbonization studies will also be started during this year and will continue into FY-1974; a process development unit for solvation is contemplated.

(Processes for conversion of lignite should enable the beneficial use of this vast lignite energy resource in forms in which energy is in demand.)

5.	Liquefaction Evaluations (Several Contractors)	650	1,000

Preliminary reviews are to be made of all aspects of OCR projects on coal liquefaction (including their suitability for combining under the "COG" concept). 2/ Preliminary specifications for a "COG" plant will be prepared as a second-generation pilot plant. As work proceeds in each of OCR's liquefaction projects, it is particularly necessary to maintain a continuous review of the technical and economic status with reference to the commercial plant that can be projected from the research results. This requires detailed engineering studies by independent third parties. Otherwise experimental work costing far more than the evaluations may be undertaken unnecessarily.

1/ Research in FY-1973 used carryover funds.

2/ For description of the "COG" concept, see the "COG Multiprocess Research" Project.

	FY-1973	FY-1974
	($ thousands)	
6. Special Purpose Coal Preparation 1/ (Pennsylvania State University)	400 (+ 40)	300 (+ 30)

This project is generating new knowledge as to the impact of coal composition, coal mining, and coal preparation on the practical aspects of gasification and liquefaction. (As mined, coal is a heterogeneous and variable mixture of materials. Only by coincidence does the mined produce approach optimum composition for any given process and, even then, the composition will be subject to variation.) Gasification and liquefaction processes will be made more attractive economically, and more trouble-free operationally, if the raw material fed into the system can be made uniform in character and near optimum in composition. Current research objectives include: (a) establishment of the relationship between a coal's composition and its behavior and yield in conversion processes; (b) development of commercially feasible methods for controlling the composition of raw coal to provide process feedstocks which can be uniformly maintained at the desired quality; (c) development of mining and preparation techniques which will increase productivity without decreasing the quality of the product, and which will provide for reclamation of the mined land and provide for the useful disposal of refuse materials; and (d) development of fully identified and representative samples of the Nation's coal seams for experimental use in defining the utilization potential of various coal types.

The beneficiation characteristics of 24 seams and 35 coal types have been established. These represent major coal seams in 15 States. Coal fractions have been prepared with reactive component concentrations as high as 98 percent and as low as 15 percent. Fractions with inert component concentrations ranging between 2 and 75 percent have also been produced. The data developed indicate that improvement of process feedstock is possible at all levels of coal rank.

A comprehensive program has been conducted to develop the information needed to properly classify coals for gasification. In addition, this information will be useful in engineering gasification plants and recommending modifications in present plant designs. Reactivities have been determined on a number of chars produced from lignites, subbituminous and bituminous coals and anthracites.

Recent studies have shown that it may prove possible to use coal itself in concentrating oxygen in an air stream; if this means of separation proves economically feasible, it will be important in making cheap oxygen available for coal gasification and other processes.

An extensive study is being made of the noncombustible material that is present in varying quantities and compositions in all coal seams. As massive volumes of coal are gasified and liquefied and as major sources of rare elements are depleted, it may become economically attractive to extract such elements as beryllium, scandium, gallium, tin, copper, uranium, and vanadium.

The presence of mineral materials can be harmful as well as beneficial. Thus, it is desirable to identify and control the corrosive agents present in some coals (sodium potassium, calcium, and magnesium).

A sampling operation has been used to increase the representation of Western coals in the sample collection available to all OCR contractors. Coal seams were sampled in Colorado, Wyoming, Montana, Utah, and Washington, providing more than 150 samples of coal types from more than 75 seams.

In connection with the coal types being studied under this project, work is being undertaken to develop high-combustion devices suitable for subbituminous coals

1/ Partly for gasification and electric power from coal.

	FY-1973	FY-1974
	($ thousands)	

(and chars) for use in conventional powerplants, as well as new methods of converting coal to electric power.

B. Electric Power from Coal

By 1985 installed generating capacity will rise from 367,395 megawatts (MW) in 1971 to 915,000 MW for an average annual growth rate of 5.8 percent. The demand for electric power will increase from 1,614 billion kilowatt hours (kwhrs) in 1971 to 4,140 billion kwhrs in 1985, and to 9,010 billion kwhrs in the year 2000, or an average annual growth rate of 6.1 percent. Electric generation will require an increasing proportion of the total supply of input fuels--this is the fastest growing sector of demand imposed on the input fuels supply.[1/] The use of coal for electric generation is being severely restricted by pollution controls, and high-sulfur coals require new technologies to enable such coals to provide clean energy. These new technologies for clean electric generation from coal will indirectly reduce the already excessive reliance on imported oil.

1. High-Efficiency Methods

OCR is proposing increased funding for (a) magnetohydrodynamic (MHD) generation, and (b) clean low-B.t.u. gasification (advanced power systems). These projects are urgent because of: the geometric growth of demand for electric power; the need to be able to use high-sulfur coals for electric generation; the shortage of clean fuels to avoid air pollution; the low water requirement of these projects, making them easier to use in arid areas of the Western States where coal is abundant; the reduced coal requirement per kwhr because of the potential conversion efficiency of 50 to 60 percent, compared with 40 percent for the best conventional powerplants; the increased value of leases of public coal lands where water is scarce; and the need to conserve low-sulfur coals for metallurgical purposes and export earnings.

(The clean low-B.t.u. gas developed for advanced power systems will also be available for nonelectric industrial uses, and will accordingly help relieve some of the demand for natural gas.)

The improved use of domestic coal for electric generation will help avoid needless reliance on imported oil, so as to help future balance of payments situations and increase security of energy supply. Electric generation in the Eastern States is already excessively dependent on foreign oil. This dependency has in recent years extended into the Middle Western States, particularly along the Great Lakes, where vast high-sulfur coal fields are located.

Without improved methods of using coal for electric generation, a very substantial increase in pollution would take place merely by reason of increased electric demand. It has been estimated that sulfur dioxide alone accounts for $8 billion damage annually; and a substantial part of this comes from electric generation.

It is estimated that a saving of 1 mill per kwhr after 1985 would represent a saving of $1 billion annually, if 10^{12} kwhr will be generated by MHD and/or clean low-B.t.u. gas. In addition, two-thirds as much coal would be burned (with two-thirds as much sulfur to eliminate in the process); and only 40 percent as much heat to dispose of.

1/ "U.S. Energy Through the Year 2000," p. 25.

	FY-1973	FY-1974
	($ thousands)	
a. Clean Low-B.t.u. Gas/Power Cycles	3,000	11,500
	(+1,000)	(+ 4,000 est.)

It is contemplated that R&D for low-B.t.u. gas will be of importance (a) to provide another alternative for clean electric power generation at high efficiency, and (b) to meet industrial demand for gas. These functions are expected to help curb excessive reliance on imported oil and LNG by enabling high-sulfur coals to be used for power generation and other purposes without pollution. (R&D for "clean mining" in volumes related to the demands for electric power is increasingly considered a necessary adjunct of power technology developments.)

When OST's "New Opportunity Program" recommended (December 1971) that OCR's budget for FY-1973 include $3 million for low-B.t.u. gas research, this was based on OCR's proposal; the recommendation contemplated an acceleration based on OCR's current high-B.t.u. gasification work. Future work on gas turbine and steam turbine cycles was included in the proposal. These efforts would build on the platform OCR now has on coal gasification and related research. OCR presented an estimate for this purpose that the work will require $69 million over 5 years (or an average of $13.6 million annually), beginning with FY-1973.

A research effort for low-B.t.u. clean fuel gas from coal will integrate with research on gas turbines. The bulk of the research funds will be expended by OCR contract, supplemented by work in Bureau of Mines laboratories. The major efforts will seek to develop low-B.t.u. gasification techniques as an outgrowth of past Departmental programs. A single commercial-size gasifier is capable of producing sufficient low-B.t.u. gas for a 1000-megawatt powerplant, and the gasifier and its associated cleanup equipment can be tailored to a conventional plant, a gas turbine plant, or an advanced gas-turbine/steam-turbine plant.

Work on several phases of research will be performed in FY-1973 and FY-1974: (1) Evaluation and monitoring; (2) For mixed fluidized-bed gasifier, using 300 pounds per hour of coal (210 psig); (3) For solid phase hot-sulfur removal (bench-scale); (4) For a 2-stage entrained bed slagging gasifier, using 50 tons per hour of coal (to 500 psi); (5) For hot-gas cleanup by molten salt scrubbing (bench-scale with existing equipment); and (6) For low-pressure entrained gasifier study leading to a 10-megawatt equivalent pilot plant.

b. MHD Power Generation	3,500	3,750
(Avco; MIT; University of Tennessee; STD Corporation; Westinghouse)	(+ 530)	(+ 650)

MHD for central station baseload electric power has potential for much higher efficiency ratios (up to 55 or 60 percent versus conventional electric power generation in thermal plants of 40 percent), with less thermal energy to dispose of through cooling. MHD power systems will require substantially less cooling water, thereby enabling reduced thermal water pollution, and usability in arid areas (particularly in the West where coal is abundant and water is scarce). Research will be included to avoid air pollution.

The OCR studies are designed to evaluate alternative proposals such as type of generator, the oxidant to be used in the combustion system, and the relative amount of plant power to come from the MHD generator and a convenient steam plant to be used in combination. There is need for an experimental program that would answer questions concerning superconducting magnets, plasma properties, materials of construction, channel geometry, generator type, variations of efficiency as a function of seed or other factors, and experimental

	FY-1973	FY-1974
	($ thousands)	

combustion of coal, char, and possibly coal-gas. MHD will require 10 or more years of accelerated effort and a higher level of funding.

This new technological development, if research is ultimately successful, involves generation without rotating parts. Coal is fired at relatively high pressure and the resulting gases are expanded through a duct at high velocity. The gases move through a magnetic field surrounding the duct, resulting in generation of an electric current. Electrodes on the wall of the duct convey the current that is generated.

In MHD generation the chemical energy in the coal is converted to heat in the gas, and the expanding gas provides mechanical energy. This in turn is converted to electric energy as the gas flows through the duct.

To be electrically conductive the gases must attain very high temperatures--upward to 4,000° F. Conductivity of the gas is improved by the injection of "seed" materials, such as potassium or cesium.

Funding of MHD R&D began in FY-1971 at $600,000 Federal contribution; FY-1972 at $1 million Federal, and $500,000 industry contribution. These amounts were substantially below the $4 million of annual expenditures recommended by the OST (Office of Science & Technology) Panel for MHD in their report of June 1969. There was a delay in the contracting by OCR, as meetings were held with the Electric Research Council toward industry contributions, and pending completion of a study of MHD by the Massachusetts Institute of Technology (MIT) to meet requirements of the Electric Research Council and the Bureau of Mines, as well as the Office of Coal Research. The MIT report (June 1971) presented a highly detailed technological review of Open-Cycle MHD Generation Systems, including the current status of the technology and the work that remains to be done. The report recommended that three years of preparatory work be undertaken at an estimated cost of $6 million annually, after which it would be determined whether to proceed with construction of an MHD pilot plant. The MIT report recommended an R&D program calling for $30 million over a period of 5 years (for both OCR and Bureau of Mines), and an additional $95 million to complete the research over an additional 6 or 7 years. (MIT estimates assume prompt funding.) The current rate of research has been far below this recommended level. OCR began contracting for MHD early in FY-1972--on the basis of the MIT report--with Avco, University of Tennessee, and STD Corporation.

For FY-1973, the "New Opportunity Program" of OST recommended that the amount then under consideration for OCR's MHD program be enhanced by $1 million to a total of $3 million. The increase of funding for FY-1974 would expedite research for clean low-cost electric power from high-sulfur coals utilizing MHD technology. R&D for MHD had also been mentioned favorably in the President's "Clean Energy" message of June 4, 1971.

It is noteworthy that by combining MHD generation with high-B.t.u. coal gasification, the unit cost of each may be further reduced.

2. Nonpolluting Combustion

The use of low-sulfur coals for power generation (in response to air pollution controls) has been accompanied by problems of slagging in the high-temperature boilers, and by reduced efficiency of precipitators. Fluidized-bed boilers had been under development by an OCR contractor for several years, and these can operate at low temperatures so as to permit the use of low-sulfur coals without slagging. This work is being expanded to include other antipollution research and improved heat-transfer technology. At a later date research may be incorporated

	FY-1973	FY-1974
	($ thousands)	

for higher pressure fluidized-bed boilers. The OCR program for nonpolluting combustion also is beginning to include desulfurizing high-sulfur coals prior to combustion.

a. Fluidized-bed Boilers	500	2,700

This project is for an improved boiler-generator method of particular interest for environmental reasons and economies.

An atmospheric-pressure coal-fired fluidized-bed boiler having a capacity of 7,000 pounds of steam per hour has been successfully operated. Furnace temperatures are approximately 1600° F., well below the temperatures at which slagging conditions can be created. When limestone or dolomite is injected into the fluidized bed, it captures up to 86 percent of SO_2. The dolomite can be regenerated and reused. For the industrial market, fluidized-bed boilers offer promise for the use of coal in compliance with environmental problems. For the electric utilities, such boilers offer promise of decreased capital and maintenance costs while keeping coal in this important market. A scaleup of effort is needed to bring the system to the point of commercial demonstration.

Additional research contemplated incorporates use of pressurization of the fluidized-bed boiler as a means of potentially effecting a major reduction in the cost of power generation. This research will be performed by utilizing and modifying existing equipment of a contractor at modest cost.

If fully successful, the boiler will enable use of low-sulfur Western coals without slagging and with low NO_x, due to the low combustion temperature. High-sulfur research will be pursued with recycling of dolomite. This will provide opportunity to use more domestic fuels for electric generation and industrial applications, and to reduce potential reliance on imported oil.

b. Desulfurizing Coal	100	100
(Colorado School of Mines)	(+ 28)	(---)

This ongoing project is a laboratory-scale investigation of process-variables which affect the degree of desulfurizing of solvent refined coal and other liquids. (This will be a supporting effort to coal liquefaction projects. Desulfurizing is a very significant part of those processes.) Various coals will be tested for these purposes.

It is anticipated that by the end of FY-1973 the contractor will complete investigation of the independent variables affecting the degree of sulfur removal by hydrogen treating while in solution--to identify those variables significant enough to warrant more complete study. About 25 percent of their study may be completed in sufficient detail to develop mathematical or graphic model of the effects of the significant variables. During FY-1974 the latter work will be completed, and the results will be used to develop the process design of a coal desulfurization process in sufficient detail to estimate its economic feasibility.

Reducing the sulfur content of the fuel for electric generation offers advantages over flue gas treatment, since it will permit one desulfurizing plant to serve several powerplants, thereby enabling economies of scale. There are few reserves of low-sulfur coal in the populated Eastern States, where almost 40 percent of the sulfurous air pollution comes from electric generation. The project will test the concept of reducing the sulfur content of high-sulfur coals by hydrogenating the coal while dissolved in an organic solvent; this project supports OCR's project for solvent refining of coal.

	FY-1973	FY-1974
	($ thousands)	

C. Other Clean Energy

Coking operations are accompanied by substantial air pollution, and in addition coking-quality coals are low-sulfur for which there is increasing demand to meet pollution controls. To meet the clean air requirements imposed on coking operations, as well as to enable high-sulfur coals in abundant supply to be used for coking purposes, a "Clean Coke and Fuels" project was instituted. It is jointly funded (2/3 Government, and 1/3 industry).

1.	Clean Coke, Liquids & Gas (U.S. Steel)	1,000 (+ 450)	1,500 (+ 645)

By the end of FY-1973 it is planned that bench-scale research will be completed and the process development unit installed ready for operation. The bench-scale work includes investigation of (a) coal hydrogenation and carbonization reactions in sufficient depth to enable its application during operation of the process development unit; (b) production of formed coke from simulated carbonization char and aromatic binder, including techniques for handling of the feed materials, formation and growth of pellets, and curing and calcining of the agglomerate; and (c) study of coal preparation to increase the yield of process feedstock. This work also includes engineering for designing various process development units, including detailed engineering and procurement of hardware, and a study of the fluidization characteristics of coal/char blends in a carbonizer-model. During FY-1974 it is planned to operate the process development unit to obtain sufficient data to enable work to begin on pilot plant design; continuous operation will be sustained where necessary to establish the feasibility of the operation, and to detect and correct any problems of continuous operation. Studies of waste water will also be pursued to avoid water pollution, and studies of corrosion will help in the choice of materials of construction for plant equipment. The extent to which this work will be completed in FY-1974 will depend on the rate of progress and funding limitations.

The objective of this project is to enable use of high-sulfur coals for coke-production, and to avoid pollution in the coking process. This would conserve the low-sulfur coals which are already in short supply for export earnings, and provide export potential for Western bituminous and subbituminous coal for steel-making purposes. It will also improve the economics of OCR's project for solvent refined low-sulfur, low-ash coal. This work is a 3-year prepilot project, having an estimated total cost of $7.5 million, almost one-third of which will be contributed by the contractor.

2.	Coal Mining Systems (Several Contractors)	---	500

A coal conversion plant will require very large quantities of coal (on the order of 50,000 tons daily), with due consideration of environmental restrictions which are becoming increasingly stringent. This project is for the development of the new large-scale coal mining systems needed to meet these requirements--for an economical coal supply for the anticipated high-capacity plants for conversion of coal to clean synthetic fuels. (Existing coal mines, surface or underground, do not approach near future needs, both as to size and environmental requirements.) The intent is to provide a base for producing low-cost energy through coal production systems with minimal environmental impact and external social cost. Much of the effort required is to be applied to engineering analysis and design of large-scale coal mining, including evaluation of existing and conceptual mine planning and equipment in order to highlight the differences in the technological and physical characteristics of mining coal by different methods; this will include the necessary engineering and engineering-economic model to formalize functional relationships which can be quantified and manipulated for purposes of simulation

	FY-1973	FY-1974
	($ thousands)	

of mine design, equipment, environmental, and technology alternatives.

D. Cresap Adjustment	-3,000	---

The carryover funds available from FY-1972 for the Cresap pilot plant were made available to other projects in FY-1973 in accordance with the instructions in the appropriations for FY-1973.

Personnel Summary

	1972 Actual	1973 Estimate	1974 Estimate
Total number of permanent positions	30	37	55
Full-time equivalent of other positions..	1	1	2
Average paid employment	27	38	57
Average GS grade.....	10.3	10.5	10.2
Average GS salary.....	$18,116	$17,947	$18,259

Itemization of Estimate

Department of the Interior
Appropriation Title: Salaries and Expenses — Office of Coal Research

	Actual 1971	Estimate 1973	Estimate 1974	Increase (+) Decrease (-)
Program and Financing:				
Total obligations.....	$30,283,557	$44,294,000	$52,500,000	$+ 8,206,000
Unobligated balance start of year.....	- 437,012	- 804,000	--	+ 804,000
Unobligated balance end of year.....	803,455	--	--	--
New obligational authority appropriation	$30,650,000	$43,490,000	$52,500,000	$+ 9,010,000
Object classification:				
11 Personnel compensation.	$ 420,204	$ 683,000	$ 883,000	$+ 200,000
12 Personnel benefits.....	34,176	51,000	73,000	+ 22,000
21 Travel & transportation of persons.....	27,250	69,000	96,000	+ 27,000
22 Transportation o things..	3,704	8,000	13,000	+ 5,000
23 Rent, communications and utilities.....	11,580	32,000	52,000	+ 20,000
24 Printing & reproduction.	32,039	27,000	40,000	+ 13,000
25 Other services	29,738,077	43,409,000	51,300,000	+ 7,891,000
26 Supplies & Material....	3,539	6,000	14,000	+ 8,000
31 Equipment.....	12,988	9,000	29,000	+ 20,000
Total obligations.....	$30,283,557	$44,294,000	$52,500,000	+ 8,206,000

ADMINISTRATION AND SUPERVISION OF OCR PROGRAM

Mrs. HANSEN. You are requesting an additional 18 positions. What is the need for these positions and what are the associated costs?

Mr. HILL. Yes, I will do the cost part first.

This year's budget for administration and supervision is $885,000. Including the additional personnel would raise it to $1.2 million, which is approximately 2 percent of the overall operating budget of the office. The additional positions would be largely technical people. We have had a study internally that I mentioned already about our clerical operation. We are going to restructure that so we do not do so much retyping. There are typing machines that you can put on record—you develop a card when you type something up, so if you make a change in one sentence, you can insert it without the whole thing being retyped. That will save a great deal of time in our office.

We believe we will be able to effect a real saving in clerical personnel by that means. The additional technical personnel, will be 9 or 10 in number. I don't yet have a secretary for the new people on my own staff yet.

NON-GOVERNMENT EVALUATIONS OF PROPOSALS

Mrs. HANSEN. After you receive the evaluations performed by the industrial firms, isn't it necessary to have someone in your office review the evaluations?

Mr. HILL. I do not have that man yet but I want to get one.

Mrs. HANSEN. You can have prejudice entering into a project.

Mr. HILL. Yes.

Right now Neal's staff has the double job of seeing that the programs go and carry out that evaluation. I intend to have an additional man on my own staff not related to the engineering staff whose sole job will be evaluation.

He won't be related to any particular project. I will simply have him concerned with critical evaluations. We do have ongoing evaluations by the National Academy of Engineering. We have evaluations we pay for by consultant companies as well as individual consultants, so that we do keep a continuing evaluation program in effect. However, I do need to have in-house capability. One of those slots would be for such an evaluator, that is correct.

LIST OF 1974 OCR PROJECTS

Mrs. HANSEN. Please provide for the record a listing of projects for which you are requesting 1974 funding, showing how much has been provided in previous years and what expected future year costs are involved.

[The information follows:]

OFFICE OF COAL RESEARCH BUDGET ESTIMATES

(Dollars in Thousands)

3-30-73

Contractors & Projects (1)	Present Contract Dates: Executed (2)	Present Contract Dates: Completion (3)	Location of Work (4)	FY-1973: Appropriation (5)	FY-1973: Encumb. To Date (6)	FY-1973: To Be Encumb. (7)	Total Encumb. To Date (8)	FY-1974: FY-74 Budget Request (9)	FY-1974: Est. Non-Federal Contrib. (10)	Total Presently Estimated: Contract Cost - * Govt. (11)	Total Presently Estimated: Contract Cost - Non-Govt. (12)
I. Pilot Plant Projects											
A. Gasification											
1. Institute of Gas Technology (HYGAS)..	7/64	6/74	Chicago, Ill.	4,000	4,000	0	20,101	4,670	2,330	27,506	7,475
2. Consolidation Coal Co. (Lignite Gasification)	6/64	10/73	(Rapid City, S.D. (Library, Pa.	2,730	2,730	0	18,679	4,670	2,330	19,336	3,300
3. Bituminous Coal Research, Inc./Stearns-Roger, Inc. (BI-GAS)	12/63	8/77	(Monroeville, Pa. (Homer City, Pa.	6,400	6,400	0	13,777	1,330	670	16,880	7,950
4. Institute of Gas Technology (Steam-Iron Process)	-	-	Chicago, Ill.	5,180	5,180 **	0	5,180 **	4,670	2,330	12,980	6,460
5. Chem Systems, Inc. (Liquid Methanation)	1/73	6/75	Hackensack, N.J.	1,010	900	110	900	340	160	1,257	629
6. Lurgi Gasifier Project	-	-	Great Britain	1,600	0	1,600	0	--	--	1,600	800
7. Battelle Memorial Institute (Hydrogen/Gas)	1/73	6/75	Columbus, Ohio	1,670	1,600	70	1,600	670	330	2,740	1,360
8. Molten Iron or Other Process 1/	-	-	--	1,670	0	1,670	0	2,320	1,180	5,190	2,610
9. Process Selection, Evaluations, Designs and Engineering Assessments..	9/72	6/75	Alhambra, Calif.	900	880 **	20	880 **	1,330	670	2,887	1,443
B. Liquefaction											
1. FMC Corporation (COED Proj.) 2/ 2/	8/71	2/74	Princeton, N.J.	3,250	2,550	700	6,119	1,000	--	8,132	--
2. Pittsburg & Midway (Low-Ash Low-Sulfur Coal--Solvent Refined).....	10/66	4/76	Ft. Lewis, Wash. Merriam, Kansas	6,107	5,997	110	13,147	8,000	--	28,416	--
C. Cresap Adjustment	8/63	8/71	Cresap, W.Va.	- 3,000	- 3,000	--	20,337	--	--	20,337	--
Subtotal: I				31,517	27,237	4,280	100,720	29,000	10,000	147,261	32,027

* Including project modifications and contract amendments.

** Contracts or amendments being negotiated; funds will be encumbered prior to 6/30/73.

1/ Under negotiation.

2/ The 9/66 contract covering preliminary research and construction of the pilot plant was completed 8/71, when a contract was executed for its operation and maintenance.

OFFICE OF COAL RESEARCH BUDGET ESTIMATES
(Dollars in Thousands)

3-30-73

Contractors & Projects (1)	Present Contract Dates: Executed (2)	Present Contract Dates: Completion (3)	Location of Work (4)	FY-1973: Appropriation (5)	FY-1973: Encumb. To Date (6)	FY-1973: To Be Encumb. (7)	Total Encumb. To Date (8)	FY-1974: FY-74 Budget Request (9)	FY-1974: Est. Non-Federal Contrib. (10)	Total Presently Estimated: Contract Cost - * Govt. (11)	Total Presently Estimated: Contract Cost - Non-Govt. (12)
II. Nonpilot Plant Projects											
A. Low-Btu Gas/Power	--	--	Various	3,000	1,903	1,097	1,903	11,500	4,000	6,914	2,571
B. Low-Sulfur Fuel Oil											
1. Liquefaction Evaluations (Parsons)..	10/72	10/76	Los Angeles, Calif.	650	300	350	300	1,000	--	507	230
2. Univ. of Utah (Western Coals)	10/69	10/74	Salt Lake City, U.	360	360	0	910	250	35	1,335	273
C. Multiproduct Fuel Processes & Related											
1. COG Research	--	--	Various	500	460	40	460	500	--	--	--
2. U.S. Steel (Clean Coke & Fuels)	3/72	3/75	Pittsburgh, Pa.	1,000	1,000	0	2,000	1,500	645	4,636	1,925
3. Coal Mining Systems Research	--	--	--	--	--	--	--	500	--	--	--
4. Pennsylvania State U. (Special Coals)	9/66	6/74	State College, Pa.	400	400	0	1,711	300	30	1,711	168
5. Colorado School of Mines (Desulfurization)	3/72	3/75	Golden, Colo.	100	98 **	2	148 **	100	--	185	29
6. Univ. of North Dakota (Lignite Processing)	3/72	3/77	Grand Forks, N.D.	0	0	0	1,600	200	--	3,357	--
D. Clean Electric Generation											
1. Magnetohydrodynamics (MHD)	--	--	Various	3,500	2,984	516	4,165	3,750	650	12,135	2,754
2. Fluidized-Bed Combustion	10/72	10/76	Various	500	500	0	500	2,700	--	5,960	--
E. Discontinued Projects											
1. Univ. of Wyoming (Multicatalyst) ...	11/68	11/73	Laramie, Wyo.	200	200	0	614	--	--	614	--
2. Iowa State U. of Science & Technology (Electrofluidic)	5/65	6/74	Ames, Iowa	200	200	0	427	--	--	427	--
3. West Virginia Univ. (Waste Utiliz.).	2/72	2/75	Morgantown, W.Va.	478	478	0	963	--	--	1,121	28
4. Virginia Polytechnic Institute (Computerized Mining)	6/64	6/73	Blacksburg, Va.	200	200	0	583	--	--	583	--
Subtotal: II				11,088	9,083	2,005	16,284	22,300	5,360	39,485	7,978
III. Administration & Supervision				885	885	--	--	1,200	--	--	--
RECAP. .... I. Pilot Plant Projects				31,517	27,237	4,280	100,720	29,000	10,000	147,261	32,027
II. Nonpilot Plant Projects				11,088	9,083	2,005	16,284	22,300	5,360	39,485	7,978
III. Administration & Supervision				885	885	--	--	1,200	--	--	--
TOTAL				43,490	37,205	6,285	117,004	52,500	15,360	186,746	40,005

PRESENT UNOBLIGATED BALANCE

Mrs. HANSEN. What is the present unobligated balance in this account? What is the expected unobligated balance at the end of the year?

Mr. HILL. That we will also furnish for the record.

[The information follows:]

OCR's unobligated balance on March 31, 1973, was $9,840,000. We do not anticipate having any unobligated balance at the end of fiscal year 1973.

Mrs. HANSEN. Do you expect to obligate all your funds?

Mr. LARSON. Yes.

We have numerous contracts under negotiation.

Mrs. HANSEN. The contracts will be let?

Mr. LARSON. These will be awarded before this year is out. Some have been in negotiation for a long period of time.

Mrs. HANSEN. You are not trying to save money to fund Cresap?

Mr. LARSON. That is separate.

Mrs. HANSEN. The Cresap project funds will be in your unobligated balance?

Mr. LARSON. Yes.

COST OF MAINTAINING CRESAP FACILITY

Mrs. HANSEN. Are you meeting your maintenance cost at Cresap from your unobligated balance?

Mr. HILL. Yes.

Mr. LARSON. Attributed to the project but unexpended.

Mrs. HANSEN. $96,000 a year.

Mr. LARSON. Approximately; very minor for the size of the investment.

Mr. HILL. I hope a decision can be made on this rather quickly.

IGT PILOT PLANT PROJECT

Mrs. HANSEN. You are requesting $4,670,000 for the hydrogasification process?

Mr. HILL. That is right.

Mrs. HANSEN. This plant was completed in 1971. What have you learned to date?

Mr. HILL. We have a couple of charts that we could show you.

Mrs. HANSEN. Insert the charts in the record.

[The charts follow:]

ACHIEVEMENTS IN FY 1973 (THROUGH FEBRUARY)
HYGAS PROCESS

ALL SYSTEMS OPERATED TOGETHER EXCEPT FINAL CATALYTIC METHANATION

GASIFIER VESSEL AND REFRACTORY DESIGN FOUND SATISFACTORY

COAL FEED AND DISCHARGE SYSTEM (SLURRY TYPE) PROVEN FEASIBLE

OPERATED GASIFIER AND GAS CLEAN-UP AT DESIGN PRESSURE OF 1000 psi

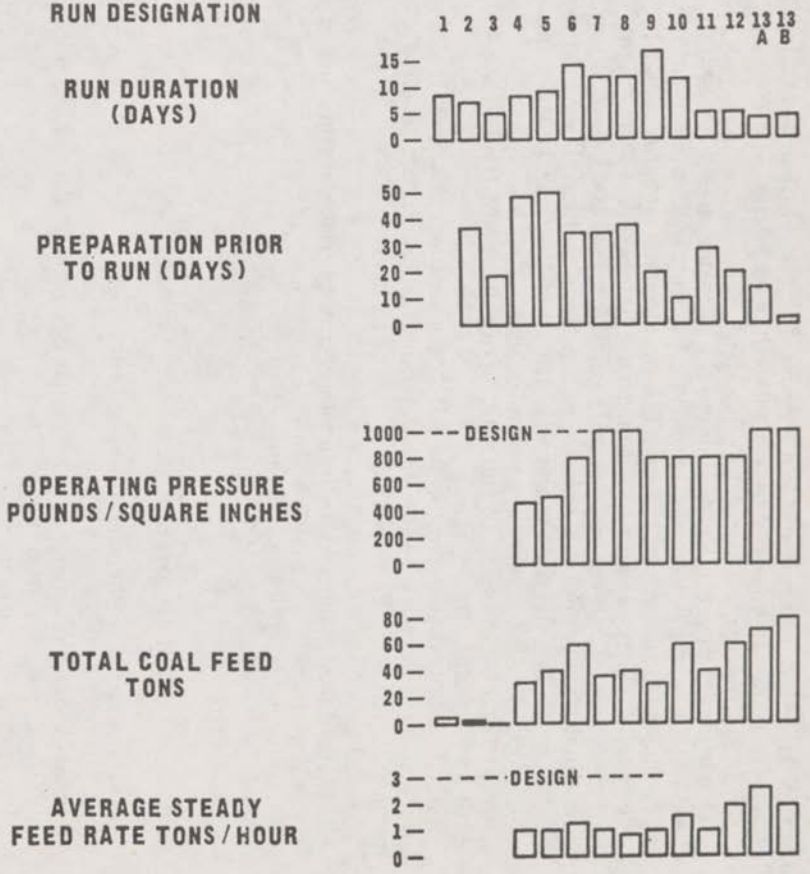
OPERATED AT FEED RATE OF 2-1/2 ton/hr (83 % OF DESIGN)

EXCEEDED DESIGN METHANE CONCENTRATION FROM GASIFIER

SULFUR LEVEL OF LESS THAN 0.25 ppm ACHIEVED IN CLEAN GAS (SUFFICIENTLY CLEAN FOR FEED TO CATALYTIC METHANATION)

OPERATED ON LIGNITE

IGT HYGAS PROGRAM



Mrs. HANSEN. The committee appreciates this kind of presentation because graphically more can be presented than by words.

Mr. HILL. We want to help out in this area.

This high gas program at IGT shows the duration in days of each of the runs; 13 A and B were really one run but they did have downtime in one unit in the middle of the run. The preparation time for each run is decreasing. They are able to get onstream quicker. As to the operating pressure, you can see the design parameter was 1,000 pounds per square inch. They were not able to get up there at first. They held a steady level below the design and now are up at the operating design.

Mrs. HANSEN. Why were they below the design?

Mr. HILL. That was due to the constriction in one of the pipes connecting to the unit.

They had to tear it out and repair it. That problem is licked. Every time you see a decrease followed by coming up again, that means we learned something. We don't like for them to make the same mistake twice and they have been pretty good about that.

Total coal feed is now up to design specification. Each of those drops from a high point was a major learning experience.

That design feature now is transmitted by report to all of the contractors with related problems, so we will minimize the number of these kinds of mistakes.

RATE OF COAL FEED PER HOUR AT IGT PLANT

Mrs. HANSEN. You mention tons per hour.

Mr. HILL. That is correct.

Mrs. HANSEN. What are you presently feeding at the IGT plant?

Mr. HILL. Coal. Earlier, char was fed.

Mrs. HANSEN. I mean tonnagewise.

Mr. HILL. Total coal feed is 3 tons an hour, which is the design capacity of the plant.

Mrs. HANSEN. What would a demonstration plant require?

Mr. HILL. If you went the full 250 million cubic feet a day, a commercial demonstration plant, you are talking about 15 or 20 thousand tons a day.

This is a major step.

SOURCE AND TYPES OF COAL USED IN IGT PLANT

Mrs. HANSEN. From what source are you receiving your coal?

Mr. HILL. In that plant we have used Illinois coal, we have used coal from Wyoming.

Mr. COCHRAN. In this particular plant they have been working with lignite.

Mrs. HANSEN. You use coal from a wide variety of areas.

Mr. HILL. Yes.

The one where we had the long-term run we used coal from the West, Midwest and East. They ran a spectrum of coals to find out which fit the best.

Mrs. HANSEN. Which type of coal is the best?

Mr. HILL. In the FMC plant lignite, bituminous coal, worked beautifully. With difficulty you can even use the highly caking coals. They do not work as well.

Mrs. HANSEN. Where are the caking coals located?

Mr. HILL. Pennsylvania, West Virginia have highly caking coals as well as non-caking coals. It is not all one kind. Both kinds are available in the eastern province.

The highly caking coals we better use for coke and we will be short of that anyway. So this is not all that bad. We tried lignite. In the process development they used 15 different coals. I believe several will be tested at the IGT plant when we get all the rest of the problems solved.

Mrs. HANSEN. Does this type of plant use a lot of water?

OTHER OCR PROGRAM ACHIEVEMENTS

Mr. HILL. I think gasification plants would use roughly the same quantity.

Excuse me, you asked for the other achievements. In this year all systems operated together except the final catalytic methanation. The gasifier vessel and refractory design were found satisfactory. Coal feed and discharge system (slurry type) proved feasible. This is one of the major things we had to determine, how you get the coal into the system under pressure.

This technique developed works. The other technique does not look like it will work. The reason I might mention for several of these plants is that we are trying out different techniques for getting the coal in, for gasifying it, in fluidized bed, in entrained bed, so different combinations of new things are being tried in each place. It is doubtful if any one will work perfectly.

A combination of elements of each will come out in the ultimate plant.

We will end up with two or three designs, one good for lignite in the West, another good for Eastern coal and another good for Midwest coal.

Moving ahead, the slurry type feeder does work. Operated gasifier and gas cleanup at design pressure of 1,000 p.s.i. This is really an accomplishment, operated at feed rate of two and a half tons per hour.

Mr. COCHRAN. We have operated at 3 tons per hour.

Mr. HILL. As a matter of fact, this is out of date. We got this a month ago. It exceeded design methane concentration from the gasifier. The cost saving to the taxpayer ultimately is going to be maximum the more methane you make in the gasification state, and the less carbon dioxide. This is a higher percent of methane than proved out in the process development unit. You get a real bonus here.

ENVIRONMENTALLY CLEAN GAS

Sulfur level of less than a quarter part per million was achieved in the clean gas which means it is clean enough to feed the methanenator. This technique of cleaning the sulfur compounds out of the gas does reduce it to the level that we can operate the catalysis unit. So that is the next major step to get the plant operating, feed the methanator unit and make 95 or 100 percent methane out of the gas which could go right into a pipeline.

Again I think this type of accomplishment list is worthwhile.

CO_2 ACCEPTOR PILOT PLANT PROGRESS

Mrs. HANSEN. You are requesting $4,670,000 for the CO_2 acceptor process.

What has been learned so far from this project?

Mr. HILL. I don't have a similar sheet because the dedication of that plant occurred just this past fall. They have had a year's less operating time. The main thing as far as my engineering background is concerned, the two main things they learned, one, the near disaster because of the insulation not being right for the system. This has been rectified. We have replaced the insulation and it is holding up. That problem is licked for all future plants.

The other thing that pleases me most is that this very complicated double stream of solids has been operated now.

They have actually demonstrated they can feed the dolomite through the circuit, heat it up, drive CO_2 out of the dolomite, have that go in and provide the heat for the steam reaction in the gasifier unit, trap the CO_2 that is omitted and then get the dolomite back for recycling.

The dolomite retains its identity. Everybody predicted that as you pull CO_2 off, heating it, and let CO_2 be absorbed again, the stuff would fall to pieces. Nearly everybody thought it would. Dolomite has magnesium and calcium carbonate in it. One of those retains its identity and holds the structure together like glue. The structures acts like it breathes. Holes form as CO_2 is driven off. When the holes fill up again, you don't break it apart. It had to be in order for the system to work. I never would have believed it, but it works. So, in addition to those two major accomplishments they have licked the problem of finding out and maintaining the fluidized bed level. We have no instrumentation for doing that adequately. They tried a number of schemes. I think it is safe to say they have a good handle on that now. They made three major engineering steps successfully, plus numbers of others of little ones, of valving, and so forth.

As far as I am concerned, these are the major accomplishments in this relatively short period.

BI-GAS PILOT PLANT PROJECT

Mrs. HANSEN. $1,330,000 is requested for the bi-gas process. When will this plant be completed?

Mr. HILL. I think I need to give you some information about a change we had to work out. We had our primary contract with the Bituminous Coal Research Corp. They were given the job of running the paper through the mill, giving approvals and everything, and things looked like they were slowing down. We had a meeting with the BCR president in which he said that his board of directors had not permitted him to add adequate staff to do this job. So he was having engineers come out of the lab to do it. This was not wise. He requested permission for BCR to back away from its prime contracting responsibility and give that to the Stearns-Roger, the company that is doing the design and construction work, but for BCR to continue their research and consulting function. We are negotiating that exchange. We acceded to the request. We think it is a great idea. It will simplify the paper work. It will save what was a built-in redundancy.

We are now moving to a more efficient system. The operation is going ahead. We have been working with Stearns-Roger to keep it going on a letter contract. We are now preparing to negotiate the final contract with them.

We have approved the bid on the gasifier subcontract from Babcock & Wilcox. Hardware is being ordered, and the plantsite is being arranged. We are negotiating with Homer City for the water supply so that we can have water adequate to meet the needs. Things are going well.

Mrs. HANSEN. Are these the reasons for the large decrease of $5,070,000 from 1973 to 1974?

Mr. HILL. Yes; the combined funding is what we estimate we will spend in the 2 years. It is not a decrease in rate but simply a readjustment between the years.

NON-PILOT PLANT GASIFICATION PROJECTS

Mrs. HANSEN. How do the non-pilot plant gasification projects relate to the pilot plant work?

Mr. HILL. As you recall from that flow diagram whenever you move into these programs you have lab work and process development work and then you move into a pilot plant operation.

You gave us the charge in July to get into the low Btu gas program. We have awarded a number of letter contracts to expedite the work, and are negotiating the final contracts, and are in the early stages of laboratory and process development unit work. There will be, down the pike, three or four pilot plants as we had in the high Btu case, and the funding will have to be increased for each of these at that stage of $15 to $25 million. That is the pilot plant stage cost. Down the road there will be a major increase in funding needed.

In addition to the low Btu program we have specific processes under investigation for different ways of methanating carbon monoxide and hydrogen to make methane for the final product, a series of these programs that are required to give us final realization of high Btu gas, liquid from coal, and low Btu gas.

Mrs. HANSEN. All of these are acceptable processes.

Mr. HILL. Yes.

The day we find out there is any technical problem that is insurmountable or the economics are way out of line we will terminate the contract, that is correct.

This is painful but necessary. If I may add another thing, this mechanism in my opinion will save the taxpayer a tremendous amount of money. If you build an in-house capability exclusively—you do need to have in-house research capability because it is vitally needed—if you do the whole thing in-house, however, then if you have something that does not fly, you have a lot of people and equipment and you kind of continue it. But if you have this kind of contracting arrangement, you can without any conscience terminate. The company goes out for another kind of contract and has the responsibility for its personnel. This is the other reason that I think we would like to hold to our pattern of minimal in-house staff and keep the engineering expertise contract arrangement. When a given project is finished, those people go back to doing what they were or on another project without continued expense to the taxpayer.

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COAL-OIL-GAS

Mrs. HANSEN. What is the COG concept? Is there any money for this in the budget?

Mr. HILL. Yes, there is money for conceptual design. The COG concept is a recognition of the fact that to go for a single product from coal may not be the most economic way to travel. It might be smarter, since coal has some components that come out easily, that are rich in hydrogen. For some components to get hydrogen into them is tough. It is wise not to go totally to liquid, which was the Cresap concept, but to only go as far as economically it makes sense and then do something else with the carbon-rich residue.

So the basic COG concept is that for a given site and a given kind of coal——

Mrs. HANSEN. Didn't Germany do this many years ago?

Mr. HILL. Yes. They have a tremendous background. They totally hydrogenated coal. The U.S. Government brought intact from Germany to Louisiana, Missouri, one of their plants. I visited that plant right after World War II. I was amazed. You had pipes that had 4 inch wall thickness in order to hold the 10,000 pound pressure required for that operation. To pound the hydrogen into the coal you had to go to such an extreme wall thickness and temperature in order to do it that economically it just was out of the ballpark. But if you only take that part of the coal which comes out with the hydrogen in it and take the liquids that come out naturally and hydrogenate them a little, you get the less expensive oil. The char can be used to make hydrogen instead of making methane. The concept is that at particular locations, depending on the demand pattern, some coals lend themselves to gasification and some to liquefaction. We need to understand which kind of combinations make the best sense.

These will fall into place naturally. We need to determine what the parameters are.

COED PILOT PLANT PROJECT

Mrs. HANSEN. You are requesting $1,000,000 for project COED. This plant has been completed for several years. What do you intend to accomplish with the additional $1,000,000?

Mr. HILL. We have to test another set of coals to determine their applicability in the process. This is the last phase of the pilot testing. We have several other coals we want to test.

Mrs. HANSEN. Such as?

Mr. HILL. The coals are Illinois coal. They have run subbituminous. They have not run high-volatile coal from the West. There are some Eastern coals.

Mr. COCHRAN. We will run lignite and complete the report on the design for the concept within those funds.

SOLVENT REFINED COAL (SRC) PILOT PLANT

Mrs. HANSEN. You are requesting $8,000,000 for solvent refined coal at Tacoma, Wash. What is the status of this project?

Mr. HILL. That plant is moving ahead of schedule.

Mrs. HANSEN. I am glad to hear that.

Mr. HILL. We are enthusiastic about the combined efforts of R. & M. and Rust Engineering. They are really going all out. So we hope the dollars set up for 1973 and that we are requesting for 1974 will cover the operation.

Our technical people and theirs are discussing how we can avoid slowing down the operation. It costs a lot of money to slow down. We don't want to do it. We are quite sure this money will do it. We may have to come back.

NONPILOT PLANT PROJECTS

Mrs. HANSEN. Please review your nonpilot plant projects.

Mr. HILL. Yes.

We have projects at several universities which are giving us the basic kinetic data that feed into the large operations. Again I can speak from firsthand experience from the Western coal adaptation project because until coming aboard here this was my baby, if you please. We were able to determine in a lab in a university things which you cannot afford to do on a commercial venture. We determined the kinetics and mechanism of the carbonization of the liquefaction steps, of the dissolution of coal, and of the elimination of sulfur. These data are then fed into the major size operations that tell them at what temperatures, how fast things are going to happen. Each coal turns out to be different in its behavior. At that operation different coals from Alaska, from several Western States, some from the Midwest and even from the East have been tested in a particular piece of equipment to determine their comparability. A number of engineers and scientists have been trained as a result of university work at each of the universities who are now integrally in the system of coal conversion who otherwise would not be. There are many advantages here.

UNIVERSITY OF TENNESSEE MHD PROJECT

Mrs. HANSEN. You are requesting $3,750,000 for MHD power generation at the University of Tennessee. One of the gentlemen from the University of Tennessee has written that enough money is not being spent, that this project could be stepped up. Yet we have had testimony from your bureau that the heat problem has not been resolved. Can you discuss this for the committee?

Mr. HILL. Yes; I have had to educate myself awfully fast in this area. I have talked with all of our contractors. I visited most of the operation. I have not been down to Tennessee yet. I have not only visited most of the other major programs, but the one in Russia. This is my assessment of MHD. The potential for 60 percent efficiency in a combined cycle using an MHD unit is real. There is a critical need for the development of materials that will hold up at the high temperatures that you would have to run at. There are many technological steps that will have to be overcome.

Mrs. HANSEN. Are they being worked on?

Mr. HILL. They are being worked on.

MHD CONTRACTORS

Mrs. HANSEN. Who is performing the work?

Mr. HILL. We are hiring the Bureau of Standards to do some of the materials work. We have a group at MIT that are concentrating on materials problems. We are really reorienting each of the contractors' functions to do better part of the work. They have been kind of prima donnas in a sense in that they wanted to do their own thing. They are great people, marvellous group, but individualists, every one.

If you talk to them individually, each one will say, my way of doing it is the only one worth supporting. To bring harmony in that kind of orchestra is a feat.

Mrs. HANSEN. I have received letters from several of them.

Mr. HILL. In my opinion that technology will not hit the mainstream until about 1985. There are that many things that will have to be done before MHD will be integral in the system.

It is longer term than the other programs we have. To justify funding at the level we are and at the increased level needed, in my opinion, will require a commitment from the utility industry that they will cosupport it. I am talking with Chauncey Starr of the Electric Power Research Institute (EPRI) to find out at what level they will come in.

I would like to have 50 percent of the money from industry and 50 percent from Government, at least in the commercial level effort. I would like to be funding it annually at $8 million. I think this would make sense.

Mrs. HANSEN. I understand that the State of Montana is deeply interested in this.

Mr. HILL. Yes. MHD power requires less water than conventional thermal power generation.

Mrs. HANSEN. They are deeply interested.

NEED FOR FINANCIAL SUPPORT OF UTILITIES

Mr. HILL. Yes. I think we would be unwise not to have the utility industry as involved in this program as the gas industry is in the high Btu gas program. I really believe that. Unless they made the decision, and this is something they will want to do, for us to develop MHD alone is a kind of academic exercise.

Mrs. HANSEN. Because they might not want to use it?

Mr. HILL. If they put money in, they would want to use it.

Mrs. HANSEN. If the committee provided all——

Mr. HILL. Yes; there is that hazard. I do not want that to happen. They need to be thinking in terms of how they would use it.

Mr. EVANS. Have they given any indication of their attitude in this regard?

Mr. HILL. Yes.

Mr. EVANS. What is that indication?

Mr. HILL. The AVCO group has obtained something like 30-percent support, the level I think all of them ought to be. At least one of the groups has been able to promote that kind of enthusiasm in the power industry. There are two men on the EPRI committee, two of the key people, who are enthusiastic about it, who are pressing hard with the Electric Power Research Institute. This is the successor group to Edison Electric that is only now jelling and is going to tax itself about

$130 million a year in order to have funds for research and development work. There is a good indication they will come aboard with us on the low sulfur oil and even put a million dollars toward Cresap if we get permission to go ahead.

Mr. EVANS. List for me examples of research done by the Office of Coal Research which has been put into commercial use by industry?

Dr. HILL. When the Office of Coal Research (OCR) got underway, it adopted some shorter term and some longer term projects. Research from several of the shorter term projects has been put into commercial use by industry, and longer term projects are progressing toward eventual commercial results.

The shorter term projects of OCR for which we have specific information of commercial use by industry are:

First, a project performed in Virginia Polytechnic Institute for development of computer mining systems. We have specific information that a significant number of coal mining companies have used these systems, and that mining equipment suppliers have used them when making recommendations to mining companies. We were also advised that other hard rock mining companies have used these mining systems. The result of their use has been significant reductions of mining cost.

Second, a project performed by Robert R. Nathan Associates for a study of foreign markets for U.S. coal was used by industry to achieve long-term export contracts for sale of U.S. coal to Canada, Italy, and Japan, totaling almost a billion dollars of balance of payments over a 12-year period starting about 1965. A project for study of markets for Midwest coal by the same contractor was credited with important assistance in a long-term coal contract for the first time from Midwest to Japan for a million tons of coal a year for 10 years.

Third, a process to make brick and other construction materials from flyash and bottom-ash from powerplant use of coal has been put into commercial use in Edmonton, Canada, and a second brick plant was added.

The Office of Coal Research has actually served its intended purpose on one of its longer term projects in that OCR has carried the research up to a point where industry is taking over and carrying on toward commercial application. The longer term project is the COED (char-oil-energy-development) process for conversion of coal to oil performed by FMC Corp. OCR is discontinuing this project early in fiscal year 1974, and a consortium of private companies will undertake the additional research at their own expense.

LOW BTU GASIFICATION PROJECTS

Mrs. HANSEN. You are requesting $11,500,000 for clean, low Btu gas/power cycles. Who are the contractors?

Mr. HILL. The low Btu gas project with Westinghouse and with seven cofunders: Air Products & Chemicals Co.; we are negotiating a contract with P&M; Batelle Northwest; and Combustion Engineering. P&M is working with Foster Wheeler and BCR on that program.

Mrs. HANSEN. Where is this being performed?

Mr. HILL. The P&M project is a letter contract thus far. No site.

Mrs. HANSEN. On what basis was the $11,500,000 derived?

Mr. HILL. It was a figure derived after much discussion in the Department and with OMB.

Mrs. HANSEN. What is the figure based on?

Mr. HILL. Optimum development during the next year of the contracts we now have signed; that is, the letter contracts we have now signed and the formal contracts being negotiated. It is preliminary to moving into pilot-plant operations which will require considerable more funding.

FUNDING FOR LOW BTU GAS PILOT PLANTS

Mrs. HANSEN. The pilot plant has not been built.

Mr. HILL. That is not in there. The first stages of pilot plant show up in the P&M and Westinghouse amount. There is the beginning of the pilot plant phase in those two for designs. We are accelerating this as much as we can.

ADDITIONAL FUNDS TO ACCELERATE LOW BTU GASIFICATION WORK

Mr. MCKAY. Are you ready to go beyond that if you had the funds?

Mr. HILL. This will allow us this year to do the job we have outlined. I am not answering your question.

Mrs. HANSEN. Did you ask for additional funds?

Mr. HILL. Yes.

Mrs. HANSEN. What did you contemplate in the "additional"?

Mr. HILL. Faster operation of these and perhaps one or two additional ones. In the overall evaluation, this is all that emerged within the present budget constraints. This is a good program.

Mr. MCKAY. What you requested is a better program.

Mrs. HANSEN. Will you go into the details of what you requested?

Mr. HILL. It seems to me we requested $20 million originally as the amount that would allow us to start a couple more different options and to move these at a faster pace. Again, additional dollars will allow you to have extra sets of possible successful operations.

You can design while you are doing some of the pilot plant testing. Again this is less efficient use of money, because you will scrub some of these and you will have to redesign as you find out something from the pilot plant. You will have to tear a valve out and put a new one in, and this will cost you more than if you waited until you found out exactly the size and kind of valve that would work. This is in terms of a compromise in terms of the low Btu gas program.

Mr. MCKAY. In light of the anticipated problem of need, is that good economy?

Mr. HILL. I think we have to recognize—and this is being reevaluated all over the place—just what intensity effort we ought to be putting in.

POSSIBLE ACCELERATION OF LOW BTU PROGRAM

Mr. MCKAY. What intensity effort do you think we ought to be putting?

Mr. HILL. This is a good effort.

Mr. YATES. That isn't an answer.

Mrs. HANSEN. The engineers and the people who have the responsibility for research don't agree with the accountants at OMB. Isn't that the situation?

Mr. HILL. Again, Madam Chairman, thank you.

Mrs. HANSEN. It reminds me of the current need for lumber, but OMB didn't provide adequate funds for programs to correct this situation.

Mr. HILL. Accelerated funding if we are requested to do it could be at a level of $100 million.

Mr. EVANS. In the next fiscal year?

Mr. HILL. In the next fiscal year.

Mr. MCKAY. With profitable use in anticipating our needs, that is, what needs face us upcoming to effect this——

NEED FOR NATIONAL COAL POLICY

Mr. HILL. Yes. This position can be well defended, that is correct. I wish the energy message had been given. I mean this would make a lot of difference.

Mrs. HANSEN. Why hasn't the energy message been issued?

Mr. HILL. You have been here longer than I have. I just came in July.

Mrs. HANSEN. As we mentioned to you, the committee felt that because we were providing research money for coal, we thought at the same time there should be the development of a national coal policy. A prohibition against strip mining could change the whole energy picture. Also recognizing the length of time it takes to develop a coal plant, you have to have some guidelines established.

Mr. HILL. Right.

Mrs. HANSEN. Considering the current energy needs obviously a coal research program is necessary, but this has to be done in concurrence with the development of a national policy.

The committee stated in our report last year that a national coal policy should be developed. Our bill was signed into law on August 10, 1972, by the President. I realize the White House has been engaged in various other enterprises but it is now almost the first of April. We deliberately delayed our hearings this year on those agencies which deal in some way or other with energy policy. We scheduled them at a later time believing that there would be a forthcoming energy message.

Well, there have been messages on everything else except energy.

Mr. HILL. I think Madam Chairman, that reflects the really serious realization.

Mrs. HANSEN. The quandaries.

ENERGY MESSAGE

Mr. HILL. The quandaries; this is right. Some of the elements you put your finger on I am sure will be part of the energy message. One element, for example, will be that there should be, there must be, regulations in strip mining that before a company can proceed with an opertaion they build into the plan an approved method for restoring the land to equal or better condition, and that can be done.

Mrs. HANSEN. Yes; this is what the committee told the public and the Congress in our report.

Mr. HILL. Right.

Mrs. HANSEN. We said we felt that the people of the United States should no longer suffer the nonreclaimed land.

Mr. HILL. Right.

Mrs. HANSEN. Incidentally, at the same time the committee added funds for reclamation research at Berea, Ky., in one of the areas where we had a critical problem. What do you think happened to those funds?

Mr. HILL. I don't know.

Mrs. HANSEN. They were impounded.

Mr. HILL. I know from personal experience having visited the site in Germany what could be done by restoration.

Mrs. HANSEN. The people at Berea have done a tremendous amount of work. The Forest Service has a great responsibility for lands. They are associated with the replenishment of the land but that item was impounded.

I just don't believe that the Office of Management and Budget is really an arm of the President. I think they are accountants shaping the policy of the United States all by themselves.

FUTURE FUNDING POSSIBILITIES

Mr. EVANS. Madam Chairman, if I may interrupt for just a moment, I have been sitting here a little stunned for a few minutes from the comment made by the witness, I think in response to a question of my good friend, Mr. McKay.

What were you referring to when you made the statement that you could in this year effectively use in fiscal 1974, $100 million.

Mr. HILL. If we were given that kind of funding we could begin the design and construction of demonstration size low-sulfur oil plants that would tie into existing powerplants and determine the suitability of the different feed strains at different levels of sulfur.

We would move ahead with the design phase of low Btu gasification, demonstration size plant. We would put additional funds, as we mentioned earlier, on the fluidized-bed program. Again, within the present budget constraints these don't fit.

Mr. EVANS. But if these moneys, the $100 million, were made available in fiscal 1974 you could efficiently and effectively use them for the project that you have just referred to and I suppose some others that would be similar.

Mr. HILL. The speeding up would be of the order of 2 years if everything went well.

Mr. YATES. You would save 2 years?

Mr. HILL. Two years, at a cost of several million more dollars, but that again is a judgment that will have to be made. We will be glad to do whatever we are directed to do.

Mr. YATES. By OMB?

Mr. HILL. By the Interior staff who will consult with OMB.

NEED GREATER FLEXIBILITY IN PROGRAM

Mrs. HANSEN. In some areas I have often felt that the budget was not flexible enough to meet contingency situations. Budget years——

Mr. HILL. They don't synchronize with the needs.

Mrs. HANSEN. They don't always synchronize with the realities of the need. This is one of the difficulties of the budget process.

Mr. HILL. Yes. When you say efficiently, I have to admit, though, not as efficiently as that same money over the longer term will be used because, as I mentioned, we would design and build a unit of a demonstration plant and by the time that was put together we would find that we had the wrong valve there. The pilot plant would have demonstrated we goofed, we used the wrong judgment, so we would have to tear that one out and put a new one in and this would cost half a million dollars that would be saved if you did it over the longer period.

Mr. YATES. What is the difference in time?

Mr. HILL. That is a tradeoff.

Mr. MCKAY. In light of the emergency needs, is it worth that expenditure?

Mr. HILL. That matter is being considered by management right now. This is a decision that is being made.

Mr. YATES. What is the difference in time between the construction of a pilot plant and taking the slower process and the speeded-up process?

Mr. HILL. This is right. If my staff and I had some discretion to move an extra $2 million onto a plant that would thus be able to operate without slowdown, without having to go the whole route, which takes a year really, this would be a real blessing. It would, in the ultimate, save time and dollars.

Fortunately, I see you set up the low Btu program that way so you have made some great strides but not enough. I find myself climbing the wall in frustration many, many times because of the problems.

Mrs. HANSEN. It is not only in this area of spending. We find it in other agencies.

Mr. HILL. I am sure that is the case.

Mrs. HANSEN. There is not enough flexibility.

Mr. HILL. We have none except in the low Btu and MHD.

Mrs. HANSEN. When you are dealing with scientific results you need some budget flexibility.

Mr. HILL. You do because so many things you simply can't anticipate, how you are going to have to rebuild the insides of that newly designed plant that we are absorbing probably out of testing time, this new liner, the insulation liner, in that CO_2 acceptor. We hoped the first insulation would work. It turned out it didn't. It was the best estimate, but now having had experience we tear it out and build a new one and this costs 3 weeks, at least, of downtime, paying all the people. They were working but not on moving the program forward.

It cost the bringing in of the crew to put in this new kind of insulation and there is no provision for that and the only place, if we are locked into a certain number of total dollars, is to come out of operations that would be of value that were designed in the first place. I couldn't agree with you more that some kind of contingency or discretionary funding would be very desirable.

Mrs. HANSEN. You have the authority to reprogram funds with the concurrence of Congress.

Mr. HILL. Yes.

Mr. HANSEN. So it is not just carte blanche authority.

Mr. HILL. No, but a mechanism for rapid response would be wonderful. That would be a wonderful asset across the board it seems to me.

Mrs. HANSEN. We have the same problems in the purchase of property.

Mr. HILL. I am sure that is so.

Mrs. HANSEN. Mr. McKay.

OIL SHALE PROBLEMS

Mr. MCKAY. We haven't touched on the oil-shale situation, as to what is happening in this field. Do you do anything about that?

Mr. HILL. I did research at the University of Utah and have some opinions.

Mrs. HANSEN. Tho oil shale program is not included in this budget.

Mr. MCKAY. Who does that?

Mr. WILES. Bureau of Mines.

Mr. MCKAY. He knows something about oil shale. I know that.

Mrs. HANSEN. Mr. Long?

Mr. LONG. How much is industry spending on the types of research you are conducting relative to the amounts you are spending?

Mr. HILL. Because most of the research by industry is performed under a cloak of secrecy we really don't know how much industry is, or has been spending for the types of research that the Office of Coal Research is engaged in. We believe that the Office of Coal Research has been quite successful in obtaining commitments for funding support from industry for our program.

Mr. LONG. Why can't we let the industry do more of the research?

Mr. HILL. In essence, coal conversion research is too long range, and much too expensive for private industry to be attracted, especially in view of the fact that final commercialization in most cases also depends on Government policy which may be uncertain. As a matter of fact we estimate that slightly more than $15 million will be forthcoming from industry to augment our fiscal 1974 program funds.

Mr. LONG. How much overlap is there between your research and that of the Bureau of Mines?

Mr. HILL. The avoidance of duplication of effort has been a major consideration from the very outset of the Office of Coal Research. A procedure for coordination of the programs was established at the beginning of the Office of Coal Research program, and has been rigorously applied. OCR always has had many more proposals for worthwhile research than its limited funds could finance, and this has been a further basis for avoidance of any duplication between our programs and the Bureau of Mines.

BRICKS FROM COAL WASTES

Mr. LONG. What is the progress of your research into making bricks out of dredging sludge—bricks which can be sold for construction purposes—thus making it unnecessary to dump the sludge spoil into the open water or into diked areas and converting a nuisance into an asset?

Mr. HILL. OCR is not working in the area of making bricks from dredging sludge. However, under OCR sponsorship a process has been developed to make bricks and other construction material from coal ash and fly ash. The bricks are physically superior to clay bricks and are generally cheaper to produce. The first commercial plant was built by International Brick & Tile Co., Ltd., Alberta, Canada. The company is planning a second plant.

The research was performed for us by the West Virginia University Coal Research Bureau at Morgantown, W. Va., and the same contractor is now working to produce useful building materials and other products from other types of coal wastes, such as mine refuse.

OIL SHALE

Mr. YATES. Tell us about oil shale, what will you be doing about it and what is your opinion as to whether or not we are going to have a breakthrough?

Mr. HILL. We have to break through. We are going to have to use all of our energy resources.

The work that we did at the University of Utah was to try to convert the kerogen in oil shale to oil in situ. We found if you pump hot natural gas into the formation—we did it in the lab with oil shale cores and later it was tested in the field—you can in fact, in a reducing atmosphere, produce a high gravity, low pour point crude that is very nice, better than the high temperature crude that you produce conventionally.

I think further efforts on in situ, reducing atmosphere, heat input, might provide the breakthrough.

Now, I say this would be a real breakthrough because oil shale consists of only 10-percent organic matter and 90-percent waste really. Marlstone is the main mineral constituent. You have to mine that material, crush it, retort it, and then dispose in an environmentally suitable way, a bigger volume of material than you mine, because it expands when you heat it. You can't put it all back in the hole you took it from.

That, therefore, means that there is going to have to be a real meeting of minds between environmentalists and industry before we can move ahead with the conventional above-ground retorting techniques, so that I think that should be done.

I think we ought to have a plant, at least one major plant built, using the technique as it is now developed, and there are indications that industry is willing to pick up the ball and move on it, and I hope we will do it because this will again put a ceiling price on crude oil.

This would help provide that ceiling price.

OIL SHALE PLANT

Mrs. HANSEN. Isn't there a plant that is scheduled to go into operation either this year or next year?

Mr. HILL. Not a commercial size plant into operation that soon. There is a commercial plant on paper now that, Tosco and Atlantic Richfield, I believe, are planning to go ahead with if they get all the permits. I hope seriously they can do it but simultaneously I would hope that the Bureau of Mines is given the funding necessary to do

the in situ studies that would allow the oil to be produced in place and then pumped out so that we wouldn't have to mine and dispose of the spent shale.

If you do that you save the cost of building a retort.

Mr. YATES. What about the plant that was closed in Rifle, Colo.?

Mr. HILL. That was a demonstration plant which determined, first, the cost of mining the rock, and we now have techniques that will allow that to be mined at, I think, a minimal cost. The Bureau of Mines determined and developed a process for retorting the shale and getting a good yield or Fischer assay yield of oil from the shale.

There have been two or three companies each of which has independently developed a retort, Union Oil Co.—let us see.

Who is our consultant from Denver? Cameron Engineers, and there probably are some other companies. Well, of course, Tosco has this alumina ball heat exchange system which looks to be a good way. So there are retorting techniques available if permission can be granted to go ahead.

OIL SHALE ENVIRONMENTAL CONSIDERATIONS

Mrs. HANSEN. Your problem really lies with environmental considerations.

Mr. HILL. Exactly.

Mrs. HANSEN. This is where your major hazard is in oil shale development.

Mr. HILL. Yes.

HIGHER EDUCATION NEEDS FOR MINING AND METALLURGICAL ENGINEERS

Mr. MCKAY. One question that we talked about briefly with the Bureau of Mines, and in light of the bill that was proposed last year, which I think was vetoed, on funding of school of mines mineralogical research, would you like to make a comment on that? I think we were arguing on whether it was 17 or 18 colleges or 20 to fund under a land-grant possibility, and what impact that may have on our future resource development in light of your field.

Mrs. HANSEN. The bill was vetoed.

Mr. HILL. And I feel badly about that because I served for 6 years as a dean of college of mines and mineral industries. There are some facts that we have to face.

As we move into this new technology we are going to need people with knowledge about mining, with knowledge about metallurgy, with knowledge about fuels engineering. We have very, very few—almost none. The United States turned out 130 mining engineers, 135 in 1971 in the whole United States.

Mrs. HANSEN. How many mining engineers is Russia producing?

Mr. HILL. 4,500 in the U.S.S.R.

Mr. MCKAY. Four thousand?

Mr. HILL. 135 against 4,500; also roughly the same number, or even 5,000, metallurgical engineers.

Mrs. HANSEN. In Russia?

Mr. HILL. We are getting down a road that frightens me. It really does.

ENGINEERS NEEDED FOR FUELS TECHNOLOGY

Mr. McKay. If we continue would you say we would have no competency in the research of the technology we need so desperately in the fuel shortage if we did not do something of that kind?

Mr. Hill. That is my strong feeling. The fact of life is that the universities are under such a dollar crunch themselves that every small class that can be phased out is being phased out.

You can teach 500 students English in a given class. Classes in mining engineering, metallurgical engineering, run maybe 10 students, and this is expensive compared to the liberal arts kind of thing. So somehow some kind of differential attention has to be given in these areas of critical need.

Mr. McKay. How many colleges would you think we would have to fund that way to provide four our national needs?

Mr. Hill. We are down now, Mr. McKay, to I think 17 colleges in the whole United States, 15 to 17, that are now giving mining and metallurgical engineering.

Mr. McKay. Of any type at all?

Mr. Hill. Of any type at all. Ten to fifteen years ago there were 35. Half of them have gone out of existence because of the economic pressures. The argument I got at Utah was how can we justify spending State of Utah money when half of your graduates go to other States in the Union.

So I was pleased with the bill that came out here that was passed because it would essentially fund half the cost of training those engineers, so the State could no longer use that argument. They put up the matching money, train their own students, but the Federal Government would essentially cover the cost of the balance. Then there would be no problem.

Mr. McKay. Madam Chairman, I wonder if he could submit for the record some testimony about how many schools he feels would be needed, whether we need 10 or 25, and some information that would lend to this.

Mr. Hill. May I suggest that I think the bill you came out with kind of did this automatically. It provided that each State that was willing to put up front-end money could get into the act. Now, States are not doing this unless they have a real incentive; so the States that have an interest in it would put up this kind of money and you have a built-in control.

No university is going to go voluntarily—they have learned their lesson—into a matching thing that is going to be a continuing cost to them unless they have a real need. So I don't think you can say there should be 17 or there should be 25. I think the laws of supply and demand——

Mrs. Hansen. Needs of the United States and what the universities recognize as the needs.

Mr. Hill. They have to put up the money. You are not going to have every State go that way.

TRAINING PEOPLE IN NEW TECHNICAL DISCIPLINES

Mr. Yates. Why can't we convert some of your Ph. D.'s who are without jobs. I think you have a lot of engineers over in California who are drifting away from the aerospace program.

Mr. HILL. Let us look at mining engineering particularly.

Some people have thought that you could take your geologist and then give him another year's work and he would be a mining engineer. This isn't so. There is a 4- to 6-year sequence of courses, if you please, that you have to go through.

Mr. YATES. Whether you are Ph. D. or otherwise?

Mr. HILL. Yes. You are a Ph. D. in a fairly narrow area in general.

NATIONWIDE DEMAND FOR MINING AND METALLURGICAL ENGINEERS

Mr. EVANS. Madam Chairman, I have a question in that regard. What is the situation nationwide as you understand it in terms of student demand for these kinds of courses, this kind of professional expertise?

Mr. HILL. There is no mechanism because of the image of the mining and metallurgical engineering area. This has been a disaster in terms of PR, so no student of his own free will and choice elects to go into mining engineering.

Mr. EVANS. Pardon my ignorance. What is the kind of image and how does it get that way?

Mr. HILL. The image of what you see in a newspaper. What a high school student sees is a newspaper report of a disaster in West Virginia, if a mine cave-in occurs, the pictures of distraught wives and mothers waiting and hoping their husband is still alive. This is the only picture they have of mining. They don't meet a single person in their educational experience that knows that this is a negligible part, that there are great satisfactions in the industry, great challenges.

There is not a high school teacher who knows anything about engineering. The closest thing you have is a chemistry teacher.

Mr. EVANS. Don't the industries try to stimulate that? Aren't they short of this expertise?

Mr. HILL. They are short of the expertise and they are now through the AIMME providing programs of education, but in order to meet the demand they have for people, I had to have each of my faculty associate himself with a high school and take over responsibility for a science club and an engineering club in order to give them some introduction.

I had to develop a series of slide-sound presentations which we distributed to all the high schools. I had to get under graduate scholarship money which the companies put up and by doing that I was able to double the enrollment in these disciplines in a period of 3 years, so it can be done but it takes all of those things.

So something of the kind that would give a university some dollars to do these things with, I think, is required.

Now, during the space thrust the Federal Government so glamorized aeronautical engineering and space engineering that the people flocked in and subsidized it and we have a surfeit of people in that area. We are starting from almost zero, almost zero, and I am concerned. I hope that we can somehow move ahead.

Mrs. HANSEN. Thank you very much, Dr. Hill. I think we have had one of the best reviews of the Office of Coal Research we have ever had. I do want to express my appreciation to you and your staff. I thought your charts were excellent.

Mr. HILL. They did a good job of preparing them.

FEDERAL METAL AND NONMETALLIC MINE SAFETY BOARD OF REVIEW

WITNESSES

HOWARD L. HARTMAN, CHAIRMAN, FEDERAL METAL AND NONMETALLIC MINE SAFETY BOARD OF REVIEW

JUBAL HALE, EXECUTIVE SECRETARY, FEDERAL METAL AND NONMETALLIC MINE SAFETY BOARD OF REVIEW

Mrs. HANSEN. We now have the Federal Metal and Nonmetallic Mine Safety Board of Review. Our principal witness is Mr. Howard L. Hartman, the Chairman. Please introduce your staff.

Mr. HARTMAN. Mr. Jubal Hale, who is our Executive Secretary, and Mr. Richard Baker, from the Office of the Secretary of Interior.

Mrs. HANSEN. You have a general statement, I am sure. Please insert it in the record at this point and review it or read it, as you wish.

Mr. HARTMAN. Thank you. Let it be entered in the record as submitted in the written form.

[The statement follows:]

GENERAL STATEMENT

Madam Chairman, I am Dr. Howard L. Hartman, Chairman of the Federal Metal and Non-metallic Mine Safety Board of Review. I would like to make a statement on behalf of the Board and answer any questions the members of your committee may have.

Members of the Board besides myself are: Peter J. Bensoni, of Duluth, Minn.; William W. Little, of Douglas, Ariz.; Robert W. McVay, of Jefferson City, Mo.; and Charles E. Schwab, of Colorado Springs, Colo.

The Board is a hearing agency, established to review contested mine closure orders which are issued by the Bureau of Mines and which require a mine operator to withdraw personnel from a mine the Bureau believes to be in violation of safety standards. As such, the Board performs essentially a judicial function; the Board is not engaged in mine inspection, or in the promulgation of safety standards. A mine closure order is reviewed by the Board whenever an operator of a mine affected by the order files an application requesting review by the Board.

Our Board provides the principal administrative remedy for an operator who wishes to contest a closure order and it is before the Board that a record is made from which further appeal may be taken to the courts. When cases come before the Board, it is essential that the Board be in a position to handle them as rapidly as is consistent with adequate consideration of the issues, not only because such is mandated by the act under which we operate, but also because it is essential to confidence in the Federal metal and nonmetal mine safety program, since mines may be closed and miners may be out of work while cases are pending before the Board.

The budget that will be required for our Board to operate effectively during fiscal year 1974 will depend on the number of cases that come before the Board. As yet, we have received no application from an operator requesting us to review a closure order.

These facts must be juxtaposed with the realization that no safety program as large and complex as that comprehended within the Federal Metal and Nonmetallic Mine Safety Act can be considered as static.

For example, important changes could arise through the routine procedure of periodically reviewing mine safety regulations within the light of experience and similarly, reviewing inspection methods and staff requirements necessary to effectively enforce the regulations. The important point to the discussion is that the mines, quarries, sand and gravel pits, and milling operations covered by the Federal Metal and Nonmetallic Mine Safety Act total approximately 17,000, and even routine changes in safety regulations and their enforcement

might generate sufficient controversy to produce a substantial number of cases for our Board to decide.

We do not know how many cases may come before our Board in fiscal year 1974, and we cannot equate specific budget requirements to a specific number of cases. Until we have had experience operating under an actual caseload, we will not know how complicated and extended the cases filed before the Board will prove to be, nor will we be able to accurately apportion costs among the various budget items. However, the Board does feel that its budget request of $160,000 is moderate when compared with the demands that could be made upon the Board. The Bureau of Mines is presently carrying on an active mine inspection program and employs 140 mine inspectors and wishes to employ 75 more in fiscal year 1974, if it can receive the funding to do so. During calendar year 1972, 208 mine closure orders were issued by the Bureau of Mines. Unsafe conditions of 149 of these mines have been corrected, and the mines reopened. In the remaining 59 mines compliance is pending. These mine operators can petition the Federal Metal and Nonmetallic Mine Safety Board of Review for annulment of, revision of, or temporary relief from, the closure orders. Thus, the Board must be in a position to act promptly should it be called upon to make an adjudicative decision of these or other cases.

LACK OF APPEAL OF CLOSURE ORDERS

Mr. HARTMAN. Perhaps I can paraphrase it briefly to say that the Board has been in existence now 2 years. We have yet to hear our first case.

Mrs. HANSEN. I know. That is what puzzles the committee.

Mr. HARTMAN. We are prepared and we continue to ask for the amount of money that we think it would take to hear a reasonable caseload but when one has no experience to go on it becomes very difficult to estimate what the cost would be if we had a caseload.

That is why we continue to ask for the same amount of money, the $160,000.

SALARIES AND EXPENSES

Mrs. HANSEN. We will insert justification pages 1 through 3 at this point in the record.

[The justifications follow:]

FEDERAL METAL AND NONMETALLIC MINE
SAFETY BOARD OF REVIEW

SALARIES AND EXPENSES

Appropriation/Total available, 1972..... $167,000

Appropriation/Total available, 1973..... 160,000

Budget estimate, 1974..... 160,000

Analysis by Activities

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Amount Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973
Adjudication and Administration.....	$59,765	$75,000	$160,000	$+85,000
Unobligated Balance Lapsing.....	107,235	85,000	---	-85,000
Total.....	167,000	160,000	160,000	---

JUSTIFICATION

Adjudication and Administration: Fiscal year 1973, $160,000; fiscal year 1974, $160,000. No change.

An appropriation of $160,000 is being requested for operation of the Federal Metal and Nonmetallic Mine Safety Board of Review for fiscal year 1974. This amount is the same as appropriated for the Board's operations during fiscal year 1973.

The Federal Metal and Nonmetallic Mine Safety Board of Review is an independent, quasi-judicial agency, established by section 10 of the Federal Metal and Nonmetallic Mine Safety Act (30 U.S.C. 721-740). More particularly, section 10(a) of the act provides:

> "An agency is hereby created to be known as the Federal Metal and Nonmetallic Mine Safety Board of Review, which shall be composed of five members who shall be appointed by the President, by and with the advice and consent of the Senate."

The membership of the Board is required to be tripartite in nature, that is, two members must represent the viewpoint of the metal and nonmetallic mine operators; two members must represent the viewpoint of the metal and nonmetallic mine workers; and the chairman, who is required to be an engineer experienced in the metal and nonmetallic mining industry and without financial or employment connection with the groups concerned.

On July 15, 1971, the Senate confirmed the following individuals as members of the Board:

Howard L. Hartman (Chairman), of Tennessee, for the term of 5 years expiring September 15, 1975.

Peter J. Bensoni, of Minnesota, for the remainder of the term of 5 years expiring September 15, 1972. On October 14, 1972, the Senate confirmed Mr. Bensoni for the term of 5 years expiring September 15, 1977.

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William W. Little, of Arizona, for the remainder of the term of 5 years expiring September 15, 1971. On October 21, 1971, the Senate confirmed Mr. Little for the term of 5 years expiring September 15, 1976.

Robert W. McVay, of Missouri, for the remainder of the term of 5 years expiring September 15, 1973.

Charles E. Schwab, of Colorado, for the remainder of the term of 5 years expiring September 15, 1974.

Dr. Howard L. Hartman, who is Chairman of the Board, is Dean of the School of Engineering, Vanderbilt University, Nashville, Tennessee. Dr. Hartman convened the Board for the first time on July 30, 1971, at which time the members were sworn in.

The Federal Metal and Nonmetallic Mine Safety Act provides for promulgation, by the Secretary of the Interior, of mandatory health and safety standards applicable to metal and nonmetallic mines, and for the enforcement of such standards.

The Bureau of Mines (Metal and Nonmetal Mine Health and Safety Division) performs the actual on-site inspections of mines.

The Board is a hearing agency, established to review contested orders issued by the Bureau of Mines which require a mine operator to withdraw personnel from a mine the Bureau believes to be in a condition in violation of mine safety standards. As such, the Board performs essentially a judicial function; the Board is not engaged in mine inspection, or in the promulgation of safety standards. A withdrawal order of the Bureau of Mines is reviewed by the Board whenever an operator of a mine affected by an order files an application for review with the Board. Appeals from final Board orders may be taken to the U.S. Courts of Appeals, and then to the U.S. Supreme Court.

To adjudicate the cases that come before it, the Board is required to conduct public hearings; to render final decisions and orders; and to certify records on appeals to the courts. Because of the "urgent need for prompt decisions," all such actions of the Board are specifically required to "be taken as rapidly as practicable, consistent with adequate consideration of the issues involved."

Apart from its adjudicative functions, the Board is required to perform the numerous organizational duties of any quasi-judicial agency in the executive branch. It is required to perform the ongoing activities of an independent agency: the maintenance of records, files and supporting data; the submission of administrative reports to other executive departments and agencies; reports to the Congress, including a detailed annual report of its operations; the prompt handling of inquiries and correspondence; and the participation in hearings before committees of the Congress.

The Board has completed its preliminary organizational work (the Board promulgated its procedural regulations on October 28, 1971) and is presently operating with a staff of two - an attorney who is also serving as Executive Secretary and a secretary. During fiscal year 1972, the Board spent only $59,765 of its $167,000 budget. The Board was able to operate on this budget partly because it was not in operation during all of fiscal year 1972, but primarily because no cases were filed before the Board. The Board, of course, must presume that cases will be filed and the present budget request is based on the assumption that only a moderate number of cases will be filed in fiscal year 1974. The Board does not wish to suggest a particular number of cases that may be filed, as even if it could accurately do so, it would be impossible to relate a particular number of cases to a particular budget - presumably, one case could be so extended

and require so many days of hearings to dispose of it, that it could use up a substantial portion of the Board's requested budget. The jurisdiction of the Federal Metal and Nonmetallic Mine Safety Act is large and covers many thousands of mining operations (the 1970 annual report of the Secretary of the Interior lists some 18,000 mines, quarries, and sand and gravel pits as being under the act). The Bureau of Mines is carrying on an active inspection program. As of November 30, 1972, there were 56 outstanding closure orders requiring operators to withdraw personnel from either all or part of a mine because of safety violations. Many of these mine operators may not intend to reopen or some may be in the process of abating safety violations. However, they could petition the Federal Metal and Nonmetallic Mine Safety Board of Review for annulment of, revision of, or temporary relief from, the closure orders. The Board must be in a position to act promptly and to adequately handle the cases that are filed.

PERSONNEL SUMMARY

	1972 Actual	1973 Estimate	1974 Estimate
Total number of permanent positions	5	5	5
Full-time equivalent of other positions	---	---	3
Average paid employment	2	2	6
Average GS grade	9.4	9.4	9.4
Average GS salary	$14,349	$14,349	$14,349

ITEMIZATION OF ESTIMATE

Appropriation Title: Salaries and Expenses — Federal Metal and Nonmetallic Mine Safety Board of Review

	1972 Actual	1973 Estimate	1974 Estimate	Increase (+) Decrease (-)
Program and Financing:				
Total obligations	$59,765	$75,000	$160,000	$+85,000
Unobligated balance lapsing	107,235	85,000	---	-85,000
Budget authority (appropriation)	167,000	160,000	160,000	---
Object Classification:				
11 Personnel compensation	27,971	35,000	88,000	+53,000
12 Personnel benefits	2,309	3,000	5,000	+2,000
21 Travel and transportation of persons	6,351	9,000	30,000	+21,000
23 Rent, communications, and utilities	15,396	16,000	16,000	---
24 Printing and reproduction	1,780	2,000	3,000	+1,000
25 Other services	4,773	8,000	15,000	+7,000
26 Supplies and materials	668	1,000	2,000	+1,000
31 Equipment	517	1,000	1,000	---
Total obligations	59,765	75,000	160,000	+85,000

OUTSTANDING CLOSURE ORDERS

Mrs. HANSEN. In your statement you state that there are 59 mine closure orders for which compliance is still pending. Do you have any knowledge as to whether any of these will be appealed?

Mr. HARTMAN. We have no knowledge. We have received no inquiries. I believe that is correct. Mr. Hale.

Mr. HALE. Out of that 59 for last year we have not received any inquiries whatsoever.

UNOBLIGATED BALANCE

Mrs. HANSEN. In 1973 you currently project an unobligated balance of $85,000. Is this based on the assumption that there will be no cases brought before the Board for the rest of the year?

Mr. HARTMAN. I believe that is correct.

Mrs. HANSEN. What portion of the $160,000 requested for 1974 will be unobligated if there are no cases brought before the Board in fiscal year 1974?

Mr. HARTMAN. Very likely close to the same amount. Our expenses last year were about $80,000.

1973 EXPENSES

Mrs. HANSEN. What did your expenses consist of?

Mr. HARTMAN. Expenses for operating an office, for two people——

Mrs. HANSEN. Where is your office located?

Mr. HARTMAN. At 1875 Connecticut Avenue, NW., here in Washington. We have two permanent staff people.

Mrs. HANSEN. What does the staff do?

Mr. HARTMAN. They maintain the office and the files that are necessary to have for this kind of a Board.

Mrs. HANSEN. What type of files do you maintain?

Mr. HALE. Mrs. Hansen, if foresight were as good as hindsight we could save a lot of money.

Mrs. HANSEN. I must say you have telephone and rental expenses.

Mr. HARTMAN. The Board does convene for administrative purposes. We met only once during the last fiscal year.

ANTICIPATED WORKLOAD

Mr. MCDADE. You don't anticipate any cases next year?

Mr. HARTMAN. It is very difficult to say that we don't anticipate cases. We have been anticipating cases for 2 years and it surprises us that none has materialized. We have no explanation to give for this.

Of course, we can't say that we expect the situation to change but yet we have to be prepared for an eventuality if cases do materialize. We receive an occasional inquiry. A person will write, as they did last week, and ask for information but they were not under a closure order.

Mrs. HANSEN. Thank you Mr. Hartman for your testimony.

Mr. HARTMAN. Perhaps we ought to regard it as insurance.

Mrs. HANSEN. I guess that is exactly what it is.

Mr. Yates.

Mr. YATES. No question.
Mrs. HANSEN. Mr. McKay?
Mr. MCKAY. No questions.
Mrs. HANSEN. Mr. Evans?
Mr. EVANS. Just one quickly.
This is not your primary occupation. As I understand you work full time doing other things.
Mr. HARTMAN. Yes, I do. I am an engineering dean at Vanderbilt so in between administrative meetings I try to look after the shop down there.
Mr. EVANS. That is true for the whole Board; isn't it?
Mr. HARTMAN. Yes, that is correct.
Mr. EVANS. Thank you, Madam Chairman.
Mrs. HANSEN. Mr. McDade.
Mr. MCDADE. No questions.
Mrs. HANSEN. Doctor, thank you very much.
Mr. HARTMAN. Thank you, Mrs. Hansen.
Gentlemen, thank you.
Mrs. HANSEN. We appreciate your appearance today.

OFFICE OF OIL AND GAS

MONDAY, APRIL 2, 1973.

WITNESSES

DUKE R. LIGON, DIRECTOR
DAVID R. OLIVER, ASSISTANT DIRECTOR (PROGRAMS AND ANALYSIS)
RALPH E. WILLIAMS, ASSISTANT DIRECTOR (EMERGENCY PREPAREDNESS AND OIL IMPORT COMPLIANCE)
LEONARD A. VICKERS, ADMINISTRATIVE OFFICER
FRANCIS M. WILES, DIRECTOR OF BUDGET, OFFICE OF THE SECRETARY

Mrs. HANSEN. The committee will come to order.
This morning we have the Office of Oil and Gas. We have as our principal witness Mr. Duke R. Ligon, the Director.

INTRODUCTION OF STAFF

Mr. Ligon, please introduce the members of your staff.
Mr. LIGON. Be glad to, Mrs. Hansen.
Mrs. Chairman, this is my first appearance before your committee. I appreciate having been given this opportunity to continue to urge your support for our Office of Programs.
With me today are Mr. Roy Goodearle, my Associate Director, on my right; Mr. David Oliver, Assistant Director, on my left, and Mr. Leonard Vickers, who is our administrative officer, and we also have with us Mr. Ralph Williams, also an Associate Director; Mr. Frank Wiles, Director of Budget of the Department of the Interior.
Mrs. HANSEN. We have met Mr. Wiles on numerous occasions.

Mr. LIGON. Mr. Fred Marsik is also with us, Madam Chairman. He just stepped out of the room. He will be in place of Mr. Dale Perry, from our oil imports division, who is sick today.

Mrs. HANSEN. Since this is your first appearance before the committee, we will insert your biography and the biographies of those individuals appearing for the first time before the committee.

[The biographies follow:]

BIOGRAPHY OF DUKE R. LIGON

Mr. Ligon, who is 31 years old, was born in Wewoka, Okla., on May 16, 1941.

His education began with a B.S., honors (chemistry) from Westminister College in 1963, followed by an M.B.A. in finance from the University of Texas at Austin in 1965 and a J.D. from the University of Texas at Austin School of Law in 1969. From 1969 to 1971 Mr. Ligon served in the U.S. Army Intelligence Corps. While serving in Vietnam he was selected to a position on the briefing staff of General C. B. Abrams.

In 1972 Mr. Ligon joined the Treasury Department where he functioned both as the Director of the Office of Natural Resources and the oil and gas policy adviser to the Secretary of the Treasury. Mr. Ligon was recently appointed as the Executive Secretary of the Oil Policy Committee. In this capacity he will be responsible for coordinating Government policy on oil imports.

Mr. Ligon and his wife, Linda, currently reside in Chevy Chase, Md. He is affiliated with the Bar of the District of Columbia, the State Bar of Oklahoma, the Federal District Court of Western Oklahoma, and the Federal Circuit Courts of Appeal in Denver and New Orleans.

BIOGRAPHY OF JAMES ROY GOODEARLE

James Roy Goodearle was recently appointed to the position of Associate Director of the Office of Oil and Gas. He was formerly a vice president of the Midland Production Corp., an independent petroleum production company in Houston, Tex. In this company he directed the geology, exploration and production programs. Between 1954 and 1960 he was assistant manager for exploration for the Slick Oil Corp. in Houston. Mr. Goodearle's most recent Federal position was Assistant to the Vice President for National Affairs.

Mr. Goodearle was born in Augusta, Ga., December 14, 1925, and grew up in Dallas, Tex. He holds a B.S. in chemical engineering from Rice University (1946) and a master's degree in petroleum engineering from the University of Houston (1954). He lives in Bethesda, Md., with his wife, Mary, and their four children.

BIOGRAPHY OF RALPH E. WILLIAMS, JR., ASSISTANT DIRECTOR, EMERGENCY PREPAREDNESS AND OIL IMPORT COMPLIANCE, OFFICE OF OIL AND GAS

Born Pecos, Tex., October 21, 1917. Graduated University of Texas 1938, B.B.A. accounting major. Commissioned Ensign, SC, U.S. Navy Reserve and ordered to active duty June 1941. Served various fleet and advanced base units in the Pacific during World War II, transferring to the regular Navy in 1943.

Subsequent duty included that of manager and cashier of the Bank of Guam; supply officer, U.S.S. *Yellowstone;* faculty and staff, U.S. Naval War College; Logistic Plans Division and Strategic Plans Division, Office of the Chief of Naval Operations; special assistant to the Chief of Naval Operations and the Secretary of the Navy; staff, Commander in Chief, Pacific; planning officer and comptroller, Naval Supply Center, Pearl Harbor. Member of the White House staff during the final 2 years of the Eisenhower administration. Retired 1965.

Upon retirement from the Navy began employment as special assistant to the Director of the Office of Oil and Gas, Department of the Interior, Washington, D.C. serving in that capacity until July 1971. Staff assistant to Assistant Secretary, Mineral Resources, July 1971 to December 1972. Assistant Director, Office of Oil and Gas, since January 1, 1973. Was a principal contributor to Department of the Interior reports, An Appraisal of the Petroleum Industry of the United States; (1965) U.S. Petroleum Through 1980; (1968) Petroleum and Sulfur on the U.S. Continental Shelf; (1969) and U.S. Energy, A Summary Report (1972). Author of numerous articles in military journals, including "Strategy and Oil," appearing in the 1967 Naval Review.

Married; three sons. Residence, Falls Church, Va.

GENERAL STATEMENT

Mrs. HANSEN. I am sure you have a general statement Mr. Ligon.

Mr. LIGON. Yes, ma'am.

Mrs. HANSEN. Please insert your general statement in the record and summarize it for the committee.

Mr. LIGON. Thank you. I will file our prepared statement and comment on it briefly.

[The statement follows:]

Madam CHAIRMAN. I am Duke R. Ligon, Director of the Office of Oil and Gas, Department of the Interior. This is my first appearance before the committee, and I appreciate having been given this opportunity to urge your continued support for our office's programs. With me are my: (1) Associate Director, Mr. Roy Goodearle, (2) my assistant directors, Mr. Dell Perry, Oil Imports, Mr. David Oliver, Programs and Analysis, Mr. Ralph Williams, Emergency Preparedness and Oil Import Compliance, (3) our administrative officer, Mr. Len Vickers, and (4) Mr. Frank Wiles, director of budget for the Department of the Interior.

Madame Chairman, I request permission to file our prepared statement and to comment on it briefly. Our 1974 budget request of $1,485,000 is no change from the amount available for the current year. The proposed funding will be entirely for coordination of oil and gas activities and to implement our assigned responsibilities under the Mining and Minerals Policy Act of 1970 (Public Law 91–631).

The committee's attention is invited to the fact that the requested level of support of $1,485,000 in the Department's direct appropriation covers 67 authorized headquarters permanent positions. Most of the salary costs for our 10 regional field staff people are provided by a transfer of funds from the Office of Emergency Preparedness' "Delegate Agency" appropriation. In 1974, we intend to continue to carry out the Department's responsibilities for oil and gas matters and to develop a more flexible and responsive organization to handle present and predicted national energy problems.

Our proposed 1974 program will be directed toward the responsibilities, programs, organization, continuing studies and projects that have been described at some length in our budget justification books.

I would like at this time to cover the highlights of our activities first in fiscal year 1973 and finally what we foresee for 1974. With your permission I would like to submit for the record our recently prepared overview of the domestic petroleum supply situation which supplies detail for the items touched on in my oral statement.

The continuing deterioration of the domestic oil and gas supply-demand balance during fiscal year 1973 has predictably resulted in an increased tempo of activity on the part of the Office of Oil and Gas.

A large part of the additional workload took the form of special analyses of actual or anticipated fuel problems, ranging from general overviews of the world petroleum situation to the special problems of distillate supply in the Midwest. Among the subjects covered were the world crude oil supply outlook; a special report on domestic and world refinery capacity and growth; an analysis of the crude oil supply problems of small midcontinent refiners; national and regional supply-demand balances for distillate fuels and for gasoline; and a report on the outlook for transportation fuels.

Over recent weeks the Office of Oil and Gas has been occupied continuously in providing analytical support for the Oil Policy Committee and its chairman. It has also participated with other departments since December in numerous studes made of the current fuel situation under the general coordination of the Office of Emergency Preparedness. It has supplied a number of other analyses and oral briefings on request of congressional committees, the Cost of Living Council and the White House.

The general tightness of distillate fuels throughout most of the country, and particularly in the Midwest, generated a large load of correspondence and telephone inquiries and requests for assistance to be answered by staff members of the Office of Oil and Gas during the months of December, January, and February. On a number of occasions the Office and its field representatives were able to be of assistance in helping buyers to locate supplies of needed products, and

to offer technical advice to State authorities involved in the solution of oil supply problems.

The disappearance of virtually all domestic spare capacity to produce and refine petroleum and our increasing dependence on foreign oil sources has involved the Office of Oil and Gas in two significant studies being undertaken by the National Petroleum Council at the request of the Secretary of the Interior. The first of these is a study of factors: (1) affecting the domestic refining industry's capaicty to respond to future demands that may be made on it. The second is an analysis of all possible: (2) emergency supplements and alternatives to oil supply in the event of a massive cut-off of foreign supply. Staff members of the Office of Oil and Gas act as government cochairman of the working subcommittees involved in these studies, and participate actively in them.

Looking further to the problem of dealing with interruptions to foreign oil supplies, the Office of Oil and Gas conducted a national petroleum exercise (NAPEX 1972) in September to test the effectiveness of its emergency organization, the Emergency Petroleum and Gas Administration (EPGA). Over 400 individuals participated, about 300 of which were members of the petroleum and gas unit of the national defense executive reserve. The exercise problem postulated a severe cutoff of foreign oil supplies in a peacetime situation—and was the first scenario ever worked for this organization outside the context of a war emergency.

To mitigate the effects of a tight domestic supply situation, the President made a number of changes in the oil import control program in December and January aimed at improving the Nation's access to crude oil and certain products in the world market. Each change in the proclamation entitled changes in the detailed regulations published by the Office of Oil and Gas to implement it. In addition there was the concurrent rise in activity related to issuing of licenses and explaining to numerous correspondents the practical effect of the changes upon their particular-circumstances.

Two ongoing responsibilties not directly related to the worsening fuel situation but which present a rapidly growing demand for professional expertise are the oil import compliance program and participating in the preparation and review of environmental impact studies related to oil and gas production and consumption.

The oil import compliance function is designed to assure that importers holding licenses or allocations to import oil are in fact qualified to receive them, and are using them in accordance with the governing regulations issued by the Office of Oil and Gas. It only began as a regular, systematic effort about a year ago when funds were made available for that purpose.

During the past 12 months, 125 inspections were conducted. It is our objective to complete 167 inspections in the 6 months immediately ahead. Our workload in this program is therefore targeted for a planned increase.

The work of the Office of Oil and Gas on environmental impact statements continues at a high level with no diminution in sight. In addition to its direct input to statements written in the Deparment of the Interior on such proposed actions as oil and gas lease sales, the Office reviews and comments upon numerous statements originating in other departments. It also has the responsibility for preparation of economic alternatives for all environmental impact statements on energy programs prepared by the Department of the Interior.

A third new and continuing requirement is the Office of Oil and Gas contribution to the annual report submitted to Congress by the Secretary of the Interior in compliance with the Mining and Minerals Policy Act of 1970. This report deals with the state of the Nation's mining, minerals, and minerals reclamation industries, including the fuel minerals. The Office of Oil and Gas submission for the second of these annual reports was made in November, and comprised data and situation analyses on petroleum and natural gas production, productive capacity, reserves, dependency on foreign supplies, and the effects of environmental regulations on oil and gas development and production.

In summary, the Office of Oil and Gas is concluding the third fiscal quarter of a busy year, and the outlook is for an even busier year ahead. I would like now to include a brief assessment of the shape of things to come in fiscal year 1974.

The experience of this past winter has marked the beginning of a period of tight domestic petroleum supply. We will not be able to overcome this situation until adequate crude supplies of appropriate quality are available, and until we can restore a level of domestic refining capacity which will provide flexibility within the industry to respond to both the normal growth in petroleum demand

and the unusual disruption of supply or spurts of demand which are occasionally experienced.

By way of summary, the distillate fuel supply problems for this winter are probably past, for the time being. The industry was able to respond to requests from the Government, with the assistance of relaxed import restrictions, to make enough supplies available to meet essentially all distillate requirements over the winter. Shortages and threats of shortages were numerous throughout the winter, but relatively few cases of shortage were actually experienced. We expect that, barring any unusual problems of supply or extreme weather through the balance of March and April, fuel demands will be met and the industry will come to an inventory level for distillates approximately the same as last year's. It must be pointed out, however, that last year's inventory at the end of the winter was unusually low, and was at least one factor in the array of circumstances which precipitated the supply problems of this winter. Our attention now is shifted toward the supply situation for gasoline during this coming summer, and beyond that, projections for next winter's distillate supplies.

Commensurate with the industry's increases in distillate production this past winter were reductions in gasoline production and a corresponding slow rate of growth in gasoline inventories. Gasoline stocks currently stand about 20 million barrels behind March 1972 levels, and 1973 gasoline demand is expected to show a strong—about 6 percent—growth over last year. Now that the demand for distillates has tapered off, we expect a shift in the industry back toward maximum gasoline production, and some of the current deficit in inventories should be erased. However, there will be strong pressure on the industry to build distillate inventories over the summer to a level which will preclude a repeat of this winter's problems in the 1973–74 winter. There is considerable doubt that domestic refineries can be operated at rates sufficient to meet both objectives of supply in 1973; that is, to meet: (1) demands for gasoline and to build up adequate distillate stocks for next winter.

The configuration of domestic refineries is keyed to high yield of gasoline—much more so than foreign refineries. It is expected that production of gasoline by U.S. refiners, with a corresponding drive toward importation of distillate fuels may provide the fuels we need. In this environment, we expect that the potential for critical and widespread shortages of gasoline over the summer is low. There will undoubtedly be problems with gasoline distribution in the market place, with many independent marketers having difficulty securing supplies from a very thin spot wholesale market. However, the overall impact on the motoring public hopefully will be minimal.

The look of things ahead in fiscal year 1974 suggests that we are going to have to run even faster to stay in the same place. The need to give assistance to consumers and State officials in solving petroleum supply and distribution problems will be as great or greater than in the current year. The Nation's increased reliance on foreign oil will require increased attention to the planning and organizing we must do to meet large-scale emergencies. Staff support must continue to be provided by those officials charged with formulating policies for assuring our access to world oil and gas supplies and for providing adequate incentives for developing our domestic petroleum resources. As oil import policy is adapted to changing circumstances, the administrative procedures to implement these policy innovations must be developed and put into operation. The net result is additional work for both the oil import administration and the oil import compliance programs. In every area of our responsibility we in the Office of Oil and Gas look for more action in fiscal year 1974 than we have seen in fiscal year 1973.

This concludes my oral testimony, Ms. Chairman. At this time we shall be happy to answer any questions that you or the other members of the committee may care to ask.

BUDGET FOR FISCAL YEAR 1974

Mr. LIGON. Our 1974 budget request of $1.485 million is no change from the amount available for the current year. The proposed funding will be entirely for coordination of oil and gas activities and to implement our assigned responsibilities under the Mining and Minerals Policy Act of 1970—Public Law 91–631.

Mrs. HANSEN. Your budget request is the same as last year. Have your responsibilities increased during the past year and do you foresee an increase in the activities during the next several months?

Mr. LIGON. We certainly anticipate an increase in activities. The literal scope of the responsibilities have not increased. Actually, our responsibilities are threefold. They involve, as I am sure you are aware, oil import responsibilities for verifying inputs, programs such as emergency preparedness and then the actual focal point of governmental and industry coordination in the Government as well as staff work.

IMPORTS OF ALGERIAN NATURAL GAS

Mrs. HANSEN. This is why I asked the question, because you have the problem of increasing demands for imports.

Yesterday I noted the signing of a contract with Algeria on natural gas. Does your office have responsibility for such contracts?

Mr. LIGON. No, ma'am. It was very interesting and also involved the FPC approval because of their jurisdictional aspects over natural gas.

Mrs. HANSEN. The gas is transported by ship?

Mr. LIGON. Yes, it is.

Mrs. HANSEN. Liquefied?

Mr. LIGON. Yes, ma'am.

Mrs. HANSEN. Is your office or FPC taking note of the hazards in shipping?

Mr. LIGON. The FPC is taking such notice.

Mrs. HANSEN. What are they doing?

Mr. LIGON. I was going to add that the Eximbank also considered the safety aspects when they were considering the Government guarantees of that loan. That was one of the things which really held up the Government guarantees when the Eximbank and other governmental agencies looked into the matter.

Mrs. HANSEN. Please insert in the record the total amount of the loan, how much gas is being imported, and the terms of the contract.

Mr. LIGON. Yes, ma'am.

[The information follows:]

Final approval by the FPC and conclusion of financial agreements between SONATRACH and the Export-Import Bank to extend $157 million credit to Algeria for gas liquefaction facilities removes the last hurdle in bringing the El Paso Natural Gas Co.-LNG import project into operation. The project provides for initial deliveries of LNG equivalent to 1 billion cubic feet per day. Project is expected to go into operation in 1976. The 25-year sales agreement is valued at $8 billion.

Mrs. HANSEN. Please proceed with your general statement, Mr. Ligon.

ADDITIONAL WORKLOAD OF OFFICE

Mr. LIGON. Very well.

The continuing deterioration of the domestic oil and gas supply-demand balance during fiscal year 1973 has predictably resulted in an increased tempo of activity on the part of the Office of Oil and Gas as we were just relating to you, Madam Chairman.

A large part of the additional workload took the form of special analyses of actual or anticipated fuel problems, ranging from general

overviews of the world petroleum situation to the special problems of distillate supply in the Midwest.

Over recent weeks the Office of Oil and Gas has been occupied continuously in providing analytical support for the Oil Policy Committee and its Chairman. It has also participated with other departments since December in numerous studies made of the current fuel situation under the general coordination of the Office of Emergency Preparedness. It has supplied a number of other analyses and oral briefings on request of congressional committees, the Cost of Living Council and the White House.

Mrs. HANSEN. I haven't seen much impact from the Cost of Living Council, is there such a thing?

Mr. LIGON. There is, Madam Chairman, believe it or not.

Mrs. HANSEN. Because the price of oil has increased, the price of meat has increased. An artichoke, advertised in the West, was 30 cents and it is 69 cents in a grocery store in Washington, D.C. Do not tell me it costs 39 cents to haul an artichoke.

Mr. MCKAY. The Cost of Living Council is just gathering facts, they are not doing anything.

Mrs. HANSEN. Who heads the Cost of Living Council?

Mr. LIGON. Mr. Dunlop heads it, Mr. Jamie McLane is the actual administrator of these programs.

Mrs. HANSEN. Please proceed, Mr. Ligon.

Mr. LIGON. The general tightness of distillate fuels throughout most of the country, and particularly in the Midwest, generated a large volume of correspondence and telephone inquiries and requests for assistance to be answered by staff members of the Office of Oil and Gas during the months of December, January and February. On a number of occasions the Office and its field representatives were able to be of assistance in helping buyers to locate supplies of needed products, and to offer technical advice to State authorities involved in the solution of oil supply problems.

OIL AND GAS STUDIES

The disappearance of virtually all domestic spare capacity to produce and refine petroleum and our increasing dependence on foreign oil sources has involved the Office of Oil and Gas in two significant studies being undertaken by the National Petroleum Council at the request of the Secretary of the Interior. Staff members of the Office of Oil and Gas act as Government cochairmen of the working subcommittees involved in these studies, and participate actively in them. You might be interested in what those studies are. The first subject has to do with refining capacity; the second is concerned with the emergency preparedness.

Looking further to the problem of dealing with interruptions to foreign oil supplies, the Office of Oil and Gas conducted a national petroleum exercise (NAPEX '72) in September to test the effectiveness of its emergency organization, the Emergency Petroleum and Gas Administration (EPGA). Over 400 individuals participated, about 300 of which were members of the Petroleum and Gas Unit of the National Defense Executive Reserve.

CHANGES IN OIL IMPORT CONTROL PROGRAM

To mitigate the effects of a tight domestic supply situation, the President has made a number of changes in the oil import control program aimed at improving the Nation's access to crude oil and certain products in the world market. Each change in the proclamation entailed changes in the detailed regulations published by the Office of Oil and Gas to implement it. In addition there was the concurrent rise in activity related to issuing of licenses and explaining to numerous correspondents the practical effect of the changes upon their particular circumstances.

Two ongoing responsibilities not directly related to the worsening fuel situation but which present a rapidly growing demand for professional expertise are the oil import compliance program and our participation in the preparation and review of environmental impact studies related to oil and gas production and consumption. Both present demands on our staff which cannot be postponed.

A third new and continuing requirement is the Office of Oil and Gas contribution to the annual report submitted to Congress by the Secretary of the Interior in compliance with the Mining and Minerals Policy Act of 1970.

SUMMARY OF GENERAL STATEMENT

In summary, the Office of Oil and Gas is concluding the third fiscal quarter of a busy year, and the outlook is for an even busier year ahead. I would like now to include a brief assessment of the shape of things to come in fiscal year 1974.

The experience of this past winter has marked the beginning of a period of tight domestic petroleum supply. We will not be able to overcome this situation until adequate crude supplies of appropriate quality are available, and until we can restore a level of domestic refining capacity which will provide flexibility within the industry to respond to both the normal growth in petroleum demand and the unusual disruption of supply or spurts of demand which are occasionally experienced.

By way of summary, the distillate fuel supply problems for this winter are probably behind us, for the time being. Our attention now is shifted toward the supply situation for gasoline during this coming summer.

GASOLINE STOCKS

Gasoline stocks currently stand about 23 million barrels behind March 1972 levels, and 1973 gasoline demand is expected to show a strong (about 6 percent) growth over last year.

Mrs. HANSEN. If all the cars consume as much gas this year compared to last year——

Mr. LIGON. I am sure they will.

Mrs. HANSEN. How much has gasoline consumption increased this year over last year?

Mr. LIGON. We anticipate 6 percent for the calendar year.

Mrs. HANSEN. What does that mean in terms of barrels?

Mr. LIGON. About 300,000 barrels a day. So it is a 6- to 8-percent increase over the past year.

Now that the demand for distillates has tapered off, we expect a shift in the industry back toward maximum gasoline production, and some of the current deficit in inventories should be erased. However, there will be strong pressure on the industry to build distillate inventories over the summer to a level which will preclude a repeat of this winter's problems in the 1973–74 winter. There is considerable doubt that domestic refineries can be operated at rates sufficient to meet both demand for gasoline and the requirements for inventory buildup of distillate stocks for next winter.

Our domestic refineries are geared to high yield of gasoline—much more so than foreign refineries. It is expected that high production of gasoline by U.S. refiners, with correspondingly high imports of distillate fuels may provide the supply we need. Under these circumstances, we expect that the potential for critical and widespread shortages of gasoline over the summer to be low. There will undoubtedly be problems with gasoline distribution in the marketplace, with many independent marketers having difficulty securing supplies from a very thin spot wholesale market. However, the overall impact on the motoring public hopefully will be minimal.

The look of things ahead in fiscal year 1974 suggests that we are going to have to run even faster to stay in the same place. In every area of our responsibility we in the Office of Oil and Gas look for more action in fiscal year 1974 than we have seen in fiscal year 1973.

This concludes my oral testimony, Madam Chairman. At this time we shall be happy to answer any questions that you or the other members of the committee may care to ask.

PETROLEUM IMPORTS FROM WESTERN HEMISPHERE

Mrs. HANSEN. Mr. Ligon, what is the current amount of oil being imported? Please indicate the sources.

Mr. LIGON. In 1972, Madam Chairman, our total products in crude oil imported was about 4.7 million barrels a day.

Mrs. HANSEN. This is what percent of total consumption?

Mr. LIGON. Our total consumption was about 16 million barrels per day. So we are importing about 28 percent of the total consumption.

Mrs. HANSEN. Where are our principal sources of this crude?

Mr. LIGON. Traditionally, we have relied upon the Western Hemisphere, particularly Canada and Venezuela, which have been our main sources.

Mrs. HANSEN. What has occurred to change this situation?

IMPORTS FROM CANADA

Mr. LIGON. I will discuss the Canadian situation first. In February the Canadian Energy Board announced their intention to impose export controls on exports of oil from Canada and they have done so.

Mrs. HANSEN. What was their reason?

Mr. LIGON. The reason simply was to protect their own domestic security. First they wanted to have enough crude oil reserves for their own needs and how they will determine what their own needs really are will be interesting to watch. This problem should be resolved in the next 2 or 3 months. It will probably be based on a formula having to do with production-to-reserve ratios. Depending on how they cal-

culate these ratios, we will know what balances will be exportable to us.

Mrs. HANSEN. What is Canada's production per year?

Mr. LIGON. 745,000 barrels a day is what we allow them under our import regulation program. However, we have lifted certain parts of the oil import program quotas to allow entry of 1.2 million barrels a day at the present time. They have always been able to do this without any problem in the past.

Mrs. HANSEN. Has Canada reached a point where she wants to retain more of her oil for her own industries?

Mr. LIGON. Yes, ma'am; that is correct.

Mrs. HANSEN. With the hope of increasing her industrial production?

Mr. LIGON. That is right. Their total production is about 2 million barrels a day. As I said previously, about 1.2 million is what they have been sending to us. In the late part of the winter, when our refiners were feeling the tight supply situation in districts 1 through 4, we were asking for more and more crude coming out of Canada, even to the point that——

Mrs. HANSEN. Did we receive the crude through the interprovincial pipeline?

Mr. LIGON. Yes, ma'am; the interprovincial pipeline is the major one.

MAJOR REFINERIES

Mrs. HANSEN. Where are the major refineries located?

Mr. LIGON. In Canada?

Mrs. HANSEN. No in this country.

Mr. LIGON. The Canadian crude, of course, supplies our major refineries in what we call the northern territory of refineries in the nothern part of the United States, as well as the Chicago area.

Mrs. HANSEN. Does this include New England?

Mr. LIGON. No; this is the Midwest. Buffalo is the furthest extent of the eastern reaches of the interprovincial pipeline.

Mrs. HANSEN. How many refiners are handling Canadian oil?

Mr. LIGON. I do not know the exact number. I will be glad to get it for you.

[The information follows:]

In districts I–IV, there are some 72 refineries which process at least some Canadian crude. On the west coast (district V) there are five or six refineries running Canadian crude. These numbers vary slightly from year to year.

Mrs. HANSEN. Have you any idea of the approximate number?

Mr. LIGON. Probably the nothern tier of refineries west of Chicago would probably be 10, 15, 20 refineries, and the Chicago area may have six.

IMPORTS FROM VENEZUELA

Mrs. HANSEN. How much do we purchase from Venezuela?

Mr. LIGON. The Venezuelan production was just under 1 million barrels per day. But with the Venezulean situation, we have found that the Government atmosphere in Venezuela has not been conducive or encouraging to further investment on the part of the oil companies.

Mrs. HANSEN. Why?

Mr. LIGON. Several reasons. First of all, the tax values have been continually rising in the past several years; the taxes that the Venezuelan Government has levied on the crude exports have been rising, as well as the royalty payments. As a result, this has cut into much of the profits that had originally been generated in Venezuela. The American oil companies have been reluctant, as a result of decreasing net returns on their investments, to put more money into it.

Mrs. HANSEN. Is Venezuela dependent upon U.S. oil companies or Dutch oil companies?

Mr. LIGON. U.S. oil companies primarily. They have a state-owned oil company, which it is called VCP. It produces about 1.3 percent of their total crude supply, which is very small, of course. They have also made some inroads in marketing, but not refining, as yet. We think they have the intention of doing so in the future. VCP controls about 30 percent of the internal marketing in Venezuela.

With regard to your question, Madam Chairman, on investment and how the adverse atmosphere has not been helpful to the oil companies and their production. It is interesting to note that most of the production in Venezuela is primary production, and of course there has been very little incentive for secondary recovery; so that we might be able to increase oil production, much less tertiary and much less tar sands development in the Orinoco tar belt and so forth. Therefore, the oil companies have refused to promote secondary recovery, if they cannot have any guarantee of a better return. There is also some fear on the part of the oil companies that there may be a nationalization of their assets.

Mrs. HANSEN. Are they afraid the VCP is going to take over the entire production?

Mr. LIGON. Yes, ma'am. That is one of the reasons why Venezuela has not been as consistent in participation with other O.P.E.C. countries, because their concessions end in the early eighties; after that all oil facilities revert to the state-owned oil companies.

Mrs. HANSEN. What other nations purchase from Venezuela and Canada?

Mr. LIGON. I think it is very fair to say in the case of Venezuela, Canada is the other large purchaser of their oil; at the same time the United States is the major purchaser of Canadian oil. Any other purchaser of Canadian oil is just very, very small and almost insignificant.

JAPANESE OIL IMPORTS

Mrs. HANSEN. Where is Japan importing her oil from?

Mr. LIGON. They are getting their oil from Indonesia; they are currently involved in negotiations in the Middle East, the Persian Gulf. They are very aggressive with their ability to make deals and guide them. They are not held down by an effective Cost of Living Council like our oil companies are. They are under no price controls.

MIDWESTERN OIL AND GAS PROBLEMS

Mrs. HANSEN. When you talked about supply you noted the tightness of fuels in the Midwest. Why is the Midwest in particular need and is this the leading shortfall area in the United States?

Mr. LIGON. The Midwest was in trouble as a result of a lack of petroleum storage facilities, first of all. Traditionally, of course, the largest consumer part of the country for No. 2 fuel oil has been district 1, or the east coast. There is considerable storage capacity available in the eastern part of the United States. Since No. 2 fuel oil supply has never been a problem in the Midwest, it was not expected to be a problem this winter.

However, there was an unusual chain effect that I know has been described to you before, which happened this past winter in the Midwest.

Mrs. HANSEN. I want to see if all your stories agree.

Mr. LIGON. First of all, there was a colder winter, and there were grain problems with regard to drying of grain, and so forth. There was a great pressure on natural gas consumption and, as a result, gas curtailments occurred and in an attempt to try to——

Mrs. HANSEN. Have not the gas curtailments been occurring for the last several years?

Mr. LIGON. Not nearly as severely as they did over the last 12 months.

LACK OF STORAGE CAPACITY

Mrs. HANSEN. Why do they lack storage capacity?

Mr. LIGON. My reference to storage capacity had to do with No. 2 fuel oil. I did not have reference to natural gas. There was a national shortage of "extra" natural gas.

Mrs. HANSEN. I understand.

Mr. LIGON. Now your question was?

Mrs. HANSEN. Why is there a lack of storage capacity in the Midwest?

Mr. LIGON. Because, in the past, the Midwest has always relied solely on natural gas availability and it has not been forced to go to the fuel oil. Many of the utility generators and industrial users, customers for natural gas, were forced to convert to residual or No. 2 fuel oil.

PROBLEMS OF INDEPENDENT REFINERS AND CUSTOMERS IN MIDWEST

Mrs. HANSEN. You mention in your prepared statement the general tightness in supply of distillate fuels, et cetera. I am sure you have had a lot of communications from the small independent dealers.

Mr. LIGON. Yes, ma'am.

Mrs. HANSEN. Why have they been singularly affected?

Mr. LIGON. This has been an interesting phenomenon. As a result of a declining domestic oil production in the Midwest, many of the smaller refineries which have always depended on Midwest sources for their supply of crude oil were unable to get enough. As a result, their customers have been in trouble for the first time. These small refineries supply much of the diesel fuel to farmers in that area. The only type of crude that these refineries can use is a singular type—low sulfur, sweet crude. Most imported oil, if it is not that type, is just not usable in those midwestern refineries. There are also transportation and distribution problems of moving even sweet crude from the coast inland. These are all reasons why the Midwest is short.

Mrs. HANSEN. They are the shipments that come from the gulf?
Mr. LIGON. Yes, ma'am.

ENVIRONMENTAL IMPACT MATTERS

Mrs. HANSEN. How many environmental impact statements do you prepare each year?
Mr. LIGON. Madam Chairman, Mr. Oliver, sitting to my left here, is the Assistant Director, responsible for the environmental impact statements. He might be able to help us on your question.
Mrs. HANSEN. Mr. Oliver?
Mr. OLIVER. We have been very fortunate, I think, that we have not had to prepare a formal environmental impact statement to date. We have had to do a number of environmental impact analyses, but so far——
Mrs. HANSEN. Yes; but do you not foresee that it will be necessary to prepare an impact statement at the time a refinery site is selected?
Mr. OLIVER. Under the present law, if this involves a major Federal action, it would have to be an environmental impact statement.
Mrs. HANSEN. If you are increasing your imports, for example, to take care of a situation, does an impact statement have to be prepared?
Mr. LIGON. There has not been a determination for a need for a statement under that situation. We have done an impact analysis, but we have not been required to file an impact statement.
Mrs. HANSEN. Do you foresee a time when you will be called upon to prepare a impact statement?
Mr. LIGON. This is possible.
Mrs. HANSEN. I think if current concerns continue about the location of refineries, this will certainly lead to preparation of impact statements, particularly if you increase imports.
Mr. LIGON. This is certainly a consideration we are trying to keep abreast of. We are trying to keep a handle on the environment problem.

PAD DISTRICTS

Mrs. HANSEN. Since many of the subcommittee members are new this year please list for us your five oil regions.
Mr. LIGON. Yes. District I—these are all Petroleum Administrative Defense districts—district I is the east coast, district II is the Southeast as well as the Midwest, district III——
Mrs. HANSEN. How far west does district II go?
Mr. LIGON. District II——
Mr. OLIVER. It comes all the way over to the Kansas-Colorado border and includes North Dakota and South Dakota.
District III is Texas, Louisiana, New Mexico, and Mississippi.
Mr. LIGON. District III, of course, is the Gulf coast area. District IV is the Rocky Mountain area.
Mr. OLIVER. Montana, Idaho, Wyoming, Utah, Colorado, and New Mexico.
Mr. LIGON. District V is the west coast, including California, Oregon, and Washington.
Mr. OLIVER. That also includes Hawaii and Alaska.
Mrs. HANSEN. In what area is your greatest shortfall?

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SHORTAGES OF REFINERIES IN DISTRICT I

Mr. LIGON. The greatest shortfall, of course, is the area where the largest consumption occurs and that is the district No. I on the east coast, an area that has had no new refinery construction. I believe—1958 was the last time there was any refinery construction in that area at all.

Mrs. HANSEN. 1958?

Mr. LIGON. 1958.

Mrs. HANSEN. How adequate are the refineries?

Mr. LIGON. Totally inadequate.

Mrs. HANSEN. Why hasn't this situation been remedied?

Mr. LIGON. There has been a problem with several factors that we can talk about.

Mrs. HANSEN. Such as?

Mr. LIGON. Lack of ability to plan, to get the available crude that is necessary to run a refinery, shortages of the particular crude which is needed to run a particular refinery, and the variety of investments and facilities needed to handle the sweet crude available or the sour crude available.

Mrs. HANSEN. From whom do they receive their crude?

Mr. LIGON. East coast refineries can get their crude from—probably the most economic source that they can get it—it would be safe to say that the imported crude would be the most economical crude to purchase.

Mrs. HANSEN. Imported from the Mideast?

Mr. LIGON. Mideast is where most of it would probably come from. It would not come from Canada, coming from the East. However, there is a possibility some Venezuelan crude could be imported.

Mrs. HANSEN. That is a long haul.

Mr. LIGON. Long haul; there are also refining and terminal siting problems.

PROBLEM OF REFINERIES CONSTRUCTION

Mrs. HANSEN. Why haven't they been able to make arrangements for long-term crude contracts so they could build refineries?

Mr. LIGON. There are several reasons for that. First of all, the import program has, quite frankly, not been a stable enough vehicle so companies could plan.

Mrs. HANSEN. Do you want to explain that further for the committee?

Mr. LIGON. Be glad to.

For the next 10 years or so you must be able to plan, if we were going to build a refinery in the East in district I.

Mrs. HANSEN. You would want to be able to say to the person constructing a refinery, you are going to be able to get x number of barrels from, say, Saudi Arabia, x number of barrels from Venezuela; is that correct?

Mr. LIGON. That is right.

Mrs. HANSEN. What proportion of domestic oil goes into that area?

Mr. LIGON. Goes into PAD I?

Mrs. HANSEN. Yes.

Mr. LIGON. There is a major pipeline system from the gulf coast, called the Colonial pipeline. This goes all the way up, makes the arc from the Houston area, New Orleans, gulf coast, on around through Atlanta, straight on up into Baltimore. It supplies much of the southern portion of district I.

Mrs. HANSEN. But not New England?

Mr. LIGON. Not New England, that is correct.

Mrs. HANSEN. So your problem is to have a long-term plan for the import of the crude?

Mr. LIGON. That is right. There is no assurance of price stability, either, which an entrepreneur might be able to use in planning as the price that he must expect to pay for crude oil. That is another major problem.

PROBLEMS OF VENEZUELA AND MIDDLE EAST CRUDES FOR EAST COAST

We discussed the two possibilities of the sources of crude. Venezuelan and Mideast crude.

Mrs. HANSEN. But you told us that there is not much stability in Venezuela, itself, as far as investments are concerned.

Mr. LIGON. That is right.

Mrs. HANSEN. So that you have no reliable source to supply the refineries in the North, is that correct?

Mr. LIGON. That is correct.

NEAR EAST OIL SITUATION

Mrs. HANSEN. What is the situation in the Near East?

Mr. LIGON. In the Near East we have even a worse problem, simply because we have an organization of petroleum exporting countries, which you are familiar with. The OPEC countries (Organization of Petroleum Exporting Countries) have formed a very effective cartel as far as being able to control the prices that they are able to demand and receive for their products, and their crude oil. But this is very unreliable for planning purposes simply because, no investor can anticipate how much he would have to pay for a barrel of crude from the Middle East.

Mrs. HANSEN. As other nations enter into increased purchases from the Mideast, and with the Near East, your situation becomes more unreliable.

Mr. LIGON. Yes, ma'am.

Mrs. HANSEN. What nations are the leading competitors for oil in the Near East?

Mr. LIGON. You mentioned a moment ago, Japan; they have been very, very aggressive in the Mideast as well as the rest of the Asian producing areas; and Western Europe, of course, is very competitive.

Mrs. HANSEN. What about West Germany?

Mr. LIGON. Yes, they are.

Mrs. HANSEN. France?

Mr. LIGON. Yes. Italy.

Mrs. HANSEN. England?

Mr. LIGON. Italy.

Now, Great Britain was much more aggressive before the successful North Sea explorations. As a result of the North Sea discoveries, a

great deal of the pressure was taken off of their aggressiveness in the Middle East markets. But all European countries continue to put a great increasing pressure on the market and prices.

Mrs. HANSEN. Which will raise the cost?

Mr. LIGON. Continue to raise the cost.

Mrs. HANSEN. You do not foresee that either the Near East or Venezuela are going to be prone to establishing a long-term price situation?

Mr. LIGON. That is correct; I do not foresee that.

Mrs. HANSEN. So the refinery situation is going to worsen?

Mr. LIGON. That is right.

Mr. MCKAY. Are we importing more finished goods than just crude now?

Mr. LIGON. The figures are about 2.5 million for products and about 2.2 million for crude in 1972. So there is an edge on products at this time.

Mr. MCKAY. So the products are increasing, as a relative portion of the crude?

Mr. LIGON. Yes, that is correct.

Mr. MCKAY. Is there greater emphasis on building refineries abroad as there is with zinc, lead, and others?

Mr. LIGON. Yes.

Mr. MCKAY. By our corporations or by the foreign countries?

Mr. LIGON. I think both. Certainly by ours.

Mr. MCKAY. Apparently they are getting the crude abroad then?

Mr. LIGON. Yes, they are.

Mr. MCKAY. They can make a contract then to get it over there?

ENVIRONMENTAL SITING PROBLEMS FOR REFINERIES

Mr. LIGON. They are, but it is very tight in the world situation. We have not gotten into some of the other aspects of the problems that we face here with refineries. These other things, many times, do not have anything to do with the justification of building a refinery in the Bahamas or Western Europe or North Africa. I mean the environmental, siting problems.

Mrs. HANSEN. We have discussed the difficulties because of the source. What are the other problems in PAD I?

Mr. LIGON. Well, the environmental problem, of course, is a very, very difficult requirement in regard to finding adequate sites. There have been several oil companies that have been capable and willing from investment and practical marketing points of view to locate a refinery in New England. But they have been unable to receive the local approval for that locality siting. It has become an almost insurmountable problem.

Mrs. HANSEN. Due to air and water pollution?

Mr. LIGON. Yes, ma'am.

Mrs. HANSEN. Do you foresee that this problem will get worse?

Mr. LIGON. Yes, I think that it will get worse; unless there is some realization that there must be some balance between the two considerations. Industry must present evidence that they can build a clean refinery, and the local people must understand and realize that it is

important to have refineries located in their areas if they are to receive the type of services that they want.

Mrs. HANSEN. What is the population of PAD I?

Mr. LIGON. I do not know, Madam Chairman.

Mrs. HANSEN. Insert the information in the record.

Mr. LIGON. Be glad to.

[The information follows:]

Population of PAD I in 1971

Maine	1,003,000
New Hampshire	762,000
Vermont	458,000
Massachusetts	5,758,000
Connecticut	3,081,000
Rhode Island	968,000
New York	18,391,000
Pennsylvania	11,879,000
New Jersey	7,300,000
Delaware	558,000
Maryland District of Columbia	4,741,000
Virginia	4,714,000
West Virginia	1,752,000
North Carolina	5,146,000
South Carolina	2,627,000
Georgia	4,664,000
Florida	7,041,000
Total	77,762,000

More than 37½ percent of total population.

CLEAN REFINERIES

Mr. YATES. Is there such a thing as a clean refinery?

Mr. LIGON. Yes, I believe there is.

Mr. YATES. You indicated there was a clean refinery. This is the first time I have heard this. I wonder if you might not want to have this for the record, Madam Chairman.

What is a clean refinery?

Mrs. HANSEN. Those that meet acceptable minimum standards for air and water pollution.

Mr. YATES. If there is a minimum of air and water pollution, why are not refineries of this kind being built?

Mr. LIGON. There are a few already built but, as I explained, there are very few or none being built at the present time. There is one that opened in Joliet, Ill., in March.

Mr. YATES. My question is, why are they not being built? You said they are not being built?

Mr. LIGON. That is right.

Mr. YATES. Why?

Mrs. HANSEN. We discussed this several minutes ago. He testified there had been no new refineries built since 1958.

Summarize for Mr. Yates why new refineries have not been built.

Mr. YATES. I beg your pardon, I am sorry. I was in another subcommittee.

Mr. LIGON. Another example of what you are talking about is in the State of Delaware, which has passed legislation——

Mrs. HANSEN. You testified that part of the problem was the potential refinery builders did not have a firm long-term commitment for obtaining their crude.

Mr. YATES. I heard that. I heard the Middle East.

Mr. EVANS. On that question of not having a dependable supply of crude over a long-term period, you refer to Middle East countries, the uncertainty of the price structure. Yet is it not true that Japan and Western Europe are buying and are refining?

Mr. LIGON. Yes; indeed it is.

Mr. EVANS. If they can, why can't we?

Mr. LIGON. There are several reasons. First of all, for at least the 23 largest oil companies, we have price controls on how much can be paid for crude oil. They are limited.

Mr. EVANS. That has just been recent?

Mr. LIGON. That is right.

Mr. EVANS. We did not have price controls before phase I?

Mr. LIGON. That is right.

Mr. EVANS. Why did we not do it before price controls went in? Other countries were.

REASONS FOR SITING REFINERIES OFFSHORE

Mr. LIGON. These other things— some of our companies, if you will notice, have developed and built refineries in Puerto Rico, in the Bahamas and the Virgin Islands and offshore United States.

Mrs. HANSEN. Is it because labor was cheaper?

Mr. LIGON. That is one factor; the siting problems were another.

Mr. YATES. The tax problems?

Mr. LIGON. Plus availability of crude. Also, it is easier for ships to get in and out of ports. Our ports are all of limited draft channelling, limiting types of and sizes of tankers which can come in with imports. That is not as true in certain island refinery areas, as well as the European areas.

We have been unable to build superports in the United States which would give us the edge necessary to get over the other disadvantages with regard to the inability to bring in the large tankers.

Mrs. HANSEN. How many large tankers are going into the Virgin Islands and the Bahamas? Compare those with the tankers coming into Anacortes and some of the refineries in the California area.

DOMESTIC PORT LIMITATIONS FOR GIANT TANKERS

Mr. LIGON. An average port in the United States can support a tanker the size of no more than 80,000 deadweight tons. You must contrast that to the types of tankers that are currently supporting the new refineries that we are discussing. We find that the size displacement is about 200,000 deadweight tons.

Mrs. HANSEN. Japan is doing two things: She is building these big tankers and at the same time she is going after the source of oil?

Mr. LIGON. That is correct. She certainly is an aggressive competitor for the world oil.

Mrs. HANSEN. There are, I think, about two regions in the United States that have a port that can handle these big tankers, is that not correct?

Mr. LIGON. Yes, that is correct.

Mrs. HANSEN. Puget Sound is one area. Where is the other site?

Mr. LIGON. I think probably on the west coast there are plans for 100,000 deadweight-ton tankers.

Mrs. HANSEN. Where?

Mr. LIGON. It has not actually been sited.

Mrs. HANSEN. Is that the site at Point Roberts in Canada?

Mr. LIGON. That has been one of the sites discussed, yes. Now the other—you asked where is the other?

In the gulf there have been two sites discussed at great length.

GIANT OIL TANKERS

Mrs. HANSEN. What ports in the United States currently can handle an 80,000-ton tanker?

Mr. LIGON. Probably New York, Houston.

Mrs. HANSEN. What ports can handle a 200,000-ton tanker?

Mr. LIGON. I am not aware of any, Madam Chairman.

Mrs. HANSEN. But is not Japan building these large ships?

Mr. LIGON. Yes, they are.

Mrs. HANSEN. You do not have to be a great prophet or have too many brains to see what is going to happen.

Mr. LIGON. That is right.

Mrs. HANSEN. Is Japan importing from Venezuela?

Mr. LIGON. No.

Mrs. HANSEN. But she is in the Mideast. At the same time she is building tankers that are beyond the capability of an American harbor?

Mr. LIGON. Yes.

Mrs. HANSEN. It seems to me that she is putting great pressure on the industrial base of the United States.

Mr. LIGON. That is right.

Mrs. HANSEN. Oil is one of the principal bases of our industrial economy; is it not?

Mr. LIGON. That is correct.

Mr. YATES. Will you expand on that? How does the fact that Japan is building these big tankers put the squeeze on?

Mr. LIGON. Simply because she is——

Mr. YATES. This assumes Japan is going to be able to make contracts with other countries.

Mr. LIGON. They have. Mrs. Hansen mentioned their activities in various parts of the world. I mentioned Indonesia previously. I understand they have been bidding for oil in Ecuador. They are able to build refineries in Japan and have been doing so. They are able to bring the oil under these contracts from all over the world in these giant tankers at very economical costs per barrel and transport the oil to their refineries in Japan for their own use.

CLEAN REFINERIES

Mr. YATES. I started to ask you about the clean refinery.

Mr. LIGON. Yes.

Mr. YATES. You said that the reason the refinery had not been built was because the companies which are thinking of building them were not able to get a commitment for supplies; is that correct?

Mr. LIGON. That was one of the things I discussed. We also talk about siting problems. I mentioned a moment ago with regard to limitations by legislation, in Delaware, they actually prohibit the building of any more refineries in the entire State of Delaware. Shell Oil Co. even had actually proposed a site for a refinery in the Delaware Bay, as I am sure you are aware.

Mr. YATES. Is there such a thing as a floating refinery? Can it be built on an ocean? I have heard they can build airports on the ocean. Can they build a refinery?

Mr. LIGON. I think there would be a transportation problem with regard to pipelines going out to the proposed refinery, the hypothetical refinery that you are talking about. And I think that that would increase the chances of oil spills and that is the last thing you want.

Mr. YATES. Let's get back to Delaware then. Does the Delaware law prevent the construction of clean refineries?

Mr. LIGON. As I understand it, it prevents the construction of any refinery.

Mr. YATES. Is that true of other States in the country?

Mr. LIGON. No, not yet.

Mr. YATES. Where are clean refineries being built? Anywhere?

Mr. LIGON. There are none at the present time, other than——

Mr. YATES. Why are there none?

Mr. LIGON. The local people who have control over the siting approvals necessary for construction, licenses and so forth, have not given approval. They do not really believe there is such a thing as a clean refinery.

Mr. YATES. The question is whether there is such a thing as a clean refinery. Is that subject to proof?

Mr. LIGON. Yes, yes.

Mr. YATES. Has the proof been offered to the people?

Mr. LIGON. I believe to the best of the companies' ability, it has been.

Mr. YATES. Where has this been attempted?

Mr. LIGON. I spoke with a man the other day who was attempting to build a refinery in New England. They had visited this so-called clean air-clean refinery on the west coast and actually taken pictures of the water around it, the air around it, talked to the people who lived in the town next to it, what their reactions were to it, in an attempt to try to persuade them there is such a thing as a clean refinery. He was unsuccessful in convincing the New Englanders to provide a construction permit.

[Discussion off the record.]

Mr. YATES. Where is the clean refinery?

Mr. LIGON. It is in Washington State.

Mr. YATES. Where in Washington and who owns it?

Mr. LIGON. Atlantic Richfield owns it; Cherry Point, Wash.

Mr. YATES. And Atlantic Richfield owns it?

Mr. LIGON. Yes.

Mr. YATES. And it is a clean refinery?

Mr. LIGON. That is correct.

Mr. YATES. Is this the only clean refinery in the country?

Mr. LIGON. Yes, sir.

Mr. YATES. When was it built?

Mr. LIGON. The lead time for building a refinery is about 3 or 4 years. It went on stream last year. So construction was in the late 1960's.

Mr. YATES. What happened to the environmentalists?

[Discussion off the record.]

Mr. YATES. Weren't they required to file an EPA justification?

Mrs. HANSEN. Not at that time.

Mr. YATES. Four years?

Mr. LIGON. It would have had to have been on the drawing boards 3 or 4 years before the leadtime.

Mr. YATES. Four years before last year. It was opened last year, you said.

Mr. LIGON. That is right, 4 years before last year——

Mr. YATES. So that would make it 1968.

Mr. LIGON. Yes, sir; it was. The planning and the licenses, and the rest were submitted before that time. I am talking about from the time they got the licenses, builder permits, and so forth, to start 4 years ago.

OTHER CLEAN REFINERY PROJECTS

Mr. YATES. So Atlantic Richfield has one clean refinery. Are there any efforts being made to build other clean refineries anywhere in the country?

Mr. LIGON. Yes. There have been a lot of efforts. Shell was trying to build a clean refinery on the Delaware Bay and they were stopped from doing so because of passage of the legislation.

Mr. YATES. That is another point. Are there any others?

Mr. LIGON. No, there are no other laws prohibiting——

Mr. YATES. No, no. Are there any other applications or efforts being made to construct refineries?

Mr. LIGON. Yes.

Mr. YATES. Where are they?

Mr. LIGON. Continental Oil Co. was going to build a new refinery in northern Louisiana.

Mr. YATES. When we talk about a new refinery we are talking about a clean refinery, aren't we?

Mr. LIGON. Yes. As a result of improved technology that is the only type of refinery that the industry knows that they will be permitted to build and that is what we are talking about.

Mr. YATES. So from this time forward at least there will be no refinery built that abuses the environment?

Mr. LIGON. That is right.

Mr. YATES. And how many such applications are pending, to your knowledge?

Mr. LIGON. First of all, when you say, "applications"——

Mr. YATES. Or efforts, intentions.

Mr. LIGON. I think probably you will find all of the major oil companies have intentions or designs or plans for refineries in particular parts of the country at this very moment. I will bet every major oil company does.

Mr. YATES. When you say you bet they have, do you know specifically?

Mr. LIGON. Yes, I do.

Mr. YATES. Can you put a list in the record?
Mr. LIGON. Yes; be glad to.
[The information follows:]

1. Phillips Petroleum Co.
2. Cities Service Co.
3. Shell Oil Co.
4. Texaco Inc.
5. Marathon Oil Co.
6. Gulf Oil Corp.
7. Sun Oil Co.
8. Atlantic-Richfield Co.
9. BP Oil Corp.
10. Mobil Oil Corp.
11. Exxon Corp.
12. Continental Oil Co.

For the long-term company planning there are so many requirements—local zoning, environmental protection, huge capitalization (in excess of one-fourth billion dollars for a new 150,000-barrel-per-day refinery), long lead times for materials procurement and construction, access to crude oil and deep water (for example: 60 feet channels) that many companies have had to defer ordinary domestic refinery construction during the midseventies. We believe most major oil companies will resume regular refinery expansion and construction programs when siting, cash flow financing, and other difficulties are resolved. For the near term, we regret to note that new refinery construction in the United States has reached a low point in the midseventies.

INCREASED COSTS OF CLEAN REFINERIES

Mr. MCKAY. Madam Chairman, on the clean oil refineries, does the technology require an increased cost of production in a new refinery versus the old?

Mr. LIGON. Yes.

Mr. MCKAY. So could you give us some figures?

Mr. LIGON. Yes; I will be glad to. Of course, also we have not only the problem of the clean air and clean water refineries we are talking about. We are talking about desulfurization units that are very, very costly, even when they are installed initially, with the construction of new refineries today. Desulfurizers were not needed several years ago, but we need them now since we will be dependent on and use foreign crude oils. With desulfurizers, it doesn't make any difference if the sulfur content is high or low, but they are responsible for one of the very large increases in cost in the refineries.

Mr. MCKAY. Will you give us some visual pictures with figure costs as to a barrel of oil, its ratio of cost as a result of that, or some figures that will give a vivid picture?

Mr. LIGON. Be glad to.

[The information follows:]

New refining capacity required to meet our products requiring by 1985 is expected to cost between $60 and $70 billion. Of this, it is estimated that from 10 to 15 percent will be required as investment in environmental protection devices and equipment. The cost of updating existing refineries to new standards for emissions will be about $2 billion. Annual operating costs associated with air and water pollution abatement is expected to grow from $2 million in 1972 to $21 million annually by 1976. The cost of having to use low sulfur fuel in refinery operations is estimated at $108 million per year.

The cost of desulfurizing fuel oil in a refinery varies greatly depending on the nature of the crude oil run in the refinery and the level of sulfur desired in the end product. The cost of operating this equipment ranges for $0.40 to $1 per barrel of fuel oil made.

Mrs. HANSEN. Who determines the clean refinery standards? Is it the State?

Mr. LIGON. It is the State and local officials, yes, ma'am, not the Federal.

Mr. YATES. Well, now, is there a Federal standard?

Mr. LIGON. Yes, sir; there is a Federal standard but I am talking about the approval of necessary ordinances and environmental licenses.

Mr. YATES. Are the Federal standards stricter or less strict than the State standards and local standards?

Mr. LIGON. It is very difficult to generalize.

Mr. YATES. Are there any States that have stricter standards of protecting environment as far as refineries are concerned than the Federal Government?

Mr. LIGON. Yes; I think there are.

Mr. YATES. Is Washington one such State?

VARYING LOCAL STANDARDS FOR CLEAN REFINERIES

Mr. LIGON. I don't know.

I think you will find the New England States as a general rule have stricter standards than, say, the national standards are. Some of the States have not as strict standards.

Mr. YATES. Would the clean refinery that is in existence at Cherry Point, Wash., be acceptable to the New England States under their standards?

Mr. LIGON. It is difficult for me to answer that without knowing, but I would guess no.

[Discussion off the record.]

Mr. YATES. Apparently I was under a misapprehension with respect to my earlier questions, I assumed that when you had established that there is such a thing as a clean refinery that it could be built anywhere in the country.

Mr. LIGON. No; absolutely not.

Mr. YATES. I see. So it could be built in Cherry Point, Wash.——

Mr. LIGON. But maybe not the State of Massachusetts.

Mr. YATES. How many places in the country can a refinery like that built in Cherry Point be built?

Mr. LIGON. I don't know. It depends on the particular State.

Mr. YATES. I know——

Mr. LIGON. And local ordinances.

Mr. YATES. I know that but apparently the refinery that was built at Cherry Point met Federal standards.

Mr. LIGON. Oh, yes; it met Federal standards.

Mr. YATES. All right. The question is the strictness of State standards.

Mr. LIGON. That is right.

Mr. YATES. We don't know how many other States in the Union have standards that are as strict in terms of strictness as the State of Washington. Those are all the questions I have.

PAD II PROBLEMS (THE MIDWEST)

Mrs. HANSEN. PAD II is basically the Midwest?

Mr LIGON. Yes. It is basically the Midwest, what we call the midcontinent.

Mrs. HANSEN. Is PAD II the second largest shortfall area in the United States?

Mr. LIGON. Yes.

Mrs. HANSEN. Why?

Mr. LIGON. The reason it is because—we started to go into this a moment ago—this is the area of the small independent, nonintegrated refiners who have traditionally been supplied by the oil produced in the midcontinent region. This crude has been——

Mrs. HANSEN. Are the supplies from Canada and the Gulf?

Mr. LIGON. No. They are supplied in the Midwest, the actual production from Kansas, Oklahoma, and on up north and then sometimes by the pipeline, as you point out now, from Canada. But I am talking about a little farther south and this is the situation with the farm belt and this is the area of the next largest shortfall, as you asked.

Mrs. HANSEN. You have some big population centers in this area.

Mr. LIGON. Yes.

Mrs. HANSEN. Such as Chicago.

Mr. LIGON. And St. Louis, Kansas City

Mrs. HANSEN. Also many of your industrial areas.

Mr. LIGON. That is right. These areas have been supplied by many of the smaller refiners, and some of the refiners in the cities that you just discussed, Chicago, St. Louis, Kansas City are independent refiners and have been able to get their supply of sweet crude from these areas geographically very close to them for a long, long time. Now as a result of a decline in the domestic production in these areas they have had big problems in securing enough crude to run at capacity. They have had to rely, as you point out, Madam Chairman, more and more on this Canadian oil and there is just not enough of that to go around.

As I pointed out a moment ago, 745,000 barrels a day is what the program called for. The United States is currently importing 1.2 million a day from Canada and Canada is putting the brakes on. The interprovincial pipeline is full and it is running at maximum capacity.

PROBLEMS OF INDEPENDENT INLAND REFINERIES

The refineries in the southern part of the midcontinent, are absolutely drying up for lack of crude in that particular area. They don't have the capital to install desulfurization units which we have described as necessary, or typical on the big coastal refineries to process the imported crude thus they must continue to rely on the sweet crude, which is in short supply. I emphasize these are very small refineries. We are talking about, only 10, 20, 30,000 barrels a day capacilties.

Mrs. HANSEN. Suppose you had to rely on imports? Where would those imports come from and what would be the distribution? Exclude the Canadian source. How much is the transportation costs going to add to import costs?

THE USE OF EXCHANGES IN IMPORT TICKETS

Mr. LIGON. If we write off the Canadian source, which is a big source at the present time, we find that they are going to have to go to the major oil companies who control a certain amount of the domestic production in their area. In order to do this, the independents are going to have to work on what we call exchange agreements. They are going to have to take their import tickets or licenses that they have received from our Oil Import Division, and exchange those tickets and rights to imported oils. The "tickets" means nothing to them as far as their physical ability to use that oil, but they can exchange that imported oil with the major oil companies who can use it in their coastal refineries. In return for major's domestic oil close to them, the smaller refiners, thus use exchange agreements and they probably are their major source of oil other than the Canadian oil.

Mrs. HANSEN. Will it be a completely satisfactory arrangement pricewise?

Mr. LIGON. No; it will not.

Mrs. HANSEN. How about the transportation situation?

Mr. LIGON. There are several things to consider here. First of all, there must be an economic incentive for the majors to exchange tickets; that is, the tickets belonging to the small refiners must have some value or the majors have no incentive to exchange those tickets. Since the majors also have their own refineries in these areas and many of these have no desulfurization units yet, they must run as much of that domestic crude as they can get their hands on also. So there must be important economic incentives to make the switches.

We find that the reciprocal or turned-around price situation that exists in the world market today has put a great deal of pressure on the refiner's value of the tickets that they have held and still hold. I am referring to the price of foreign oil being equal to or greater than domestic crude for the first time in a long time. There was a traditionally higher value which represented the difference between the lower prices of foreign oil and the prices of comparable domestic items. This customary trading value for the independent refiners no longer exists. They are real problems as they no longer create any kind of incentive to entice the majors to exchange crude oil import tickets, because they also need the domestic crude oil stocks. Unless the majors can get more than a one-per-one exchange basis in their trades, they are not willing to negotiate.

Mrs. HANSEN. So this could raise the cost of domestic crudes and products in PAD II?

Mr. LIGON. Yes, ma'am.

Mr. YATES. May I ask a question here?

Mrs. HANSEN. Yes.

OPEC CONTRACTING COMPANIES

Mr. YATES. Who are the companies that have contracts with the OPEC countries?

Mr. LIGON. There are two major nationalities of companies, the American companies and the British-Dutch companies.

Mr. YATES. Do the Americans and the British and Dutch receive the same kind of treatment from the OPEC countries?

Mr. LIGON. No, they haven't; although I am not sure that that is an intentional setup. I think that it is probably just the way that the many agreements evolved.

Mr. YATES. Who pays more? The American companies?

Mr. LIGON. Yes.

Mr. YATES. Who are the American companies who have contracts with the OPEC countries?

Mr. LIGON. Most of the major companies that you know well—Gulf, Texaco, Exxon, and Continental.

Mr. YATES. Atlantic Richfield?

Mr. LIGON. Yes; Mobil.

Mr. YATES. In other words, the big American companies?

Mr. LIGON. Yes, that is right.

Mr. YATES. Isn't it to the advantage of those companies to pay higher prices from the OPEC countries so that they will be compelled to raise the prices of their domestic crude?

Mr. LIGON. No.

Mr. YATES. Isn't this what they are trying to do?

Mr. LIGON. No.

IMPORT PRICES AND COMPANY INCENTIVES

Mr. YATES. As I understand the thrust of the argument of the oil and gas companies as explained by the agencies that come before this committee, and in articles that I have read they are arguing that now that the price of imports has risen and we must have imports in view of the shortage in this country, it is unfair, certainly in the case of gas, not to permit the price of gas to rise to that of the imported gas like LNG from Algeria, for example. This is their argument. Why isn't it to the interest of such companies to pay higher prices to the countries from which they export the product so they can raise the prices in the United States?

Mr. LIGON. Because of the instability of the supply sources in these particular exporting countries. They don't know from one minute to the next if they will be able to rely on a continued supply. The companies would be far more secure in their planning if they were able to develop domestic production the way they would like.

Security of crude supply sources is worth a premium to the operating companies as well as it is to us as consumers. They know that as we do and if they were given the incentives to develop domestic sources I don't think there is any question that they would do so.

Mr. YATES. They would do what?

Mr. LIGON. Invest more heavily in domestic resources and allow a greater amount of utilization of our domestic resources from oil and gas to fuel alternatives that we can talk about.

Mr. YATES. Are they losing money now, those companies?

Mr. LIGON. No, they are not.

Mr. YATES. And they want additional incentives in order to develop resources?

Mr. LIGON. Domestically, they do.

Mr. YATES. They do?

Mr. LIGON. That is right.

Mr. YATES. Is this because——

Mrs. HANSEN. Because they face reform of the depletion allowance tax.

Mr. YATES. No; they are not suffering that at the present time. They are asking for the increases now.

Mr. LIGON. They have a choice, as you realize. Since they have resources overseas as well as in the United States they have a choice as to where they are going to put their investment dollars. They have a fiduciary duty to do that, I guess, to their stockholders and they will always consider their requirements in their decisions.

If we can make it attractive on a competitive basis for them to put their dollars and facilities in this country and to develop our resources they will surely do so.

Mrs. HANSEN. What do they consider attractive rates?

Mr. LIGON. I think they consider attractive price, depending on the commodity we are talking about.

PRICING OF IMPORTED GAS

For instance, in natural gas, I think they would consider that decontrol of the price of natural gas would create a climate that they could compete in. You mentioned the Algerian LNG thing. We are talking about $1, $1.10 per unit or per MCF, and, of course, our considering natural gas price here, or LNG, which is a substitute for natural gas. The average wellhead price in the United States is 26 cents. For casing head gas, that is gas produced and associated with production of oil, which is just as usable as natural gas coming from natural gas resource, is as low as 7, 8 cents per MCF.

These prices do not create any kind of investment climate that the oil companies are willing to put their money into in the United States and you can't blame them.

Mr. YATES. I would like to pursue this but I will do this when we get through with the PAD's.

NEWSPAPER ARTICLE ON GAS PRICING RULINGS BY FPC

Mr. YATES. Did you see the article in yesterday's Washington Post by any chance?

Mr. LIGON. Yes, sir, I did.

Mr. YATES. Of course I assume from what you said that you tend to agree with the latest order of the Power Commission?

Mr. LIGON. Yes, sir, I do.

Mr. YATES. That amounts to relieving the companies from regulation, doesn't it, price regulation, as far as new fields are concerned?

Mr. LIGON. No, it does not. It relieves—I started to say it relieves producers. It doesn't even relieve producers of regulation; which is the central thrust of decontrol.

Are you discussing the latest Fedral Power Commission order which considers optional pricing?

Mr. YATES. Well, let me read from the article.

It says here:

Consumers of natural gas face multibillion-dollar price increases in the wake of a Federal Power Commission hearing that ended last Monday.

Probably within a matter of weeks, the Commission will decide whether to approve a 73-percent increase in the price of natural gas at the wellhead, or

whether to approve something less. Either way, a national precedent will be set.

A 73-percent increase for producers would translate into an increase for householders on the order of 15 percent. In the Washington-Baltimore area, the owner of a "typical" one-family home would pay about $35 a year more for heating than he does now.

For one of the three companies involved in the proceeding, Tenneco Oil, a 73-percent increase would yield returns of 27.5 percent on total investment and 48 percent on equity, according to testimony by FPC economist John W. Wilson.

And then they go into the arguments and so forth on the thing.

What the Commission is doing actually is doing what the Congress refused to do in 1954 or 1957, isn't it, and that is really removing the regulation, and in those Congresses we had the Harris bill and other bills at that time which sought to remove regulation.

Now by the orders of the Federal Power Commission there is no longer any need to go to Congress for it; isn't that correct?

Mr. LIGON. This is an exception to the domestic situation.

Mr. YATES. Yes.

Mr. LIGON. There is no attempt there to remove any type of FPC control or jurisdiction from the transmission companies.

Mr. YATES. That is true; we are talking about the wellhead producers.

Mr. LIGON. Yes.

Mr. YATES. The transmission companies are common carirers?

Mr. LIGON. Yes.

Mr. YATES. And there is no question from anybody that they have the right to regulate them. The question is asked, Who regulates the production of gas at the wellhead that flow in interstate commerce?

Mr. LIGON. Yes.

Mr. YATES. And this was the fight we had back in the fifties and which is now being carried on by the Federal Power Commission.

Mr. LIGON. The actual act itself, as I understand, in 1936 or 1937 did not intend to include the producers within its purview but in 1954 the Supreme Court of course allowed them to come under the jurisdiction.

Mr. YATES. You know the reason for it. The reason for the Supreme Court decision was the so-called Attleboro Gap, if you will recall.

Mr. LIGON. Yes.

Mr. YATES. And that was the fact that the gas consumers had to pay whatever the producers were charging all the way along the line and the Supreme Court said that Congress intended to regulate production of wells. At any rate, that is only tangential to your testimony here, but as one who participated in that fight I think the decision of the Federal Power Commission is wrong. The companies are allowed what now on their investment? I am talking about the natural gas producers.

Mr. LIGON. They are allowed about 12 to 15 percent.

Mr. YATES. I thought it was 15 to 18.

Mr. LIGON. What I understand is 12 to 15 percent, but even that is somewhat cloudy. Based on the old cost, there is one price, and based on the option pricing procedure of pricing and assessing cost, there is another. So it depends on what method you use. But I think it is unfair to base the net return on costs that were available 3, 4, or 5 years ago. It is not realistic.

Mr. YATES. Is there any truth in your judgment to the contention of Senator Hart that optional prices over the varying time periods in which known supplies of gas will be exhausted will cost consumers at least $750 billion?

Mr. LIGON. I have no way of answering that. It will certainly cost consumers more; there is no question about that.

GASOLINE SHORTAGES AND PRICES

Mr. YATES. Much more, and that is being shown, too, in respect to oil by the fact that there are shortages of gasoline now and I assume that as soon as the prices go up there won't be a shortage of gasoline anymore; will there?

Mr. LIGON. I don't know that that necessarily follows, Mr. Yates.

Mr. YATES. You mean that there will be a shortage and a high price and the shortage will continue?

Mr. LIGON. No; I don't think it is an overnight thing. I think probably if we do create the incentive for—you are talking about gasoline prices and shortages specifically?

Mr. YATES. Yes.

Mr. LIGON. As we were talking about refining capacity, we need greater refinery capacity and we need the ability to get crude oil to supply those refineries. When both are available we will be able to provide more product for the consumer, that is gasoline. But until that occurs, we are not going to have a totally clear picture and we are going to continue to have spot shortages.

Mr. YATES. Thank you, Madam Chairman.

PAD III PROBLEMS

Mrs. HANSEN. Please discuss the problems of PAD III.

Mr. LIGON. PAD III. Madam Chairman, of course is the Gulf areas.

Mrs. HANSEN. The PAD III situation is certainly better than I and II. This area contains many of the largest oil producers.

Mr. LIGON. Yes, ma'am, that is correct. They have the facilities to take many of the tankers and so forth. You may also be aware, Madam Chairman, of the plans being made by the Louisiana Legislature and the Texas Legislature to create superports off of the respective States to take care of larger and larger tankers in the very, very near future.

Mrs. HANSEN. With pipeline to——

Mr. LIGON. Yes, ma'am. Pipelines have also been suggested.

Mrs. HANSEN. You have another problem involved in the import of oil and that is oil spills.

Mr. LIGON. Yes, ma'am.

Mrs. HANSEN. Isn't it true that tankers are the greatest source of oil spills?

Mr. LIGON. Yes, ma'am.

Mrs. HANSEN. So this has been another part of the cost factor, the cleanup of the tanker spills. Isn't that correct?

Mr. LIGON. Yes, ma'am. As the demand has been for more economical transportation of oil, the tankers have gotten larger and of course if there is a spill from a larger tanker it is much more damaging.

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Mrs. HANSEN. You have the potential for a tanker spill of disastrous proportions and the concerns of the U.S. people mount particularly in the coastal regions.

Mr. LIGON. Yes, ma'am.

PAD REGION IV

Mrs. HANSEN. Please discuss Region IV.

Mr. LIGON. Region IV is the Rocky Mountain area and there we find a situation of more scattered population centers than in the other regions that we have discussed. Even here, from time to time, we find product shortages. Those are more likely to be distribution problems than they are anything else. Region IV has the ability to produce the necessary oil for their refineries which are now in operation and there are many independent refineries in the Rocky Mountain area, too, in Wyoming and in Colorado.

Mr. EVANS. May I ask a question.

Mrs. HANSEN. Yes.

HEATING OIL SHORTAGES

Mr. EVANS. Was it poor planning that caused the heating oil difficulty?

Mr. LIGON. It was distribution and it was a similar chain of events such as I was talking about previously with regard to the natural gas. Natural gas deliveries were disrupted as a result of the reduced supply and the consumers couldn't use substitutes for the natural gas as they would on the east coast. They didn't have the No. 2 fuel oil. They didn't have the availability of converters to use No. 2 oil, say, in the Denver school system. I assume that is what you are talking about.

Mr. EVANS. Yes.

Mr. LIGON. And in that particular case that was started by a natural gas delivery and availability curtailment.

Mr. EVANS. Did they have shortages in any other fuel? I understand they had a shortage in gasoline as well.

Mr. LIGON. I am not aware of that. There is no question there can be spot shortages of product through any of these regions that we are talking about because of the complex of factors that we have been discussing.

SHORTAGES OF GASOLINE IN WHOLESALE MARKETS

Mr. EVANS. Isn't it true that the independent retail gasoline salesmen are, at a time such as we have today when there are shortages of gasoline, at the mercy of the large companies from whom they buy what used to be formerly surplus gasoline?

Mr. LIGON. I assume you are talking about the independent marketers.

Mr. EVANS. That is right.

Mr. LIGON. For a long time there was availability of excess productive and refining capacity including crude oil and the refined products in PAD IV. As a result of those conditions, a fine wholesale market was created.

This wholesale market was major oriented and I guess they were responsible for it since they were the refiners, marketers and suppliers. This allowed the independent marketers and the independent refiners to have a profitable price range for products in this wholesale market. It was also an outlet for the majors who were able to live and thrive on it. If you will notice, the Middle West, was the area where they developed, to the greatest extent, facilities for independent refining and marketing.

Conditions changed drastically in the last couple of years. There was no longer a refinery overrun and therefore the wholesale market dried up. We now find the independent marketers and the independent refiners having a big problem supplying those segments of the market, they have traditionally handled and serviced.

I am not sure that it is fair to say that they are at the mercy of the large majors. I am just saying that the economic factors in the market have created a situation where the supply is just no longer available to them.

PRICING MATTERS

Mr. EVANS. Madam Chairman, it has come to my attention that shortly before the wage-price freeze went into effect that, not just in region IV but nationally, a very interesting thing occurred. All major oil companies in the United States for a period of a week or 10 days, without market conditions indicating any reason for it at all, suddenly took a dramatic increase and then went down. Some have indicated to me that they thought maybe this occurred because they were warned in advance quietly and secretly that wage and price controls were coming and they thought if they raised their prices nationally all over the country it would establish a high base where they would have an advantage.

Have you heard this accusation at all?

Mr. LIGON. Yes, I have and——

Mr. EVANS. Was there such a national rise in petroleum and gasoline prices before the wage-price freeze? Was that a fact or was it not a fact?

Mr. LIGON. Are you talking about this winter when the No. 2 prices were increased? I have heard that comment with regard to those facts. I have also heard the same allegation with regard to the facts prior to August 1971.

Mr. EVANS. August of 1971?

Mr. LIGON. That is what you have reference to?

Mr. EVANS. Yes.

Mr. LIGON. The oil companies have been called in twice, three times, to public hearings to cost-justify any increases in price of crude or products that they made.

Mr. EVANS. Since August of 1971.

Mr. LIGON. August of 1971.

Mr. EVANS. Was there or was there not a widespread rise in prices immediately before that time?

Mr. LIGON. I wasn't aware that there was a rise in prices before that. All I know is that the oil companies have been called in on three separate occasions since August 1971. Any time they had any price increase to cost-justify and approve those increases.

Mr. EVANS. Could you investigate the record and make sure or discover whether or not there was a week or 10 days or 2 weeks before the August 15, 1971, wage-and-price law?

Mr. LIGON. Be glad to. I think we will find when we look into that that the price of gasoline—which is most relevant at the time of that freeze, and which is what has been the subject of the accusations as far as the price increase——

Mr. EVANS. It is gasoline that has come to my attention.

Mr. LIGON. I think we will find that the Midwest wholesale prices were so low compared to what the industry calls the national norm that any increase they argued could have been justified because it was so far below their industry norm, anyway. The industry norm was based on an average retail price for *x* number of years prior to the time of the freeze. They said, "This is our norm."

Mr. EVANS. Could you place in the record what that norm was and what happened to gasoline prices immediately, we will say a month or 3 weeks before August 15, 1971, and what happened to prices in the month following the wage-price freeze?

Mr. LIGON. Be glad to.

[The information follows:]

There are no daily gasoline price series available. Some weekly data is reported but it is of very poor quality. The best available series are collected monthly and represent the price as of the date on which it is collected. The prices used in the attached chart were collected by Platt's Oilgram Price Service and represent the tank wagon price as of the first of each month. The tank wagon price is the price charged the service station operator exclusive of taxes.

For the 10 cities shown, prices varied greatly over the entire year. Of the 10 cities only 3 show a price increase between July 1 and August 1. One shows a loss. Only two of the cities show a price increase between January 1 and August 1 and one shows a loss. Four of the cities show a lower price in at

A pattern of price increase prior to August 15 is not discernable.

DEALER TANK WAGON GASOLINE PRICES -- 1971

City	J	F	M	A	M	J	J	A	S	O	N	D
Boston	19.4	19.4	19.4	19.3	15.2	19.4	19.4	19.4	19.4	19.4	17.3	19.4
Chicago	19.6	19.6	17.5	17.5	17.5	17.5	18.2	19.6	19.6	19.6	18.2	19.6
Cleveland	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6
Dallas	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Los Angeles	18.4	18.4	18.4	15.6	15.6	17.1	18.4	18.65	18.4	18.4	13.15	16.9
New York	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
St. Louis	19.6	19.6	13.3	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6
Seattle	17.9	17.9	17.9	14.5	14.5	16.8	17.9	17.52	17.9	17.9	11.52	16.77
Minn.-St. Paul	17.5	19.6	19.6	11.9	17.5	17.5	18.2	19.6	19.6	19.6	19.6	19.6
Washington, D.C.	18.7	18.7	18.7	18.7	17.3	17.3	18.7	18.7	18.7	18.7	18.7	18.8

Mr. EVANS. Thank you.
Thank you, Madam Chairman.

PAD REGION V PROBLEMS

Mrs. HANSEN. You also have a short-fall in region V.
Mr. LIGON. Yes, ma'am.
Mrs. HANSEN. What is the reason for that short-fall?
Mr. LIGON. The major reason for the short fall in region V, the West Coast, is the situation of declining domestic production once again. For many, many years the production in California, was sufficient to carry region V. Now the production in California has declined to the point that they must rely on more and more imports.
Mrs. HANSEN. Where are their imports coming from?
Mr. LIGON. Some of their imports are coming from Indonesia and places in Asia. Those are somewhat limited, but they also are coming from the Far East.
Mrs. HANSEN. Supposing Japan captures the market.
Mr. LIGON. U.S. companies——
Mr. YATES. Captures the market where?
(Discussion off the record.)
Mr. LIGON. District V has also depended, as far as their differences between the supply and demand, very heavily upon Canadian imports and that is the major supply.
Mrs. HANSEN. How are the Canadian imports shipped to California?
Mr. LIGON. They come in from the Edmonton pipelines through Canada and the Northwest and they all come through pipelines.
Mrs. HANSEN. No tankers are involved?
Mr. LIGON. Very few tankers involved, very few. Most of it is imported by overland pipelines.
Mrs. HANSEN. Where do their tankers come from?
Mr. LIGON. Vancouver.
Mrs. HANSEN. Prices can go no place but up on the West Coast.
Mr. LIGON. Of the crude and products.
Mrs. HANSEN. Mr. Veysey, do you have a question at this point?

GASOLINE RATIONING

Mr. VEYSEY. Yes. Thank you, Madam Chairman.
I just returned from California where the newspapers carried this weekend the announcement of Texaco and Mobil that they were going to have to ration gasoline.
Mrs. HANSEN. What will Los Angeles do?
Mr. VEYSEY. That is what I am wondering. That is my question. What are you doing about it or what is your role in it?
Mr. LIGON. The reason that there is gasoline allocation or gasoline rationing, or whatever we will call it, is because of the inability of oil refineries to produce increased quantities of the necessary products and gasoline.
Mr. VEYSEY. That is the story. Now what?
Mr. LIGON. As a result the answer, of course, is increased product imports for the short term and——
Mr. VEYSEY. Do you attribute that inability to supply the stations to refining capacity, or crude unavailability, or what is it?

Mr. LIGON. It is a combination of all the factors.

Mr. VEYSEY. Shortages of everything?

Mr. LIGON. Yes, everything. There has been a drastic drop in the production of crude, as you have heard us discuss this morning; the refining capacity in the United States is way off compared to an ever-increasing demand for products, and it is a combination.

ROLES OF THE OFFICE OF OIL AND GAS

Mr. VEYSEY. We have ranged pretty widely in our discussion here this morning. I would really like to relate this back to an examination of the budget and to really find out what it is the Office of Oil and Gas does.

I read a little bit to my surprise on page 3 your opening statement is: "The Office of Oil and Gas has been given responsibilities for all oil and gas matters—domestic and worldwide."

That sounds to me like all the ills that have been mentioned this morning are your responsibility. Is this correct?

Mr. LIGON. No; that is not correct. We mean wide-ranging interest in energy and oil and gas matters.

Mr. YATES. The remedy he is responsible for.

Mr. VEYSEY. Will you please translate that sentence for me?

Mr. LIGON. Yes; I will be glad to.

The Office of Oil and Gas has been given responsibility for all oil and gas matters within the guidelines of their actual functional directives through the Department of the Interior.

Mr. VEYSEY. Then that sentence doesn't mean what it says?

Mr. LIGON. Well, we are not responsible for all of the oil and gas matters, domestic and worldwide, exclusively. There are at least 65 other Federal agencies involved in oil and gas matters, too.

Mr. VEYSEY. My attention was certainly caught by that statement which is, I think, erroneous judged by your testimony. I would like to really find out what it is you do.

You spend $1.5 million roughly a year and have 67 people, but what are you really responsible for? Do you just gather statistics?

Mr. LIGON. No. With regard to the statement, the statement is true but not to the point of exclusiveness. Of course, our small office is not the only agency responsible for all of the oil and gas matters. We are also involved in the liaison between industry. Any time industry wishes to contact a point in the Government, we are that point, to express concern about what they want to know about. We are the focal point for liaison between the Federal Establishment and the oil and gas industries.

Mr. VEYSEY. You mean about regulation, for example?

Mr. LIGON. Yes. I am going to get to that.

Mr. VEYSEY. You don't regulate anybody, though. Do you regulate anyone?

Mr. LIGON. No; we administer the oil import program.

Mr. VEYSEY. Administer the oil import program.

Mr. LIGON. That is right.

Mr. VEYSEY. That is what that sentence should say then.

Mr. LIGON. No, no. If I may explain——

Mr. VEYSEY. Please.

Mr. LIGON [continuing]. With regard to the staff functions and support that we provide to the Department of the Interior and the other agencies in the Government, we are involved in providing staff support, economic background, and analysis of data to policymakers concerned with oil and gas matters.

Mr. VEYSEY. Statistical information.

Mr. LIGON. Statistical as well as analysis of statistics.

Mr. VEYSEY. Let me ask you this question. It is kind of blunt.

But suppose we just did away with the appropriations for the Office? Would we have any worse problems with oil and gas than we have at the present time?

Mr. LIGON. Yes, you certainly would say so.

Mr. VEYSEY. We have heard a list of troubles around the table. Almost everything is wrong, it sounds like.

ADMINISTRATION OF THE OIL IMPORT PROGRAM

Mr. LIGON. We also are involved in the oil import program and verifying the basis of inputs for all of the allocations that are given to various refineries, various petrochemical groups, and the terminal operators.

Mr. VEYSEY. What does that do for us?

Mr. LIGON. That helps stabilize the program and insures that the regulations are fair and just and that the people who are subject to those regulations are absolutely complying to the letter of the administrative regulations themselves.

Mr. EVANS. Would the gentleman yield for a question right on that point?

Mr. VEYSEY. Yes, certainly.

SOURCES OF DATA USED BY OCG

Mr. EVANS. Do you develop your own facts and figures or do you accept without question the facts and figures that are given to you by the oil and gas industry?

Mr. YATES. Very important question.

Mr. LIGON. I think there is a combination. Of course in the Department, we rely on the Bureau of Mines, primarily, for our mineral resources data. We rely on some industry figures. We also use many inputs that we develop ourselves; and we also use the Geological Survey data. So it is a combination.

Mr. EVANS. Do you have a high degree of confidence in the accuracy and factualness of the figures that you develop and work with?

Mr. LIGON. Yes, I do.

Mr. EVANS. Thank you.

Mr. VEYSEY. Going back to trying to relate this to specifics, I would like to find out what you do that helps solve or does solve some of the problems we are talking about. We will take the gasoline shortage in Los Angeles area.

What are you doing about that?

Mr. LIGON. One of the functions, as outlined in the justifications, is our directive to help in the area of emergency problems that you are now discussing. We have been involved for many years with planning

the skeletal resource management program for a national emergency such as a civil emergency——

Mr. VEYSEY. Civil defense?

Mr. LIGON. Yes; or a world war type of thing. At the present time we have a different situation—a regional spot shortage situation such as you are describing.

Our function would be in this type of situation would be to work with the Office of Emergency Preparedness as we did this last winter in the Midwest on the No. II shortage, helping them in an advisory role to work with the local officials, trying to establish distribution, more adequate distribution of supplies.

We also work with the oil companies to try to get their help in coordinating of redistribution, transportation, even increased production when we are in short periods, and so forth.

LOS ANGELES GASOLINE SHORTAGE PROBLEM

Mr. VEYSEY. Relating it specifically again to the Los Angeles situation, as I read the papers, the short supply seems on the part of Texaco and Mobil, who can't supply their dealers. What specifically are you doing about that? You are talking about the possibility of a world war situation or something like that. What are you doing about Los Angeles?

Mr. LIGON. No. There were two specific directives within that emergency function. First is the larger situation, emergency disruptions. Now we are talking about the second one; that is, the local disruption—and those are the kinds of things that I was just describing.

Mr. VEYSEY. What are you doing about that?

Mr. LIGON. We have people in the regional field offices who work with the local officials in each particular city and county. They also work with the appropriate oil company officials in trying to help locate other companies that might be in the Los Angeles area and would have a surplus of product. In this particular case, there may be some.

Perhaps the Texaco and Mobil refineries and storage facilities in this particular area are short, but there may be other companies in this area that might have available larger supplies.

Mr. VEYSEY. I would suspect that if that is the situation those companies would, with a few telephone calls, make those arrangements themselves.

Mr. LIGON. No; that is not always true; we are usually called in to help after routine negotiations have proven unproductive

Mr. VEYSEY. What do you do about a shortage of capacity, shortage of crude supply, and, as you said, shortage of everything that exists?

Mr. LIGON. Our function with regard to that is somewhat limited. As a small staff office of the Secretary of the Interior, we can put forth policy analysis to policymakers and explain that "This is the problem, these are the things that need to be done, please make the decision so that we might avoid excess refining capacity crunches," and so forth and so on.

Mr. VEYSEY. In other words, you bring the statistics together before someone——

Mr. LIGON. And the analysis to the Oil Policy Committee, and to the Secretary of the Interior.

Mr. VEYSEY. Have you anticipated this particular situation and done so?

Mr. LIGON. Yes; we have.

Mr. VEYSEY. What time, what date, and to whom?

Mr. LIGON. Within the Oil Policy Committee; I didn't mean to say the program separately considered the problems of a specific shortage of gasoline in the Los Angeles area. What I meant to say was we anticipated spot shortages in every one of the districts we are talking about, and this Los Angeles situation comes absolutely as no surprise. We have been talking about this particular thing for almost a year now.

Mr. VEYSEY. You have been talking about it?

Mr. LIGON. Yes; with regard to——

Mr. VEYSEY. Doing what?

Mr. LIGON. Putting forth recommendations to the policymakers that more product imports in the short term are needed to alleviate this kind of pressure, shortage pressure; added incentives, and so forth, are needed with regard to the refineries.

We are very limited to the policy that we can make on these matters.

Mr. VEYSEY. You really make no decisions in these matters?

Mr. LIGON. No, sir. We are a staff functioning organization.

Mr. VEYSEY. You are a statistical gathering and recommending and coordinating type of organization.

Mr. LIGON. That is right.

Mr. VEYSEY. I guess I still come back to my original question. Suppose the Office of Oil and Gas disappeared. Would we be in any worse trouble?

Mr. LIGON. Yes, I certainly think you would, because I am not sure many of the policymakers would be aware of the problems, what the cause of the problems are, or various suggestions as to solutions we might take to alleviate the problem.

Mr. VEYSEY. What are you going to recommend that they do about the Los Angeles gasoline shortage?

Mr. LIGON. As remedies we have recommended for handling various shortages all over the country we have increased imports on crude and products. Working with the oil companies in the immediate area, is about the extent of what we can do within our limited jurisdictional control. We are a staff agency, not an operating agency of the Department.

Mr. VEYSEY. I thank you, Madam Chairman.

Mrs. HANSEN. The committee will adjourn until 1 p.m.

AFTERNOON SESSION

Mrs. HANSEN. The committee will come to order.

POLICY CHANGES IN LAST YEAR

What major policy changes in the past year have affected your office?

Mr. LIGON. I think the calls for emergency actions with regard to the oil and gas product shortages and the spot shortages across the country have been most important to us. The oil import program has, of course, not changed significantly but important increased allocations have been allowed and have had some effect.

An increased staff burden has presented itself as a result of more and more policymakers becoming more involved in this particular area. I think, Mrs. Hansen, the emergency area has been our major additional program addition.

Mrs. HANSEN. Do you foresee being in an emergency situation for a great many years due to ever-changing use, the disappearance in some areas of resources, and the international problem?

Mr. LIGON. Yes, ma'am, for several years, at best.

THE OIL POLICY COMMITTEE

Mrs. HANSEN. You refer in your statement to the support your office provides to the Oil Policy Committee. What is this committee and what is its function?

Mr. LIGON. The Oil Policy Committee, Madam Chairman, is made up of seven representative agencies.

Mrs. HANSEN. Please list those agencies.

Mr. LIGON. Yes, ma'am. Justice, Commerce, Defense, Interior, State, Treasury, and Council of Economic Advisers.

We have also three observers that you might be interested in, who participate regularly in this committee. That is a White House representative, an Environmental Protection Agency representative, and one from OMB.

Now, as to the functions of the Oil Policy Committee, this committee was formed as a result of the Presidential task force headed by Mr. Shultz. One of the recommendations of that 1970 task force was to create an Oil Policy Committee, with the principal members being the secretaries of these various departments or heads of agencies.

Its charge is to come up with policy recommendations for the President.

Mrs. HANSEN. How many years has the Oil Policy Committee been in existence?

Mr. LIGON. Since 1970.

Mrs. HANSEN. What agency handled this phase of operations prior to 1970?

Mr. LIGON. I am not sure that there was a single organization that handled it. That was the reason for the recommendation of the Presidential task force. I think traditionally, virtually all the authority was in the Department of Interior.

INVOLVEMENT OF THE DEPARTMENT IN OIL AND GAS MATTERS

Mrs. HANSEN. In the Department of the Interior we have several agencies working in some degree with oil and other fuels.

The BLM is involved in leasing procedures. The Geological Survey is involved with exploration, research, and the development of techniques.

The Bureau of Mines is charged with the overall responsibility of providing minerals data in the United States. The Office of Coal Research is working on research to produce oil from coal.

To what extent do you coordinate with, for example, BLM on leasing?

If you have a shortfall, what do you do with the BLM to analyze the situation?

The leasing information is based directly on what Geological Survey supplies.

I want to know how you relate the total needs of the United States to what the resources are, and the knowledge of where they lie, et cetera.

Mr. LIGON. We coordinate with and provide information to all these groups in Interior various analysis, data and information on specific issues which may come up before the Oil Policy Committee. This coordination is essential because our office is the chief staff support to our representative to the Oil Policy Committee. If there is an issue with regard to offshore leasing, we must work with the appropriate subagency, try to analyze the information available and forward it to our representative for the Oil Policy Committee.

Mrs. HANSEN. Are the oil imports based to any extent upon the total knowledge you have about leasing and production on offshore as well as the onshore lands?

Mr. LIGON. Yes, ma'am. I do not think you can separate them. They are all intertwined.

IMPACT OF IMPORTATION OF OIL IN UNLIMITED QUANTITIES

Mrs. HANSEN. So there is complete coordination?

There are a great many people who contend, that it would be well for us to not use our own resources and just buy Mideast and Venezuelan oil.

What is your answer in this regard?

Mr. LIGON. This is not an acceptable course.

Mrs. HANSEN. Why?

Mr. LIGON. This is the reason why it is not: There are two basic points:

First, the national security with regard to traditional defensive security matters. By "the national security" I am considering our country cannot afford any type of physical disruption in the flow of oil imports even from insecure areas across the world. The more dependency we have on Middle East oil or overseas oil, the more we are overly dependent on imports and the more vulnerable. This is the situation——

Mrs. HANSEN. By "overly dependent," do you mean that it could mean the lack of development of expertise, technology, in our own country's exploration and development?

Mr. LIGON. Yes, I certainly do. There has been an interesting phenomenon that we touched on this morning. Instead of the traditional relationship of the favorable oil prices that we have had in the market for years, we now have the foreign price for crude oil even with or above the domestic price, a great change.

Well, if we simply locked up our domestic resources and did not allow more production development—I mean depended entirely upon oil imports, we would create an adverse investor psychology in the United States. I am convinced, and that we would not be able to entice prospective investors to make capital investments for a 10- to 20-year payout, simply because they would have no stability as far as domestic prices or assured cash flow are concerned. Then our domestic prices would be merely following the foreign prices, and there is not even stability in these foreign prices, which can be basically controlled by the OPEC cartel as we discussed this morning.

I know it is arguable whether that cartel is workable for long periods or not. In the past few years, it has been extremely workable and effective; there is no reason for us to believe that it will not be at least as well managed in the future.

EFFECTS OF ABOLISHMENT OF THE OIL IMPORT PROGRAM

Mrs. HANSEN. Suppose the oil imports program was abolished, what would happen?

Mr. LIGON. All right—I would quickly say that we cannot have an elimination disruption of our oil imports simply because of defense or vulnerability reasons.

BALANCE OF PAYMENTS PROBLEMS

Now I also want to talk about the national security vulnerability based on economics. There is another reason why we cannot wholly depend, or increasingly depend on foreign imports through the years ahead. The costs of oil all over the world is continuing to increase. This has presented us with a very severe, adverse balance-of-payments problem.

In 1972 we had a deficit balance of payment resulting in a problem, an import bill due mainly to oil imports. This was actually a trade deficit due to imports of amounting oil to almost $4 billion. For 1985, Interior estimated $25 billion deficit; Commerce estimates $30 billion. Chase-Manhattan Bank estimates the deficit will be as high as $30 to $35 billion. This, of course, puts great added pressures on the monetary scene, further erodes the dollar, and it is just something we cannot afford.

Mrs. HANSEN. But suppose you abolished the oil import system?

Mr. LIGON. We would become more and more dependent upon increasing quantities of imported crude oil and refined products.

Mrs. HANSEN. Do you think we would import all of our oil needs?

Mr. LIGON. No, I do not think we would go the whole way. Because our demand is increasing at such a rapid pace, that each year's imported portion of total oil consumed the increment would continue to increase. By 1985, Mrs. Hansen, some people say our consumption would be 50 percent imported oil.

Mrs. HANSEN. The balance of trade brings up another interesting problem. You have Japan, and so forth, acquiring more and more oil. Japan at the same time is the major constructor of large tankers.

Then as you decrease the potential of manufacturing in this country because of increasing prices and the lack of energy sources, does not Japan create a tremendous imbalance in trade at the same time?

Mr. LIGON. If the present conditions do not change and the present trends continue, yes.

Mrs. HANSEN. Japan is a leading manufacturer of cars, cameras, radios, TV, almost anything that you can name. Will not this become an ever-increasing problem? What does that do to the industrial production in the United States?

NEW TANKER CONSTRUCTION

Mr. LIGON. I would add one more thing in the realm of petroleum for your consideration. You said Japan is the largest builder of supertankers, and that is true. But they are also the largest manufacturer of regular size tankers, such as the tankers that we use in the U.S. ports.

Mrs. HANSEN. What are the leading shipbuilding nations in the world?

Mr. VICKERS. Japan, Western Germany, and Eastern Germany, England has been reducing their new construction tonnage each year.

Mr. LIGON. France and Sweden have been principal constructors of the cryogenic tankers necessary for the LNG transportation we were talking about this morning. They are still the principal manufacturers of that special type.

Mrs. HANSEN. What ports is LNG going to come into?

Mr. LIGON. Right now the quantity shipped to the United States is very small. But certainly has a potential for a great deal of growth.

EXPORT-IMPORT BANK LOAN FOR LNG

Mrs. HANSEN. You spoke about a loan. Please discuss the loan from the Export-Import Bank.

Mr. LIGON. It is for two things: One, liquefaction plant, and two, for the construction subsidies needed to build the ships to transport this.

Mrs. HANSEN. Who is going to receive the construction subsidies?

Mr. LIGON. American manufacturers; by that I mean the American shipbuilders.

Mrs. HANSEN. In this country?

Mr. LIGON. Yes. And a very interesting point is that cryogenic transportation has a special technology. With regard to the Export-Import Bank financing considerations, the Bank authorities had to be sure that we had the necessary technology for cryogenic tankers construction. We thought that this would be easy enough. I was in Treasury at the time and worked on some of those projects. Finally, our shipbuilders had to go to the French and the Swedish shipbuilders to secure their permission, by purchasing the rights to use their special technology for construction of cryogenic tankers.

Mrs. HANSEN. This brings up an increasing problem. Every time we slip economically and technologically, we are putting more people

permanently out of competition, and eventually out of the labor picture. Is that not correct?

Mr. LIGON. Yes, ma'am. I am also fearful of that.

Mrs. HANSEN. The United States used to be a leading shipbuilder. How many ships do we build in proportion to the rest of the world?

Mr. LIGON. Very few.

Mrs. HANSEN. The other day the committee discovered the United States is training about 135 mining engineers at the same time the Soviet Union is training more than 4,000. This tells a story about our whole mineral exploration program.

Mr. LIGON. The need is there because our American companies, as you know, are buying scores of tankers every year, but not from U.S. shipbuilders.

Mrs. HANSEN. What has been the primary reason, in your opinion, that American shipbuilders have failed to compete?

Mr. LONG. On the question of oil, are we leaving that subject? I have a question raised by a constituent.

Mrs. HANSEN. No.

Mr. LIGON. It is lower costs of labor and cost of materials.

SPECIAL STUDIES UNDERWAY

Mrs. HANSEN. Your statement refers to studies you are involved in relating to refining capacity and emergency oil supply.

Mr. LIGON. Yes, ma'am.

Mrs. HANSEN. What significant findings have these studies uncovered?

Mr. LIGON. The two studies I referred to are studies that we are cochairmen of the working group committees for the National Petroleum Council. These studies are just underway and they have not come up with any conclusions as yet. Can you add any more to that?

Mr. OLIVER. No. Both these studies should issue first reports by midyear. I think the first one, the refining study, will document construction programs, not just the new refineries, but also refinery expansion and the bottlenecks. This kind of information is not generally available. It will go further and consider some of the factors and trends we talked about this morning such as the problems encountered by domestic refiners in the construction of new facilities, with some recommendations as to what may be done about that.

Mr. LIGON. The second emergency study will be developed with various assumptions, such as we have so many days' supply of this and so many days' supply of that.

Mrs. HANSEN. When will these reports be completed?

Mr. OLIVER. In midyear.

Mrs. HANSEN. July?

Mr. OLIVER. Yes.

DIESEL OIL SUPPLY PROBLEMS

Mrs. HANSEN. Dr. Long?

Mr. LONG. I have the attached letter from Mr. Robert Kahoe, president of Kahoe Transportation Co. of Bel Air, Md. He received a notice from Shell Oil Co. that Shell will no longer sell diesel oil to Kahoe Enterprises because of the shortage of fuels. He is a prime contractor

with the U.S. Postal Service. His trucks have a definite time schedule to meet and they cannot stop and purchase the fuel on the road. His company is subject to fines and possibly default for lateness and nonperformance.

I will read the following letter to you from Shell Oil Co., to the Kahoe Transportation Co.:

SHELL OIL CO.,
Baltimore, Md., March 23, 1973.

KAHOE TRANSPORTATION CO., INC.,
Bel Air, Md.

GENTLEMEN: Please refer to our letter of December 26, 1972, in which we stipulated Shell's position in regard to the potential national shortage of distillate fuels. Accordingly, in face of the actual short position that has arisen, Shell must decline to supply Dieseline to your account after midnight March 31, 1973. This possibility was also included in our letter of December 26, 1972.

We have halted all work and canceled all purchase orders covering the tank installation at your Seat Pleasant, Md., location. This is, of course, because we cannot supply the fuels.

We sincerely regret that we must take these steps as we have enjoyed serving you in the past.

Very truly yours,

E. J. REMSON,
District Manager.

I present that and I present a letter from Kahoe Enterprises to me describing this situation, in which is said:

KAHOE ENTERPRISES INC.,
Bel Air, Md., March 27, 1973.

Hon. CLARENCE LONG,
House of Representatives,
Washington, D.C.

DEAR SIR: We have been buying diesel oil from Shell Oil Co. for the past 6 years at the rate of 7,000 gallons per week.

We learn this week (see enclosed letter) that we are no longer a customer and we cannot expect any fuel from them.

Other majors will not take new accounts, but are striving to take care of their old accounts. This is what they tell us when we apply for product.

We think this action is highly unethical and bordering illegality. Our history and past records with Shell indicate some sort of trust and faithfullness.

Something has to be done. We are solely Government contractors and are in line for possible default and complete wipeout. (I am sure others have had the same drastic news.)

If anyone can help to solve my situation, I am sure you can. You have never let me down, and I sincerely believe this action bears investigation. Take a look at the defense fuel supply bids for region 6, just opened. There is no place for anyone but the majors.

Yours truly,

ROBERT F. KAHOE,
President, Kahoe Transportation Co. Inc.

I am going to put these two letters in the record, and a third letter here I would like to put in the record.

[The letter follows:]

KAHOE ENTERPRISES INC.,
Bel Air, Md., March 26, 1973.

Mr. HARRY BRIDGES,
President, Shell Oil Co.,
Houston, Tex.

DEAR SIR: We have received a 10-day notice from Mr. E. P. Remson, district manager, eastern wholesale division, that our company is being cut off from their supply of diesel oil.

We are solely U.S. mail contract haulers. We use approximately 7,000 gallons every 7 days. We have been a customer of Shell Oil for the past 8 years in this category, and Shell jobbers for the past 20 years.

We have never tried to negotiate prices with Shell or to market prices with others. Shell has been our sole supplier without question. Our historical position with your company should be honored and we ask that we be treated equally with similar customers.

As a prime contractors with the U.S. Post Office we are not in the same position as a regular carrier who can easily purchase fuel on the road. Our trucks have a definite time schedule to meet. We are subject to exclusive fines and possible default for lateness and for nonperformance.

On the other hand, Shell, as a critical supplier to the Kahoe Transportation Co. could be subject to a rated order from the Government to supply Kahoe with their needs. I am sure your company is well aware the handling of such an order could be extremely costly and time consuming to you, to us and to the Federal Government. However, there is justification for such an order both in Asper and the postal regulations as approved by the Congress.

I sincerely hope that your company carefully reviews our situation and past records, and reconsider your termination notice.

If I can be of further assistance to you in this regard, I remain at your disposal.

Very truly yours,

ROBERT F. KAHOE,
President, Kahoe Transportation Co., Inc.

Mr. LONG. Also a statement from Mr. Hollis P. Albert, chairman of the board of Operators Heat, Inc., Baltimore, who wrote me about the problem and the following question for today's witness.

He said:

I have a letter from the president of the National Oil Jobbers Council which contains some interesting statements about the use of home heating oil by he electric utilities to run their combustion turbines. The letter reads in part: "These electric utilities, in 1972, used approximately 2.1 billion gallons of home heating oil to run their combustion turbines. This is a 67 percent increase over their 1971 requirements. Due to the gross inefficiency of these combustion turbines, approximately 80 percent, or 1.68 billion gallons of this valuable finite natural resource was wasted. This wasted oil would be enough to heat the oil heated homes and commercial properties in Pennsylvania for an entire year. Oil burners in homes to provide heat and hot water are 80 percent efficient. In a Wall Street Journal survey in September 1972, the manufacturers of combustion turbines estimated that the electric utilities' purchase of these turbines by 1980 will nearly triple their purchases in 1972."

This is disturbing to me and I should like to have your comment on both these questions: one, the discontinuance of the Shell Oil Co. arrangement with a contractor, a U.S. contractor, and two, the usurpation of heating oil by electric utilities.

I would like to know what your policy is in both cases and what my constituents can do about these problems.

Mr. LIGON. First of all, these problems are very distressing to the Office of Oil and Gas as well, Mr. Long. I want you to understand that our function is to support certain policymakers. My position is not to make policy, I want to lump both of the examples together, if I might, simply because the first had to do with diesel oil, the second had to do with No. 2. These middle distillates are very close and interchangeable in many, many cases.

There is a chronic nationwide shortage of middle distillate products, as I know you are aware, which is included with a general product shortage that exists in the United States. The shortage is in our present refining capacity which is totally inadequate to meet the Nations growing demands for middle distillate products—jet fuels, diesel fuels, and heating oils.

Mr. LONG. Why not let oil come in from other countries to relieve this temporary situation until the refining capacity can be enlarged?

Mr. LIGON. All oil import restrictions have already been lifted on No. 2 fuel oil, through April 30.

Mr. LONG. In another 30 days or less than that?

Mr. LIGON. Yes; at the present time the Oil Policy Committee is completely reviewing the entire oil import program, partially because of the inability of the program to respond to the supply shortage situations that you have just illustrated. All over the country things like this example have happened. The system is just not working right and there must be some reason why.

Our Oil Policy Committee intends to act before we get into a general gasoline shortage. That is another problem as well.

But for the short term, the restrictions on No. 2 were suspended. These products may be imported in unlimited quantities.

Now, with regard to your first letter, which is very interesting. I do not think you were here, when we discussed this morning the inability of Shell Oil Co., which was the subject of the first letter, to respond to product demands in district I, and the east coast generally, because of their inability to add the refining capacity to supply those needs. Shell had plans on the drawing board, as I am sure you are aware, for refinery construction in the Delaware area; but they were stopped from putting up such a refinery to supply those needs of the Middle Atlantic States.

TRADING OF OIL

Mr. LONG. Why can they not get oil from other companies? I understand oil companies do a great deal of swapping of oil.

Mr. LIGON. They do.

Mr. LONG. In fact, oil is almost a fungible good.

Mr. LIGON. They do.

Mr. LONG. Why should Shell, in a sense, dishonor a contract? Why can they not go out and substitute?

Mr. LIGON. I cannot answer that question for Shell. But, you are right, trading is going on all the time. There are crude oil swapping, and product swappings. I do not know what the supply situation is in that particular case. Shell should now be able to do something because they have the authority to import the products, No. 2 particularly.

Mr. LONG. Can you tell me what satisfaction I can give my constituents on both of these questions?

Mr. LIGON. I am not sure of any specifics that I can suggest; except we would be happy to work with Shell Oil Co., along with your office to supply any help that we possibly can.

Mr. LONG. Can we count on your office then to help us with Shell Oil Co. to honor these contracts?

Mr. LIGON. You can count on us to contact Shell and to see what we can do about the situation and we will help in any way we can. I will also go a step further and tell you I will be glad to bring this to the attention of the Oil Policy Committee chairman.

PETROLEUM FUELED POWER PRODUCTION

Mr. LONG. Thank you very much.

This matter of electric utilities being much more inefficient in their use of oil than if, say, the oil was provided to home heating plants, are the facts in this letter as he has stated them true?

Mr. LIGON. I think this may be a result of a variety of things. Many utilities have long relied on natural gas for fuel, as you know. As the last falls' squeeze began to develop, utilities turned more and more to No. 2 fuels, which thus put more pressure on the No. 2 market and that, in return, put the squeeze on the interruptible industrial customers that the company supplied.

I talked to someone from Detroit Edison the other day who had been even using crude oil to turn generators. That is a very costly and inefficient way to provide energy for electric power products.

Mr. LONG. As he says here.

Mr. LIGON. Yes, very inefficient way of doing it. Yet the people in that industry have been driven to utilize that source of fuel.

Mr. LONG. Why is that so?

Mr. LIGON. Simply because, as I explained, the chain reaction, with the natural gas curtailments, that was the first step, then it just passed on down the line of alternative fuels the increased consumption of the No. 2; then the pressure on the diesel fuels et cetera.

Mr. LONG. Did not most of these electric generating plants at one time use coal?

Mr. LIGON. Yes, coal and natural gas.

Mr. LONG. Is that not the most efficient way of doing it?

Mr. LIGON. Yes, except that coal is dirty and gas is scarce.

REDUCED CONSUMPTION OF COAL

Mr. LONG. Why have we moved away from coal?

Mr. LIGON. Environmental problems.

Mrs. HANSEN. That was brought out in testimony earlier today.

Mr. LONG. I realize that. Was it not brought out in earlier hearings that this was unfortunate because there is on the drawing boards at least, or in existence in the trade, techniques which would enable you to use coal and still not have this pollution problem?

Mr. LIGON. Certainly. There is coal gasification and various other developing technologies that, if given the opportunity to compete in the present market, will be able to. But at the present prices of crude oil and natural gas, there is no way for that alternative to be adopted.

OIL AND GAS PRICING

Mr. LONG. Are not these prices of gas and oil to a very large extent a contrived thing?

Mr. LIGON. No, sir, they are not.

Mr. LONG. You would disagree then with the statement——

Mr. LIGON. Yes.

Mr. LONG [continuing]. Which has been widely made that the reason why we have been using oil wastefully and gas wastefully is because of the pricing structure that has been allowed to develop by the industry and by government? You would disagree with that?

Mr. LIGON. No. Now I would agree—you said several things. First of all, I do not think the price has been contrived. Secondly, I think probably the cleanest, most efficient fuel, natural gas, has been wasted insofar as efficiency in end use is concerned simply because of its low price. We have all wanted to use gas, since it is clean, it is efficient, it is fine fuel.

Mr. LONG. Why cannot the price be raised? For example, we have many taxes on various products which could be adjusted to reflect the longrun realities of the scarcity of oil and the efficiency of using oil as opposed to electricity.

Mr. LIGON. Now we are talking about gas. Are you talking about oil also now?

Mr. LONG. Yes, of course, because my constituent talked about oil.

Mr. LIGON. Of course.

FOREIGN INVESTMENT IN OIL COMPANY OPERATIONS

With regard to the oil situation. We talked about this morning, the decision of a foreign operating oil company to develop foreign oil supplies versus their ability to produce and invest here. They have that choice and will take whichever is most beneficial to them and their stockholders, so economically, they will choose their route. At this time the foreign investments must be more beneficial to them, or there would have been more domestic investment. If we had had more domestic investment in production and refining facilities, your constituents would not be having the problems they have today.

Mr. LONG. Is not our foreign investment to a very large extent a result of our tax policies which encourage the export of capital overseas and allows capital overseas to escape taxation?

Mr. LIGON. No, sir; I am not sure of that; I disagree with that. No, sir.

Mr. LONG. You do disagree with that?

Mr. LIGON. Yes, sir; I do disagree.

Mr. LONG. I wonder if you would put in the record—document your disagreement.

Mr. LIGON. Be glad to.

Mr. LONG. Because there is a great deal of literature on that now to the contrary.

Mr. LIGON. Certainly.

[The information follows:]

U.S. law gives a U.S. income tax credit for foreign taxes paid on foreign income to the extent the foreign tax is no greater than the U.S. tax on that income. If the foreign tax is less than that of the United States, then the difference between the foreign tax and the U.S. tax is payable to the United States: Limitations are applied that prevent a taxpayer from claiming foreign tax credits against income derived from sources within the United States. Therefore, the total tax burden of U.S. oil companies operating both at home and abroad is never less than the taxes that would have been paid if the income had been wholly earned in the United States. For this reason, foreign investments by U.S. oil

companies do not escape taxation, per se. The foreign tax credit merely assures the companies that they are not subject to double taxation.

Assuming, then, that the total tax burden will be the same regardless of where oil is found and produced, the company will seek to invest in the place where the potential for finding oil is greatest and where the finding and producing costs will be lowest in order to gain the greatest profit advantage. In past years, the Middle East and Africa provided a preferred area for such investments. Current activities involving OPEC and the producing companies are changing the profit conditions to a point that other alternative potential energy source areas may become relatively more attractive.

Further, it is our understanding that all industrialized nations avoid double taxation of foreign source earnings by allowing foreign tax credits or by exempting foreign earnings from tax.

If this foreign tax concept were not in effect it would render U.S. business noncompetitive abroad vis-a-vis a foreign owner operation and would force U.S. business to surrender foreign markets to foreign controlled business.

The foreign tax credit applied to all U.S. businesses operating in foreign countries and U.S. oil companies receive no different treatment or benefits than any other type of business.

JUSTIFICATION MATERIAL AND OVERVIEW ON DOMESTIC PETROLEUM SUPPLY

Mrs. HANSEN. At this point in the record, please insert justification pages 1 through 13 and the report on the overview of the domestic petroleum supply situation, furnished by the Office of Oil and Gas.

[The justifications and report follow:]

SUMMARY AND HIGHLIGHT STATEMENT
COORDINATION OF OIL AND GAS ACTIVITIES

Office of Oil and Gas

Established May 6, 1946, pursuant to Presidential letter, this staff organization is responsible for information, leadership and coordination of Federal oil and gas policies and activities. The estimate of funds required for Fiscal Year 1974 is $1,485,000, no increase over 1973. Staff required for Fiscal Year 1974 consists of 67 at headquarters and 9 in the field, the latter funded and reimbursed by the Office of Emergency Preparedness. The Office of Oil and Gas prepares special studies on the oil and gas industries and implements international and domestic emergency plans. The Office of Oil and Gas is also responsible for carrying out the Department's Oil Import program. This program was established March 13, 1959, pursuant to Presidential Proclamation No. 3279, as amended. The Office established maximum quotas for importers of crude oil petroleum products into the United States and Puerto Rico. An expanding program of quotas for crude oil imports intended for the petrochemical industry, residual oils, and asphalt has increased the technical and administrative support requirements for this Office for 1974. Our comprehensive program requires continued inspection and surveillance for effective industry compliance.

DEPARTMENT OF THE INTERIOR
OFFICE OF OIL AND GAS
SALARIES AND EXPENSES

Appropriation, 1972	$1,570,000	
Transferred to "Departmental Operations", Office of the Secretary	-70,000	
Total Available 1972		$1,500,000
Appropriation, 1973	1,558,000	
Transferred to "Departmental Operations", Office of the Secretary	-73,000	
Total Available 1973		1,485,000
Budget Estimate, 1974		1,485,000

Analysis by Activity

Activity	Fiscal Year 1972 Amount Available	Fiscal Year 1973 Total Appropriation	Fiscal Year 1973 Transfers	Fiscal Year 1973 Available
1. Coordination of Oil and Gas Activities	$1,491,924	$1,485,000	---	$1,485,000
2. Oil Import Appeals Board	---	73,000	-$73,000 1/	---
Unobligated balance lapsing	8,076	---	---	---
Total	$1,500,000	$1,558,000	-$73,000	$1,485,000

1/ Transferred to "Departmental Operations", Office of the Secretary

	F.Y. 1972 Amount Available	F.Y. 1973 Amount Available	F.Y. 1974 Estimate	Increase(+) Decrease(-) compared with 1974 Total
1. Coordination of Oil and Gas Activities	$1,491,924	$1,485,000	$1,485,000	---
Unobligated balance lapsing	8,076	---	---	---
Total	$1,500,000	$1,485,000	$1,485,000	---

OFFICE OF OIL AND GAS
JUSTIFICATION

Responsibilities of the Office of Oil and Gas

The Office of Oil and Gas has been given responsibilities for all oil and gas matters -- domestic and worldwide. Recent domestic and international problems in oil and gas supply, affecting the public and private sectors alike, have clearly demonstrated the need for increasingly sophisticated economic analyses. These, in turn, must rest upon improved reporting capabilities and an expanded liaison with industry, other governmental agencies and departments and with international organizations.

The emphasis is on encouraging industry, and the private sector as a whole, to develop, stabilize and expand their activities in research programs, improve services to the nation, promote orderly economic developments of domestic resources, and protect industrial security; which are major concerns of the Office of Oil and Gas. The Office, as the point of contact between the Federal Government and the oil and gas industries, must be able to respond promptly to additional needs of government-industry coordination in the energy program of the Nation and the Free World.

In October 1971, the Oil Import Administration was abolished as a separate office and its functions were merged into the Office of Oil and Gas as part of the Secretary's reorganization of four mineral resources offices intended to develop a single energy program within the Department. The Office of Oil and Gas is one of the activities under the direction of the Assistant Secretary for Mineral Resources concerned with the minerals and energy aspects of departmental programs.

In providing staff support on oil and gas matters to the Secretary and the Assistant Secretary - Mineral Resources, the Office of Oil and Gas has three major functions:

(1) to act as the principal line of communication between the Federal Government and private industry on matters relating to petroleum;

(2) to insure that the responsibilities of the Department of the Interior for emergency preparedness in oil and gas are appropriately fulfilled; and

(3) to carry out the Department's responsibilities in the Oil Import Program.

To be more responsive in these three functional program areas, this Office is now organized into three divisions:

I Programs and Analysis
II Emergency Preparedness/Oil Import Compliance
III Oil Imports

I. Programs and Analysis Program

The Programs and Analysis Division has the following functions:

(1) It develops, evaluates and coordinates oil and gas information to provide sound bases for establishment and implementation of Government policies and programs for oil and gas.

(2) Provides information and services to Government Agencies with respect to physical and economic factors affecting the petroleum and gas industries both in the United States and abroad.

(3) Recommends programs and policies to improve the position and capabilities of these domestic industries, especially as required by the Mining and Minerals Policy Act of 1970.

(4) The Division also provides such informational and analytical support as the other Office of Oil and Gas divisions may require in the performance of their respective functions.

In the performance of its functions, the Plans and Programs Division is responsible for communications and liaison in matters relating to or affecting oil and gas, with:

(1) other offices of the Department of the Interior;

(2) other Federal agencies;

(3) the Interstate Oil Compact Commission and State regulatory bodies;

(4) the petroleum and gas industries, its trade and professional associations, its suppliers and its customer groups;

(5) others, including academic, financial and public interests.

Legislative -- Maintains a continuing awareness and appraisal of hearings, investigations, proposals and actions of the Congress relating to oil and gas matters, and prepares proposals for legislation needed in the national interest to improve the position and capabilities of the oil and gas industries.

Statistical -- Coordinates the development of data and data systems essential to the analyses and understanding of domestic and foreign oil and gas resources and activities. Designs and develops a data bank to provide storage of and ready access to such data.

Environmental -- Maintains continuing intelligence concerning the effects of oil and gas production, transportation, manufacturing and consumption on air, water and other environmental qualities; and the effect on these activities of regulations and actions to maintain or improve environmental quality. Identifies and anticipates problems arising from the interface between oil and gas and the environment and develops and proposes remedial action. Reviews for accuracy and completeness Environmental Impact Statements which relate to oil and gas, and prepares such statements as may be required in support of proposed oil and gas programs.

Under an Assistant Director, the Programs and Analysis Division is organized into a Production Section which is concerned with resources, organization and performance relating to the production of crude oil, natural gas and natural gas liquids. This section:

(1) performs the aforementioned liaison, legislative, statistical and environmental functions as they relate to the production of oil and gas;

(2) appraises, audits and reports estimates of reserves and resources;.

(3) evaluates trends in exploration, drilling, discovery, development, production and producing capacity.

(4) conducts technologic and economic evaluations of supplies and potentials for supplies;

(5) evaluates the effects of proposed policies and programs on oil, gas and gas liquids production; and

(6) develops proposals for improvement of the domestic industry.

The Distribution and Consumption Section is concerned with organization, performance and requirements relating to the transportation, manufacturing, distribution and consumption of petroleum and natural gas and their derivatives (including petrochemicals) and manufactured substitutes (including shale oil and synthetic oil and gas). This Section:

(1) performs the aforementioned liaison, legislative, statistical and environmental functions as they relate to oil and gas transportation, manufacturing, distribution and consumption;

(2) monitors and advises concerning current market developments in oil and gas, especially supply adequacy and price developments;

(3) evaluates the adequacy of present and prospective capabilities to meet market requirements;

(4) conducts technologic and economic studies of means to meet future requirements and prepares proposals as needed to assist in meeting these requirements;

(5) evaluates the effects of proposed policies and programs on oil and gas distribution and use;

(6) receives, evaluates and responds to consumer inquiries and problems; and

(7) anticipates consumer problems, proposes remedies, alerts consumers to needs for pre-planning, and provides consumer information.

The Economics and Statistics Section

(1) prepares special economic studies as required;

(2) coordinates oil and gas forecasts (volumes, capacities, and prices; short and long term) with other sections and with other Department of the Interior agencies);

(3) provides economic, statistical and computer programming assistance to other sections and divisions as required;

(4) coordinates the development of petroleum statistics;

(5) develops and oversees the maintenance of a petroleum data bank; and

(6) compiles and analyzes current data on international petroleum production, consumption and flows.

Committee Activities

The Office of Oil and Gas chairs or furnishes staff representatives or Government Co-chairmen to a variety of international, Federal, state, and industrial committees interested in or affected by petroleum and gas operations or supply. Some of these are:

Domestic:

National Petroleum Council (Government Co-chairman)
Emergency Advisory Committee for Natural Gas
(Government Co-chairman)
Petroleum Statistics Interdepartmental Liaison Group
(Chairman)
American Petroleum Institute Committee on Statistics
(Representative)

Committee on the Secondary Impact of Pollution Abatement
(Member)
Interstate Oil Compact Commission (Observer)
Departmental Trans-Alaskan Pipeline Committee (Member)

International:

North Atlantic Treaty Organization Petroleum Planning
Committee (Member)
U.S./Canadian Joint Emergency Requirements Planning
Committee (Member)
Foreign Petroleum Supply Committee and its Petroleum
Security Subcommittee (Chairman)
Emergency Petroleum Supply Committee (Chairman & Co-chairman)
Organization for Economic Cooperation and Development
Special Committee for Oil (Member)
Operating Committee of the Advisory Committee of
Export Policy
Department of Commerce (Member)
United Nations Economic Commission for Europe - Gas
Committee (Representative)

Special Programs - Continuing Studies and Projects

1. In March 1966, the Bureau of the Budget assigned to the Department of the Interior "focal agency" responsibility for implementing the Interagency Petroleum Statistics program. The program has achieved important progress in designing data systems for petroleum resources, productive capacities, well drilling, expenditures and revenues, petroleum transportation, measurement techniques, definitions, and standardization of terms. Industry sources are now providing significantly improved statistical information on wells, reserves, and expenditures, and standarized reporting forms and terminology. This program has expanded in its concentration on oil and gas reserves' producing capacities and expenditures will continue through 1974.

2. Programming and analysis of a computerized "Study of Major U.S. Oil and Gas Fields" is well advanced toward filling the need for better data on production, reserves, productive capacity, geographic and geological location, and geologic and engineering characteristics of United States oil and gas fields. The study considers individual pools, emphasizing the physical parameters of the reservoirs and the nature of the resources in a format amenable to computer analysis. This program is being assisted by the Oklahoma University Research Institute, which provides the data processing capability. It is jointly funded by the Bureau of Land Management, the U.S. Geological Survey, Federal Power Commission, Bureau of Mines, Bureau of Land Management, and the Office of Oil and Gas.

3. The office participates with the National Petroleum Council, an industry advisory group to the Secretary of the Interior, in major study projects. For 1972 and 1973 the new U.S. Energy Outlook (through 1985 and 2000) study has been the major joint concern of NPC and this office. Individual task groups have studied Energy Demand; Oil Demand, Supply, Logistics, and Capital Supply; Gas Demand, Supply and Transportation, Other Energy Resources (Coal, Shale, Tar Sands, Nuclear and New Energy; and Energy), Government Policies. This joint Government/industry effort is probably the most important energy study NPC has ever made. It should have significant impact on the development of government policy positions on energy problems.

4. Various aspects of oil imports into the United States and their relation to our national security, the balance of payments problems, the abatement of air and water pollution and improvement of the environment will continue to be studied in Fiscal Year 1974.

II. Emergency Preparedness and Oil Import Compliance Program

A. Emergency Preparedness Program

1. The emergency preparedness functions of the Office of Oil and Gas include the development of emergency oil and gas plans and the organization, staffing, maintenance and training of a standby emergency oil and gas agency (known as the EPGA) and the development of suitable emergency operating facilities.

2. Petroleum and gas emergency planning involves efforts to assure that oil and gas emergency plans are available at the Federal, regional, State and local governmental levels for all contingencies. This work also involves testing of plans and providing guidance to industry. A major facet of the planning effort is participation in international planning; principal activities are development of NATO civil emergency planning, development of an international oil and gas emergency agency and full participation in joint U.S.-Canada emergency plans.

3. The Secretary of the Interior established the Emergency Petroleum and Gas Administration on August 28, 1963, and delegated emergency authority to its officials. This provides an organization in being, known to Federal and State government agencies and to industry, ready and authorized to discharge promptly the Secretary's defense responsibilities for petroleum and gas in the event of an attack upon the United States or a civil defense emergency declared by the President or the Congress. Tables of organization for key positions of the EPGA call for 239 in the National Headquarters Unit of the EPGA and a total of 701 in eight Regional EPGA offices (ten Regional offices changeover under study). National Defense Executive Reservists recruited primarily from the petroleum and gas industries under authority of Section 710 (e) of the Defense Production Act are designated for key positions in the EPGA. Current manning includes over 600 Executive Reservists in an active status, participating in training programs and assigned specific emergency responsibilities. Five regional offices supervise and maintain staffing of the regional and State organizations. They also provide coordination of EPGA participation in regional training exercises of other agencies' emergency organizations. The field staff is taking on added responsibilities in the area of oil import compliance, so maintenance of present field programs for emergency preparedness will require increased planning and coordination effort.

Should an emergency develop which affects foreign oil supply, the Office of Oil and Gas, in coordination with other interested departments and agencies, provides leadership within the Federal Government in its relationships with the oil industry through the Foreign Petroleum Supply Committee and its several subordinate committees. As part of this leadership, the Office, in collaboration with the Department of Defense and the Office of Emergency Preparedness, investigates essential civilian and industrial emergency requirements for oil. It prepares studies on the capacity and facilities available in the Free World to produce, refine, store and transport oil and gas under peacetime, emergency and conventional or nuclear war conditions.

4. Other mobilization functions include the acquisition and development of emergency operating sites and facilities for the EPGA, participation in special research studies and projects and participation in interagency damage assessment programs. Research project work results from requests by other Federal agencies to manage, assist and/or participate in projects established by research contracts. These projects, such as the pre-emergency calculation of the probable effects of nuclear attack on petroleum and gas supplies and facilities, deal primarily with emergency preparedness. Specific vulnerability studies of the total petroleum system and for the gas system concentrating on the State of Louisiana are continuing for the Defense Civil Preparedness Agency. These studies are designed to pinpoint the critical points in the oil and gas system where the effects of incapacitation of a few units can result in the shutdown of other major facilities dependent on those critical units. Damage assessment and

related work primarily involves participation in programs of OEP's National Resource Analysis Center. This involves compilation of resource data and efforts to provide a computer capability for making assessments of damage to oil and gas facilities by nuclear attack, or other causes, and for making analyses of surviving resources.

5. Voluntary Agreement functions involve the establishment and maintenance of Government-industry arrangements for obtaining information on foreign petroleum operations and worldwide requirements and supply of petroleum; also the development and implementation of Government-industry plans of action to meet petroleum emergencies due to disruption of foreign supplies. The basic purpose of the Voluntary Agreement is to provide specific procedures under which companies can take cooperative action with antitrust immunity to prevent, eliminate or alleviate shortages of petroleum supplies which threaten the defense interests or programs of the United States. These functions include the activitation and use of the Foreign Petroleum Supply Committee, the Petroleum Security Subcommittee of the FPSC, and the Emergency Petroleum Supply Committee whenever they are needed to assist the Government in responding to crises and emergencies involving foreign supplies of petroleum.

6. Most recent activities of the EPGA involve training exercises where the emphasis has been on response to a limited war rather than nuclear war, although capabilities are being maintained in the latter. Field representatives have found it necessary to devote a major portion of their time to recruiting Executive Reservists to replace promotions, transfers, and retirements of oil company executives. Additionally, this office has assisted the OEP Regional Field Board activities in relation to threatened and potentially threatened regional fuel shortages. All of these activities are expected to continue in FY 1974, with the EPGA planning and training designed to emphasize emergencies short of active war.

B. Emergency Advisory Committees Program

The Office of Oil and Gas is responsible for the use of emergency advisory committees to obtain advice and assistance on oil and gas matters. This includes:

(1) determination of need and the conduct of committee studies dealing with courses of action to assure an adequate supply of natural gas for national crises or national emergency purposes;

(2) committee studies dealing with compilation of information relating to foreign petroleum operations and related supply and demand;

(3) committee deliberations designed to cope with emergencies outside the U.S. which might require action to prevent, eliminate or alleviate shortages of petroleum supplies which could affect adversely the defense or security interests of the U.S.;

(4) committee actions with respect to development of plans of action to meet specific emergencies;

(5) the conduct of special classified wartime petroleum supply and demand studies for the Department of Defense and/or the Office of Emergency Preparedness; and

(6) the provision of related technical assistance by committees to the Government in the evaluation of petroleum resources to meet defense and security needs of the U.S. in possible emergency situations.

The Emergency Advisory Committee for Natural Gas conducts studies and prepares reports recommending courses of action which in the Committee's judgment would best assure an adequate supply of natural gas in the event of an attack upon the U.S. or the involvement of the U.S. in a limited war or a period of grave international tension. The Committee has 26 members selected from the industry.

The committees authorized by the Voluntary Agreement Relating to the Foreign Petroleum Supply Committee, its Petroleum Security Subcommittee and the Emergency Petroleum Supply Committee:

The Foreign Petroleum Supply Committee is authorized to advise the Government on how best to obtain information relating to foreign petroleum operations and to requirements and supplies of petroleum. It also advises the Government with respect to estimates dealing with any aspect of petroleum operations. In case of an emergency outside the U.S. which the Government determines requires action to prevent, eliminate, or alleviate shortages of petroleum supplies which threaten to affect adversely the defense mobilization interests or programs of the U.S., the Committee may, upon request, prepare for Government approval a plan or plans of action to meet the emergency. The Committee is composed by twenty-one American oil companies with foreign petroleum operations.

The Emergency Petroleum Supply Committee is an ad hoc industry committee which was established by an emergency Plan of Action approved by Interior, Justice and OEP in 1967 to assist the U.S. Government in coping with oil supply problems generated by the 1967 Middle East oil crisis. The function of the EPSC is to obtain, analyze and keep current the information and data which are necessary to provide a continuing composite appraisal of the magnitude and detail of the petroleum supply and transportation problems affecting the nations of Western Europe and other countries. The Committee is composed of 21 American oil companies and it has a Supply and Distribution Subcommittee and a Transportation Subcommittee. This is an ad hoc committee and is on a standby basis until the 1967 emergency Plan of Action is terminated.

It is anticipated that these committee activities will continue at the same levels in Fiscal Year 1974 as they have during the past several fiscal years. The maintenance and record keeping requirements also continue at the same rate.

C. Oil Import Compliance Program

The Oil Import Compliance/Inspection/Surveillance Program provides nationwide coverage and services.

The oil import control compliance program has as its primary objective to assure compliance with all the requirements of Oil Import Regulation 1 (Revision 5), as amended. This includes, in every instance, a verification of inputs claimed by refineries, petrochemical plants and deepwater terminal operators as well as all eligibility requirements for the various categories of allocation holders. It also includes field on-site inspections, detailed reports of findings, verification of records, recommendations, and conclusions. Functions of the Office of Oil and Gas dealing with compliance with the Oil Import Program are authorized by Presidential Proclamation 3279 of March 10, 1959 (24 F.R. 1781) and its amendments pursuant to Section 2 of the Act of July 1, 1954 (72 Stat. 678), 19 U.S.C. 1862, and Section 232 of the Trade Expansion Act of 1962 (P.L. 87-794).

An effective compliance inspection and surveillance program is essential to assure the equitable application of regulations of the oil import control program to all importers. To permit distribution of allocations, without the ability to assure the accuracy of the information upon which the distribution is based, is unacceptable. The Office of Oil and Gas must be in a position to assure that importers understand and comply with oil import regulations. In filing applications for an allocation and license, the prospective importer is required to certify the accuracy of the information contained in the application. Except through the

Office of Oil and Gas, Oil Import Compliance Program, it would be impossible to determine if the computer allocations were based upon factual information. Without being able to verify the accuracy or correctness of the information in all cases, licenses could be issued to ineligible applicants.

There are currently approximately 600 refineries and petrochemical plants earning regular allocation. These plants are located in 44 states and 300 cities and towns. These facilities should be inspected and applications verified on a cyclical basis of not less than once every two years. In addition to the noted 600 refinery/petrochemical applications, during the last three years, the Department has received an average of 60 new applications per year based on estimated inputs to several facilities in most applications. The regulations require that these new plants be inspected before any license can be issued. By area, there are approximately 282 refinery/petrochemical plants in the Southwest, 48 in New Jersey-Philadelphia area, 97 in the Great Lakes area, 36 in the Southeast, 39 in the Rocky Mountains, and 79 on the West Coast, plus 29 No. 2 oil allocation holders, and 49 residual fuel oil importers, with import allocations of over 1,300,000,000 barrels.

In Fiscal Year 1973, this office developed a program to utilize regional field offices' staffs in the Oil Import Compliance Program. The Industrial Specialists assigned to the Houston office have been augmented by OOG representatives (West Coast, Rocky Mountains, South and Southwest and the Eastern offices). They have been assigned to help compliance officers review applicants' performances on-site, inspect quota applicants' facilities to verify compliance with regulations and report to the Washington office on findings. Our Oil Import Compliance Inspectors have offices and headquarters in Houston, San Francisco, Chicago, Denver, Denton, Texas and Boston.

III. THE OIL IMPORT PROGRAM

The Oil Import (regulatory) program is designed to insure a stable and healthy oil industry in the United States capable of supplying the certified oil and gas requirements for continued national security. Incident to this, the program seeks to insure in the oil industry a healthy capacity for exploration and development of new petroleum reserves to replace those being depleted. Accordingly, it reserves a share of the domestic market for domestic oil producers, refiners and marketers.

The Oil Import Program is highly important, controversial, and vital to the joint defense interests of the U.S. and the nations of the Free World, especially the oil exporting nations. Import policies affect diplomatic relations and the economic development of the western hemisphere, the operation and construction programs of the petroleum petrochemical, and allied industries, and the utilization of petroleum and petrochemicals by consumers. The program directly involves imports of more than a billion dollars worth of energy and special resources. Not one phase of the oil import program can be administered inadequately without the possibility of economic imbalances and embarrassment to the Department and the Administration.

The limiting of imports of oil into the United States is basically a problem of balancing a sufficient level of imports with domestic production to encourage international trade and maintenance of Free World supplies without depressing or eliminating domestic crude oil exploration, development and production efforts. On an average, imported petroleum has been less expensive than domestically produced petroleum . Therefore, some indirect effect upon petroleum product prices is involved.

Authority

Pursuant to Section 2 of the Act of July 1, 1954, as amended (72 Stat. 678, 19 U.S.C. 1862b) the Director, Office of Civil and Defense Mobilization, made an appropriate investigation and determined that crude oil and crude oil derivatives and products were being imported in such quantities and under such circumstances as to threaten to impair the national security. The President concurred in the recommendation of the Director, Office of Civil and Defense Mobilization, and issued Presidential Proclamation No. 3279, dated March 10, 1959, "Adjusting Imports of Petroleum and Petroleum Products into the United States" (24 F.R. 1781), as amended. The Presidential Proclamation authorized the Secretary of the Interior to issue regulations. The Secretary of the Interior, pursuant to the Presidential Proclamation established on March 13, 1959, an Oil Import Administration within the Department of the Interior, issued regulations for the operation of the oil import program, and delegated, except for appeals, authority conferred upon him by the proclamation to the Administrator, Oil Import Administration. During 1970 the President established an Oil Policy Committee of which the Director of the Office of Emergency Preparedness is the Chairman. This Committee continues to provide policy direction to the Oil Import Program. In 1971, the Secretary directed the merger of the Oil Import Administration into the Office of Oil and Gas by revision to the Departmental Manual 111 DM 5, release number 1349 dated October 22, 1971; and the delegated oil import program authority is now assigned to the Director of the Office of Oil and Gas.

In the past few years, the Oil Import Program was assigned new responsibilities in the requirement to grant oil import allocations to the domestic petrochemical industry. Programs for air pollution abatement in metropolitan areas, increased allocations of "finished products" (heating oils) for the East Coast during periods of possible short supply, imports of asphalt, allocations to facilities in Foreign Trade Zones, Canadian oil import restrictions, assistance to the Virgin Islands and Puerto Rico, etc., have also been included in the program.

Program Procedure: Prior to the beginning of each allocation period the Administrator determines in accordance with the limitations imposed by section 2 of Proclamation 3279, as amended, the quantities of imports of crude oil and unfinished oils which are available for allocation in District I through IV and in District V, respectively, and the quantities of imports of residual fuel oil to be used as fuel and of imports of finished products other than residual fuel oil to be used as fuel which are available for allocation in such districts.

Pursuant to paragraph (a) of section 2 of Proclamation 3279, as amended, the Secretary must review the level of imports into District I, Districts II-IV and District V, of residual fuel oil to be used as fuel on a monthly basis if required, making such adjustments as he determines to be consonant with the objectives of the proclamation.

Allocation Periods: Allocations of imports of crude oil, unfinished oils, and finished products are made for periods of one year -- that is, January 1 through December 31; except that allocations of imports into Districts II-IV of residual fuel oil to be used as fuel will be made on an annual basis beginning April 1.

Applications: An application for allocations of imports of crude oil, unfinished oils, or finished products and for a license or licenses must be filed with the Director, in such form as he may prescribe, not later than 60 calendar days prior to the beginning to the allocation period for which the allocation is required.

Oil Import Program Staff Operations:

(1) Analysis of data published by the Bureau of Mines for crude oil, unfinished oils, and finished products by petroleum industry coordinating districts, and types of petroleum and petroleum products. Also, analyze data furnished in reports by over 250 importers as well as past allowances for imports. Summarize data by districts and type of products and set overall amounts to be imported during each allocation period.

(2) Analysis of applications from over 250 importers to determine eligibility for annual import allocations for crude oil, unfinished oils, finished products and residual fuel oil used as fuel.

(3) Establishment of annual allocations for imports of crude oil, unfinished oils, finished products and residual fuel oil. (Includes determining amounts to be allocated to each eligible applicant by type of products.)

(4) Issue of annual licenses to eligible importers authorizing the amounts of crude oil, unfinished oils, and finished products to be imported during each annual period, and licenses for eligible importers of residual fuel oil twice each year.

(5) Analysis of reports from each importer showing the amount of crude oil, unfinished oils, or finished products entering the United States under the license issued, the port of entry, and date of entry and, in the case of residual fuel oil, the sulfur content. These reports must be filed with the Office of Oil and Gas within 15 days after the end of each month.

(6) Initiate, when appropriate, action to start the necessary investigations to determine whether a crime has been committed. Persons concealing material facts or making false statements in or in connection with any application or report filed, or in connection with any license presented to or statements made to a collector or customs with respect to imports of crude oil, unfinished or finished products are guilty of a crime and upon conviction may be punished by fine or imprisonment or both. Therefore, analysis must be made for allocations, licenses and reports to prevent possible or actual violations of the Oil Import Regulations.

(7) Analysis of monthly reports of stocks of residual fuel oil in the east and gulf coast areas as a major factor in determining necessary adjustments to import levels for residual fuel oil.

(8) Analysis and reconcilation of monthly reports furnished by collector of customs and by importers showing the amount of crude oil, unfinished oils, and finished products imported by overland transportation from the country in which produced and exempt from the overall import program to determine whether these imports tend to threaten the accomplishment of the purpose of Proclamation 3279, as amended.

(9) Review approximately 350 exemption requests for the importation of small quantities of crude oil, unfinished oils, and finished products, including samples for testing or analysis, baggage entries and informal entries.

(10) Prepare affidavits and furnish other technical exhibits, information and advice to the Department of Justice in the continual challenges of the program in suits brought in the Federal Courts.

(11) Review and analysis of more than 500 exchange agreements. (Any exchange of foreign for domestic crude oil which is made on less than a barrel-for-barrel basis must have the prior written approval of the Administrator).

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(12) Analysis of all petitions filed with the Oil Import Appeals Board and, in cases deemed necessary, prepare for the Board a formal statement setting forth the position of the Administration. Attend hearings before the Board and file post-hearing statements commenting on testimony and evidence presented at the hearing.

Personnel Summary

	1972 Actual	1973 Estimate	1974 Estimate
Total Number of permanent positions.....	67	67	67
Full time equivalent of other positions..	4	5	5
Average Paid employment.....	61	66	65
Average GS Grade.....	10.5	10.4	10.4
Average GS Salary.....	$17,566	$17,512	$17,476

Itemization of Estimate

Appropriation Title: Salaries and Expenses — Office of Oil and Gas

	Actual 1972	Estimate 1973	Estimate 1974	Increase (+) Decrease (-)
Program and Financing:				
Total obligation.....$1,491,924		$1,485,000	$1,485,000	---
Unobligated balance lapsing..	8,076	---	---	---
Budget authority (Appropriation).....	1,500,000	1,485,000	1,485,000	---
Budget Authority:				
Appropriation.....	1,570,000	1,558,000	1,485,000	-73,000
Transferred to other accounts	-70,000	-73,000	---	+73,000
Appropriation (Adjusted)...	1,500,000	1,485,000	1,485,000	---
Object Classification:				
11.0 Personnel Compensation		992,311	1,027,500	1,027,500 ---
12.0 Personnel benefits		77,139	77,500	77,500 ---
21.0 Travel & Transportation of persons		67,415	72,000	72,000 ---
22.0 Transportation of things		2,499	10,000	10,000 ---
23.0 Rent, Communications & Utilities		45,322	50,000	50,000 ---
24.0 Printing & Reproduction		28,128	30,000	30,000 ---
25.0 Other Services		226,009	175,000	175,000 ---
26.0 Supplies & Materials		12,952	13,000	13,000 ---
31.0 Equipment		40,139	30,000	30,000 ---
Total obligations		1,491,924	1,485,000	1,485,000 ---

Overview of the Domestic Petroleum Supply Situation

I. Short-Range Petroleum Supply

A. Distillate fuel oil - winter 1972/73

"Distillate fuel oil" encompasses the range of petroleum products heavier than kerosene and lighter than residual fuel. The principal products in this range are diesel fuels and heating oils, with the latter category including three separate gradations:

a) No. 1 distillate--A relatively light, kerosene-type fuel commonly used in some space heating applications.

b) No. 2 distillate--The material which is commonly called home heating oil, and which is only slightly heavier and lower in quality than truck diesel fuel.

c) No. 4 distillate--A light residual fuel used principally in industrial or commercial heating installation and by some utilities and industries as boiler fuel. No. 4 is commonly produced by blending a light distillate (perhaps No. 2) with residual fuel oil.

Because of the flexibility in refineries to interchange the production of these fuels, and because of the basic similarity in their principal end-uses, recognized data sources report only "distillate" supply and demand statistics. No current statistics are available which differentiate among the sub-categories of diesel, No. 1, No. 2, or No. 4 distillate fuels with respect to refinery output or demand. Included at Attachment 1 is a summary of historical and projected distillates demand by end-use for PAD Districts I-IV.

Distillate supplies during the 1972/73 winter were extremely tight nationally and localized shortages of product were reported, particularly in the Midwest. Most of the factors which caused the reported supply problems were foreseen to some degree, but the simultaneous occurrence of these factors was unexpected. After an unusually cold first quarter of 1972, the industry was left in a position of low distillate inventories and shortages during the last weeks of the 1971/72 winter were only narrowly avoided. Phase II price controls and exceptional gasoline demands led the industry to maximize gasoline production during the summer at the expense of a normal seasonal buildup of distillate inventories. Gasoline demands were met, but we entered the 1972/73 heating season far below normal levels of distillate inventories. Attached for information are tables of historical product and crude inventories, as Attachments 2, 3, and 4. The chance occurrence of very cold weather and late crop harvests caused demands for fuel in the early winter to increase markedly, leading to localized natural gas cutbacks, LPG shortages, and finally distillate fuel shortages as fuel alternatives were exercised by those with the capability to switch. Despite some logistical problems, most demands were met, but inventories were drawn down at more than a normal seasonal rate.

Reports of Midwest distillate shortages and impending shortages increased in November and on November 17, Interior's Office of Oil and Gas sent a letter to PAD I-IV refiners requesting increases in distillate production. In early December, PAD I-IV production increased significantly, and distillate output

climbed to record high levels. Refiners pushed to near-capacity crude runs and increased distillate yields, despite a deteriorating crude supply situation, both domestic and foreign. Presidential action was taken on January 17, 1973, to suspend import controls temporarily on distillate fuel oil, allowing a significant increase in foreign supplies to help offset the tight supply situation. Attachments 5, and 6 show operating data for the industry over this winter. Included are charts of crude runs, motor gasoline production, distillate production and distillate imports.

Crude runs are now (January/February) averaging over 90% of capacity, distillate production remains at very high levels, and demand is lower than expected due to the warm weather in most areas of the country. As of February 16, distillate inventories are about 8 million barrels behind last year's in PAD Districts I-IV (versus a 34 million barrel deficit at year end 1972).

Inventories at the end of this heating season in PAD Districts I-IV will probably be between 80 and 90 million barrels, about the same as last year, and below desirable end-of-season inventories. Our prognosis is for no widespread shortages, with some potential, however, for dislocations of supply and spot shortages because of the low inventory position.

B. Projection for 1973

Demand for all products is expected to show continued strong growth in 1973, with both distillates and gasoline demand growing about six percent in 1973 versus 1972. (Included at Attachments 7, 8, and 9 are historical and projected demands for gasoline, distillates and total products.) Over

the year we project high levels of refinery operation--about 91% of capacity--to be maintained, with peak operations perhaps as high as 93-95% for short periods. However, with the tight crude supply situation, the regional distribution problems and the need for refinery maintenance (which has generally been deferred through this winter), average levels of operation above 91% do not appear feasible. In order to increase currently depleted industry product inventories back up to normal levels in addition to meeting product demands in 1973, our supply projection for 1973 suggests a clean product shortage of about 250 MB/D (approximately 90 million barrels) beyond the capability of domestic refinery output. The only practical short-range means of closing this gap is to increase product imports.

Domestic refineries are designed for efficient operation on generally low-sulfur crude, and at high conversion levels (maximum gasoline). (Refer to Attachment 5 , section II for comments on the conversion capability of U.S. refiners.) A shift toward maximum gasoline output by U.S. refiners is expected (and favored by current market economics) in the next few weeks. We anticipate gasoline inventories to increase rapidly in preparation for the summer, barring unusual supply disruptions or extremely cold weather. A widespread gasoline shortage does not appear to be highly probable this summer, particularly if increased imports can be utilized to bolster distillate inventories and take pressure to produce excess distillates off domestic refiners during the summer. Localized gasoline shortages, especially in the interior regions of the country and among the independent segment of the market place have a relatively high potential in any event, but to

offer some perspective, we do not think gasoline rationing, for example, need be contemplated. Although some foreign supplies will certainly be available to help alleviate some of the potential logistical problems, we expect that volumes will be generally limited.

If we do not take action promptly to increase product imports, we can expect some shortages of product in 1973, most likely to be reflected in distillate fuel supplies for next winter. The options available for increasing imports will be discussed later in this paper.

PAD DISTRICTS I-IV DISTILLATE DEMAND

BY END-USE CATEGORY

(Thousand Barrels per Day)

	1968	1969	1970	1971	1972*	1973*
Heating Fuel - #1	131	118	118	118	120	120
#2	1,133	1,146	1,168	1,159	1,195	1,215
#4	71	76	79	89	100	115
Total	1,335	1,340	1,365	1,366	1,415	1,450
Industrial and Oil Company	122	123	120	142	175	185
Electric Utility	22	31	66	95	145	220
Railroads, Vessels and Military	252	262	268	269	278	285
Highway Diesel	289	324	347	377	400	420
Off-Highway Diesel and Other	139	154	142	148	152	155
Total Demand	2,159	2,234	2,308	2,397	2,565	2,715

*Preliminary Estimates

Attachment 1

Attachment 2 ✓

CRUDE STOCKS
MILLIONS OF BARRELS
PAD I - IV

	1968	1969	1970	1971	1972	1973
January	205.9	235.0	224.3	234.2	209.2	197.2
February	204.0	225.0	227.2	231.2	212.0	
March	214.3	222.5	228.2	229.5	217.1	
April	219.9	232.9	234.0	233.2	223.2	
May	221.7	239.6	239.5	243.1	233.7	
June	226.3	241.9	236.0	240.0	226.4	
July	226.3	236.8	225.0	234.3	219.5	
August	227.2	225.6	215.5	232.7	212.5	
September	226.0	221.6	221.2	228.0	206.7	
October	227.5	222.1	229.4	225.1	211.3	
November	232.1	222.2	234.3	223.9	210.5	
December	231.2	221.8	238.2	217.1	202.1	

Attachment 3 ✓

GASOLINE STOCKS
MILLIONS OF BARRELS
PAD I - IV

	1968	1969	1970	1971	1972	1973
January	197.0	184.8	199.3	204.7	211.3	192.7
February	200.2	192.5	205.7	216.8	221.2	
March	200.1	200.2	209.5	219.9	210.1	
April	188.1	189.2	205.9	204.5	200.5	
May	180.1	180.3	198.7	197.8	189.9	
June	177.2	174.4	188.1	186.2	176.6	
July	169.7	166.6	175.6	181.0	176.1	
August	164.6	162.7	171.0	182.2	169.0	
September	173.1	166.7	172.3	184.3	176.5	
October	170.5	167.3	168.3	184.4	181.9	
November	174.5	178.6	174.9	183.6	183.4	
December	186.7	185.7	184.5	194.1	185.3	

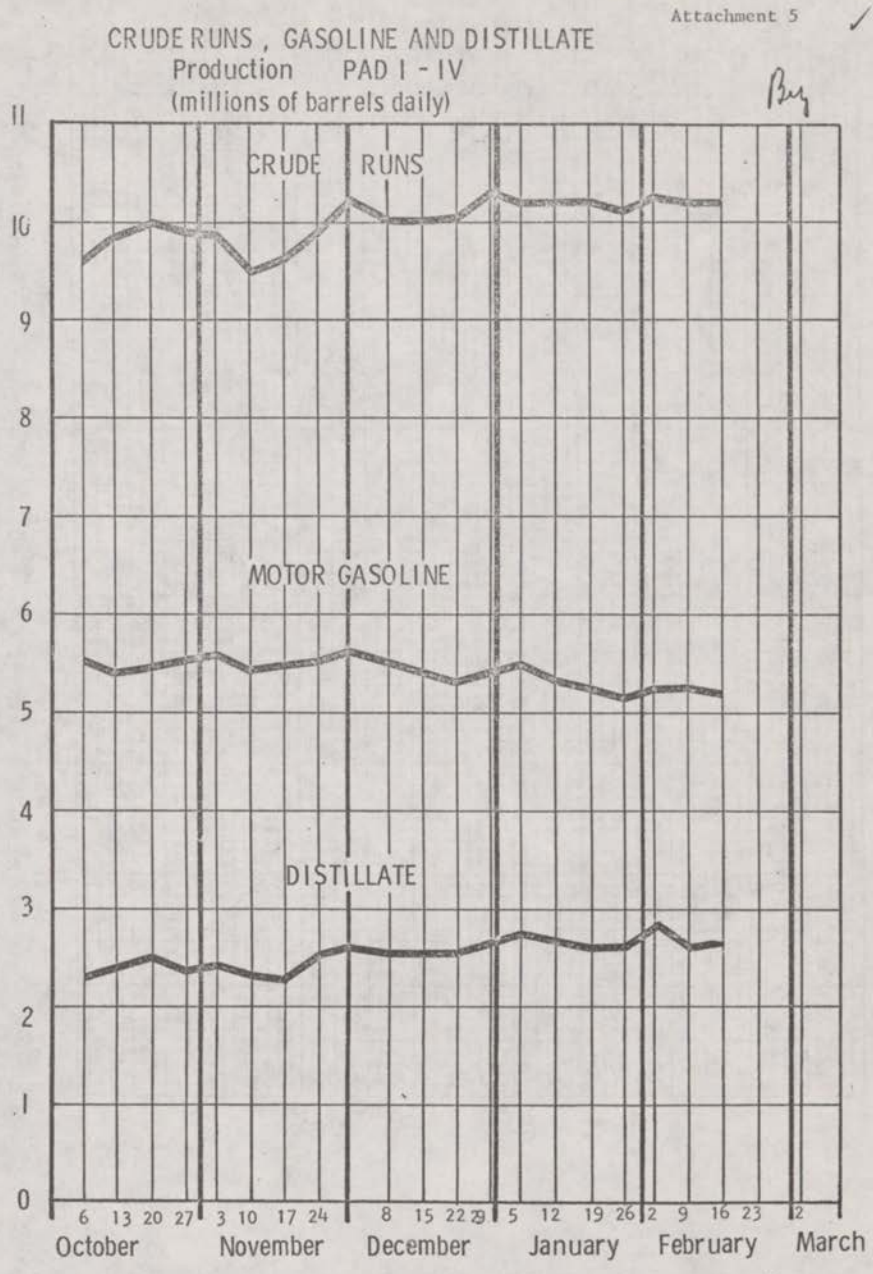
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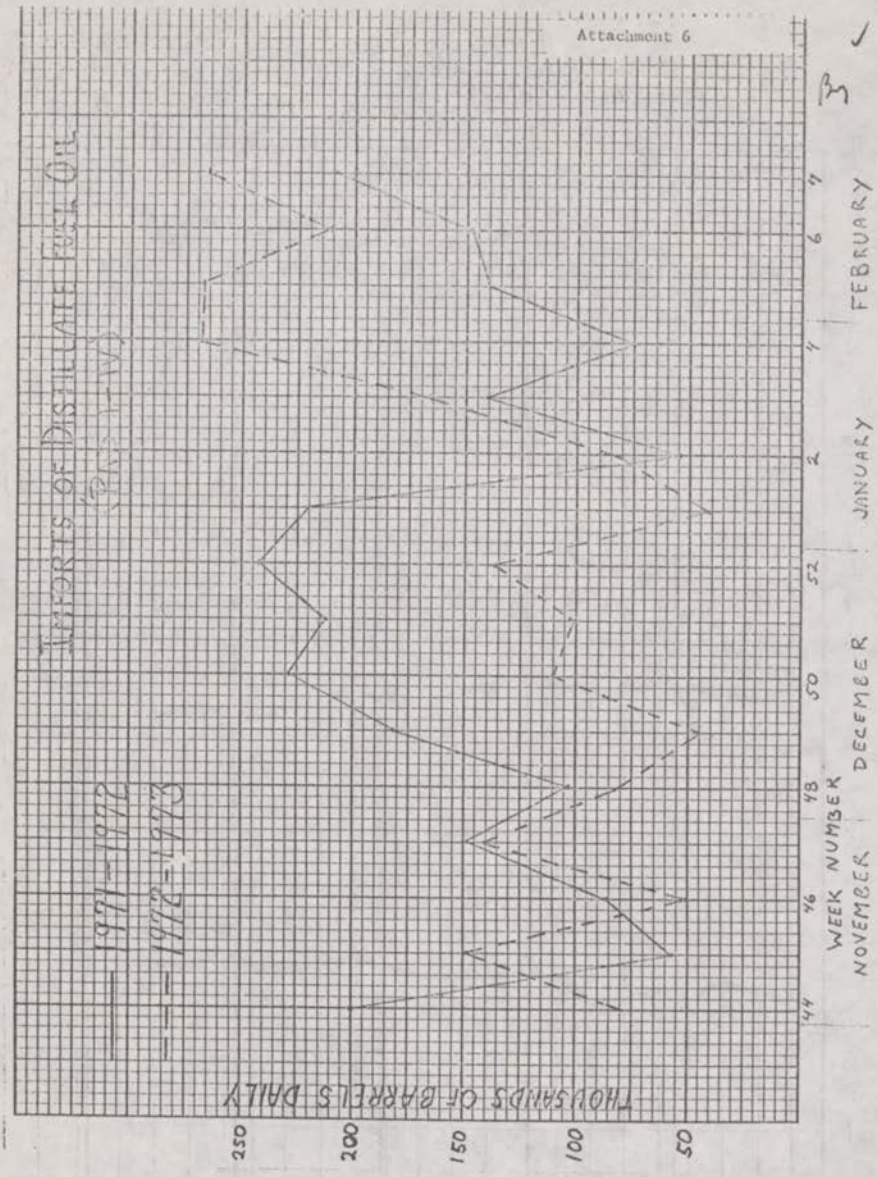
DISTILLATE STOCKS

PAD I-IV
(Millions of barrels)

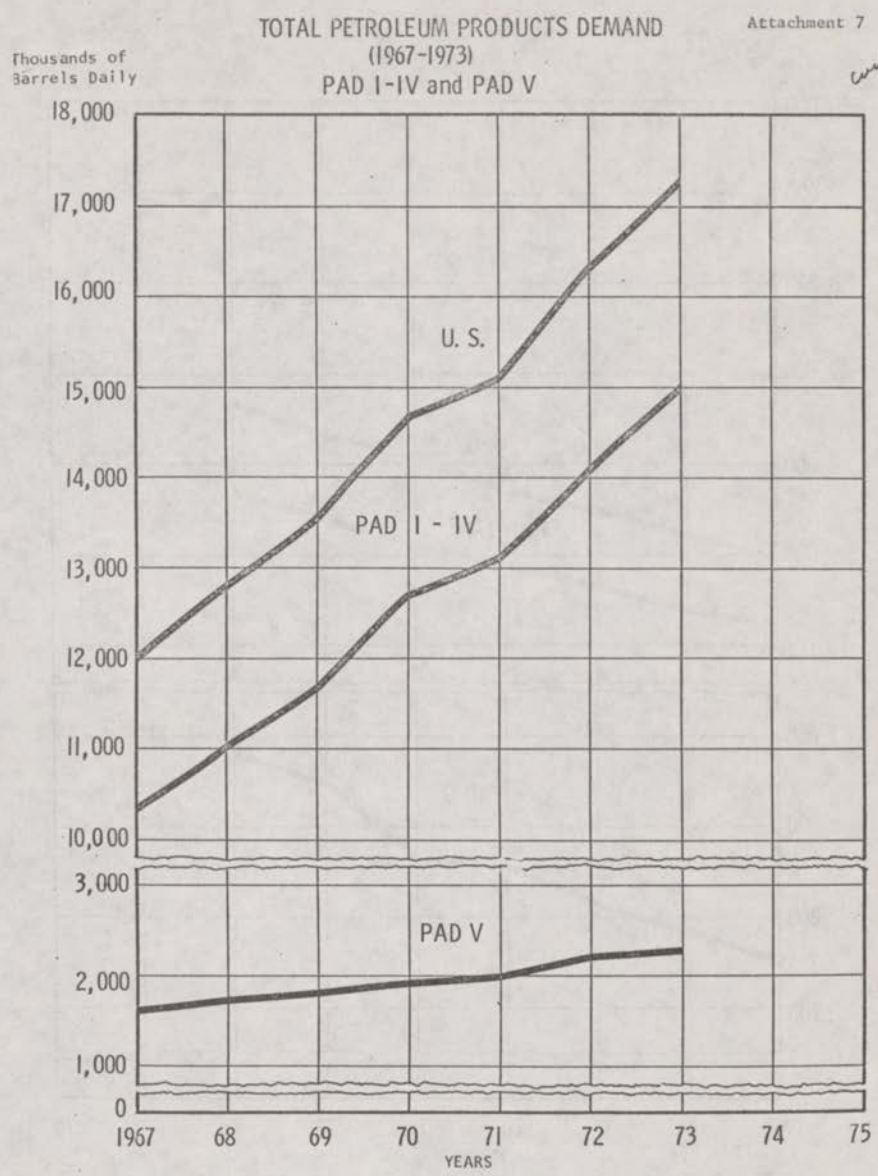
	1968	1969	1970	1971	1972	1973
January	109.0	121.4	116.9	146.8	148.6	122.4
February	86.5	97.8	97.8	117.0	109.7	
March	83.1	87.5	88.5	102.5	89.3	
April	90.8	90.5	89.9	103.0	91.5	
May	105.4	100.6	104.2	115.1	100.4	
June	128.3	121.1	125.3	135.0	116.4	
July	156.1	147.5	150.1	160.9	142.7	
August	179.0	170.3	175.0	184.9	161.5	
September	193.8	184.1	192.8	197.6	177.4	
October	200.1	194.7	204.0	210.3	181.7	
November	188.4	186.6	204.8	201.5	168.6	
December	162.1	157.6	182.3	178.6	146.4	

Attachment 5 ✓

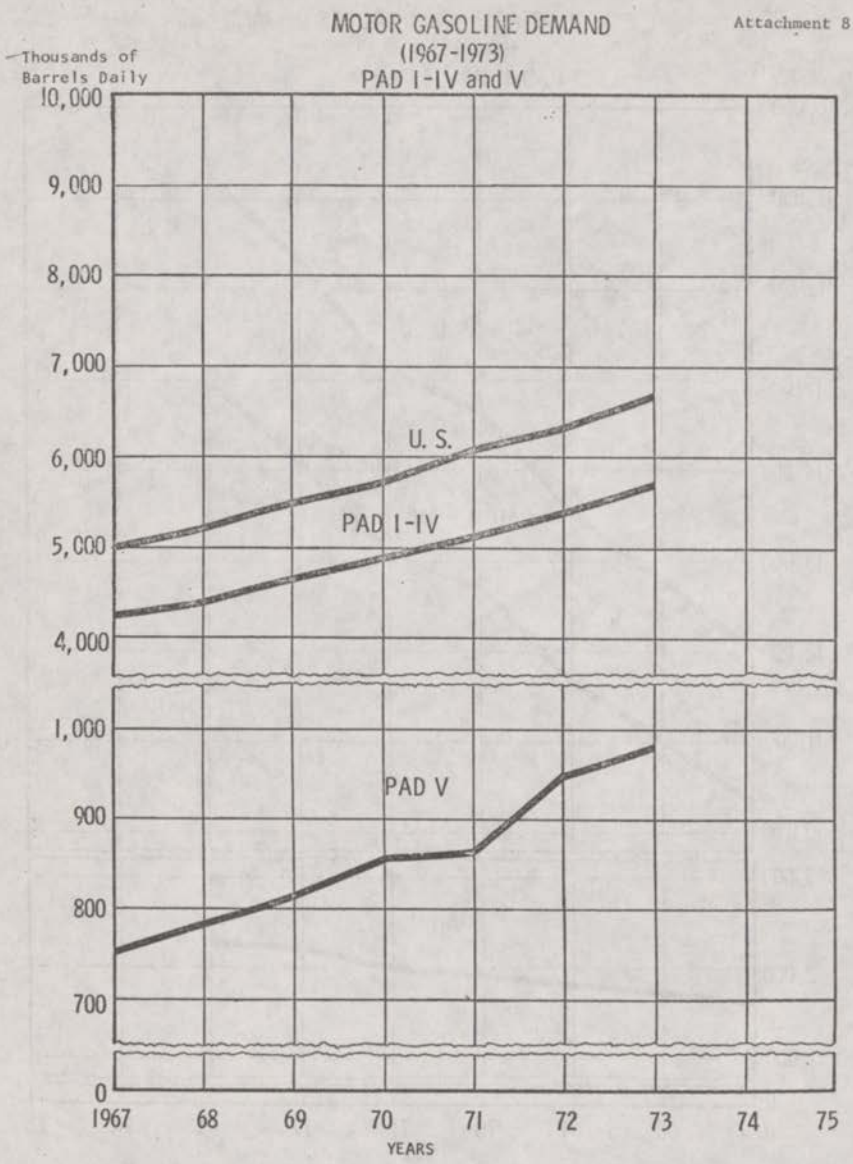



Attachment 6
3
THEORETS OF DISTILLATE FUEL OIL
(PADD I-IV)
1971-1972
1972-1973
THOUSANDS OF BARRELS DAILY
250
200
150
100
50
WEEK NUMBER
44
46
48
50
52
1
2
4
6
7
NOVEMBER
DECEMBER
JANUARY
FEBRUARY

Attachment 7

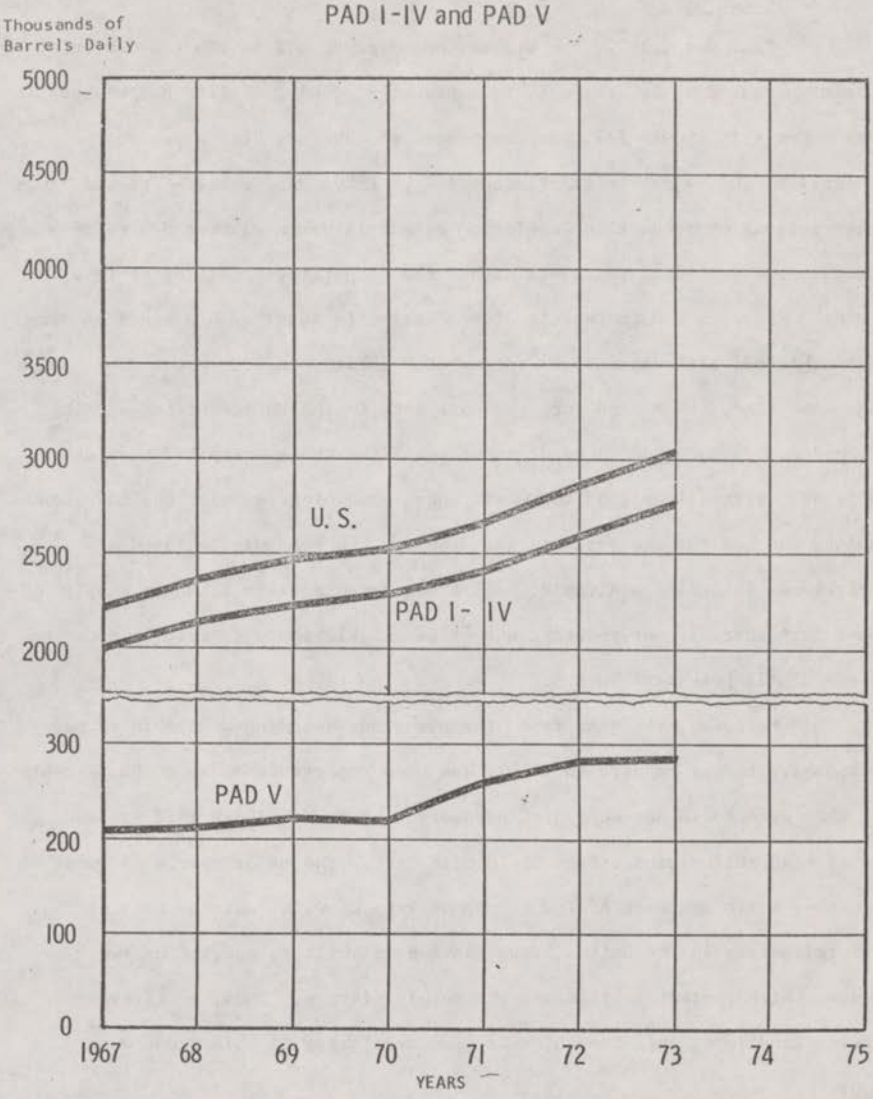


Attachment 8 ✓



Attachment 9

DISTILLATE DEMAND
(1967 - 1973)
PAD I-IV and PAD V



Note: 1973 Projected, 1972 partially estimated

II. Foreign Supply Availability

A. Crude Supply

Last year, 1972, the production of crude oil in the non-Communist world increased by 5.2 percent, to a new high of 41.8 million barrels per day.* But this growth fell somewhat short of what had been expected. Several of the major exporting countries -- Libya and Kuwait -- placed restrictions on production levels and output in Venezuela was depressed because newly imposed taxes diminished the competitive position of this crude. Expected new increments of production in Saudi Arabia and Iran were not achieved, although output was expanded greatly in both countries. At the same time, the demand for crude oil both in the United States and in Europe and Japan moved ahead at rates exceeding those which had been anticipated. Virtually all of the world spare producing capacity has now been put to use and the new capacity added during the year was employed as quickly as it became available. All these factors taken together simply mean that there is not enough crude oil available today to meet at once the needs of all potential buyers.

Moreover, the quality of the new crude becoming available is not responsive to our requirements. It has been reported that about 90 percent of the increase in non-Communist production of crude oil in 1972 was made up of high sulfur crudes from the Middle East. The major source of sweet crude -- North and West Africa -- cannot keep up with demand. Most of the oil refineries in the United States have been built to operate on sweet crude, which further complicates the supply picture. Thus, a refinery could stand idle, even though crude were available, if this crude were sour.

* See Attachment 1

The tightness of the crude oil supply in the market place has been quickly reflected in the going price. We are now faced with the unique situation wherein the price of some crude oils imported by the United States have exceeded the price of our domestic crudes. This means that the value of an offshore import ticket is a negative one.

As an illustration, we can demonstrate that a barrel of high quality, low-sulfur crude oil from Libya, delivered to the New York Harbor would have a landed price of about $4.12. (These landed prices take the dollar devaluation into consideration and as such are representative of the anticipated market in the coming weeks.) The landed price of a barrel of comparable quality crude oil from our Gulf Coast, also at New York Harbor, woudl fall within a range of $4.18 to $4.40. Nigerian crude oil enjoys a similar advantage.

Comparison of Comparable Domestic Offshore Crude Prices with Foreign Crudes Landed at U.S. Ports 1/

Source and Gravity of Crude	Landed Price 2/	Destination
Libyan 40°	$4.12/bbl.	N.Y. Harbor
Gulf OCS 40°	$4.18-$4.40/bbl.	N.Y. Harbor
Libyan 40°	$4.36/bbl.	Baton Rouge, La.
Gulf OCS 40°	$3.85-$4.07/bbl.	Baton Rouge, La.
Nigerian 34°	$4.01/bbl.	N.Y. Harbor
Gulf OCS 34°	$4.08-$4.30/bbl.	N.Y. Harbor
Nigerian 34°	$4.20/bbl.	Baton Rouge, La.
Gulf OCS 34°	$3.73-$3.95/bbl.	Baton Rouge, La.
Indonesian 35°	$4.37/bbl.	Los Angeles
California OCS 35°	$3.65-$3.70/bbl.	Los Angeles

1/ These estimates are based on large contracts with chartered tankers. Spot sales and spot tanker charges will probably be considerably higher than those shown above.

2/ Transportation charges for foreign oils are estimated at Worldscale 110 for medium range tankers. Duty is added at 10½¢ per bbl. Variance of domestic landed prices is dependent on distance of offshore platforms to port terminals. Domestic tanker rates to New York Harbor are based on ATRS rate of flat scale.

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There are current negotiations between the oil producing nations of the Persian Gulf and the oil companies which, if brought to successful conclusion, may signify additional amounts of crude oil becoming available. But the time needed for implementation of these negotiations and the time needed for the completion of new producing and handling facilities imply that these additional volumes will not become available to us within the short-run period being considered. To illustrate, an accord has just been reached between the government of Iraq and the Iraq Petroleum Corporation, which brings a 12-year dispute to an end. As part of this accord, the production at the Basrah fields is to be increased to 1.6 million barrels per day by 1976 (last year, 1972, output averaged 660,000 barrels per day). Gearing up to this increment of 1 million barrels per day will come in stages, with the bulk of the growth to come in 1975 and 1976.

When new production does become available, these crudes will be subject to the various pressures of the market place and most likely will carry a higher price. Consuming countries not inhibited by price controls may be in a position to outbid their U.S. competitors. Thus, we cannot with any confidence look to any relaxation of the tight crude oil supply situation this year.

B. Product Supply

In 1971 we imported an average of about 2.2 million barrels per day of petroleum products, of which slightly more than 1.5 million barrels per day was residual fuel oil.* Traditionally, our product imports have originated in the Western Hemisphere -- largely the Caribbean (including Venezuela) and the Virgin Islands. Only 200,000 barrels per day of our product imports that year came from the Eastern Hemisphere and these again were primarily residual fuel oils.

* See Attachment 2 for a comparison of imports in 1971, 1972 and estimated 1973.

Except for Venezuela, our larger suppliers of products in the Western Hemisphere depend in turn upon imported crudes, which in themselves are in limited supply. Venezuelan crude oil production is expected to remain relatively static. Thus, our sources for product purchases in the Western Hemisphere by definition will be limited by the restrictions on crude available to the refineries.

We have had little experience in the purchasing of distillates and gasoline in the Eastern Hemisphere for consumption in the United States. Refining capacity in Europe is sizeable, and expanding rapidly. Such rapid expansion often means that unused capacity is available, at least until demand catches up. Italy, for one, has unused capacity on the order of 1.4 million b/d.* The Netherlands also has capacity surplus to domestic needs, but this surplus is fully utilized to generate exports to other Common Market countries.

Refining capacity in the Middle East averaged somewhat more than 2.6 million barrels per day in 1971, or roughly 5 percent of the world total. The net export capacity of this group of refineries probably is on the order of 1.8 million barrels per day; the remaining capacity is utilized to cover domestic needs. The net export capacity in turn is used to service bunkering requests and to respond to our offshore military procurements. Very little of the exportable surplus from these refineries find their way into our domestic market. In 1971 we imported just 44,000 barrels per day of products from the Middle East.

It should be noted that European refineries do not emphasize motor gasoline yields. In 1970 the output of motor gasoline by European refineries accounted for just 12 percent of total product yields. By contrast, our

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* See Attachments 3 and 4

motor gasoline yield exceeds 40 percent. (For additional discussion of this point, see Attachment 5) Given this minimal emphasis on motor gasoline, and given the growing motor car requirements in Europe, it is unlikely that significant amounts of gasoline would be available for export to the United States unless the refineries set out to deliberately take advantage of our shortages by maximizing crude runs.

Moreover, offshore purchases of gasoline, from whatever the source, would encounter difficulties with regard to octane quality and lead content. In Europe, motor gasoline octane ratings showed little change during the 1960s, and octane qualities of 91 RON for regular and 99 RON for premium can be considered typical. As a contrast, typical U.S. gasolines are 94RON and 100 RON for regular and premium, respectively. Some restrictions on the use of lead in gasoline are being instituted in Europe, especially in West Germany, but U.S. restrictions are far ahead of Europe in general. Thus, those amounts of motor gasoline which might become available for export to us may not be suitable to our needs. Additionally, reblending significant volumes of finished gasoline in domestic refineries to upgrade quality is virtually impossible. Handling leaded products as input to a refinery involves complicated and expensive segregation facilities to avoid contamination of other feedstocks with lead. Few refineries are equipped to handle such material in large quantity.

At the same time, distillates are a major end product of European refinery operations.

If European stocks have not been drawn down too far when the current heating season ends, if there is only normal growth in demand during the summer, and if there is the economic incentive to export to the United States, then we might expect assistance from Europe in meeting product

requirements this summer. Unfortunately, these are rather large "ifs" to count upon and we should not look to Europe automatically as a source of additional supplies. There is, further, the complication that distillates available in spot foreign markets will not generally have low enough sulfur content to be used in some restrictive U.S. markets. For example, typical European distillates approximate 0.5% sulfur content, while in the U.S. East Coast areas of Boston, New York and New Jersey, restrictions allow only 0.2-0.3% sulfur content for distillates burned in these areas.

Attachment 1

CRUDE OIL PRODUCTION AND NGL PRODUCTION
IN THE NON-COMMUNIST WORLD
(Thousands Barrels Daily)

Country or Area	1970	1971	1972
United States	11,297.0	11,156.6	11,218.0
Canada	1,476.9	1,586.8	1,787.0
Mexico	486.6	485.7	510.0
Caribbean	4,121.9	3,859.7	3,625.0
Other W. Hemisphere	698.8	749.7	830.0
Total W. Hemisphere	18,081.2	17,838.5	17,970.0
Non-Comm. Europe	484.8	446.1	460.7
North Africa	4,747.0	3,919.2	3,586.6
West Africa	1,290.8	1,760.0	2,088.0
Near East	153.3	232.7	239.0
Middle East	13,778.2	16,163.5	17,884.0
South Africa	10.0	10.0	10.0
Other E. Hemisphere	1,371.0	1,650.5	1,949.0
Total E. Hemisphere	21,835.1	24,182.0	26,217.3
Grand Total	39,916.3	42,020.5	44,187.3

Attachment 2

U.S. IMPORTS OF CRUDE OIL AND REFINED PRODUCTS
(000's Barrels Daily)

Country or Area	1971		1972		1973[a/]	
	Crude	Products	Crude	Products	Crude	Products
Canada	721.4	136.6	853.6	249.4		
Mexico	-	27.8	-	21.4		
Caribbean	311.6	1304.9	283.1	1314.2		
Other W. Hemis.	2.9	526.8	15.1	614.6		
Total W. Hemis.	1035.9	1996.1	1151.8	2199.6		
Non-Comm. Europe	-	130.4	-	158.0		
North Africa	88.3	1.9	211.5	17.5		
West Africa	99.0	4.7	258.6	10.9		
Middle East	340.2	44.0	426.1	47.7		
Other E. Hemis.	117.2	11.9	166.4	22.1		
Communist Area	-	6.8	0.9	10.7		
Total E. Hemis.	644.7	199.7	1063.5	266.9		
GRAND TOTAL	1680.6	2195.8	2215.3	2466.5[b/]	2,888	3,237

a/ Regional allocation not possible.

b/ 11 months only.

F. SUMMARY

A consolidation of the export potential of the refining centers discussed above reveals that these centers will have doubled their capabilities in the period from 1966 to 1975. This is summarized below together with the potential product (assumed at 90 percent of capacity) and actual exports in 1966 and 1971.

	Net Exportable Capacity - M B/D		
Refining Center	1966	1971	1975
Bahamas/Caribbean	1,737	2,758	3,773
Middle East	978	1,790	1,798
Eastern Canada	0	0	100
Italy	994	1,152	2,151
Total	3,709	5,700	7,822
Product Export-Potential	3,338	5,130	7,040
-Actual	3,314	4,215	-

Attachment 3

SUMMARY OF EXPORTABLE
REFINING CAPACITY IN SELECTED
FOREIGN REFINING CENTERS

	Net Exportable Capacity - M B/D		
Refining Center	1966	1971	1975
Bahamas/Caribbean	1,737	2,758	3,773
Middle East	978	1,790	1,798
Eastern Canada	0	0	100
Italy	994	1,465	2,441
Total	3,709	6,013	8,112
Product Export-Potential	3,338	5,412	7,300
-Actual	3,314	4,215	-

GROWTH IN REFINERY CAPACITY
Past And Projected
1966 = 100

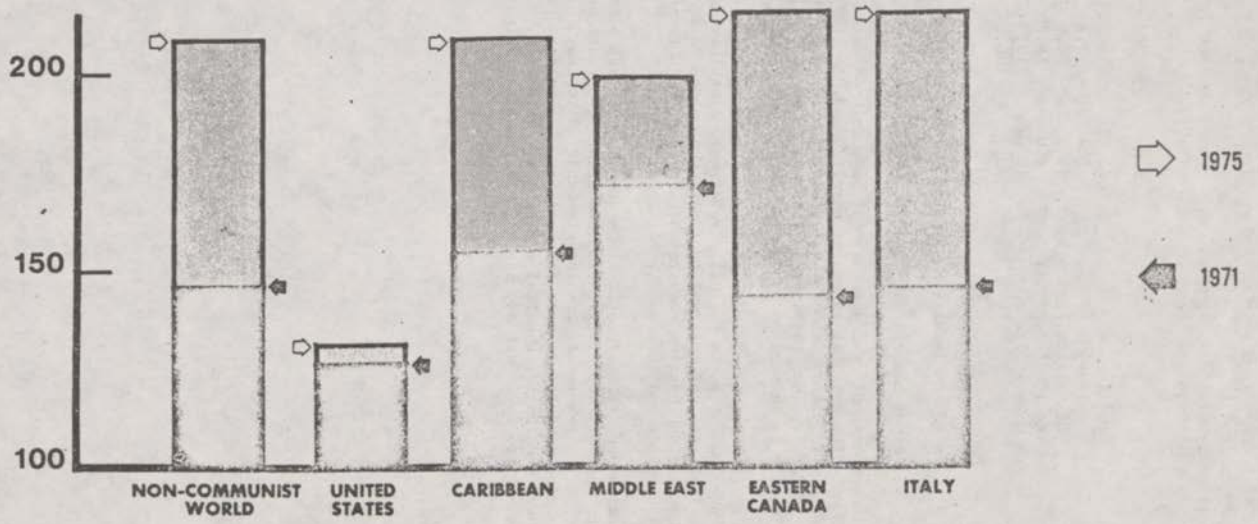


Figure 3

Attachment 4

ATTACHMENT 5

COMPARISON OF U.S. AND FOREIGN REFINING

Typical refinery yields in the U.S. and other important refining centers are tabulated below. Data are based on the year 1971.

	U.S.	Europe	Caribbean
Gasoline	47.8%	14.5%	10.3%
Jet Fuel	6.7	2.8	5.6
Distillate Fuel Oil(1)	21.9	32.8	14.3
Residual Fuel Oil	6.0	36.2	60.1
Others (2)	17.6	13.7	9.7
	100.0%	100.0%	100.0%

(1) Includes Kerosene, heating oil and diesel fuel.
(2) Includes waxes, grease, lubes, asphalt, coke, chemicals, etc.

Very high yields of quality gasoline are produced in the U.S. through processing in complex and expensive conversion equipment. This gasoline is obtained at the expense of residual fuel oil and, to some extent, distillate fuel oils. Due to the seasonal nature of gasoline and distillate fuel oil demand, yields are adjusted seasonally. In winter, yields of heating oil may run about 2% higher than the above average while gasoline is 2% lower. The reverse is true in summer.

In Europe, refineries are designed to meet the demand pattern. Gasoline requirements are lower than in the U.S., relatively speaking. Large amounts of distillate fuel oils and residual fuel oils are needed to meet the Continent's industrial and heating requirements. The average refinery is therefore much less complex and less costly to build.

In the Caribbean, refinery operations are the simplest of all, consisting of little more than primary distillation and treating operations. The large yields of fuel oil which result are largely exported to the U.S. The small amount of gasoline produced is used for local requirements and much of it is used as ordinary naphtha for chemical feedstocks. This area would indeed be limited in ability to export any appreciable amounts of high quality gasoline.

III. Regional Supply Problems

A. Supply systems - general comments

Essentially all of our comments in this paper are directed toward PAD Districts I-IV and exclude, therefore, the West Coast. Although there are small volumes of raw material and product exchange between PAD V and PAD I-IV, the petroleum markets and supply mechanisms are widely separated, both physically and economically. A map of PAD Districts is included as Attachment 1 for reference to the geographic area covered by each District.

I n PAD Districts I-IV, there are a wide range of distribution patterns. The Gulf and East Coasts are tied together with major pipelines and marine routes, and supply from both domestic and foreign sources is readily accessible to all areas within this basic network. The largest concentrations of refining capacity, product demand, and domestic crude supply all lie in the Coastal areas and afford this region (roughly PAD Districts I and III) large flexibility to respond to unusual demands or logistical problems.

PAD District IV, the Rocky Mountain area, is roughly self-sufficient in terms of both crude supply (including Canadian imports) and product supply and, additionally, is sparsely populated. Distribution problems in PAD IV, when they occur, are largely due to the scattered demand pattern and supplemental supplies are not easily diverted into the remote areas where problems may occur. Generally speaking, PAD IV supply is largely beyond the scope of influence of the broader policy options.

PAD District II, the Midwest, is the most difficult area to supply completely. There are large avenues of access to the Midwest (several major crude and products pipelines plus the Mississippi River complex) but they

are limited in number. As a consequence, supply flexibility is low (few supply alternatives are available to any individual Midwest concern) but demands are relatively high and somewhat scattered. Several areas of the Midwest were at one time major crude producing areas, and scattered concentrations of fairly small refineries are consequently evident throughout this area. Few major refiners and suppliers have penetrated the Midwest market except at the junctures of the major supply routes. With the decline in crude production from the Midwest producing areas, the scattered, small refiners in PAD II have had difficulty in securing alternative crude supplies to maintain operations, and at the same time have little competition for the markets which they have historically supplied. Attachment 2 shows historical U.S. crude production figures which underscore the decline of the Midcontinent producing areas.

B. Midwest crude supply situation

The crude supply problem in the Midwest bears further comment. As mentioned previously, local crude supplies are dwindling, and the supply system is inflexible, affording few alternatives. An additional complication arises because of the increasing demand in many areas of the U.S. for products of low sulfur content. The small Midwestern refiners have traditionally refined locally-produced low sulfur crudes and have not needed to invest in sulfur-removal facilities or equipment capable of handling sour crudes. As an increasing premium is put on sweet crude for use in other regions of the U.S. as well, the already tight crude supply situation in the midcontinent is becoming intolerable.

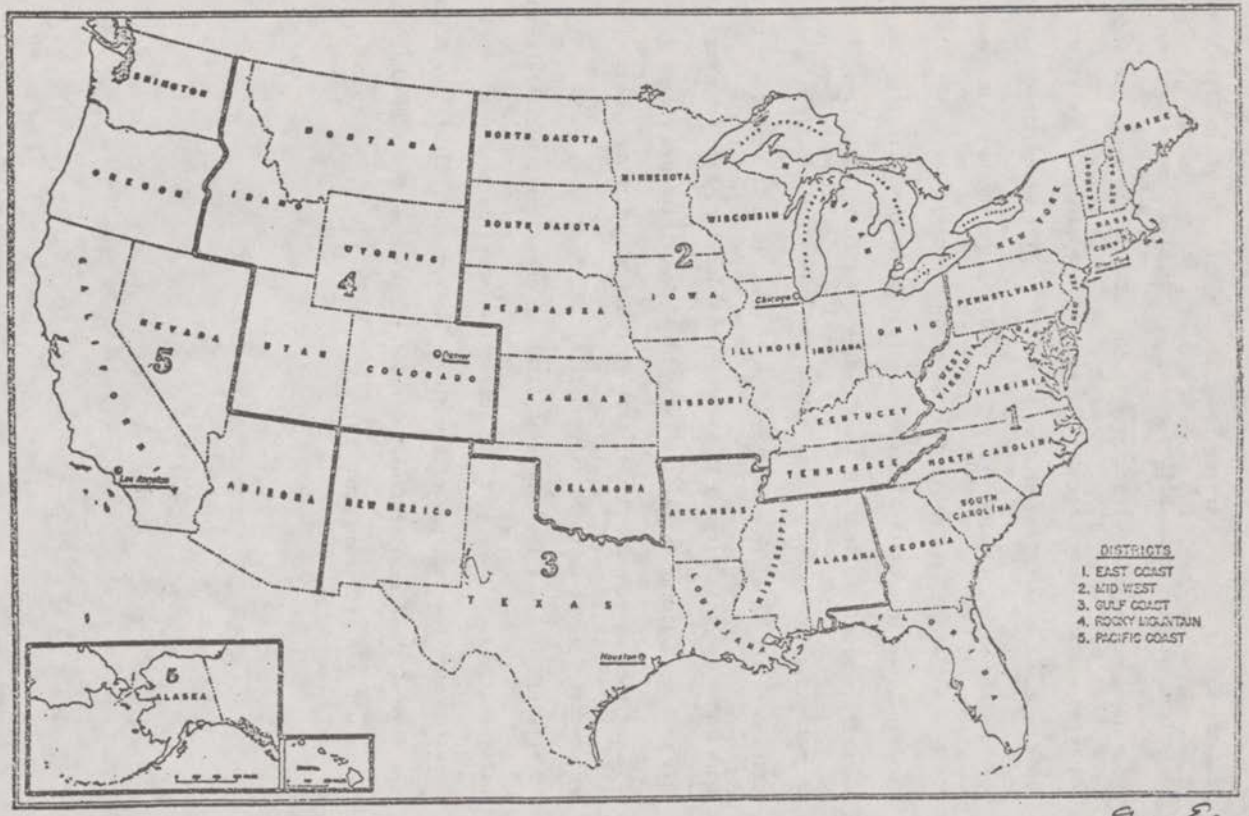
Since the mid-1960's, a sizeable, cheap wholesale product market has been available (until recently) throughout PAD I-IV. This market resulted from

the large excess of refining capacity in the industry until 1972, and the activity of the refiners trying to sell their excess producibility. The low prices and easy availability of supply attracted a proliferation of small independent marketers, particularly in the Midwest, where markets were scattered and the refiners generally not in the business of retailing their own output. The resulting product price wars in the Midcontinent severely weakened the price at which the refiner sold his products. This situation, now exacerbated by the crude supply problems discussed above, has left some small refiners in a critical economic situation in the current environment.

While most of the small Midwest refiners are fully competitive in their own markets, many do not possess either the economies of scale of the larger refiners or the benefits of integration from wellhead to market and as a consequence are only marginally viable, economically. Some have survived only upon the sliding scale of foreign crude import license allocation which provided them an economic "prop" through the value of their import rights and, consequently, leverage to obtain supplies.

Potential avenues for economic relief for these small refiners are not easily available. However, their collective output is needed to supply at least the more remote areas of the Midwest. We cannot, literally, afford to lose many of these small refiners without leaving some areas of the Midwest unsupplied with petroleum products.

PETROLEUM ADMINISTRATION FOR DEFENSE (PAD) DISTRICTS



700

Attachment 1

Attachment 2

CRUDE OIL PRODUCTION FOR SELECTED STATES
(Thousand barrels per day)

	January 1970	January 1971	January 1972	November 1972 (1)
Illinois	121	110	104	94
Kansas	232	211	200	190
North Dakota	61	59	57	56
Oklahoma	596	594	570	549
Louisiana	2,366	2,610	2,452	2,427
Texas	3,404	3,535	3,215	3,601

(1) Latest available data

IV. Economic and Market Factors

A. Economic relationships

The whole range of economics affecting refining and supply decisions in the industry has changed with the introduction of major disruptions of traditional economic and supply patterns. Domestic crude production decline (and consequent shift to foreign crudes as marginal refinery input), environmental restrictions (with attendant product quality, refining siting, and operational problems), and price controls have all had a significant effect on industry economics. Economics have always been, and continue to be, the major determinant of industry action. In light of these changes, decisions in the industry are beginning to take new directions, and the industry is confronted with problems far different that those of just a few years ago.

The shift from domestic to foreign marginal supply markedly changes the geographical emphasis on decisions of refinery location, together with plans for transportation facilities. Depending on the imports policies adopted, the range of geographical emphasis on refining investment can be Gulf Coast versus East Coast or can extend to considerations of U.S. versus foreign location. The long-range interests of our national security and balances of payment positions indicate a general import policy oriented toward looser control of crude petroleum imports, with product imports tightly controlled or eliminated altogether. Such a policy will provide us with the maximum flexibility to supply our own product markets. Continued high volumes of product imports would maintain an incentive to build refining capacity outside the U.S. This effect is illustrated in the large growth of foreign residual

fuel capacity since residual fuel imports into the U.S. were decontrolled in 1966.(1) Simultaneous with that foreign growth, residual fuel oil production capability in the U.S. has now all but disappeared, and residual fuel imports now supply about 90% of the East Coast demand for residual.

Foreign refining capacity is generally more economically attractive than domestic capacity, depending on the imports policy of the U.S. Lower investments, tax incentives and lower operating costs, in addition to the relative ease of securing appropriate sites and permits for construction, favor most locations outside the U.S. However, continued growth in imports, and in our dependence, then, on foreign refineries, will introduce some problems. Flexibility to respond to unusual demand patterns or logistics problems will be reduced, since imports of products introduce more dependence on foreign transportation availability and scheduling. The generation of jobs, local service industry and other economic "boosts" occasioned by the construction and operation of refinery facilities will be lost to other countries. These factors can be sizeable, in terms of dollar effect. It has been estimated that each 1,000 B/D of refinery capacity is associated with generating sixty jobs, including workers in the refinery itself.

Environmental controls are having significant short-term impact on supply and cost. Blending of higher cost distillates into residual fuels in order to meet sulfur content restrictions has raised the cost of industrial fuels and has significantly tightened the world supply of low sulfur crudes and products. Addition of costly hydrodesulfurization capacity has been necessary in both domestic and foreign refineries in order to reduce the sulfur content

(1) Refer back to Section II, Attachment 3

94-250 O - 73 - 45

of products.[1] Higher petroleum fuels demand growth, due at least in part by automotive emissions controls, and substitutions for coal and dwindling natural gas supplies have forced refinery throughputs to high, marginally efficient levels. Environmental factors are now a major determinant in refinery design and operation, as well as a recent deterrent to obtaining approval for expansion or construction. Environmental costs are becoming a significant factor in the overall industry economics and have occasioned different approaches to problems and decisions by the industry.

Finally, another direct economic effect has been introduced into the industry in Phases I, II and now Phase III price controls. As yet, foreign product markets remain uncontrolled in price. Foreign gasoline prices have already risen to parity--and perhaps beyond--with U.S. prices, effectively removing gasoline imports as a viable alternative to increasing short-term supply. With the U.S. participating in the world product market to the extent of at least an additional 250 MB/D in 1973 and probably more in 1974, other products prices will very quickly respond to the increased competition for marginal supplies.

B. Market relationships

Within the U.S. petroleum industry, one familiar delineation in the market place is readily apparent--"independent" versus "major." The independent sector of the market is characterized by small size (individually), non-integration (i.e., usually a marketer, refiner or producer, but not all three), and highly price-competitive. The situation confronting the independent refiners has been discussed previously. The independent producer

(1) See Attachment 1, this section.

is actually tied into large crude gathering systems and lease arrangements, with other producers, both independent and "major", and thus does not impact heavily on the activity of the petroleum products market. We will, therefore, confine these comments to the independent marketer.

"Major" refiners (in this definition, about the top twenty companies in terms of refining capacity) supply about 75% of the U.S. gasoline market and control about 80% of U.S. refining capacity. (See Attachment 2 .) Thus, at a minimum, majors supply about 5% of the total U.S. gasoline market via sales to "non-major" suppliers. This volume amounts to about 300 MB/D (minimum) and approximates 20% of the "non-major" supplies of gasoline. Data is not available on other products, but we can infer that directionally, the same general relationship applies. Thus, in the various product markets, there is a sizeable volume of wholesale trading between independents and majors. Many independents will contract with suppliers for all or part of their supplies, but frequently will depend heavily on "spot" purchases of available surplus to fill out their needs. From the mid-1960's until about 1972, a significant excess of spare refining capacity existed in the U.S. This situation gave rise to low wholesale prices, abundant supplies, and a resulting proliferation of small independent companies. Independent marketers since about 1965 have shown steady accelerating growth in market share. In periods of little excess refining capacity, the "spot" market declines significantly in volume and increases in price. It is extremely difficult in such an environment for many of the small marketers to obtain supplies for which they have no firm contracts, and many of them will be completely cut off

from supply. Their customers can generally go to other suppliers to obtain motor gasoline or home heating oil (except in some remote areas), but there is little encouragement for the small marketer in the current supply environment, unless the larger companies are forced to supply the independent sector to the detriment of their own business. Excess refining capacity is now all but gone, and there are no significant refinery expansions or new refinery construction projects as yet announced for 1973.(1) With static capacity in refineries and increasing product demands, 1973 will put extreme pressure on the spot market, and thus on the small marketer.

(1) See Attachments 3 and 4, this section.

Attachment 1

U.S. HYDROTREATING AND HYDROREFINING CAPACITY
(Source: Oil & Gas Journal)

Type	Capacity (MB/D)		
	Jan 1971	Jan 1972	Jan 1973(est.)
Catalytic Reformer Feedstock	2,465	2,823	3,023
Middle Distillates	985	986	1,139
Catalytic Cracking Feed and Recycle	267	295	325
Naphtha, lubes, gas oil, residual and other	628	789	901

U.S. REFINERY CAPACITY (1/1/72)
(Source: Oil & Gas Journal)

Company	No. of Refineries	Crude Capacity (MB/D)
Exxon	5	1,180
Texaco	12	1,110
Shell	8	1,060
Amoco	11	988
Standard (Calif)	11	971
Gulf	8	825
ARCO	6	800
Mobil	9	797
Sun	5	456
Union	4	444
SOHIO/BP	4	436
Phillips	6	398
CONOCO	7	321
Ashland	6	319
Cities Service	2	281
Marathon	3	205
Subtotal "Majors"	107	10,591 (81%)
All Others	140	2,496 (19%)
Total U.S.	247	13,087

NEW REFINERIES OR EXPANSIONS SCHEDULED IN THE UNITED STATES BY PAD DISTRICTS - M Bbls/DAY OF CRUDE DISTILLATION

Company/Location	I	II	III	IV	V	TOTAL
1972						
Witco Chem. Corp. (Bradford, Pa.)	7.5					
Mobil (Paulsboro, N.J.)	6.9					
Quaker State (Hancock Co.W.Va.)	10.0	(New)				
Ashland Oil Co. (St. Paul, Minn.)		10.0				
Total Leonard (Alma, Mich.)		5.0				
Alabama Ref Co. (Mobile, Ala.)			4.0			
Murphy Oil Corp. (Meraux, La.)			31.0			
Southland Oil (Lumberton, Miss.)			1.0			
Sage Creek Ref. (Cowley, Wyoming)				1.0		
Refinery Corp. (Commerce City, Co)				4.0		
Chevron Asphalt (Portland, Oreg.)					6.0	
Hawaiian Ind. Ref. (Barbers Point, Oahu)					35.0 (new)	
Mobil (Ferndale, Wash.)					8.1	
San Joaquin Oil Co. (Oildale, Calif.)					6.0	
Douglas Oil Co. (Santa Maria, Calif.)					2.0	
	24.4	15.0	36.0	5.0	57.1	137.5
1973						
Mobil (Joliet, Illinois*)	-	164.0 (New)	-	-	-	164.0
1974						
None	-	-	-	-	-	-
1975						
Energy Co. (North Pole, Alaska)	-	-	-	-	15.0	15.0

*Expected to be on stream about January 1, 1973

Attachment 4

PROJECTED U.S. REFINERY CAPACITY THROUGH 1975
AND REQUIRED CRUDE RUNS VS. PRODUCT IMPORTS
(thousands of barrels per day)

Year	Refinery Capacity	CRUDE RUNS			
		A	B	C	D
1971 (Act.)	12,847	11,199	11,199	11,199	11,199
1972 (Proj.)	13,104	12,056	11,872	11,989	12,538
1973	13,248	12,188	12,545	12,779	13,877
1974	13,348	12,280	13,219	13,570	15,217
1975	13,355	12,287	13,892	14,360	16,556

	PRODUCT IMPORTS (1)			
	A	B	C	D
1971 (Act.)	2,196	2,196	2,196	2,196
1972 (Proj.)	2,081	2,313	2,196	1,647
1973	2,691	2,430	2,196	1,098
1974	3,340	2,547	2,196	549
1975	4,074	2,664	2,196	0

(1) Includes unfinished oils

A - Maximum runs feasible with projected capacity (92%).

B - Crude runs required to hold product imports at constant percentage of total demand - 14.48% (based on 1971).

C - Crude runs required to hold product imports at same absolute level as 1971 (2,196,000 Bbls/Day).

D - Crude runs required to phase out all product imports by 1975.

V. Alternatives for Federal Action - Short Range

A. Product Imports

In the preceding discussion of the current and projected supply situation, we have noted our projection for a net product shortage of about 250 MB/D in 1973, implying the strong need for more product imports. Increasing product imports can be done, broadly, in two ways: by decontrolling imports altogether for one or more products; or by maintaining volume controls and allocating the license to import one or several products among members of the industry. Of the latter, there are, further, alternative means of allocation. Two allocation techniques are most feasible: direct allocation; or auction of the import license ("tickets"). Of course, there are many decisions which must be made and alternatives which must be chosen to implement any of these systems. Import source restrictions (e.g. Western Hemisphere preference provisions), if any, should be determined, the specific products to decontrol or allocate under control must be decided, and many other decisions must be made. We will limit these comments, however, to the broad implications of decontrol versus control, and will address the principal allocation schemes without discussing all the various details.

Decontrol implies just that -- no controls at all. This option can apply to only one product (as per the temporary decontrol of distillates by the President on January 17, 1973, for example) or to several (or all) products. Administratively, decontrol is obviously very simple. Even in a decontrolled situation, however, we might still require that licenses be issued by the Office of Oil and Gas, for data collection purposes, even though there would be no control on volume. With no volume limits on imports, however, and if the differential between foreign and domestic

product prices were favorable, there is a risk of importing too much product. A large volume of imported products could cause domestic refiners to decrease crude runs and, thus, production of clean products could diminish. Additionally, decontrol may be the most difficult position to retreat from. The probability of maintaining future controls on imports would be substantially lessened by the political problems which a one-or-two-year decontrol action would engender.

In order to maintain controls on imports and at the same time increase imports level, requires that an authorized level of imports be determined and announced by the President. Although this method does limit the volume of material which can be imported (no over-supply problems), the determination of the appropriate import level is decidedly inaccurate. If, however, the volume so determined turns out to be too little to solve the expected supply shortages, then during the course of the year the President can amend the proclamation again to raise the authorized level. Preserving control on product imports maintains the traditional status quo in the industry and will not further encourage the industry to invest in foreign refining facilities. Over even a short period of time, for example, our policy regarding product import controls can influence investment and operating decisions in the industry which may have a far-reaching effect.

The key decisions to be made in the realm of a policy of controlled imports are those concerning method of allocation. Allocating tickets directly to the industry is relatively simple and is the method we now use. However, there are equitable formulas for distributing crude import tickets to refiners, and there are set regulations for distributing the small amount of product tickets we now issue. For a sizeable increase in product tickets,

however, there are no guidelines for distribution. We will have to decide to whom to give tickets and how many. The implications of ticket distribution are varied. If the refiners get most or all of the tickets, then there is no way to be sure that product imports will get to the independent marketer. If the marketers get all the tickets, they will probably have to trade them through refiners, for the most part, in order to gain access to imports, because many marketers cannot physically receive foreign supply directly. If prices in foreign markets are too high compared to domestic, the refiners won't trade for product tickets and the independents will be left holding unused tickets -- the desired volume won't get into the country. The problems concerning ticket distribution in the market place are complex and numerous. Suffice to say that the potential economic impact of any allocation proposal should be carefully considered before implementation.

Auction of product tickets has not been tried before. The idea is generally to set a volume of tickets, invite the industry to submit bids, and distribute the tickets to companies according to the high bids until they are all gone. One point in favor of an auction is that it does inject an element of competition into the import program, and in theory, the company to whom the tickets are most valuable will get them (since their bid will be commensurately high). There are a great many arguments for and against the auction proposal on both the concept itself and on some of the details of its implementation. One thing, however, is important above all. The auction system depends upon a differential between foreign price and domestic price. If such a differential does not exist (as it may not for gasoline this year), then there is a risk that no company will offer bids for any import tickets. Thus, we can't be sure of getting the imports we need even

allocated among the industry, let alone actually brought into the country.

B. Crude Imports

The current problems with crude supply suggest, as we have mentioned, the need for generally less restrictions on crude oil imports. In actuality, crude oil imports are decontrolled, in a fashion, already. The authorized level for imports is now set in PAD Districts I-IV and PAD District V by estimating the difference between forecast supply and demand and allowing the balance to be closed by a sufficient volume of imports. Further, if during the year conditions change, and more imports are needed, the level is raised as necessary. The authorized crude imports level in PAD I-IV, for example, was raised twice during 1972.

An alternative to continuing the current method of controlling and allocating crude imports would be outright decontrol. In a decontrolled environment, no tickets would be necessary, although, as we mentioned for product imports,we might continue to issue tickets as an expedient for collecting data on imports. The principal difference between the current policy and decontrol is in the allocation system. Today, crude tickets are allocated on a sliding scale which gives small refiners a larger share of their requirements as imports, compared to large refiners. Since foreign crudes are generally less expensive than domestic, then, a ticket takes on some economic value which permits small refiners to use their import rights as economic leverage to obtain supplies. In the current tight worldwide supply environment, this value has been very limited -- actually zero in many instances -- but, nonetheless, decontrol of crude imports would completely remove the possibility of any economic subsidy to small refiners through the import program, and could prove economically damaging to some small refiners.

If the current system of crude import controls is maintained, there also remains the alternative to auction crude tickets instead of allocating them directly. The implications are essentially the same as those discussed for auction versus direct allocation of product tickets, except that the potential distribution problems affect independent refiners instead of independent marketers.

OOG FISCAL YEAR 1974 PROGRAM REQUEST

Mrs. HANSEN. You are requesting $1.485 million, the same as 1973.

Mr. LIGON. Yes, ma'am.

Mrs. HANSEN. What is the impact on your program of having to absorb general inflationary increases such as pay cost increases?

Mr. LIGON. I would like to let Mr. Vickers answer that question, if I may.

Mr. VICKER. Madam Chairman, we are to absorb the $30,000-plus for the costs of increased salary for this fiscal year January through June. We have not yet decided or been advised as to how we will handle the approximately $70,000 anticipated increase for fiscal year 1974.

PROGRAM AND ANALYSIS PROGRAM

Mrs. HANSEN. In your justifications you list three programs: Programs and analysis, emergency preparedness and oil import compliance, and the oil imports program.

Would you please discuss your programs and analysis program?

Mr. LIGON. Yes, ma'am, be glad to.

Mr. Oliver may have some comments here. He is the Division's Assistant Director and head of that particular function. In this area we have been established and we are used as a focal or coordinating point between Government and industry. Any of the type of information that we want to give to industry is handled in programs and analysis.

Mrs. HANSEN. What types of information do you provide to industry?

Mr. LIGON. Industry asks questions about various things with regard to the oil import program pertinent to their particular situations. If they have a problem, they say "Can you talk to Shell or find out something from Shell about a particular supply situation in another part of the country?"

This particular group, Madam Chairman, is especially involved with supplying the staff support and the analysis for the Department's policymakers that we noted this morning as well as the Oil Policy Committee itself, and the Department's designated member to that committee.

Mrs. HANSEN. What type of information does industry provide to you?

Mr. LIGON. Industry helps us in various ways such as giving us figures on forecasting. This is not the only source of forecasting data, of course.

Mrs. HANSEN. I was going to ask if this was the only source.

Mr. LIGON. No, no, it is not. We have discussed Bureau of Mines, we have discussed other sources, FPC studies, which we add to the industry studies.

Dave, do you have other comments on that?

EXCHANGE OF INFORMATION

Mr. OLIVER. Our relationships with industry are both formal and informal, through the Petroleum Advisory Committee, where we meet with them, and the Advisory Board on a formal basis. We are informal in our relationships with individual companies. We are very careful

not to meet with more than one company out of the formal context; however, we will meet with a sequence of companies through personal contacts; they also come in to us if they have a particular problem they need to be reviewed.

We maintain our contacts and our associations; we also will call on them for assistance as needed. Such requests are very often in the forecasting area, in the technical area, or an appraisal of a market, particularly world market where the published materials are not as current as we require.

Mrs. HANSEN. How reliable is the information that they furnish you?

Mr. OLIVER. In each case we try to cross-check the information that we get. Generally we would conclude that the information is reliable.

Mrs. HANSEN. With whom do you cross-check?

Mr. OLIVER. Other companies; with available public data; published data, where we can; with government agencies, other appropriate government agencies.

Mrs. HANSEN. That would be the Bureau of Mines?

Mr. OLIVER. Especially the Bureau of Mines, or, if another Federal agency is involved, we will check with them.

Mr. MCKAY. Is not the Bureau of Mines' data fairly limited on these things, however, and more in technology.

Mr. OLIVER. Bureau of Mines maintains a very comprehensive statistical data system on the petroleum industry. I would say that the Bureau of Mine's petroleum industry's statistics are probably as comprehensive and reliable as any you will find, particularly in the refining sector of the industry.

Mr. MCKAY. Do they not get a lot of their data from business as well?

Mr. OLIVER. Remember, much business data has to originate with business, such as the Bureau of Census data comes from industry questionnaires.

OKLAHOMA RESEARCH INSTITUTE OIL AND GAS FIELD STUDY

Mr. LIGON. There is a very interesting Department of the Interior program that I think might be a relevant example. It involves the University of Oklahoma Research Institute and this of course is not a Government agency. I mean it is certainly not a corporate source as these others are.

Dave might have some comments about that. OURI has developed an oil and gas field data bank which has given more computized information on oil and gas reserves, production capacity, costs, and so forth. This is a continuing multiyear study which has gone on with regard to all of the major pools and fields that exist domestically onshore in the United States.

Did you have anything else to add?

Mr. OLIVER. We became aware 5 or 6 years ago of the rather voluminous data that were available in State and regulatory agencies sources on individual oil and gas fields. But at the same time much of this data was scattered varied in nomenclature and terminology, unorganized hard to get one's hands on, extremely difficult and costly to correlate and put into meaningful form with respect to producing trends and reserves. The Office of Oil and Gas has undertaken a project funded

by several other agences and ourselves. First there was a joint pilot study with the University of Oklahoma Research Institute to pull together information from the public domain and put it in a computer center with a random access retrieval program.

We now have data entered since 1967 to date for more than 60,000 oil and gas fields. That information is now becoming operational. It will probably be most useful to people like USGS and the Federal Power Commission in their independent calculations of resource availability, and reserves. Both the FPC and USGS have made some use of the data system. We anticipate they will use it more frequently in the future. We are pleased to manage this continuing study.

Mrs. HANSEN. How do you keep informed of the industry abroad?

Mr. LIGON. We have several Government/industry committees. This is going into other functions that we will be glad to talk about.

PROGRAM AND ANALYSIS DIVISION FUNCTIONS

Mrs. HANSEN. You say in your justification that the Programs and Analysis division has the following functions:

> It develops, evaluates and coordinates oil and gas information to provide sound bases for establishment and implementation of Government policies and programs for oil and gas.
>
> Provides information and services to Government agencies with respect to physical and economic factors affecting the petroleum and gas industries both in the United States and abroad.

So obviously you have to be currently very well aware of, we will say tax programs in Venezuela, cartel situations in the Mideast, the rivalry of tanker operations and so forth.

Mr. LIGON. It is the same type of cooperation that Mr. Oliver described on the informal as well as the formal level through the National Petroleum Council. The same types of information and responses are acquired from these levels and sources.

We have the same type of requests from the international oil companies for liaison and discussion as we do on the domestic level. We also work very closely with the State Department on the trends, developments, and results of, say, the cartel situation in the Middle East which you referred to, or increased Japanese or other nationals' negotiations and bargaining in the producing and marketing areas.

Mr. OLIVER. My group is made up of industrial specialists; I have a producing specialist, a refinery specialist, a transportation specialist, a marketer. These people are charged with keeping abreast of current developments and trends throughout the world.

There is also a member of the programs and analysis group who puts together, on an annual basis, a brochure on world flow of petroleum. He uses published sources, he uses unpublished sources, he assimilates data or information from whatever source he can get a hold of, and publishes what to my knowledge is the only comprehensive statement of the world flow of petroleum energy on an annual basis.

IMPORTS OF LNG

Mrs. HANSEN. I want to return to your importation of Algerian gas.

Mr. LIGON. Very well.

Mrs. HANSEN. Supposing you have one dock disaster, what is going to happen?

Mr. LIGON. I am not sure how to respond. Hopefully, the receiving liquefaction plants will be built in Cove Point, Md., and Savannah, Ga.

Mrs. HANSEN. Supposing you are not allowed to build any plants?

Mr. LIGON. Well, if there are no superports either to receive them, there will be no possibility that the liquefied gas can be used. It will be of no use in the quantities in which it is going to be transported, unless there are facilities to reverse the liquefaction process and to introduce the gas into the long distance interstate transmission system.

Mrs. HANSEN. Do you not think you have to face some of these problematical questions?

I do not believe that those people contemplating the oil leases off California were aware of what was going to happen at Santa Barbara.

There is a drive against superports except in the gulf area.

Mr. LIGON. That is right.

Mrs. HANSEN. It seems the whole east coast wants nothing to do with refineries, superports, and pipelines. A member said to me the other day that gas should not even come in because if there was one explosion this would be so disastrous to an American city.

Mr. LIGON. I think that danger of explosions was presented to the FPC and to the Ex-Im Bank. They felt there were overriding considerations plus safety technology which could be utilized to prevent such disasters. But I am sure it certainly could happen.

Mrs. HANSEN. But 10 years ago they thought there were overriding factors that would permit the construction of refineries.

Mr. LIGON. That is true.

Mrs. HANSEN. They also thought there were overriding factors that would allow construction of superports and nuclear energy plants. This has changed now. They thought there were overriding factors to allow the development of coal.

As you know, coal use has disappeared in one area and another because of the sulfur and the particulate content. You might as well face the current situations.

Mr. LIGON. No question, that is very true.

Mrs. HANSEN. I do not think the American public can make up its mind if they do not see the whole spectrum. After all, it is the American public that has to make the decision.

Mr. LIGON. It certainly is.

Mrs. HANSEN. I mentioned this morning, when we were discussing the meat situation, year after year the Office of Management and Budget has consistently curtailed money for the grazing lands which could have increased the size of beef herds. Nothing can result but the decrease in the size of the beef herd.

[Discussion off the record.]

PUBLIC AWARENESS OF ENERGY SITUATION

Mrs. HANSEN. What are you doing to resolve the current energy situation? What are you doing to make people aware of the realities of superports and the necessity to transport by pipeline oil from the superports to the mainland?

I think the average American does not realize that the oil has to be transported.

Mr. LIGON. Our function with regard to what you just outlined is certainly to present options to policymakers. Our program and Analysis Division in presenting options, is presenting the dangers that are present and the alternatives available. If, in fact, we do close off one option or another, we must pass these on to the Oil Policy Committee as well as to the Secretary of the Interior.

NEGOTIATIONS WITH CANADA

Mrs. HANSEN. As you mentioned, Canada curtailed exports, so that they will have a reservoir for their own use.

What type of negotiations are proceeding with Canada at the present time?

Mr. LIGON. At the current time and for probably the last year, the only negotiations that have been going on with Canada have been in the areas of possible alternatives in cases of an emergency cutoff of both countries. "What will we both do if our imports are, all of a sudden, cut off from the Eastern hemisphere?" and "What can we do in order to cooperate as one instead of two separate countries to supply each other's needs in any way we can as a result of cooperation?" That is the only type of formal discussions that have been going on and these have only been going on, at a working level.

We must remember that Canada still imports about one-half of its crude oil requirements. With regard to Canada's recently announced export controls and how they will affect us. I think we are going to have to wait until the National Energy Board in Canada meets. Until we see what their determination of the new regulatory formula will be and learn how that production to reserve ratio affects us and our imports.

ALASKAN OIL

Mrs. HANSEN. A great many Members of Congress suggest that the oil from the North Slope of Alaska should be piped through Canada. It is my understanding that Canada would require a large share of that oil.

Mr. LIGON. Yes, ma'am; 51 percent.

Mrs. HANSEN. Fifty-one percent of our reserves. What share would the United States receive of their northern reserves?

Mr. LIGON. They argue that if such a pipeline were built that we would have the benefit of production that is not developed at the present time that would be as a result of that pipeline. Of course we argue that would take at least 3 more years than the——

Mrs. HANSEN. What is the total estimated production per day in the North Slope of Alaska?

Mr. LIGON. Two million barrels.

Mrs. HANSEN. Fifty-one percent of that, or about 1 million barrels a day the United States would not receive. What does that do in terms of satisfying the shortfall on the west coast, the Rockies, and the Middle West?

Mr. LIGON. That would be an untenable position which we could not accept; not with that level of resources. We cannot afford to give away 50 percent of the Alaskan resources, which we need so badly in the Midwest. That also includes Alaska gas, which has not yet been considered.

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Mrs. HANSEN. I understand.

A second consideration is the oil will come down the long coastline from Valdez, by tanker. Vancouver is already using tankers.

Supposing the pipeline goes across Canada to supply the west coast. You would have to have a branch from Edmonton. Isn't this correct?

Mr. LIGON. That is right.

Mrs. HANSEN. Through part of a really mountainous terrain.

Mr. LIGON. That is right.

Mrs. HANSEN. If you nullify the use of tankers from Valdez to the United States, this could set a precedent and restrict any oil production off our shores.

Mr. LIGON. That is right.

Mrs. HANSEN. We may be curtailing all oil supplies from any offshore or onshore area in Alaska, is this not correct?

Mr. LIGON. That is correct.

[Discussion off the record.]

Mrs. HANSEN. You say in your justifications that you "Recommend programs and policies to improve the position capabilities of these domestic industries, especially as required by the Mining and Minerals Policy Act of 1970."

LIMIT OF PIPELINE RIGHT-OF-WAY

Will someone please tell me why, before the Trans-Alaska pipeline reached this stage someone did not look at the Mineral Leasing Act to see about the limitations on the width of the pipeline rights-of-way?

Please insert in the record an explaination for us in this regard.

Mr. LIGON. Be glad to.

[The information follows:]

As a matter of policy interpretation the Department of the Interior has issued permits for the construction of pipelines so long as the installed line does not exceed a right-of-way that is 50 feet in width. The fact that more than 50 feet of width was needed to contain installation equipment was not assumed to be an item that would be in opposition to the letter and intent of the Mineral Leasing Act.

The Department of the Interior has been aware of the width limitation contained in section 28 of the Mineral Leasing Act (30 U.S.C. sec. 185) since the passage of that act (1920). However, the Department has interpreted this width limitation as applying only to the grant of an interest in public land. It was not felt that the statute limited the issuance of revocable special land use permits under other authority for temporary use of additional land for construction or maintenance purposes, until the Court of Appeals for the District of Columbia Circuit ruled, from which decision the Supreme Court denied certiorari. The position of the Department before this ruling is discussed in detail in the brief of the Department before the District of Columbia Circuit.

It should be noted that all parties to that lawsuit were in agreement that no major pipeline could be built today anywhere in the United States within the width limitation of section 28 of the Mineral Leasing Act as interpreted by the court. It is because of this fact that the Department is supporting legislation. now before the Senate Committee on Interior and Insular Affairs, which would modify this width limitaiton.

VIOLATIONS OF PIPELINE WIDTH LIMITATION

Mr. VEYSEY. On that same point, I have been informed that this width restriction has been widely violated, and is violated by many pipelines now under construction and in existence.

Mrs. HANSEN. How many pipelines are currently violating this limitation?

Mr. LIGON. I am not sure, but I know that you are right about that statement. In practice, most piplelines have not been really concerned with the width of the right-of-way. Of course that is the basis of the reversal in the court of appeals case, no question.

Mr. VEYSEY. I understand the Supreme Court decided today to not do anything further.

May I ask this? Under that law could an existing pipeline that would violate the requirement be shut down?

Mr. LIGON. I am sure the court wouldn't apply the law retroactively to such a case. But I have no way of knowing what the court would do.

Mr. VEYSEY. That wouldn't be retroactive application. The law has been on the books a long time.

Mr. LIGON. I think if you can show that it hadn't been adhered to in practice——

Mrs. HANSEN. You just say they have been violating the law for x number of years. Under the present tenor and the present temper——

Mr. LIGON. Of course, that is what I was arguing for. You are right.

INFORMATIONAL AND ANALYTICAL SUPPORT

Mrs. HANSEN. You also say in the justifications: "The Division also provides such informational and analytical support as the other Office of Oil and Gas divisions may require in the performance of their respective functions."

What do you supply the other divisions?

Mr. LIGON. These functions are the departmental oil policy program leaders, the various studies that we present the oil and gas policymakers on various issues and problems that are before them, options which the policymakers can use or select.

Mrs. HANSEN. Dr. Pecora said that the basis of our whole oil policy was to know what resources we had and know what the alternatives were so that we might at all times as a free nation have our options open.

Do you agree with that?

Mr. LIGON. Yes, ma'am.

Mrs. HANSEN. Mr. McKay.

LONG-RANGE FORECASTING

Mr. MCKAY. You do analysis and so on and give advice and counsel. How far do you project in the way of futuristic goals or long-range planning in this counsel?

Mr. LIGON. Dave, can you answer that question?

Mr. OLIVER. The responsibility for long-range energy forecasting lies principally with the Bureau of Mines. We cooperate with them and review their forecasts, comment upon them, assist them where we can. Their latest publication which came out earlier this year projected the energy situation to the year 2000. Again, the National Petroleum Council in December completed a study of the national energy outlook. Their projections went to the year 1985, with some further speculation of what might happen between 1985 and the year 2000.

If you haven't seen it, this is the set of publications from the NPC, their energy study.

The green publication on the top is a brief summary; the second publication, the thinner one, is the full summary. The thick white publication is the full detailed report in which NPC looked at the demand for energy and the potential contributions from each of the available sources, both the close-in sources and some of the more exotic energy sources.

Mr. McKay. How long has this type of thing been going on?

Mr. Oliver. Oh, with various degrees of intensity, for many, many years.

PRACTICAL USE OF RECOMMENDATIONS

Mr. McKay. If that is true, apparently nobody is paying any attention. Otherwise there ought to have been some recommendations that could help us to avoid in the long term some things we are in now.

Mr. Ligon. There have been recommendations and I think the recommendations have been proper and have predicted many of the things that we are living right now.

Mrs. Hansen. It seems as if nobody has paid any attention.

Mr. Ligon. I don't know whether they paid any attention, but perhaps it was the surprising combination that so many of the adverse predictions could have happened concurrently.

Mr. McKay. It would appear that nobody is really paying that much attention or even if they had all happened together you could have avoided it to some degree and maybe we have.

Mr. Ligon. I think we have already avoided some of the possible problems but it has been difficult. We hear about complaints, protests and problems from the oil companies, from the Congressmen's constituents, and the press and it is very understandable. I would be upset, too.

Mr. McKay. I am one who thinks that we need to do more long-range planning and then start implementing some policies which will anticipate those needs down the road.

Mrs. Hansen. Mr. McKay, there is one establishment of this Government that is totally against long-range planning and that is the Office of Management and Budget.

Mr. McKay. That may be so but that doesn't change my view.

Mrs. Hansen. It doesn't change mine either.

EMERGENCY PREPAREDNESS AND OIL IMPORT COMPLIANCE PROGRAM

Will you please discuss your emergency preparedness and oil import compliance program for us?

Mr. Ligon. Yes, ma'am, be glad to, and Mr. Williams, who is on my left, may have something to add to this.

The emergency preparedness aspect of our organization is more important with regard to the current emergency shortage conditions than most of our other present functions.

We are presently trying to beef up the regional office staffing of this division to try to spot shortage situations such as we discussed in Los Angeles this morning and to try to help respond in rapidly changing situations all over the country.

The oil import compliance inspection part of the division is an industry performance surveillance program which is increasingly important. We must be sure that the companies who apply for allocations for oil imports are applying on a sound, firm, and fair basis.

The certified information inputs in the Oil Import Allocation/License are the basis of the allocations. The petrochemical applicants, the terminal fuel operators, and the refiners themselves are all checked through the oil import compliance inspections. We have utilized the emergency preparedness staff members as well as the oil import compliance staff in headquarters and Houston and through the existing four regional field office organizations. We have used the industrial specialists that we have in those offices for both functions, trying to utilize to the maximum their expertise.

Ralph, do you have anything to add on that since this is your office?

Mr. WILLIAMS. No, sir; I think you have done very well.

Mr. LIGON. Fine.

OIL IMPORT PROGRAM

Mrs. HANSEN. Please discuss your oil import program.

Mr. LIGON. Yes, ma'am.

The oil import program function of our office involves in reviewing the regulations concerned with the actual oil import program, the oil import division also does such very practical things as reviewing the fairness of the exchange agreements that we talked about this morning. Since these are so necessary to the independent refiners, certainly in the Midwest, we have also helped spot trouble areas in the oil import program, bringing to the attention of the Oil Policy Committee items that they are deficient or unresponsive to or certain things which should be revised or modified as a result of changing circumstances.

DOMESTIC PRODUCTION INVESTMENT

Mrs. HANSEN. Supposing Venezuela increases their taxes and Middle East oil supplies become more unstable, will this tend to make the oil industry of the United States invest more in our own domestic production?

Mr. LIGON. Only if the economic incentives are present.

Mrs. HANSEN. Supposing they haven't any economic incentives abroad.

Mr. LIGON. Well, in that case obviously the answer is "yes," but the rationale may go something like this: It would be more economically beneficial to go to Saudi Arabia and drill an oil well and produce all you could without any restrictions for 4 or 5 years versus drilling a much deeper well in the United States at greater costs for drilling, and for a lower price for the crude oil produced. Obviously, they will drill the Saudi Arabian well even though it may only last for 3, 4, or 5 years depending on that government's policy. Thus the relative security of the domestic investment at higher cost will be offset by the chances to have a faster payout.

[Discussion off the record.]

Mrs. HANSEN. Supposing an American oil company decided to invest in Venezuela and nationalization occurs months later.

Mr. LIGON. That is a problem we have already encountered with the tar sands possibility; there are tremendous reserves in the Orinoco tar

belt. It will take a great deal of investment and a change in climate to create and stimulate that investment. This would be a tremendous opportunity for us as well as the Venezuelans; but the American companies will not undertake the job with the present attitude that exists toward American investment in Venezuela.

Mrs. HANSEN. Are other foreign investments welcomed besides American?

Mr. LIGON. The British Petroleum Co. and Royal Dutch Shell have also had the same problems as we have had.

Mrs. HANSEN. So this is not a problem peculiar just to the United States.

Mr. LIGON. No. It is only peculiar to U.S. companies because we now have a dominant position in production of crude oil in that particular country.

Mrs. HANSEN. When the U.S. companies invest, say, in Saudi Arabia or any of the other Near East countries, they could well be providing a major part of their production for Japan?

Mr. LIGON. Yes.

Mrs. HANSEN. Mr. Veysey.

ACCOMPLISHMENT OF OBJECTIVES

Mr. VEYSEY. On the oil import program, the very things we heard around the table here today lead me to believe that we haven't accomplished some of the objectives that we would like to accomplish. It hasn't stimulated, at least sufficiently, the development of our own resources and our refining capacity and it apparently has gone some distance to assure the shortages that have been noted here of one type or another.

Mr. LIGON. I think conditions certainly could have been much worse; if you will look at the variables in the present situation: domestic price versus foreign price; domestic supply versus foreign supply; domestic demand and its amazing growth since the inception of the oil import program. You will find that there is an entirely different set of circumstances that prevail today which actually weren't even present as recently as 1969 when the Presidential Task Force on Oil Imports was working.

Mr. VEYSEY. That may be but we have a different set of circumstances now.

Mr. LIGON. We certainly do.

Mr. VEYSEY. Does the program make sense today?

Mr. LIGON. It makes sense with certain modifications.

Mrs. HANSEN. What are those modifications?

Mr. LIGON. If you will recall, I said that the Oil Policy Committee earlier is making a complete review of the entire oil import program to permit appropriate modifications which they finally decide upon.

IMPORT RESTRICTIONS

Mr. VEYSEY. Suppose we took this step, which would be drastic—I don't know that much about it—to do away with the present import restrictions and substitute therefor some type of a tariff, $2 a barrel on all imported oil. What would that do for us?

Mr. LIGON. It depends on how the tariff was administered. It depends on how much the tariff was.

Mr. VEYSEY. Say $2 a barrel on everything.

Mr. LIGON. Crude and end products?

Mr. VEYSEY. I am talking about crude, yes.

Mr. LIGON. Well, it is important. The tariff idea has definite advantages in being able to protect certain segments of the entire picture which we should protect, there is no question about that. I think that is part of the tariff's advantage.

Mr. VEYSEY. What does the import restriction do?

Mr. LIGON. An import restriction helps protect——

Mr. VEYSEY. The other segments of the picture?

Mr. LIGON. Yes.

Mr. VEYSEY. What would be the difference?

Mr. LIGON. The people who support the quota program say that a tariff, even in your hypothetical question, cannot be finely tuned to be responsive to rapid changes. The administration must be carried on by many parts of the Government in order to be effective. It can't be nearly as effective or responsive as a quota.

Mr. VEYSEY. Effective in what sense?

Mrs. HANSEN. Are you saying the Tariff Commission and the State Department couldn't run it?

QUOTA VERSUS TARIFF SYSTEM

Mr. LIGON. No. I am saying those who support quota system over a tariff system might argue that a tariff would be very difficult to administer and not able to fine tune it or adjust it fast enough.

Mrs. HANSEN. Give us a specific instance of that.

Mr. VEYSEY. Yes; relate it to some of these shortages that we are trying to solve and you are trying to solve.

Mr. LIGON. I am presuming an argument. I am not saying this is one of the things——

Mrs. HANSEN. We will understand that you are just giving us a hypothetical case.

Mr. LIGON. These are some of the things which are now being discussed before the Oil Policy Committee. I think that a tariff would definitely provide the type of protection that the present quota system now provides. But you have to be very careful about the distinctions between crude and products. What is good crude tariff figure could be unrealistic for finished products in great demand—such as the middle distillates on the east coast.

Mr. VEYSEY. Yes.

Mr. LIGON. Perhaps you have to provide more protection for the product area for reasons discussed today. It is very important to protect refining capacity that we do have and create and stimulate more incentive for increased investments; and probably a smaller tariff in relationship——

Mrs. HANSEN. Our refineries have to have a certain maximum continuing load as I understand it, to be efficient.

Mr. LIGON. That is right.

Mrs. HANSEN. Would that same stability continue with the tariff system?

Mr. LIGON. It depends on the rest of the program. If the program were set up so that the refineries could go into the marketplace and bid for as much crude as needed to run the refineries at that maximum production augmenting what they were able to get in domestic crude oil and permitting competitive prices and tariff would probably be acceptable assistance in providing stability.

Mrs. HANSEN. Who would set the rates?

Mr. LIGON. I am not really sure. I have explained that some argue that not very many people are capable of establishing the proper tariff rates with flexibility to permit adjustments for economic impacts.

Mrs. HANSEN. Other nations also have the ability to impose a tariff. This is a two-way street.

Mr. LIGON. It certainly is. The Canadians have indicated that if we put a tariff on Canadian oil they will put export controls on their oil and reduce our imports from Canada even more than what they are proposing now.

Mrs. HANSEN. Could this happen with, we will say, Saudi Arabia?

Mr. LIGON. Sure.

Mrs. HANSEN. So it has its risks.

Mr. LIGON. Yes, ma'am.

Mr. MCKAY. Madam Chairman, what is to stop that Middle East coalition from working us against ourselves, if we open up the price of oil that we could just bid ourselves clear out of usage?

Mr. LIGON. We certainly could.

Mr. MCKAY. Because they could arbitrarily just say, "Well, you have the pricing. Let us stick it a little more," so they become the arbitrators of our own economy.

Mr. LIGON. There is that danger.

[Discussion off the record.]

DOMESTIC EXPLORATION

Mr. VESEY. Madam Chairman, in that regard it seems to me our programs have failed because our domestic exploration has definitely declined. We are not bringing in the new fields, aren't even trying in many cases.

Mr. LIGON. It is a situation there where there are options for investors. I mean the foreign exploration and development option or the domestic option.

Mr. VEYSEY. Our domestic refinery capacity has not increased and the chart you have given us shows most other nations have shot way ahead of us in that matter. In other words, our policy has been a failure in this regard. It has not done the things it purports to.

Mr. LIGON. I think it is a matter of degree and you could also argue that our present situation could have been a little worse.

Mr. VEYSEY. Would be worse?

Mr. LIGON. Could be worse and the problems could have accumulated in a lot faster period of time.

Mr. VEYSEY. I think we ought to opt for some better way to do it than to say it could have been worse.

Mr. LIGON. No; I agree; and we are. As I explained, the Oil Policy Committee is completely reviewing the entire oil import program as a result of its recently recognized inability to respond to the changing needs. There has been no disguise and nobody is kidding themselves.

They know that the allocation system hasn't worked as well as it should under current circumstances.

OTHER FUEL PROBLEMS

Mrs. HANSEN. You have had other difficulties than just the allocation system. The Santa Barbara experience limited certain leasing procedures. You have environmental problems on oil shale lands.

Also, as we discussed, you have the current and continuing difficulties involving the trans-Alaskan pipeline You have had problems in the gulf with fire. All along the east coast there is controversy between saving the beaches versus construction of refineries, so actually added to the foreign impact and the problem of not having enough totals imports coming in to perhaps balance the picture, you have added U.S. problems created by a wide variety of reasons.

You have had a great many problems arising since about 1967 that have not been prevalent prior to 1967.

Is this not correct?

Mr. LIGON. Yes, ma'am, that is correct. The chairman of the Oil Policy Committee has stated that the objectives that he thinks that the oil import program should accomplish are (1) a better allocation of the supplies that we do have and (2) policies that will promote a viable domestic production industry and a viable domestic refining industry. He has stated that many of our policies, including some of the policies associated with the oil import program, have not provided these incentives and that he intends to see that immediate modification is prepared to respond to these objectives.

He is a new man in a new job and I believe quite frankly that he means what he says.

Mrs. HANSEN. Very frankly, I think you have to come to some decisions rather shortly because time is short.

Mr. LIGON. Very true.

Mrs. HANSEN. I wish to express my appreciation to you, Mr. Ligon, and your staff for a very excellent presentation. I think we have had a very comprehensive review.

Mr. LIGON. Thank you.

WEDNESDAY, APRIL 4. 1973.

OFFICE OF THE SOLICITOR

WITNESSES

RAYMOND C. COULTER, DEPUTY SOLICITOR
ANDREW E. LATVALA, ADMINISTRATIVE OFFICER
FRANCIS M. WILES, DIRECTOR OF BUDGET
TIMOTHY A. VANDERVER, SPECIAL ASSISTANT TO THE SOLICITOR

Mrs. HANSEN. The committee will come to order.

This morning we have the Office of the Solicitor. Our principal witness is Mr. Coulter, the Deputy Solicitor.

REPLACEMENT OF SOLICITOR AND DEPUTY SOLICITOR

Mr. Coulter, we understand you are leaving the Department of the Interior. I would like to express my regrets that you are leaving. The committee has found that you have been a very frank and able witness. Very frankly, I think this is a poor way to reward capability.

Mr. WYATT. Madam Chairman, will you yield at that point?

Mrs. HANSEN. I will.

Mr. WYATT. I would like to have the record show that Mr. Coulter is a longtime career employee. Particularly at a time when the Solicitor himself is being changed, I deeply regret the fact that someone has seen fit to replace him. He has performed over the years under both political administrations in an exceptionally able, capable, and nonpartisan fashion. Perhaps that has been the problem, Mr. Coulter.

I would like to commend my friend, Ray Coulter, whose roots are deep in Oregon soil, upon his able performance in office. I want to express for the record my deep regret at this action.

I might say also for the record that, as usual, no one down there or anywhere else consulted with me prior to this action. I thank you for your years of service.

Mrs. HANSEN. The committee is deeply appreciative, Mr. Coulter, of the many difficult problems which have been before the Solicitor's Office in which Mr. Melich and yourself did an excellent job. We have had many controversial opinions from the Solicitor's Office and they have come forthrightly to the committee. I don't think at any time has the Department of the Interior Solicitor been as frank, as forthright, nor as prompt about sending decisions to the committee upon which the committee could base its action.

Mr. COULTER. Madam Chairman, I certainly appreciate both your remarks and those of Congressman Wyatt. Personally, as you know, I have very much enjoyed the 4 years that I have had the opportunity to appear before you each time. I appreciated the courtesy and the attention that you have given the Solicitor's Office during the period that I have been the Deputy Solicitor. My hope is, of course, that it will continue in the same fashion that we have experienced in the past 4 years.

NEW APPOINTMENTS

Mrs. HANSEN. The committee will try and maintain its usual interested relations. However, the Department has been notified that their appointments should be confirmed before the committee reviews the various agencys' budgets. The Secretary is well aware of the committee's position because we addressed a letter to the Department long before our hearings began requesting that only confirmed officials testify in support of their respective budgets.

Mr. LONG. Madam Chairman, are they proposing to put many before us who have not been confirmed?

Mrs. HANSEN. Mr. Melich will no longer be the Solicitor. I assume the new Solicitor has not been confirmed and is before the Senate. Mr. Coulter, the Deputy Solicitor, has appeared before the committee for many years. He has been a very able and capable Deputy Solicitor. This morning we are advised that Mr. Coulter is being replaced.

Mr. LONG. Your contract has not been renewed?

Mrs. HANSEN. His resignation was accepted. In expressing our feelings, the committee did feel an obligation to commend both Mr. Melich and Mr. Coulter because they have made decisions that are long and far reaching.

I think one of the most important opinions the Solicitor issued was on the requirement that the oil companies reimburse the Department of Interior for cost related to the construction of the trans-Alaska pipeline. This was one of the long and far-reaching opinions of the Solicitor, I feel, and it was given with frankness and dispatch. The committee has appreciated this kind of frankness.

Mr. Coulter is from my neighboring State of Oregon, and Mr. Melich is from another neighboring State in the West, Utah. I felt that it was not amiss this morning to recognize the kind of service they have given the United States of America.

Mr. LONG. Was it your opinion that the advice which they gave on the trans-Alaska pipeline was the reason why their resignations were accepted?

Mrs. HANSEN. I have no idea.

Mr. YATES. I want to join the chairman. I didn't come to know you or Mr. Melich very well because of my activities on other subcommittees which took me away from the hearings of this subcommittee. I want to agree completely with what Mrs. Hansen has said. I am sorry to see you go.

Mr. COULTER. Thank you very much.

Mr. YATES. She said you have done a very good job, and I know she is a good judge of this.

Mrs. HANSEN. I have worked with many attorneys and I have never found two more dedicated men than Mr. Melich and Mr. Coulter.

Mr. COULTER. Thank you very much, Mrs. Hansen.

Mr. LONG. The mystery then is why they lasted this long.

OPENING STATEMENT

Mrs. HANSEN. I am sure, Mr. Coulter, you have a general statement. Please insert your statement in the record and summarize it for us.

Mr. COULTER. I can summarize it for you, Mrs. Hansen.

[The statement follows:]

Madam Chairman, I am pleased to appear before this committee to present the appropriation request for the Office of the Solicitor.

Our request for fiscal year 1974 is $7,850,000. This constitutes an increase of $499,002 over the amount available in fiscal year 1973. The specific areas requiring increased funds are as follows:

1. Plus $72,002.—This sum represents annualization of the fiscal year 1973 supplemental appropriation for Mine Health and Safety.
2. Plus $300,000.—Printing and publication of Indian civil rights works.
3. Plus $50,000.—Legal support for Department's labor-management relations program.
4. Plus $37,000.—Additional staff in Riverside, Calif.
5. Plus $40,000.—Staff to reopen Gallup, N. Mex. office.

All of the above staffing would be accomplished by filling positions already authorized to us, so that no new positions are requested.

The first item of increase in the fiscal year 1974 budget is the $72,002 necessary to annualize the $360,000 appropriated for fiscal year 1973. The $360,000 was designed to provide funding for only 10 months of fiscal year 1973, and therefore the $360,000 carried forward in the fiscal year 1974 base will be short by $72,002 of full year funding for the full staff expected to be on board in fiscal year 1974.

In connection with the supplemental appropriation, the Solicitor's Office is presently recruiting the remaining personnel to achieve the full staffing position. During the hearing on the supplemental appropriation we pointed out that the employment of attorneys for the program required a close coordination with the Office of Hearings and Appeals and attorneys would be employed on a time schedule that would match the appointment of administrative law judges. Initial constraints by way of hiring restrictions, together with difficulty in obtaining qualified administrative law judges, inhibited recruitment efforts. These difficulties have been overcome and we are now bringing additional staff on. The inability to fully staff did have one advantage, however. The lapse permitted us to absorb the full amount of pay costs associated with the January 1973, pay increase.

The workload forecasts that were presented with the supplemental request are still valid, with the exception that those predictions now appear unduly conservative. Full year funding for fiscal year 1974 in the amount of $432,002 will be absolutely required.

The second increase request is for printing and publication of two works prepared by the Solicitor's Office in compliance with title VII of the Civil Rights Act of 1968 (25 U.S.C. 1341). Kappler's "Indian Affairs, Laws and Treaties" has been completed and ready for publication for some time. The compilation of the Solicitor's opinions has also been completed and we expect to complete the subject matter indexing of this work by the end of fiscal year 1973.

Title VII of the 1968 Civil Rights Act authorized appropriation of the sums necessary for preparation of this material "but not including printing". Under the cosponsorship of Senators Hruska and Ervin, Senate bill 969 has been introduced to amend this provision of the 1968 Civil Rights Act, to remove this restrictive language and authorize appropriation of such funds as are necessary to carry out the terms of the act. This bill is presently in the Senate Subcommittee on Constitutional Rights. We anticipate no difficulty in its passage before the end of this fiscal year.

Our appropriation last year included $10,000 for printing of drafts of material for the Model Code required under Title III of the 1968 Civil Rights Act, and printing of drafts of material prepared for inclusion in the revised Handbook of Federal Indian Law provided for in Title VII of that Act. This material is to be printed in the Department of the Interior printing plant during the next few months. The drafts of the model code will be utilized by staff members of our Indian Civil Rights Task Force and Indian law students participating in a summer program sponsored by the Department to confer with tribal judges, council members, attorneys and other interested people, so that tribal members may comment and have meaningful participation in the development of the code.

It is anticipated that for fiscal year 1975 we will be requesting funds for the final printing of the model code. We will also need funds for Departmental printing of further drafts of the Handbook. It is expected at this point that the Handbook will be completed in late fiscal year 1975, and funds for final printing will be requested either as a supplemental appropriation in fiscal year 1975 or as an increase in fiscal year 1976.

The remaining increase requests all concern areas where the Department's legal services demands have grown beyond the capabilities of the Solicitor's present staff. Labor-management relations now requires far more than the part-time assistance we are able to provide; the Bureau of Indian Affairs is experiencing great difficulty managing without the full time services of a Field Solicitor at Gallup, N. Mex.; and the Riverside, Calif. office has now determined, after a trial period following its July 1, 1972 establishment, that the present staff is not sufficient to meet the now stable and too-great workload.

We appreciate your consideration.

Mr. COULTER. First I might mention for the record I have with me Mr. Timothy Vanderver, a special assistant to the Solicitor; Mr. Andrew Latvala, administrative officer; and, of course, Mr. Francis Wiles, director of the budget for the Department.

With your permission, Madam Chairman, I will summarize the budget. Our request for fiscal 1974 totals $7,850,000, which represents an increase of $499,002 over the amount that was available to us in fiscal 1973. I would like to mention briefly the reasons for this increase.

MINE HEALTH AND SAFETY

There is an increase of $72,002 which represents the annualization of the fiscal year 1973 supplemental appropriation which, as you recall, we obtained for mine health and safety.

Mrs. HANSEN. Was this the result of the number of appeals?

Mr. COULTER. Yes; I might mention a little bit about that, too.

Mrs. HANSEN. Please do.

Mr. COULTER. As you recall, we appeared before you last fall on this supplemental request and we are presently in the posture of fully staffing up. We had some difficulty in obtaining a full staff immediately after the supplemental appropriation was approved for several reasons.

As you recall, there was a freeze on hiring which handicapped us somewhat. But the more difficult situation was the problem that confronted the Office of Hearings and Appeals in getting qualified administrative law judges. During our testimony last fall, both Mr. Day, and myself, indicated that the hiring of lawyers had to be handled in a manner that was consistent with the employment of the administrative law judges over in the Office of Hearings and Appeals. There was no use of us putting on lawyers if we had no judges to hear our cases.

So the difficulty that the Office of Hearings and Appeals experienced in getting qualified administrative law judges held us down somewhat, too, in the staffing up completely in accordance with the supplemental appropriation. However, that has been rectified and the new administrative law judges are now coming onboard. He hasn't yet got them all onboard.

Mrs. HANSEN. How many new administrative law judges will be hired?

Mr. LATVALA. I think it is nine new ones.

Mr. COULTER. He has 9 new law judges and we will have 10 new attorneys on board, Mrs. Hansen, to handle this problem.

INDIAN CIVIL RIGHTS PRINTING

The second item I wanted to mention categorically is an appropriation request in here for $300,000, which is a request to print the work we have been doing on the Indian civil rights task force. We have completed now the revision of Kappler's Laws and Treaties.

Mrs. HANSEN. How far back does Kappler's Laws and Treaties go? Is this from the very beginning of our treaty obligations with the Indians?

Mr. COULTER. Yes; this sets out the treaties and the laws generally. We had to update this. Kappler's was originally a five-volume work. Our work on it will make it a seven-volume edition. That is now ready to go to the printers.

We have also completed our work on the compilation of the Solicitor's opinions. This is ready for printing.

As you recall, the Civil Rights Act of 1969 directed the Solicitor to do four pieces of work. One, revise Kappler's; two, publish the Solicitor's opinions; three, develop a model code; and four, revise Cohen's handbook on "Federal Indian Law."

The latter two we are in the process of working on now. I would expect they will be through probably in another year to a year and a half.

AUTHORIZING LEGISLATION

The difficulty and the reason I wanted to mention this $300,000 request, Madam Chairman, is this, that in the 1968 Civil Rights Act, the Congress in its wisdom specifically provided that there would be no appropriation for printing of these works. They told us to do them, but we were not authorized to seek appropriations to print them. This was specific in the 1968 act. Apparently it was the thought of Congress at the time that the printing of these works would be done through the Congress itself.

Subsequently, when we presented this problem, Senator Ervin and Senator Hruska introduced legislation to amend the 1968 Civil Rights Act to authorize the Office of the Solicitor to seek appropriations for the printing of these books. This legislation has not yet passed the Congress. It's Senate bill 969.

Mrs. HANSEN. What is the status of the bill? Is it in committee?

Mr. COULTER. Yes, ma'am; our report is due to come up here shortly, as well as the report from the Justice Department recommending favorable action on the bill. However, at the present time we don't have basic authority to expend $300,000 for the printing. We asked that we be allowed to put this $300,000 in our budget request this year in order that we would have it available in 1974.

Mrs. HANSEN. So your request should be contingent on the enactment of this legislation?

Mr. COULTER. That is right. It will be a contingency appropriation. If we don't get the authority, then the money will revert to the Treasury.

There is a third item that I would like to mention categorically.

TRAIL OF BROKEN TREATIES

Mrs. HANSEN. Before we leave the matter of Indian civil rights, I have several questions. The committee directed the appropriations investigative staff to prepare a review of the problems inherent in the Trail of Broken Treaties occupation of the BIA building. Part of the review pertained to the validity of the grievances expressed by the Trail of Broken Treaties. This report has now been prepared. The investigators have done a very able job.

PROPOSALS OF TRAIL OF BROKEN TREATIES

One proposal of the Trail of Broken Treaties was restoration of constitutional treaty-making authority.

Additional proposals involved the establishment of a Treaty Commission to develop new treaties, a review of treaty commitments and violations, and a proposal for the resubmission of unratified treaties to the Senate.

It was also proposed that all Indians would be governed by treaty relations and would receive mandatory relief against treaty rights violations.

The next proposal was judicial recognition of Indian rights to interpret treaties.

The report states:

> Sentiments were expressed for reexamination of current treaties to insure that their original intent is being fulfilled. While there is an disinclination to enter into new treaties, there is support for any Indian people who feel that a need for new treaties is an issue. Prevailing opinion, however, indicated that the proposal is unrealistic and unacceptable as a matter of policy with the Federal Government.

The response of the White House, who undertook in their negotiation procedures to deal with the Trail of Broken Treaties:

> The citizenship relationship with one's Government and treaty relationship is mutually exclusive. A government makes treaties with foreign nations, not with its own citizens, and Indians have been citizens since 1924.

That refers to resubmission of unratified treaties to the Senate. They go on further:

> The treaties that were concluded and ratified with Indian tribes are still in force, and will be respected by the United States. To call for new treaties is to raise a false issue that would be both unconstitutional and misleading.

On judicial recognition of Indian right to interpret treaties, the White House response was:

> This proposal would require fundamental revision of our judicial processes which would impinge on the judicial powers of courts and thereby present constitutional problems.

In essence, this is a summary of the overall treaty issue. I have two questions based on this.

TRAIL OF BROKEN TREATIES NEGOTIATIONS

Did the White House at any time during the Trail of Broken Treaties negotiations ask the Solicitor to prepare these responses?

Mr. COULTER. No. Mr. Melich participated in several conferences. I would presume, Madam Chairman, some of these matters were discussed. I don't know.

INDIAN CITIZENSHIP

Mrs. HANSEN. Do you agree with their basic interpretation, that the citizenship of the Indians granted in 1924 is mutually acceptable, and that the Government makes treaties with foreign nations, not with its own citizens?

Mr. COULTER. Yes; I would as a matter of law. That, I think, is absolutely correct as a matter of legal interpretation.

We have a problem, Madam Chairman, in dealing with matters of Indian law in semantics, really. It's true, these documents were signed as treaties originally with foreign nations. I am not too sure in my own mind just what they have been converted to as a result of the citizenship being accorded to the Indians.

CIVIL RIGHTS IMPLICATIONS

Mrs. HANSEN. Has anyone in the Solicitor's Office prepared a study to determine the implications of the Indians' citizenship role and their treaty status as it relates to overall civil rights? I am sure you are aware, Mr. Coulter, that the committee has been requested to specifically provide services to urban and nonreservation Indians.

The committee has had some misgivings about a conflict with the Civil Rights Act which guarantees equal treatment to all citizens of the United States.

The specific programs the committee is being requested to fund are basically, Mr. Coulter, beyond the status concept developed in the treaties.

How elastic can that policy of assisting all Indians become without conflicting with the U.S. Civil Rights Act as passed by Congress? It is possible to foresee in the future that there could be an uprising within all minority groups based upon this discrimination. Has the Solicitor been called upon to prepare an opinion in this regard?

There seems to be an overwhelming desire to move beyond the perimeters of what was accepted.

Mr. COULTER. Let me answer your question categorically first.

No; we have not addressed ourselves to the broad question of this nature. Nor have we been asked to do so.

Mrs. HANSEN. Has the Justice Department addressed itself to this question?

Mr. COULTER. No; not in the broad context you are suggesting, as far as my knowledge is concerned.

However, Madam Chairman, I think I should point out to you that this week, out of the Supreme Court came two decisions, one involving the State of Arizona and one involving the State of New Mexico, relating to taxation and taxation of Indians by the State government. One was an income tax proposition and the other was a State-use tax proposition. If you would like, I could submit the opinions for the record.

Mrs. HANSEN. Please do.

Mr. COULTER. I would be very happy to, Madam Chairman.

[The information follows:]

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SUPREME COURT OF THE UNITED STATES

No. 71-738

The Mescalero Apache Tribe, Petitioner, v. Franklin Jones, Commissioner of the Bureau of Revenue of the State of New Mexico, et al.	On Writ of Certiorari to the Court of Appeals of New Mexico.

[March 27, 1973]

MR. JUSTICE WHITE delivered the opinion of the Court.

The Mescalero Apache Tribe operates a ski resort in the State of New Mexico, on land located outside the boundaries of the Tribe's reservation. The State has asserted the right to impose a tax on the gross receipts of the ski resort and a use tax on certain personalty purchased out of state and used in connection with the resort. Whether paramount federal law permits these taxes to be levied is the issue presented by this case.

The home of the Mescalero Apache Tribe is on reservation lands in Lincoln and Otero Counties in New Mexico. The Sierra Blanca Ski Enterprises, owned and operated by the Tribe, is adjacent to the reservation and was developed under the auspices of the Indian Reorganization Act of 1934, 48 Stat. 984, as amended, 25 U. S. C. § 461 *et seq.*[1] After a feasibility study by the Bureau of Indian Affairs, equipment and construction money was provided by a loan from the Federal Government under

[1] In 1936, the Tribe adopted a constitution, pursuant to § 16 of the Act, 25 U. S. C. § 476.

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§ 10 of the Act, 25 U. S. C. § 470, and the necessary land was leased from the United States Forest Service for a term of 30 years. The ski area borders on the Tribe's reservation, but with the exception of some cross-country ski trails, no part of the enterprise, its buildings or equipment is located within the existing boundaries of the reservation.

The Tribe has paid under protest $26,086.47 in taxes to the State, pursuant to the sales tax law, § 72-16-1 *et seq.*, N. M. S. A. (1953), based on the gross receipts of the ski resort from the sale of services and tangible property.[2] In addition, in 1968 the State assessed compensating use taxes against the Tribe in the amount of $5,887.19 (plus penalties and interest), based on the purchase price of materials used to construct two ski lifts at the resort. § 72-17-1 *et seq.*, N. M. S. A. (1953). The Tribe duly protested the use tax assessment and sought a refund of the sales taxes paid. The State Commissioner of Revenue denied both the claim for refund and the protest of assessment and the Court of Appeals of the State affirmed. The court held, essentially, that the State had authority to apply its nondiscriminatory taxes to the Tribe's enterprise and property involved in the dispute, and that the Indian Reorganization Act did not render the Tribe's enterprise a federal instrumentality, constitutionally immune from state taxation, nor did it, by its own terms, grant immunity from the taxes here involved. 83 N. M. 158, 489 P. 2d 666. The Supreme Court of New Mexico denied certiorari. 83 N. M., at 161. We granted the Tribe's petition for a writ of certiorari, 406 U. S. 905, to consider its claim that the income and property of the ski resort are not properly

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[2] The Tribe asserts that "no sales tax (gross receipts tax) is being . . . charged for any ski rentals, lift tickets, food or beverages."

subject to state taxation. We affirm in part and in part reverse.

I

At the outset, we reject—as did the state court—the broad assertion that the Federal Government has exclusive jurisdiction over the Tribe for all purposes and that the State is therefore prohibited from enforcing its revenue laws against any tribal enterprise "[w]hether the enterprise is located on or off tribal land."[3] Generalizations on this subject have become particularly treacherous. The conceptual clarity of Chief Justice Marshall's view in *Worcester* v. *Georgia*, 31 U. S. (6 Pet.) 515, 556–561 (1832), has given way to more individualized treatment of particular treaties and specific federal statutes, including statehood enabling legislation, as they, taken together, affect the respective rights of States, Indians, and the Federal Government. See *McClanahan* v. *State Tax Commission of Arizona*, *ante*, ——; *Organized Village of Kake* v. *Egan*, 369 U. S. 60, 71–73 (1960). The upshot has been the repeated statements of this Court to the effect that even on reservations state laws may be applied unless such application would interfere with reservation self-government or would impair a right granted or reserved by federal law. *Organized Village of Kake*, *supra*, at 75; *Williams* v. *Lee*, 358 U. S. 217 (1959); *New York ex rel. Ray* v. *Martin*, 326 U. S. 496, 499 (1946); *Draper* v. *United States*, 164 U. S. 240 (1896). Even so, in the special area of state taxation, absent cession of jurisdiction or other federal statutes permitting it, there has been no satisfactory authority for taxing Indian reservation lands or Indian income from activities carried on within the boundaries of the reservation, and

[3] Brief for Petitioner 16.

McClanahan v. *State Tax Commission of Arizona, ante*, —, lays to rest any doubt in this respect by holding that such taxation is not permissible absent congressional consent.

But tribal activities conducted outside the reservation present different considerations. "State authority over Indians is yet more extensive over activities . . . not on any reservation." *Organized Village of Kake, supra*, at 75. Absent express federal law to the contrary, Indians going beyond reservation boundaries have generally been held subject to nondiscriminatory state law otherwise applicable to all citizens of the State. See, *e. g., Puyallup Tribe* v. *Department of Game*, 391 U. S. 392, 398 (1968); *Organized Village of Kake, supra*, at 75–76; *Tulee* v. *Washington*, 315 U. S. 681, 683; *Shaw* v. *Gibson-Zahniser Oil Corp.*, 276 U. S. 575 (1928); *Ward* v. *Race Horse*, 163 U. S. 504 (1896). That principle is as revelant to a State's tax laws as it is to state criminal laws, see *Ward* v. *Race Horse, supra*, at 516, and applies as much to tribal ski resorts as it does to fishing enterprises. See *Organized Village of Kake, supra*.

The Enabling Act for New Mexico, 36 Stat. 557 (1910),[4] reflects the distinction between on- and off-reservation activities. Section 2 of the Act provides that the people of the State disclaim "all right and title" to lands "owned or held by any Indian or Indian tribes the right or title to which shall have been acquired through the United States . . . and that . . . the same shall be and remain subject to the disposition and under the absolute jurisdiction and control of the Congress of the United States." But the Act expressly provides, with respect to taxation, that "nothing herein . . . shall preclude the said State from taxing, as other lands and other property are taxed,

[4] A corresponding provision appears in the Constitution of the State of New Mexico, Art. XXI, § 2.

any lands or other property outside of an Indian reservation owned or held by any Indian, save and except such lands as have been granted . . . or as may be granted or confirmed to any Indian or Indians under any Act of Congress, but . . . . all such lands shall be exempt from taxation by said State [only] so long and to such extent as Congress has prescribed or may hereafter prescribe." It is thus clear that in terms of general power New Mexico retained the right to tax, unless Congress forbade it, all Indian land and Indian activities located or occurring "outside of an Indian reservation." [5]

We also reject the broad claim that the Indian Reorganization Act of 1934 rendered the Tribe's off-reservation ski resort a federal instrumentality constitutionally immune from state taxes of all sorts. *McCulloch* v. *Maryland*, 17 U. S. (4 Wheat.) 316 (1819). The intergovernmental immunity doctrine was once much in vogue in a variety of contexts and, with respect to Indian affairs, was consistently held to bar a state tax on the lessees of or the product or income from restricted lands of tribes or individual Indians. The theory was that a federal instrumentality was involved and that the tax would interfere with the Government's realizing the maximum return for its wards. This approach did not survive; its rise and decline in Indian affairs is described and reflected in *Helvering* v. *Mountain Producers Corp.*, 303 U. S. 376 (1938); *Oklahoma Tax Comm'n* v. *United States*, 319 U. S. 598 (1943); and *Oklahoma Tax Comm'n* v. *Texas Co.*, 336 U. S. 342 (1949), where the Court cut to the bone the proposition that restricted Indian lands

[5] The Tribe's treaty with the United States, 10 Stat. 979 (1852), which acknowledges that the Tribe is "exclusively under the laws, jurisdiction, and government of the United States . . . ," does not alter the obvious effect of the State's admission legislation. See, *e. g.*, *Organized Village of Kake*, *supra*, 396 U. S., at 67–68, and cases cited therein.

and the proceeds from them were—as a matter of constitutional law—automatically exempt from state taxation. Rather, the Court held that Congress has the power "to immunize these lessees from the taxes we think the Constitution permits Oklahoma to impose in the absence of such action" and that "[t]he question whether immunity shall be extended in situations like these is essentially legislative in character." *Oklahoma Tax Comm'n* v. *Texas Co.*, *supra*, at 365–366.

The Indian Reorganization Act of 1934 neither requires nor counsels us to recognize this tribal business venture as a federal instrumentality. Congress itself felt it necessary to address the immunity question and to provide tax immunity to the extent it deemed desirable. There is, therefore, no statutory invitation to consider projects undertaken pursuant to the Act as federal instrumentalities generally and automatically immune from state taxation. Unquestionably, the Act reflected a new policy of the Federal Government and aimed to put a halt to the loss of tribal lands through allotment. It gave the Secretary of the Interior powers to create new reservations, and tribes were encouraged to revitalize their self-government through the adoption of constitutions and bylaws and through the creation of chartered corporations, with powers to conduct the business and economic affairs of the tribe.[6] As was true in the case before us, a tribe taking advantage of the Act might generate substantial revenues for the education and the social and economic welfare of its people.[7] So viewed, an enterprise such as the ski resort in this case, serves a

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[6] See generally U. S. Department of the Interior, Federal Indian Law, 129–132 (Cohen, 1958 rev.) (hereinafter Federal Indian Law); Comment, Tribal Self-Government and The Indian Reorganization Act of 1934, 70 Mich. L. Rev. 955 (1972).

[7] For other examples see Comment, n. 6 *supra*, at 983–985. See also J. Collier, On the Gleaming Way 149, 129–149 (1962 ed.).

federal function with respect to the Government's role in Indian affairs. But the "mere fact that property is used, among others, by the United States as an instrument for effecting its purpose does not relieve it from state taxation." *Choctaw, Oklahoma & Gulf R. Co.* v. *Mackey*, 256 U. S. 531, 536 (1921). See also *Henderson Bridge Co.* v. *Kentucky*, 166 U. S. 150, 154 (1897).

The intent and purpose of the Reorganization Act was "to rehabilitate the Indian's economic life and to give him a chance to develop the initiative destroyed by a century of oppression and paternalism." H. R. Rep. No. 1804, 73d Cong., 2d Sess., 6 (1934). See also S. Rep. No. 1080, 73d Cong., 1st Sess., 1 (1934). As Senator Wheeler, on the floor, put it:

> "This bill seeks to get away from the bureaucratic control of the Indian Department, and it seeks further to give the Indians the control of their own affairs and of their own property; to put it in the hands either of an Indian council or in the hands of the corporation to be organized by the Indians." 78 Cong. Rec. 11125 (1934).

Representative Howard explained that

> "The program of self-support and of business and civic responsibilities in the management of their own affairs, combined with the program of education, will permit increasing numbers of Indians to enter the white world on a footing of equal competition." *Id.*, at 11732.[6]

The Reorganization Act did not strip Indian tribes and their reservation lands of their historic immunity from

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[6] See also *id.*, at 11727, 11731–11732 (remarks of Rep. Howard); the statements of Mr. John Collier, the Commissioner of Indian Affairs, in Hearings on H. R. 7902, before the House Committee on Indian Affairs, 73d Cong., 2d Sess., 37, 60, 65–67 (1934) (hereinafter, 1934 House Hearings).

state and local control." But in the context of the Reorganization Act, we think it unrealistic to conclude that Congress conceived of off-reservation tribal enterprises "virtually as an arm of the government." *Department of Employment* v. *United States*, 385 U. S. 355, 360 (1966). Cf. *Clallam Co.* v. *United States*, 263 U. S. 341 (1923). On the contrary, the aim was to disentangle the tribes from the official bureaucracy. The Court's decision in *Organized Village of Kake*, *supra*, which involved tribes organized under the Reorganization Act, demonstrates that off-reservation activities are within the reach of state law. See also *Puyallup Tribe*, *supra*,

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[8] The predecessor bills to the Wheeler-Howard Act, H. R. 7902 and S. 2755 (introduced respectively at 78 Cong. Rec. 2437 and 2440), expressly provided that the chartered Indian communities may act "as a Federal agency in the administration of Indian Affairs," and, correspondingly, that the United States would not "be liable for any act done . . . by a chartered Indian community." Title I, § 4 (i). 1934 House Hearings, p. 3. The bills further provided that "Nothing in this Act shall be construed as rendering the property of any Indian community . . . subject to taxation by any State or subdivision thereof . . . ." Title I, § 11. *Id.*, p. 5. The memorandum of John Collier, which accompanied the bills, stated that "[a]s a Federal agency, the property of a chartered community is constitutionally exempt from State taxation . . . ." *Id.*, p. 25. These extensive provisions for tax immunity were discarded in the Wheeler-Howard Bill, along with the accompanying provisions for more extensive governmental powers on the part of the chartered communities. See H. R. Rep. No. 1804, *supra*, p. 6. We do not read this legislative history, however, as suggesting that Congress intended to remove the traditional tax immunity that Indian Tribes enjoyed on their reservations. This reading finds support in Felix S. Cohen's treatise, see Federal Indian Law, pp. 852–853, although we believe that the broader thrust of his statement—that any "attempt by a State to impose income or other types of taxes" upon "tribal corporations organized under the Indian Reorganization Act . . . would still be held a direct burden on a Federal instrumentality"—is not supported by the modern cases and should be read with and in the light of other discussions of the immunity doctrine in particularized contexts. See *id.*, pp. 872–873, 864–873.

strued to support an exemption for taxation on income derived from the land. See *Squire* v. *Capoeman*, 351 U. S. 1 (1956); cf. *Superior Bath House Co.* v. *McCarroll*, 312 U. S. 176 (1941).[12] But absent clear statutory guidance, courts ordinarily will not imply tax exemptions and will not exempt off-reservation income from tax simply because the land from which it is derived, or its other source, is itself exempt from tax.

"This Court has repeatedly said that tax exemptions are not granted by implication . . . . It has applied that rule to taxing acts affecting Indians as to all others. . . . If Congress intends to prevent the State of Oklahoma from levying a nondiscriminatory estate tax applying alike to all its citizens, it should say so in plain words. Such a conclusion cannot rest on dubious inferences." *Oklahoma Tax Comm'n* v. *United States*, *supra*, 319 U. S., at 606–607 (1943). See *Squire* v. *Capoeman*, *supra*, 351 U. S., at 6. Absent a "definitely expressed" exemption, an Indian's royalty income from Indian oil lands is subject to the federal income tax although the source of the income may be exempt from tax. *Choteau* v. *Burnet*, 283 U. S. 691, 696–697 (1931).

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[12] *Squire* v. *Capoeman* involved the attempted imposition of federal capital gains taxes on the sale price of timber logged off allotted Indian timberland (located within a reservation). The timber constituted "the major value"—if not the only practical value—of the Indian's allotted land and it was clear that if the capital gains tax was to apply, the purposes and intent of the General Allotment Act of 1887 would in large measure have been frustrated. *Id.*, at 10. The Court, relying in part on "relatively contemporaneous official and unofficial writings" on the intended scope of the income tax laws, *id.*, at 8–9, declined to so interpret those latter-enacted laws and to find that the government intended to tax its own ward in this particular manner. In contrast to *Squire*, we find nothing fundamentally inconsistent with the intent of the Indian Reorganization Act in permitting the gross receipts of the Tribe's off-reservation enterprise to be subject to nondiscriminatory state taxes.

The Court has also held that a State, as well as the Federal Government, may tax an Indian's pro rata share of income from a tribe's restricted mineral resources. *Leahy v. State Treasurer*, 297 U. S. 420 (1935). Lessees of otherwise exempt Indian lands are also subject to state taxation. *Oklahoma Tax Comm'n v. Texas Co.*, 336 U. S. 342 (1949).

On the face of § 465, therefore, there is no reason to hold that it forbids income as well as property taxes. Nor does the legislative history support any other conclusion. As we have noted, several explicit provisions encompassing a broad tax immunity for chartered Indian communities were dropped from the bills that preceded the Wheeler-Howard Bill. See n. 9 *supra*. Similarly, the predecessor to the exemption embodied in § 465 dealt only with lands acquired for new reservations or for additions to existing reservations. 1934 House Hearings, p. 11. Here, the rights and land were acquired by the tribe beyond its reservation borders for the purpose of carrying on a business enterprise as anticipated by § 476 and § 477 of the Act.[13] These provisions were designed to encourage tribal enterprises "to enter the white world on a footing of equal competition." 78 Cong. Rec. 11732 (1934). In this context, we will not imply an ex-

[13] It is unclear from the record whether the Tribe has actually incorporated itself as an Indian chartered corporation pursuant to § 477. But see Charters, Constitutions, and By-Laws of the Indian Tribes of North America, pt. III, pp. 13–15 (G. Fay, ed., 1967). The Tribe's constitution, however, adopted under 25 U. S. C. § 476, gives its Tribal Council the powers that would ordinarily be held by such a corporation, Art. XI, and by both practice and regulations, the two entities have apparently merged in important respects. See 25 CFR § 91.2; Comment, n. 6 *supra*, at 973. In any event, the question of tax immunity cannot be made to turn on the particular form in which the Tribe chooses to conduct its business.

pansive immunity from ordinary income taxes that businesses throughout the State are subject to. We therefore hold that the exemption in § 465 does not encompass nor bar the collection of New Mexico's nondiscriminatory Gross Receipts Tax and that the Tribe's ski resort is subject to that tax.

B

We reach a different conclusion with respect to the compensating use tax imposed on the personalty installed in the construction of the ski lifts. According to the Stipulation of Facts, that personal property has been "permanently attached to the realty." In view of § 465, these permanent improvements on the Tribe's tax-exempt land would certainly be immune from the State's ad valorem property tax. See *United States* v. *Rickert*, 188 U. S. 432, 441–443 (1903). We think the same immunity extends to the compensating use tax on the property. The jurisdictional basis for use taxes is the use of the property in the State. See *Henneford* v. *Silas Mason Co., Inc.*, 300 U. S. 577 (1937); *McLeod* v. *J. E. Dilworth Co.*, 322 U. S. 327, 330 (1944). It has long been recognized that "use" is among the "bundle of privileges that make up property or ownership" of property and in this sense, at least, tax upon "use" is a tax upon the property itself. *Henneford* v. *Silas Mason Co., Inc., supra*, at 582. This is not to say that use taxes are for all purposes to be deemed simple ad valorem property taxes. See, *e. g.*, *United States* v. *City of Detroit*, 355 U. S. 466 (1958), and its companion cases; *Sullivan* v. *United States*, 395 U. S. 169 (1969). But use of permanent improvements upon land is so intimately connected with use of the land itself that an explicit provision relieving the latter of state tax burdens must be construed to encompass an exemption for

the former. "Every reason that can be urged to show that the land was not subject to local taxation applies to the assessment and taxation of the permanent improvements." *United States* v. *Rickert*, *supra*, at 442.

The judgment of the Court of Appeals is

Affirmed in part and reversed in part.

SUPREME COURT OF THE UNITED STATES

No. 71-738

The Mescalero Apache Tribe, Petitioner, *v.* Franklin Jones, Commissioner of the Bureau of Revenue of the State of New Mexico, et al.	On Writ of Certiorari to the Court of Appeals of New Mexico.

[March 27, 1973]

MR. JUSTICE DOUGLAS, with whom MR. JUSTICE BRENNAN and MR. JUSTICE STEWART concur, dissenting in part.

The power of Congress granted by Art. I, § 8 "To regulate commerce . . . with the Indian tribes" is an exceedingly broad one. In the liquor cases the Court held that it reached acts even off Indian reservations in areas normally subject to the police power of the States. *Perrin* v. *United States*, 232 U. S. 478. The power gained breadth by reason of historic experiences that induced Congress to treat Indians as wards of the Nation. See *Gritts* v. *Fisher*, 224 U. S. 640, 642–643; *United States* v. *Thomas*, 151 U. S. 577, 585; *United States* v. *McGowan*, 302 U. S. 535, 538. The laws enacted by Congress varied from decade to decade. See Federal Indian Law (1958), pp. 94–138, which is a revision of the monumental work Handbook of Federal Indian Law prepared by Felix S. Cohen and published in 1940.

The present Act, 48 Stat. 984, 25 U. S. C. § 461 *et seq.*, was enacted in 1934 with various purposes in mind, the ones most relevant being first, "To permit Indian tribes to equip themselves with the devices of modern business organizations, through joining themselves into business corporations" and second, "To establish a system of

financial credit for Indians." S. Rep. No. 1080, 73d Cong., 2d Sess., p. 1.

Loans had been made by the federal agency to individual Indians, but the experience had not been satisfactory. Federal Indian Law, *supra*, p. 13. The 1934 Act precluded such loans and set up a $10 million revolving credit fund for loans to incorporated tribes. The industry established pursuant to that Act and involved here is a ski enterprise, adjacent to the reservation and located on lands leased from the U. S. Forest Service.

The Court makes much of the fact that the ski enterprise is not on the reservation. But that seems irrelevant to me by reason of § 5 of the Act, which provides in part "Any lands or rights acquired" pursuant to the 1934 Act "shall be taken in the name of the United States in trust for the Indian tribe . . . for which the land is acquired, and such land or rights shall be exempt from State and local taxation." 25 U. S. C. § 465. While the lease of Forest Service lands was not technically "acquired . . . in trust for the Indian tribe" the Court concedes that the lease arrangement was sufficient to bring the Tribe's interest in the land within the immunity afforded by § 465. And so the question respecting income taxes comes down to whether these taxes are within the scope of "such land or rights" as used in § 5.

I start from the premise made explicit in the Senate Report on the 1934 Act. It set forth the endorsement by President Roosevelt of "a new standard of dealing between the Federal Government and its Indian wards." S. Rep., *supra*, at 3. Art. 10 of the 1852 Treaty with the Apaches described the role of the guardian as respects these wards: "For and in consideration of the faithful performance of all the stipulations herein contained, by the said Apache's Indians, the government of the United States will grant to said Indians such donations, presents,

and implements, and adopt such other liberal and humane measures as said government may deem meet and proper."

The 1934 Act obviously is an effort by Congress to extend its control to Indian economic activities outside the reservation for the benefit of its Indian wards. The philosophy permeating the present Act was articulated by Chief Justice Marshall in *Worcester* v. *Georgia*, 6 Pet. 515, 556–557.

"From the commencement of our government, Congress has passed acts to regulate trade and intercourse with the Indians; which treat them as nations, respect their rights, and manifest a firm purpose to afford that protection which treaties stipulate."

As noted in *Warren Trading Post* v. *Tax Commission*, 380 U. S. 685, most tax immunities of Indians have related to activities on reservations. But as we stated in that case, the fact that the activities occurred on a reservation was not the controlling reason, "but rather because Congress in the exercise of its power granted in Art. I, § 8, has undertaken to regulate reservation trading in such a comprehensive way that there is no room for the States to regulate on the subject." *Id.*, 691, n. 18.

The powers of Congress "over Indian affairs are as wide as State powers over non-Indians," subject of course to the limitations of the Bill of Rights. Federal Indian Law, p. 24. One illustration of its extent is shown by the liquor cases already cited. We deal here, however, with "tribal property"—a leasehold interest in federal lands adjoining the reservation. "The term tribal property . . . does not designate a single and definite legal institution, but rather a broad range within which important variations exist." Federal Indian Law, pp. 590–601. There is no magic in the word "reservation." *United States* v. *McGowan*, 302 U. S. 535, held that land

purchased by Congress for a tribe but outside a "reservation" was nonetheless "indian country." While that case involved application of liquor laws, the Court stated that "Congress alone has the right to determine the manner in which this country's guardianship over the Indians shall be carried out," *id.*, at 538, and that it was immaterial what the tract of land was called. *Id.*, at 539.

In the present case Congress has attempted to give this tribe an economic base which offers job opportunities, a higher standard of living, community stability, preservation of Indian culture, and the orientation of the tribe to commercial maturity. We deal only with a tribal developed enterprise. State taxation of that enterprise interferes with the federal project. The ski resort, being a federal tool to aid the tribe, may not be taxed by the State without the consent of Congress. Congress by § 5 of the Act has made the "lands or rights" acquired for the tribe exempt from state and local taxation. Section 5 indeed states that "lands or rights" acquired under the 1934 Act shall be held "in trust for the Indian tribe or individual Indian for which the land is acquired." There is no more persuasive way to tax "rights" in land than to impose an income tax on the gross or net income from those rights. If § 5 be thought to be ambiguous, we should resolve the ambiguity in favor of the tribe. As stated in *Carpenter* v. *Shaw*, 280 U. S. 363, 367, "Doubtful expressions are to be resolved in favor of the weak and defenseless people who are the wards of the nation, dependent upon its protection and good faith." In *Squire* v. *Capoeman*, 351 U. S. 1, we resolved doubts respecting the federal income tax in favor of the Indian. There is the same reason for taking that course here.

The tribal ski enterprise, unlike the private entrepreneur in *Helvering* v. *Producers Corp.*, 303 U. S. 376,

on which the Court relies, is plainly a federal instrumentality—authorized and financed by Congress with the aim of starting the tribe on commercial ventures. This case has no relation to *Oklahoma Tax Commission* v. *United States*, 319 U. S. 598, which raised the question whether state inheritance taxes could be levied on restricted property. The Court only held that restricted property, as created by Congress, carried no implication of estate tax exemption. *Oklahoma Tax Commission* v. *Texas Co.*, 336 U. S. 342, also relied on by the Court, merely held that a lessee of mineral rights in Indian lands was not immunized from paying state gross production taxes and state excise taxes on petroleum produced from the lands. Those cases would be relevant here if the tribe had leased the ski resort to an outsider who sought the tribal tax immunity. We deal only with an income tax levied on a tribal corporate enterprise conducted by the tribe with federal funds on federal lands leased to the tribe. Federal Indian Law distinguished the *Helvering* and like cases relied on by the Court from an enterprise "organized solely to carry out governmental obligations, such as the tribal corporations organized" under the 1934 Act with which we now deal, pp. 852–853.

In my view this state income tax is barred by § 5 through which Congress has given tax immunity to these new tribal enterprises.

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NOTE: Where it is feasible, a syllabus (headnote) will be released, as is being done in connection with this case, at the time the opinion is issued. The syllabus constitutes no part of the opinion of the Court but has been prepared by the Reporter of Decisions for the convenience of the reader. See *United States* v. *Detroit Lumber Co.*, 200 U.S. 321, 337.

SUPREME COURT OF THE UNITED STATES

Syllabus

MESCALERO APACHE TRIBE *v.* JONES, COMMISSIONER, BUREAU OF REVENUE OF NEW MEXICO, ET AL.

CERTIORARI TO THE COURT OF APPEALS OF NEW MEXICO

No. 71-738. Argued December 12, 1972—Decided March 27, 1973

The State of New Mexico may impose a nondiscriminatory gross receipts tax on a ski resort operated by petitioner Tribe on off-reservation land that the Tribe leased from the Federal Government under § 5 of the Indian Reorganization Act, 25 U. S. C. § 465. Though § 465 exempts the land acquired from state and local taxation, neither that provision nor the federal-instrumentality doctrine bars taxing income from the land. But § 465 bars a use tax that the State seeks to impose on personalty that the Tribe purchased out of State and which, having been installed as a permanent improvement at the resort, became so intimately connected with the land itself as to be encompassed by the statutory exemption. Pp. 3–13.

83 N. M. 158, 489 P. 2d 666, affirmed in part and reversed in part.

WHITE, J., delivered the opinion of the Court, in which BURGER, C. J., and MARSHALL, BLACKMUN, POWELL, and REHNQUIST, JJ., joined. DOUGLAS, J., filed an opinion dissenting in part, in which BRENNAN and STEWART, JJ., joined.

NOTICE: This opinion is subject to formal revision before publication in the preliminary print of the United States Reports. Readers are requested to notify the Reporter of Decisions, Supreme Court of the United States, Washington, D.C. 20543, of any typographical or other formal errors, in order that corrections may be made before the preliminary print goes to press.

SUPREME COURT OF THE UNITED STATES

No. 71-834

Rosalind McClanahan, Etc., Appellant, *v.* State Tax Commission of Arizona.	On Appeal from the Court of Appeals of Arizona, Division One.

[March 27, 1973]

MR. JUSTICE MARSHALL delivered the opinion of the Court.

This case requires us once again to reconcile the plenary power of the States over residents within their borders with the semi-autonimous status of Indians living on tribal reservations. In this instance, the problem arises in the context of Arizona's efforts to impose its personal income tax on a reservation Indian whose entire income derives from reservation sources. Although we have repeatedly addressed the question of state taxation of reservation Indians,[1] the problems posed by a state income tax are apparently of first impression in this Court.[2] The Arizona courts have held that such state taxation is permissible. See *McClanahan* v. *State Tax Commission*,

[1] See, *e. g.*, *Oklahoma Tax Commission* v. *United States*, 319 U. S. 598 (1943); *Childers* v. *Beaver*, 270 U. S. 555 (1926); *United States* v. *Rickert*, 188 U. S. 432 (1903); *The Kansas Indians*, 72 U. S. (5 Wall.) 737 (1867). Cf. *Squire* v. *Capoeman*, 351 U. S. 1 (1956).

[2] State courts have disagreed on the question. Compare *Ghahate* v. *Bureau of Revenue*, 80 N. M. 98, 451 P. 2d 1002 (1969), with *Commissioner of Taxation* v. *Brun*, 286 Minn. 43, 174 N. W. 2d 120 (1970). See *Powless* v. *State Tax Commission*, 253 N. Y. S. 2d 438 (1964); *State Tax Commission* v. *Barnes*, 178 N. Y. S. 2d 932 (1958).

14 Ariz. App. 452, 484 P. 2d 222 (1971). We noted probable jurisdiction, 406 U. S. 916 (1972), and now reverse. We hold that by imposing the tax in question on this appellant, the State has interfered with matters which the relevant treaty and statutes leave to the exclusive province of the Federal Government and the Indians themselves. The tax is therefore unlawful as applied to reservation Indians with income derived wholly from reservation sources.

I

Appellant is an enrolled member of the Navajo tribe who lives on that portion of the Navajo reservation located within the State of Arizona. Her complaint alleges that all her income earned during 1967 was derived from within the Navajo reservation. Pursuant to Ariz. Rev. Stat. § 43–188 (f), $16.20 were withheld from her wages for that year to cover her state income tax liability.[3] At the conclusion of the tax year, appellant filed a protest against the collection of any taxes on her income and a claim for a refund of the entire amount withheld from her wages. When no action was taken on her claim, she instituted this action in Arizona Superior Court on behalf of herself and those similarly situated, demanding a return of the money withheld and a declaration that the state tax was unlawful as applied to reservation Indians.

[3] The liability was created by Ariz. Rev. Stat. § 43–102 (a) which, in relevant part, provides: "There shall be levied, collected, and paid for each taxable year upon the entire net income of every estate or trust taxable upon this title and of every resident of this state and upon the entire net income of every nonresident which is derived from sources within this state, taxes in the following amounts and at the following rates upon the amount of net income in excess of credits against net income provided in §§ 43–127 and 43–128." Appellant conceded below that she was a "resident" within the meaning of the statute, and that question, which in any event poses an issue of state law, is not now before us.

The trial court dismissed the action for failure to state a claim, and the Arizona Court of Appeals affirmed. Citing this Court's decision in *Williams* v. *Lee*, 358 U. S. 217 (1959), the Court of Appeals held that the test "is not whether the Arizona state income tax infringes on plaintiff's rights as an individual Navajo Indian, but whether such a tax infringes on the rights of the Navajo tribe of Indians to be self-governing." 14 Ariz. App., at 454, 484 P. 2d, at 223. The Court thus distinguished cases dealing with state taxes on Indian real property on the ground that these taxes, unlike the personal income tax, infringed tribal autonomy.

The Court then pointed to cases holding that state employees could be required to pay federal income tax and that the State had a concomitant right to tax federal employees. See *Helvering* v. *Gerhardt*, 304 U. S. 405 (1938); *Graves* v. *New York ex rel. O'Keefe*, 306 U. S. 466 (1939). Reasoning by analogy from these cases, the Court argued that Arizona's income tax on individual Navajo Indians did not "[cause] an impairment of the right of the Navajo tribe to be self-governing." 14 Ariz. App., at 455, 484 P. 2d, at 224.

Nor did the Court find anything in the Arizona Enabling Act, 36 Stat. 557, to prevent the State from taxing reservation Indians. That Act, the relevant language of which is duplicated in the Arizona Constitution, disclaims state title over Indian lands and requires that such lands shall remain "under the absolute jurisdiction and control of the Congress of the United States." 36 Stat. 569. But the Arizona court, relying on this Court's decision in *Organized Village of Kake* v. *Egan*, 369 U. S. 60 (1962), held that the Enabling Act nonetheless permitted concurrent state jurisdiction so long as tribal self-government remained intact. Since an individual income tax did not interfere with tribal self-government, it followed that appellant had failed to state a claim. The

Arizona Supreme Court denied a petition for review of this decision, and the case came here on appeal. See 28 U. S. C. § 1257 (2).

II

It may be helpful to begin our discussion of the law applicable to this complex area with a brief statement of what this case does not involve. We are not here dealing with Indians who have left or never inhabited reservations set aside for their exclusive use or who do not possess the usual accoutrements of tribal self-government. See, *e. g., Organized Village of Kake* v. *Egan*, 369 U. S. 60 (1962); *Metlakatla Indian Community* v. *Egan*, 369 U. S. 45 (1962); *Oklahoma Tax Commission* v. *United States*, 319 U. S. 598 (1943). Nor are we concerned with exertions of state sovereignty over non-Indians who undertake activity on Indian reservations. See, *e. g., Thomas* v. *Gay*, 169 U. S. 264 (1898); *Utah Northern R. Co.* v. *Fisher*, 116 U. S. 28 (1885). Cf. *Surplus Trading Co.* v. *Cook*, 281 U. S. 647, 651 (1930). Nor, finally, is this a case where the State seeks to reach activity undertaken by reservation Indians on nonreservation lands. See, *e. g., The Mescalaro Apache Tribe* v. *Jones, post.* Rather, this case involves the narrow question whether the State may tax a reservation Indian for income earned exclusively on the reservation.

The principles governing the resolution of this question are not new. On the contrary, "[t]he policy of leaving Indians free from state jurisdiction and control is deeply rooted in the Nation's history." *Rice* v. *Olson*, 324 U. S. 786, 789 (1945). This policy was first articulated by this Court 140 years ago when Chief Justice Marshall held that Indian nations were "distinct political communities, having territorial boundaries, within which their authority is exclusive, and having a right to all the lands within those boundaries, which is not only

acknowledged but guarantied by the United States." *Worcester* v. *Georgia*, 31 U. S. (6 Pet.) 515, 557 (1832). It followed from this concept of Indian reservations as separate, although dependent nations, that state law could have no role to play within the reservation boundaries. "The Cherokee nation . . . is a distinct community, occupying its own territory, with boundaries accurately described, in which the laws of Georgia can have no force, and which the citizens of Georgia have no right to enter, but with the assent of the Cherokees themselves, or in conformity with treaties, and with the acts of congress. The whole intercourse between the United States and this nation, is, by our constitution and laws, vested in the government of the United States." *Worcester* v. *Georgia*, *supra*, at 561. See also *United States* v. *Kagama*, 118 U. S. 375 (1886); *Ex parte Crow Dog*, 109 U. S. 556 (1883).

Although *Worcester* on its facts dealt with a State's efforts to extend its criminal jurisdiction to reservation lands,[4] the rationale of the case plainly extended to state taxation within the reservation as well. Thus, in *The Kansas Indians*, 72 U. S. (5 Wall.) 737 (1867), the Court unambiguously rejected state efforts to impose a land tax on reservation Indians. "If the tribal organization of the Shawnees is preserved intact, and recognized by the political department of the government as existing, then they are a 'people distinct from others,' capable of making treaties, separated from the jurisdiction of Kansas, and to be governed exclusively by the government of the Union. If under the control of Congress, from necessity there can be no divided authority." 72 U. S., at 755. See also *The New York Indians*, 72 U. S. (5 Wall.) 761 (1867).

[4] See also *Williams* v. *United States*, 327 U. S. 711 (1946); *United States* v. *Chavez*, 290 U. S. 357 (1933); *United States* v. *Ramsey*, 271 U. S. 467 (1926).

It is true, as the State asserts, that some of the later Indian tax cases turn not on the Indian sovereignty doctrine, but on whether or not the State can be said to have imposed a forbidden tax on a federal instrumentality. See, *e. g., Leahy* v. *State Treasurer of Oklahoma,* 297 U. S. 420 (1936); *United States* v. *Rickert,* 188 U. S. 432 (1903). To the extent that the tax exemption rests on federal immunity from state taxation, it may well be inapplicable in a case such as this involving an individual income tax.[5] But it would vastly oversimplify the problem to say that nothing remains of the notion that reservation Indians are a separate people to whom state jurisdiction, and therefore state tax legislation, may not extend. Thus, only a few years ago, this Court struck down Arizona's attempt to tax the proceeds of a trading company doing business within the confines of the very reservation involved in this case. See *Warren Trading Post Co.* v. *Arizona Tax Commission,* 380 U. S. 685 (1965). The tax in no way interfered with federal land or with the National Government's proprietary interests. But it was invalidated nonetheless because "from the very first days of our Government, the Federal Government had been permitting the Indians largely to govern themselves, free from state interference." 380 U. S., at 686–687.[6] As a leading text on Indian problems

[5] The federal instrumentality doctrine does not prohibit state taxation of individuals deriving their income from federal sources. See *Graves* v. *New York ex rel. O'Keefe,* 306 U. S. 466 (1939). Cf. *Leahy* v. *State Treasurer of Oklahoma,* 297 U. S. 420 (1936). The doctrine has, in any event, been sharply limited with respect to Indians. See *Oklahoma Tax Commission* v. *United States,* 319 U. S. 598 (1943).

[6] The Court below distinguished *Warren Trading Post* as limited to cases where the Federal Government has preempted state law by regulating Indian traders in a manner inconsistent with state taxation. See 14 Ariz. App., at 455, 484 P. 2d, at 224. But although the Court was, no doubt, influenced by the federal licensing require-

summarizes the relevant law "State laws generally are not applicable to tribal Indians on an Indian reservation except where Congress has expressly provided that State laws shall apply. It follows that Indians and Indian property on an Indian reservation are not subject to State taxation except by virtue of express authority conferred upon the State by act of Congress." United States Department of Interior, Federal Indian Law 845 (1958) [hereinafter cited as Federal Indian Law].

This is not to say that the Indian sovereignty doctrine, with its concomitant jurisdictional limit on the reach of state law, has remained static during the 140 years since *Worcester* was decided. Not surprisingly, the doctrine has undergone considerable evolution in response to changed circumstances. As noted above, the doctrine has not been rigidly applied in cases where Indians have left the reservation and become assimilated into the general community. See, *e. g., Oklahoma Tax Commission* v. *United States*, 319 U. S. 598 (1943). Similarly, notions of Indian sovereignty have been adjusted to take account of the State's legitimate interests in regulating the affairs of non-Indians. See, *e. g., New York ex rel. Ray* v. *Martin*, 326 U. S. 496 (1946); *Draper* v. *United States*, 164 U. S. 240 (1896); *Utah & Northern R.* v. *Fisher*, 116 U. S. 28 (1885). This line of cases was summarized in this Court's landmark decision in *Williams* v. *Lee*, 358 U. S. 217 (1959): "Over the years this Court has modified [the *Worcester* principle] in cases where

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ments, the reasoning of *Warren Trading Post* cannot be so restricted. The Court invalidated Arizona's tax in part because "Congress has, since the creation of the Navajo Reservation nearly a century ago, left the Indians on it largely free to run the reservation and its affairs without state control, a policy which has automatically relieved Arizona of all burdens for carrying on those same responsibilities." *Warren Trading Post Co.* v. *Arizona Tax Commission*, *supra*, at 690.

essential tribal relations were not involved and where the right of Indians would not be jeopardized .... Thus, suits by Indians against outsiders in state courts have been sanctioned. . . . And state courts have been allowed to try non-Indians who committed crimes against each other on a reservation. . . . But if the crime was by or against an Indian, tribal jurisdiction or that expressly conferred on other courts by Congress has remained exclusive. . . . Essentially, absent governing Acts of Congress, the question has always been whether the state action infringes on the right of reservation Indians to make their own laws and be ruled by them." 358 U. S., at 219–220 (footnote omitted).

Finally, the trend has been away from the idea of inherent Indian sovereignty as a bar to state jurisdiction and toward reliance on federal preemption.[7] See *The Mescalaro Apache Tribe* v. *Jones*, *post*. The modern cases thus tend to avoid reliance on Platonic notions of Indian sovereignty and to look instead to the applicable treaties and statutes which define the limits of state power. Compare, *e. g.*, *United States* v. *Kagama*, 118 U. S. 375 (1886), with *Kennerly* v. *District Court*, 400 U. S. 423 (1971).[8]

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[7] The source of federal authority over Indian matters has been the subject of some confusion, but it is now generally recognized that the power derives from federal responsibility for regulating commerce with Indian tribes and for treaty making. See U. S. Const. Art. I, § 8, cl. 3; Art. II, § 2, cl. 2. See also *Williams* v. *Lee*, 358 U. S. 217, 219 n. 4 (1959); *Perrin* v. *United States*, 232 U. S. 478, 482 (1914); Federal Indian Law 3.

[8] The extent of federal preemption and residual Indian sovereignty in the total absence of federal treaty obligations or legislation is therefore now something of a moot question. Cf. *Organized Village of Kake* v. *Egan*, 369 U. S. 60, 62 (1962); Federal Indian Law 846. The question is generally of little more than theoretical importance, however, since in almost all cases, federal treaties and statutes define the boundaries of federal and state jurisdiction.

The Indian sovereignty doctrine is relevant, then, not because it provides a definitive resolution of the issues in this suit, but because it provides a backdrop against which the applicable treaties and federal statutes must be read. It must always be remembered that the various Indian tribes were once independent and sovereign nations, and that their claim to sovereignty long predates that of our own Government. Indians today are American citizens.[9] They have the right to vote,[10] to use state courts,[11] and they receive some state services.[12] But it is nonetheless still true, as it was in the last century, that "[t]he relation of the Indian tribes living within the borders of the United States [is] an anomalous one and of a complex character. . . . They were, and always have been, regarded as having a semi-independent position when they preserved their tribal relations; not as States, not as nations, not as possessed of the full attributes of sovereignty, but as a separate people, with the power of regulating their internal and social relations, and thus far not brought under the laws of the Union or of the State within whose limits they

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[9] See 8 U. S. C. § 1401 (a)(2).

[10] See, *e. g.*, *Harrison* v. *Laveen*, 67 Ariz. 337, 196 P. 2d 456 (1948).

[11] See, *e. g.*, *Felix* v. *Patrick*, 145 U. S. 317, 332 (1892).

[12] The Court below pointed out that Arizona was expending tax monies for education and welfare within the confines of the Navajo reservation. See 14 Ariz. App., at 456–457, 484 P. 2d, at 225–226. It should be noted, however, that the Federal Government defrays 80% of Arizona's ordinary social security payments to reservation Indians, see 25 U. S. C. § 639, and has authorized the expenditure of more than $88 million for rehabilitation programs for Navajos and Hopis living on reservations. See also 25 U. S. C. §§ 13, 309, 309a. Moreover, "[c]onferring rights and privileges on these Indians cannot affect their situation, which can only be changed by treaty stipulation, or a voluntary abandonment of their tribal organization." *The Kansas Indians*, 72 U. S. (5 Wall.) 737, 757 (1867).

reside." *United States* v. *Kagama*, 118 U. S. 375, 381–382 (1886).

III

When the relevant treaties and statutes are read with this tradition of sovereignty in mind, we think it clear that Arizona has exceeded its lawful authority by attempting to tax appellant. The beginning of our analysis must be with the treaty which the United States Government entered with the Navajo nation in 1868. The agreement provided, in relevant part, that a prescribed reservation would be set aside "for the use and occupation of the Navajo tribe of Indians" and that "no persons except those herein authorized to do, and except such officers, soldiers, agents, and employes of the government, or of the Indians, as may be authorized to enter Indian reservations in discharge of duties imposed by law, or the orders of the President, shall ever be permitted to pass over, settle upon, or reside in, the territory described in this article." 15 Stat. 667, 668 (1868).

The treaty nowhere explicitly states that the Navajo were to be free from state law or exempt from state taxes. But the document is not to be read as an ordinary contract agreed upon by parties dealing at arms length with equal bargaining positions. We have had occasion in the past to describe the circumstances under which the agreement was reached. "At the time this document was signed the Navajos were an exiled people, forced by the United States to live crowded together on a small piece of land on the Pecos river in eastern New Mexico, some 300 miles east of the area they had occupied before the coming of the white man. In return for their promise to keep peace, this treaty 'set apart' for 'their permanent home' a portion of what had been their native country." *Williams* v. *Lee*, 358 U. S. 217, 221 (1959).

It is circumstances such as these which have led this Court in interpreting Indian treaties, to adopt the general rule that "Doubtful expressions are to be resolved in favor of the weak and defenseless people who are the wards of the nation, dependent upon its protection and good faith." *Carpenter* v. *Shaw*, 280 U. S. 363, 367 (1930). When this canon of construction is taken together with the tradition of Indian independence described above, it cannot be doubted that the reservation of certain lands for the exclusive use and occupancy of the Navajo and the exclusion of non-Navajos from the prescribed area was meant to establish the lands as within the exclusive sovereignty of the Navajos under general federal supervision. It is thus unsurprising that this Court has interpreted the Navajo treaty to preclude extension of state law—including state tax law—to Indians on the Navajo reservation. See *Warren Trading Post Co.* v. *Arizona Tax Commission*, 380 U. S. 685, 687, 690 (1965); *Williams* v. *Lee*, *supra*, at 221–222 (1959).

Moreover, since the signing of the Navajo treaty, Congress has consistently acted upon the assumption that the States lacked jurisdiction over Navajos living on the reservation.[13] Thus, when Arizona entered the Union, its entry was expressly conditioned on the promise that the State would "forever disclaim all right and title to . . . all lands lying within said boundaries owned or held by any Indian or Indian tribes, the right or title to which shall have been acquired through and from the United States or any prior sovereignty, and that until

[13] "Congress has acted consistently upon the assumption that the States have no power to regulate the affairs of Indians on a reservation. . . . Significantly, when Congress has wished the States to exercise this power it has expressly granted them the jurisdiction which *Worcester* v. *Georgia* had denied." *Williams* v. *Lee*, 358 U. S. 217, 220–221 (1959) (footnote omitted).

the title of such Indian or Indian tribes shall have been extinguished the same shall be and remain subject to the disposition and under the absolute jurisdiction and control of the United States." Arizona Enabling Act, 36 Stat. 557, 569 (1910).[14]

Nor is the Arizona Enabling Act silent on the specific question of tax immunity. The Act expressly provides that "nothing herein, or in the ordinance herein provided for, shall preclude the said State from taxing as other lands and other property are taxed any lands and other property *outside of an Indian reservation* owned or held by any Indian." *Id.*, at 570 (emphasis added). It is true, of course, that exemptions from tax laws should, as a general rule, be clearly expressed. But we have in the past construed language far more ambiguous than this as providing a tax exemption for Indians. See, *e. g.*, *Squire* v. *Capoeman*, 351 U. S. 1, 6 (1956), and we see no reason to give this language an especially crabbed or restrictive meaning.[15]

Indeed, Congress' intent to maintain the tax exempt status of reservation Indians is especially clear in light of the Buck Act, 4 U. S. C. § 104 *et seq.*, which provides comprehensive federal guidance for state taxation of those

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[14] This language is duplicated in Arizona's own constitution. See Ariz. Const., Art. 20, ¶ 4. It is also contained in the Enabling Acts of New Mexico and Utah, the other States in which the Navajo Reservation is located. See New Mexico Enabling Act, 36 Stat. 558–559; Utah Enabling Act, 28 Stat. 108.

[15] There is nothing in *Organized Village of Kake* v. *Egan*, 369 U. S. 60 (1962), to the contrary. In *Egan*, we held that "'absolute' federal jurisdiction is not invariably exclusive jurisdiction," and that this language in federal legislation did not preclude the exercise of residual state authority. See 369 U. S., at 68. But that holding came in the context of a decision concerning the fishing rights of *nonreservation* Indians. See 369 U. S., at 62. It did not purport to provide guidelines for the exercise of state authority in areas set aside by treaty for the exclusive use and control of Indians.

living within federal areas. Section 106 (a) of Title 4 grants to the States general authority to impose an income tax on residents of federal areas, but § 109 expressly provides that "Nothing in sections 105 and 106 of this title shall be deemed to authorize the levy or collection of any tax on or from any Indian not otherwise taxed." To be sure, the language of the statute itself does not make clear whether the reference to "any Indian not otherwise taxed" was intended to apply to reservation Indians earning their income on the reservation. But the legislative history makes plain that this proviso was meant to except reservation Indians from coverage of the Buck Act, see S. Rep. No. 1625, 76th Cong., 3d Sess., 2, 4; 84 Cong. Rec. 10685 (1939), and this Court has so interpreted it. See *Warren Trading Post Co.* v. *Arizona Tax Commission*, 380 U. S. 685, 691 n. 18 (1965). While the Buck Act itself cannot be read as an affirmative grant of tax exempt status to reservation Indians, it should be obvious that Congress would not have jealously protected the immunity of reservation Indians from state income taxes had it thought that the States had residual power to impose such taxes in any event. Similarly, narrower statutes authorizing States to assert tax jurisdiction over reservations in special situations are explicable only if Congress assumed that the States lacked the power to impose the taxes without special authorization.[16]

Finally, it should be noted that Congress has now provided a method whereby States may assume jurisdiction over reservation Indians. Title 25 U. S. C. § 1322 (a) grants the consent of the United States to States wishing to assume criminal and civil jurisdiction over reservation

[16] See, *e. g.*, 25 U. S. C. § 398 (congressional authorization for States to tax mineral production on unallotted tribal lands). Cf. 18 U. S. C. § 1161 (state liquor laws may be applicable within reservations); 25 U. S. C. § 231 (state health and education laws may be applicable within reservation).

Indians, and 25 U. S. C. § 1324 confers upon the States the right to disregard enabling acts which limit their authority over such Indians. But the Act expressly provides that the State must act "with the consent of the tribe occupying the particular Indian country," 25 U. S. C. § 1322 (a),[17] and must "appropriately amend [its] constitution or statutes." 25 U. S. C. § 1324. Once again, the Act cannot be read as expressly conferring tax immunity upon Indians. But we cannot believe that Congress would have required the consent of the Indians affected and the amendment of those state constitutions which prohibit the assumption of jurisdiction if the States were free to accomplish the same goal unilaterally by simple legislative enactment. See *Kennerly* v. *District Court*, 400 U. S. 423 (1971).[18]

Arizona, of course, has neither amended its constitution to permit taxation of the Navajos nor secured the

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[17] As passed in 1953, Pub. L. 280, 67 Stat. 588, delegated civil and criminal jurisdiction over Indian reservations to certain States, although not to Arizona. See 18 U. S. C. § 1162; 28 U. S. C. § 1360. The original Act also provided a means whereby other States could assume jurisdiction over Indian reservations without the consent of the tribe affected. See 67 Stat. 590. However, in 1968, Congress passed the Indian Civil Rights Act which changed the prior procedure to require the consent of the Indians involved before a State was permitted to assume jurisdiction. See 25 U. S. C. § 1322 (a). Thus, had it wished to do so, Arizona could have unilaterally assumed jurisdiction over its portion of the Navajo Reservation at any point during the 15 years between 1953 and 1968. But although the State did pass narrow legislation purporting to require the enforcement of air and water pollution standards within reservations, see Ariz. Rev. Stat. (Cum. Supp.) § 36-1801. Ariz. Rev. Stat. (Cum. Supp.) § 36-1865, it declined to assume full responsibility for the Indians during the period when it had the opportunity to do so.

[18] We do not suggest that Arizona would necessarily be empowered to impose this tax had it followed the procedures outlined in 25 U. S. C. § 1322 *et seq.* Cf. 25 U. S. C. § 1322 (b). That question is not presently before us, and we express no views on it.

consent of the Indians affected. Indeed, a startling aspect of this case is that appellee apparently concedes that, in the absence of compliance with 25 U. S. C. § 1322 (a), the Arizona courts can exercise neither civil nor criminal jurisdiction over reservation Indians. See appellee's brief, at 24–26.[19] But the appellee nowhere explains how, without such jurisdiction, the State's tax may either be imposed or collected. Cf. Transcript of oral argument, at 38–39. Unless the State is willing to defend the position that it may constitutionally administer its tax system altogther without judicial intervention, cf. *Ward* v. *Board of County Commissioners*, 253 U. S. 17 (1920), the admitted absence of either civil or criminal jurisdiction would seem to dispose of the case.

IV

When Arizona's contentions are measured against these statutory imperatives, they are simply untenable. The State relies primarily upon language in *Williams* v. *Lee* stating that the test for determining the validity of state action is "whether [it] infringed on the right of reservation Indians to make their own laws and be ruled by them." 358 U. S., at 220. Since Arizona has attempted to tax individual Indians and not the tribe or reservation as such, it argues that it has not infringed on Indian rights of self-government.

In fact, we are far from convinced that when a State imposes taxes upon reservation members without their consent, its action can be reconciled with tribal self-determination. But even if the State's premise is accepted, we reject the suggestion that the *Williams* test was meant to apply in this situation. It must be remem-

[19] In light of our prior cases, appellee has no choice but to make this concession. See, *e. g.*, *Kennerly* v. *District Court, supra; United States* v. *Kasama*, 118 U. S. 375 (1886).

bered that cases applying the *Williams* test have dealt principally with situations involving non-Indians. See also *Organized Village of Kake* v. *Egan*, 369 U. S. 60, 75–76 (1962). In these situations, both the Tribe and the State could fairly claim an interest in asserting their respective jurisdictions. The *Williams* test was designed to resolve this conflict by providing that the State could protect its interest up to the point where tribal self-government would be affected.

The problem posed by this case is completely different. Since appellant is an Indian and since her income is derived wholly from reservation sources, her activity is totally within the sphere which the relevant treaties and statutes leave for the Federal Government and for the Indians themselves. Appellee cites us to no cases holding that this legislation may be ignored simply because tribal self-government has not been infringed.[20] On the contrary, this Court expressly rejected such a position only two years ago.[21] In *Kennerly* v. *District Court*, 400 U. S. 423 (1971), the Blackfeet Indian Tribe had voted to make state jurisdiction concurrent within the reservation. Although the State had not complied with the procedural prerequisites for the assumption of jurisdiction, it argued that it was nonetheless entitled to extend its laws to the reservation since such action was obviously consistent with the wishes of the Tribe and, therefore, with tribal self-government. But we held that the *Wil-*

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[20] *Organized Village of Kake* v. *Egan*, 369 U. S. 60 (1962), is not such a case. See n. 15, *supra*.

[21] Indeed, the position was expressly rejected in *Williams* itself, upon which appellee so heavily relies. *Williams* held that "*absent governing Acts of Congress*, the question has always been whether the state action infringed on the right of reservation Indians to make their own laws and be ruled by them." 358 U. S., at 220 (emphasis added).

liams rule was inapplicable and that "[t]he unilateral action of the Tribal Council was insufficient to vest Montana with jurisdiction." 400 U. S., at 427. If Montana may not assume jurisdiction over the Blackfeet by simple legislation even when the Tribe itself agrees to be bound by state law, it surely follows that Arizona may not assume such jurisdiction in the absence of tribal agreement.

Nor is the State's attempted distinction between taxes on land and on income availing. Indeed, it is somewhat surprising that the State adheres to this distinction in light of our decision in *Warren Trading Post Co.* v. *Arizona Tax Commission, supra,* wherein we invalidated an *income tax* which Arizona had attempted to impose within the Navajo Reservation. However relevant the land-income distinction may be in other contexts, it is plainly irrelevant when, as here, the tax is resisted because the State is totally lacking in jurisdiction over both the people and the lands it seeks to tax. In such a situation, the State has no more jurisdiction to reach income generated on reservation lands than to tax the land itself.

Finally, we cannot accept the notion that it is irrelevant "whether the . . . state income tax infringes on [appellant's] rights as an individual Navajo Indian," as the State Court of Appeals maintained. *McClanahan* v. *State Tax Commission,* 14 Ariz. App. 452, 454, 484 P. 2d 221, 223 (1970). To be sure, when Congress has legislated on Indian matters, it has, most often, dealt with the tribes as collective entities. But those entities are, after all, composed of individual Indians, and the legislation confers individual rights. This Court has therefore held that "the question has always been whether the state action infringed on the right of *reservation Indians* to make their own laws and be ruled by them." *Williams* v. *Lee, supra,* at 220 (emphasis added). In

this case, appellant's rights as a reservation Indian were violated when the state collected a tax from her which it had no jurisdiction to impose. Accordingly, the judgment of the court below must be

Reversed.

NOTE: Where it is feasible, a syllabus (headnote) will be released, as is being done in connection with this case, at the time the opinion is issued. The syllabus constitutes no part of the opinion of the Court but has been prepared by the Reporter of Decisions for the convenience of the reader. See *United States* v. *Detroit Lumber Co.*, 200 U.S. 321, 337.

SUPREME COURT OF THE UNITED STATES

Syllabus

McCLANAHAN v. ARIZONA STATE TAX COMMISSION

APPEAL FROM THE COURT OF APPEALS OF ARIZONA, DIVISION ONE

No. 71–834. Argued December 12, 1972—Decided March 27, 1973

The State of Arizona has no jurisdiction to impose a tax on the income of Navajo Indians residing on the Navajo Reservation and whose income is wholly derived from reservation sources, as is clear from the relevant treaty with the Navajos and federal statutes. Pp. 4–18.

14 Ariz. App. 452, 484 P. 2d 221, reversed.

MARSHALL, J., delivered the opinion for a unanimous Court.

SOVEREIGNTY OF INDIAN NATIONS

Mr. COULTER. The Supreme Court had before it a problem of sovereignty of Indian nations. This was a very integral part of both of those two cases. In the course of discussing the sovereignty problem, the Court has clearly indicated, it seems to me, that the Indian people on the reservation do have certain rights. But these rights are vested in the Congress of the United States.

Mrs. HANSEN. But these cases only pertain to reservation Indians?

Mr. COULTER. Yes. Those two cases pertain only to reservations.

SNYDER ACT

A third case was handed down, I believe, by the court of appeals—I could be wrong on the court—a few months ago interpreting the Snyder Act relative to urban Indians. I think you would be interested in a copy of that decision as well.

Mrs. HANSEN. We would, because the Snyder Act has far-reaching implications.

Mr. COULTER. Yes; the Snyder Act is very broad in its terms. The court construed it in a welfare case. I think that opinion would be of interest to the committee as well. We will be most happy to supply that to you.

Mrs. HANSEN. Please do.

[The information follows:]

Ramon RUIZ and Anita Ruiz, Plaintiffs-Appellants,

v.

Rogers C. B. MORTON, Secretary of the Interior, Defendant-Appellee.

No. 25568.

United States Court of Appeals, Ninth Circuit.

May 31, 1972.

Rehearing Denied Aug. 31, 1972.

Unemployed members of Indian Tribe who lived off reservation sought to obtain general assistance benefits from Bureau of Indian Affairs. The United States District Court for the District of Arizona, James A. Walsh, Chief Judge, dismissed complaint and entered judgment in favor of the Secretary of Interior, and plaintiffs appealed. The Court of Appeals, Kilkenny, Circuit Judge, held that phrase "throughout the United States," within provision of Snyder Act authorizing Bureau of Indian Affairs, as supervised by Secretary of the Interior, to expend such monies as Congress may from time to time appropriate for benefit, care, and assistance of Indians throughout the United States, is expansive in meaning and is not the type of restrictive phrase Congress would presumably have utilized had it intended to limit general assistance to reservation Indians, and further held that even if position of Bureau of Indian Affairs that general assistance provision of Snyder Act is limited to reservation Indians was consistent on issue of responsibility for off-reservation Indians, where intent of Snyder Act was clearly to provide assistance for Indians on and off the reservation, Bureau could not amend intention by regulation.

Reversed and remanded with instructions.

Merrill, Circuit Judge, dissented and filed opinion.

1. Statutes ⇐206

Statutes are to be given, wherever possible, such effect that no clause, sentence or word is rendered superfluous, void, contradictory or insignificant.

2. Statutes ⇐188

Absent persuasive reasons to contrary, courts will give statutory words their ordinary meaning.

3. Indians ⇐6

Phrase "throughout the United States," within provision of Snyder Act authorizing Bureau of Indian Affairs, as supervised by Secretary of the Interior, to expend such monies as Congress may from time to time appropriate for benefit, care, and assistance of Indians throughout the United States, is expansive in meaning and is not the type of restrictive phrase Congress would presumably have utilized had it intended to limit general assistance to reservation Indians. 25 U.S.C.A. § 13.

See publication Words and Phrases for other judicial constructions and definitions.

4. Indians ⇐6

Statutes, such as the Snyder Act, passed for the benefit of Indians and Indian communities, are to be liberally construed. 25 U.S.C.A. § 13.

5. Administrative Law and Procedure ⇐386

An administrative agency has no power to create a rule or regulation that is out of harmony with statutory grant of its authority.

6. Indians ⇐6

Even if position of Bureau of Indian Affairs that general assistance provision of Snyder Act is limited to reservation Indians was consistent on issue of responsibility for off-reservation Indians, where intent of Synder Act was clearly to provide assistance for Indians on and off the reservation, Bureau could not amend intention by regulation. 25 U.S.C.A. § 13.

Winton D. Woods, Jr. (argued), Tucson, Ariz., Lindsay Brew (argued), Sells, Ariz., Anthony B. Ching, Tucson, Ariz., for plaintiffs-appellants.

Carl Strass, Washington, D. C. (argued), Raymond N. Zagone, Shiro Kashiwa, Asst. Atty. Gen., Washington, D. C., Richard K. Burke, U. S. Atty., Richard S. Allemann, Asst. U. S. Atty., Phoenix, Ariz., for defendant-appellee.

Before BARNES, MERRILL and KILKENNY, Circuit Judges.

KILKENNY, Circuit Judge:

Ramon and Anita Ruiz, appellants in this cause, are members of the Papago Tribe of American Indians. They reside with one of their children in Ajo, Arizona, some fifteen miles from the Papago Indian Reservation. The Ruiz home is in a section of Ajo known as the "Indian Village," where the community is predominantly of Papago origin.

Appellants left the Papago Reservation approximately thirty years ago to seek employment in the copper mines near Ajo, operated by the Phelps-Dodge Company. Ramon Ruiz worked in the copper mines until they were closed by a strike on July 19, 1967. Unable to obtain other employment, Ruiz sought welfare assistance from the state of Arizona. He was informed by the Pima County Welfare Director, however, that neither general assistance nor emergency relief from the Arizona Department of Public Welfare was available to striking union members.[1] At the time, the Ruiz family was receiving fifteen dollars per week from the union in the form of strike benefits.

On December 11, 1967, Ruiz applied for general assistance benefits from the Bureau of Indian Affairs [Bureau]. The Bureau notified appellants by letter of December 13, 1967, that such benefits were not available to them. Ruiz appealed to the Superintendent of the Papago Indian Agency, then to the Phoenix Area Director of the Bureau, and was granted a hearing before the latter on January 23, 1968. Under departmental regulations, general assistance benefits are made available only to those Papago Indians living within the boundaries of a reservation.[2] The Ruiz appeal was denied on January 25, 1968. The parties agree that the sole reason for the denial of general assistance benefits to appellants was the fact that they resided outside the boundaries of the Papago Reservation.

On February 19, 1968, appellants brought their action in federal district court to compel payment of general assistance benefits to them. The court, after a hearing on cross-complaints for summary judgment, dismissed the complaint and entered judgment in favor of the Secretary of the Interior. This appeal followed.[3]

Appellants contend that the policy of the Secretary and the Bureau is inconsistent with (1) Congressional intent to provide aid for needy Indians, and (2) constitutional due process.

[1] The initial legislative approval of expenditures here characterized as "general assistance," the Snyder Act of 1921,[4] authorized the Bureau, as supervised by the Secretary of the Interior, to expend "such moneys as Congress may from time to time appropriate, for the benefit, care, and assistance of the Indians *throughout the United States*. . . ." [Emphasis supplied] In evalu-

1. *See*, 15 A.R.S. § 46-233, subsec. A, par. 4 [Supp.1971]; *see also*, letter of November 8, 1968, from Pima County Welfare Director Ever L. Hanson to appellants' attorneys.

2. 66 Bureau of Indian Affairs Manual 3.1.4(A).
"*Residence.* Eligibility for general assistance is limited to Indians living on reservations and in jurisdictions under the Bureau of Indian Affairs in Alaska and Oklahoma."

3. The Secretary does not raise the issue of mootness on this appeal: in any event, we note that the "continuing controversy" limitation on the mootness doctrine applies here. Friend v. United States, 128 U.S.App.D.C. 323, 388 F.2d 579, 581 (1967); Women Strike for Peace v. Hickel, 137 U.S.App.D.C. 29, 420 F.2d 597, 604 (1969); *cf.*, Quevedo v. Collins, 414 F.2d 796, 797 (5th Cir. 1969).

4. 25 U.S.C. § 13, 42 Stat. 208 (1921).

ating the Congressional intent that lay behind this enactment, we keep in mind the rule that statutes are to be given, wherever possible, "such effect that no clause, sentence or word is rendered superfluous, void, contradictory or insignificant." Rockbridge v. Lincoln, 449 F.2d 567, 571 (9th Cir. 1971); Richards v. United States, 369 U.S. 1, 11, 82 S.Ct. 585, 7 L.Ed.2d 492 (1962).

[2, 3] The Snyder Act provides that benefits are to be available to Indians "throughout" the United States and, absent persuasive reasons to the contrary, courts will give statutory words their ordinary meaning. Banks v. Chicago Grain Trimmers Ass'n, 390 U.S. 459, 465, 88 S.Ct. 1140, 20 L.Ed.2d 30 (1968). The ordinary meaning of the preposition "throughout" is expansive,[5] and it is not the type of restrictive word Congress would presumably have utilized had it intended to limit general assistance to reservation Indians. There is nothing equivocal about the phrase "throughout the United States," nor do we find anything in the legislative history of the Act that counters its broad thrust.

Although, as the Secretary argues, it is evident that Congress did not intend to create new programs through passage of the Snyder Act, neither did it intend to constrict the Bureau's jurisdiction nor the scope of expenditures already being made by the agency.[6] It is not precisely clear what these earlier expenditures encompassed, but they included general funds for "numerous activities . . . undertaken in order to more speedily bring about the civilization of the Indian tribes. . . ."[7] It is clear, moreover, that the jurisdictional responsibility of the Bureau had traditionally extended beyond the borders of the reservation. The authority of the Commissioner of Indian Affairs substantially pre-dated the establishment of many reservations, and his jurisdictional mandate was sweeping.[8] Congressional interest in the general welfare of those Indian tribes not hostile to the United States was apparent in the period surrounding the creation of the commissioner's office,[9] and was reflected in the broad grant of authority to that office.

[4] This legislative and administrative background supports the reading we have given the statute, applying the ordinary sense of its text. That background indicates Congressional concern extending to the general welfare of all Indians, irrespective of their place of residence. Our duty is to construe the Act in a fashion which best serves the clearly indicated legislative purpose, and we decline to adopt a narrow reading that would counter the wide responsibility that Congress has entrusted to the Bureau. Hudson Distributors, Inc. v. Eli Lilly & Co., 377 U.S. 386, 84 S.Ct. 1273, 12 L.Ed.2d 394 (1964); Federal Trade Commission v. Fred Meyer, Inc., 390 U.S. 341, 88 S.Ct. 904, 19 L.Ed.2d

5. The preposition "throughout" is defined in Webster's New International Dictionary, 2d Edition, as follows: "All the way from one end to the other of; in or to every part of; during the whole course or period of; as *throughout* the house; *throughout* the year."

6. H.R.Rep.No.275, 67th Cong., 1st Sess. (1921); S.Rep.No.294, 67th Cong., 1st Sess. 52 (1921).

7. Letter from Acting Secretary of the Interior, E. C. Finney, to Sen. Charles Curtis, Chairman of the Committee on Indian Affairs, August 19, 1921; S.Rep. No.294, 67th Cong., 1st Sess. 52 (1921).

8. The office of Commissioner of Indian Affairs was established in 1832, to have "the direction and management of all Indian affairs, and of all matters arising out of Indian relations. . . ." 4 Stat. 564, 22nd Cong., 1st Sess., Ch. 174 (1832).

9. *Cf.*, 4 Stat. 564, 22nd Cong., 1st Sess., Ch. 174, § 4 (1832) [prohibition of "ardent spirits" in Indian country]; 4 Stat. 514, 22nd Cong., 1st Sess., Ch. 75 (1832) [making available supplies of smallpox vaccine to the Indian tribes]; 4 Stat. 616, 22nd Cong., 2d Sess., Ch. 40 (1833) [appropriations for Indian annuities]; 4 Stat. 705, 22nd Cong., 2d Sess., Ch. 105 (1833) [appropriations of general benefits to "effect certain Indian treaties."].

1222 (1968); Logan Lanes, Inc. v. Brunswick Corp., 378 F.2d 212 (9th Cir. 1967), cert. denied, 389 U.S. 898, 88 S. Ct. 219, 19 L.Ed.2d 216 (1967). Even if some uncertainty as to the construction of the Act existed, we would be compelled to resolve it in favor of the appellants.[10] Statutes, such as the Snyder Act, passed for the benefit of Indians and Indian communities, are to be liberally construed. Rockbridge v. Lincoln, *supra*; Hopkins v. United States, 414 F.2d 464 (9th Cir. 1969). In light of the foregoing, we conclude that Congress intended general assistance benefits to be available to all Indians, including those in the position of appellants, at the time the Snyder Act was passed.

Congressional action following the Snyder Act illustrates the continuing broad scope of responsibility lodged in the Bureau, with no indication of any developing policy to exclude nonreservation Indians. The House Report on the Johnson-O'Malley Act of 1934,[11] for example, asserted federal responsibility for the Welfare of those Indians intermixed with the general community, and concluded that it would be advantageous to permit certain health and educational services for those Indians to be transferred to state agencies for reasons of economical administration. The transfers were to impose no additional financial burden on the states, since the cost of providing services to the nonreservation Indians would be borne by the federal government. This report had the approval of the Commissioner of Indian Affairs, whose accompanying letter did not indicate any reticence to provide services for these off-reservation groups.[12] Later federal action in the area of welfare does not reveal any intent to displace the general assistance system of the Snyder Act, originally available to *all Indians*. The legislative history of the Social Security Act, to illustrate, is silent on that legislation's relationship to the Snyder Act. In sum, neither party has indicated to us a federal act usurping the jurisdiction of the Bureau over Indian welfare, granted in 1832 and reaffirmed by the Snyder Act.

Nor, for that matter has the agency itself shown a less expansive attitude than Congress toward its jurisdiction in related areas of service. Scholarship funds are available to off-reservation students.[13] General assistance grants are available to those Indians in Alaska and Oklahoma not living on reservations.[14] Loans "to promote the economic development of the borrower" can be obtained by Indians and Indian groups without apparent regard for residency.[15] Health benefits, adminis-

10. As the Supreme Court has stated in the context of unclear Congressional intent:

> "Doubtful expressions are to be resolved in favor of the weak and defenseless people who are wards of the nation, dependent upon its protection and good faith." Squire v. Capoeman, 351 U.S. 1, 6-7, 76 S.Ct. 611, 615, 100 L.Ed. 883 (1956).

11. H.R.Rep.No.864, 73d Cong., 2d Sess. (1934).

12. "In many sections of the country there are many people of Indian blood who are so definitely a part of the general population that it is neither necessary nor wise for the Federal Government to deal with them on any segregated plan. In much of this rural area where Indians are living, educational, health, and other facilities are so limited that it is highly desirable for the Federal Government and the several States to combine resources wherever possible. This has been done in the field of education and has resulted in arrangements whereby many Indian children are attending local public schools successfully with whites.

> * * * * *

> In the case of Indians living in widely scattered communities, we find it extremely difficult to render effective service and cooperative endeavors with State authorities which would help both Indians and whites living in these more isolated areas." Letter of February 26, 1934, from John Collier, Commissioner of Indian Affairs; *see* H.R.Rep.No.864, 73d Cong., 2d Sess. (1934).

13. 25 C.F.R. § 32.1.

14. 66 Bureau of Indian Affairs Manual 3.1.4(A).

15. 25 C.F.R. § 91.

tered in conjunction with the Public Health Service are made available to off-reservation Indian groups.[16] Various Commissioners of the Bureau have proclaimed, in justifying their budget requests, that agency services extended to Indians on *or near* reservations,[17] and have used the total Indian population of the United States in citing the number of people their agency serves.[18] Needless to say, the Bureau cannot be permitted to expand and contract its jurisdiction to justify its own purposes at the expense of the group it aids.

[5, 6] Despite the foregoing, the Secretary's position is that Congress was well aware of the agency's limitation of general assistance to reservation Indians, and has acquiesced in agency policy by making appropriations limited to that group. We note that an administrative agency, such as the Bureau, has no power to create a rule or regulation that is out of harmony with the statutory grant of its authority. Dixon v. United States, 381 U.S. 68, 74, 85 S.Ct. 1301 (1965); Brannan v. Stark, 342 U.S. 451, 72 S.Ct. 433, 96 L.Ed. 497 (1952). Even if its position were consistent on the issue of responsibility for off-reservation Indians, there is no support in the statute for the distinction drawn by the agency. In our view, the intent of the Snyder Act is unambiguous, and the agency cannot amend it by regulation. Koshland v. Helvering, 298 U.S. 441, 56 S.Ct. 767, 80 L.Ed. 1268 (1936).[19] Be

16. Hearings on H.R. 6767, Before a Subcommittee of the Senate Committee on Appropriations, on Department of the Interior and Related Agencies Appropriations, 89th Cong., 1st Sess., pt. 1 at 999–1001 (1965); *cf.*, 42 C.F.R. § 36.12.

17. *E. g.*, Commissioner Robert L. Bennett, Hearings on H.R. 17354, Before a Subcommittee of the Senate Committee on Appropriations, on Department of the Interior and Related Agencies Appropriations, 90th Cong., 2d Sess., pt. 1 at 368 (1968); Commissioner Philleo Nash, Hearing on H.R. 6767, Before a Subcommittee of the Senate Committee on Appropriations, on Department of the Interior and Related Agencies Appropriations, 89th Cong., 1st Sess., pt. 1 at 637 (1965).

In addition, testimony of various Bureau officials has indicated varying degrees of responsibility for off-reservation Indians. In 1959, Senator Mundt was told that from ten to twenty thousand Indians in Los Angeles alone were receiving general assistance, health insurance policies, and other services as part of the Bureau relocation program. Hearings on H.R. 5915, Before a Subcommittee of the Senate Committee on Appropriations, on Department of the Interior and Related Agencies Appropriations, 86th Cong., 1st Sess., at p. 337 (1959). Indians in other cities, whether part of the relocation program or not, were apparently receiving some assistance. *Id.*, at 338. In 1960, the House Committee on Appropriations was told that the Bureau assumes "some responsibility" for Indians living adjacent to reservations, as well as those on reservations, in its relocation program. Hearing on Bureau of Indian Affairs Budget, Before a Subcommittee of the House Committee on Appropriations, on Department of the Interior and Related Agencies Appropriations, 86th Cong., 2d Sess., pt. 1 at 512 (1960).

18. Hearings on H.R. 5189, Before a Subcommittee of the Senate Committee on Appropriations, on Interior Department and Related Agencies Appropriations, 85th Cong., 1st Sess. at 284 (1957); Hearings, Before a Subcommittee of the House Committee on Appropriations, on Interior Department and Related Agencies Appropriations, 84th Cong., 2d Sess. at 460 (1956); Hearings, Before a Subcommittee of the House Committee on Appropriations, on Interior Department Appropriations [Bureau of Indian Affairs], 82d Cong., 2d Sess., pt. 1, at 202 (1952); Hearings, Before a Subcommittee of the House Committee on Appropriations, on Interior Department Appropriations [Bureau of Indian Affairs], 82d Cong., 1st Sess., at 264–265 (1951).

19. See Generally I. K. Davis, Administrative Law Treatise, §§ 5.01, et seq. (1958). Professor Davis notes that even long-standing regulations are not immune to scrutiny by the courts. Where an agency had excluded payments under the Social Security Act that the Supreme Court thought were included by Congress, the practice was overturned, as being beyond the limits of administrative interpretation. Social Security Board v. Nierotko, 327 U.S. 358, 66 S.Ct. 637, 90 L.Ed. 718 (1946).

that as it may, the legislative history does not reveal a clear-cut policy on the part of the Bureau toward off-reservation groups. The first formalized notice of its restrictive residence policy appeared on May 12, 1952, with the publication of the Indian Affairs Manual.[20] At times, both prior to and following the rule's publication, the Bureau seems to have accepted responsibility for those non-reservation Indians living close to the reservation, excluding only those Indians in large metropolitan centers.[21] At other times, Bureau officials seem to refer only to reservation Indians when discussing the services they offer.[22] By 1966, the Bureau was providing full welfare benefits for certain off-reservation groups, denying benefits entirely to other groups, and considering the provision of limited general assistance to still other groups.[23] This confusion over jurisdictional responsibility belies any assertion that there was a well-defined administrative position, known to and approved by Congress.[24] The Bureau is

20. 66 Bureau of Indian Affairs Manual 3.1.4(A): Unlike most of the regulations referred to herein, this residency restriction appears only in the Manual and does not appear in the Code of Federal Regulations. Apparently the agency is of the opinion that this section does not "relate to the public, including Indians." *See*, Introduction to Bureau of Indian Affairs Manual, § 1.2.

21. Hearings on H.R. 10433, Before a Subcommittee of the Senate Committee on Appropriations, on Interior Department and Related Agencies Appropriations, 88th Cong., 2d Sess., 227–228 (1964).

"Senator Bible. How many Indians do you have under your jurisdiction?

Mr. Nash. 380,000.

Senator Bible. How many nonreservation Indians do you have? Are those just reservation Indians?

Mr. Nash. These are *on or near*. This would not include, for example, Indians living in Los Angeles, San Francisco, Chicago, Denver, Minneapolis, *unless they were brought there as part of our vocational training or relocation programs.*" [Emphasis added.]

* * * * *

"Senator Bible. . . . where does your jurisdiction rest in that regard? Do you have a measuring stick [with regard to blood].

Mr. Nash. No, sir. Our basis for providing services to an Indian is primarily on real estate. That is, we service those individuals who reside on trust or restricted land, or so close to it that the program of the reservation would be affected by services not performed for that person."

22. Hearings on Bureau of Indian Affairs Budget, Before a Subcommittee of the House Committee on Appropriations, on Interior Department and Related Agencies Appropriations, 86th Cong., 1st Sess., at 801 (1959):

"Miss Gifford. . . . I believe the question comes up concerning Indians living off the reservation and who are in need not for these categories [areas covered by Social Security] but for other types of assistance. In many cases the States and counties say that those Indians ought to be the responsibility of the Bureau of Indian Affairs; that they do not have sufficient funds to take care of them. We have *never* included in our request for welfare appropriations funds to take care of the needs of those Indians *living off the reservation.*" [Emphasis Added.]

23. The Bureau was providing "100 percent of the needs" of an Indian person or family who moved to a new location under the Bureau relocation program. These services could extend up to three years in a state such as California, which had a three-year residency requirement at the time. Contract medical care was available to Indians remote from one of the Bureau facilities. A new program was recommended for offering complete health care services to Indians living in Rapid City, South Dakota, apparently prompted by the inquiries of Senator Mundt.

On the other hand, the Bureau was denying general assistance to Indians who relocated on their own, and presumably those in the category of appellants. Hearings on H.R. 14215, Before a Subcommittee of the Senate Committee on Appropriations, on Department of the Interior and Related Agencies Appropriations, 89th Cong., 2d Sess., pt. 1, 295–302 (1966).

24. The confusion over Bureau jurisdiction had not been cleared up as late as 1971. The following colloquy between Senator

capable of articulating its position on other policy matters for consideration and adoption by Congress.[25] It has not done so here.

We conclude that the Bureau has imposed unauthorized residency restrictions upon the availability of general assistance benefits, in excess of its authority and in contravention of Congressional intent. In so holding, we do not reach the constitutional due process question raised by appellants, and express no view on the issue of whether Congress could, if it so desired, limit general assistance benefits to reservation Indians.

We hold that, under the circumstances of this case, it was improper for the Bureau to deny general assistance benefits on the basis of residency alone.

The judgment is accordingly reversed and remanded to the district court with instructions to enter a judgment in conformity herewith.

MERRILL, Circuit Judge (dissenting):

I dissent.

The question concerns the reasonableness of the construction effectively placed upon the Snyder Act by the regulation.[1] I do not find that construction to be unreasonable.

Bible and Mr. Bruce of the Bureau illustrates:

"Senator Bible. . . . Now what Indians are under your jurisdiction that you have a responsibility for?

First, give the qualifications. *I have never been quite sure who qualifies.* [Emphasis Added.] I have heard one-sixth and one-eighth and one-thirty-second and all kinds. What rule do you use to determine who is under your jurisdiction? Who is under the jurisdiction of the Bureau of Indian Affairs?

Mr. Bruce. American Indians living on reservations, one-fourth degree blood or more living in the United States and Alaska.

Senator Bible. One-fourth degree or more is one of the qualifications. They must also live on a reservation?

Mr. Bruce. On or near.

INDETERMINATE DEFINITIONS OF "NEAR"

Senator Bible. What does the word "near" mean?

Mr. Bruce. It is very difficult to define. *Near reservation would be a nearby community.* [Emphasis Added.]

Senator Bible. Well, half a mile, 1 mile, 5 miles, 100 yards? I am just trying to find out what your jurisdiction is. You have some responsibilities. Now what are you responsible for?

Mr. Bruce. They vary and that is why it is difficult to answer specifically.

Senator Bible. Well, give me the variable then. From 100 yards up to 10 miles?

Is that defined in a statute anywhere? If I was to become the Commissioner of Indian Affairs, God forbid, how would I know who I had jurisdiction over? They must make some determination.

Mr. Bruce: There is a definition for Oklahoma, and Alaska.

* * * * *

Senator Bible. . . . what do your lawyers tell you is your jurisdiction? Can you go into the heart of Manhattan and find some Indian with one-fourth degree of Indian blood? Do you have jurisdiction over him in the heart of Manhattan?

Mr. Bruce. No, sir; not over Manhattan."

Hearings on H.R. 9417, Before a Subcommittee of the Senate Committee on Appropriations, on Department of the Interior and Related Agencies Appropriations, 92d Cong., 1st Sess., pt. 1, at 751 (1971). *See also*, House Hearing on the same appropriations, generally.

25. 66 Bureau of Indian Affairs Manual 3.1.4(B). The problem of duplication between federal and state welfare benefits, or other federal benefits administered by the states had been thoroughly aired, and Congressional approval of the Bureau's position is readily apparent.

1. Great weight is to be attributed to a regulation of such long standing. *See* Udall v. Tallman, 380 U.S. 1, 16, 85 S.Ct. 792, 13 L.Ed.2d 616 (1965). This court has similarly emphasized the deference owing to a regulation promulgated by an agency that is responsible for administration in the sphere in which the regulation operates. *See, e. g.*, Udall v. Battle Mountain Co., 385 F.2d 90, 94-96 (9th Cir. 1967), cert. denied, 390 U.S. 957, 88 S.Ct. 1041, 19 L.Ed.2d 1151 (1968).

Here, the regulation of the Bureau of Indian Affairs limiting general assistance benefits to Indians living on reservations (with exceptions for the special cases of

I think it important to note that the statute is simply one authorizing expenditures for the Indians. *See* S.Rep. No.294, 67th Cong., 1st Sess. (1921); H.Rep.No.275, 67th Cong., 1st Sess. (1921); 61 Cong.Rec. 4659, 4668–69, 4671–73, 4675, 4680, 4683–84 (1921). As such, it is quite naturally stated in the broadest terms and thus allows the Bureau of Indian Affairs to help Indians everywhere in the nation. As one commentator has noted, the Act was "intended merely as an authorization for general appropriations," with the specifics of administration left to the Secretary of the Interior and the Bureau. Wolf, Needed: A System of Income Maintenance for Indians, 10 Ariz.L.Rev. 597, 607–08 (1968).

But the granting of broad authority does not preclude (indeed, it seems to require) reasonable Bureau decisions as to how its limited funds may best be allocated and the drawing of reasonable classifications determining areas of greatest need. It does not to me seem an unreasonable determination that reservation Indians, who apparently have less employment opportunity, see Wolf, *supra*, at 598, and greater difficulty in obtaining state assistance, *see id.* at 599–606, 608–09, comprise a category particularly in need of ongoing, general financial assistance, while off-reservation Indians generally are in a better position to fend for themselves. Further, the difficulties of administering a system of general aid, if extended off reservations, would pose substantial problems.[2]

As to the constitutional questions, which the majority found it unnecessary to reach, for the reasons stated I do not regard the classifications drawn as unreasonable and a denial of equal protection. Dandridge v. Williams, 397 U.S.

Bureau jurisdictions in Alaska and Oklahoma), 66 Indian Affairs Manual 3.1.4 (A), was first issued in 1952. The Bureau's policy reflected in the regulation has been repeatedly presented to Congress. *See, e. g.*, Hearings on H.R. 9029 Before Subcom. of Senate Appropriations Comm., 90th Cong., 1st Sess., pt. 1, at 695 (1967); Hearings on Dep't of Interior & Related Agencies Appropriations for 1968 Before Subcom. of House Appropriations Comm., 90th Cong., 1st Sess., pt. 1, at 777 (1967); Hearings on H.R. 14215 Before Subcom. of Senate Appropriations Comm., 89th Cong., 2d Sess., pt. 1, at 267, 298, 301–302 (1966); Hearings on Dep't of Interior & Related Agencies Appropriations for 1967 Before Subcom. of House Appropriations Comm., 89th Cong., 2d Sess., pt. 1, at 255 (1966); Hearings on H.R. 6767 Before Subcom. of Senate Appropriations Comm., 89th Cong., 1st Sess., pt. 1, at 653 (1965); Hearings on Dep't of Interior & Related Agencies Appropriations for 1966 Before Subcom. of House Appropriations Comm., 89th Cong., 1st Sess., pt. 1, at 747; Hearings on H.R. 10433 Before Subcomm. of Senate Appropriations Comm., 88th Cong., 2d Sess., at 148 (1964); Hearings on Dep't of Interior & Related Agencies Appropriations for 1965 Before Subcom. of House Appropriations Comm., 88th Cong., 2d Sess., at 775 (1964); Hearings on H.R. 5279 Before Subcom. of Senate Appropriations Comm., 88th Cong., 1st Sess., at 70 (1963); Hearings on Dep't of Interior & Related Agencies Appropriations for 1964 Before Subcom. of House Appropriations Comm., 88th Cong., 1st Sess., at 843–844 (1963). *See also* Hearings on H.R. 10746 Before Subcomm. of Senate Appropriations Comm., 85th Cong., 2d Sess., at 292 (1958); Hearings on Dept. of Interior & Related Agencies Appropriations for 1960 Before Subcomm. of House Appropriations Comm., 86th Cong., 1st Sess., at 801 (1959).

That the Bureau has provided assistance in various forms to off-reservation Indians, *e. g.*, through programs offering relocation, educational and health care services, should not alter, in my view, this court's assessment of the Bureau's policy with regard to general assistance benefits. *See* text and note 2 *infra*. Nor do I find the majority's discussion of *jurisdictional* uncertainty on the part of the Bureau to be relevant to the narrower issue presented here as to the limited character of the general assistance program.

2. *See, e. g.*, Hearings on H.R. 14215 Before Subcomm. of Senate Appropriations Comm., 89th Cong., 2d Sess., pt. 1, at 301–302 (1966); Hearings on Dep't of Interior & Related Agencies Appropriations for 1960 Before Subcomm. of

471, 90 S.Ct. 1153, 25 L.Ed.2d 491 (1970).

Nor do I find merit in appellants' contention that the regulation infringes their right to travel under Shapiro v. Thompson, 394 U.S. 618, 89 S.Ct. 1322, 22 L.Ed.2d 600 (1969). The question there was the right of those who had recently traveled to and established residence in a particular state or the District of Columbia to stand on an equal footing respecting welfare benefits with others similarly situated in their new place of residence. It did not suggest that the travelers could claim benefits equal to those who had chosen to stay behind.

Accordingly I would affirm.

Mrs. HANSEN. What did that decision hold?

Mr. COULTER. That decision held that urban Indians were entitled to the benefits of the Snyder Act.

Mrs. HANSEN. This is in essence providing reservation benefits to all Indians.

Mr. COULTER. Yes.

CONFLICT WITH CIVIL RIGHTS

Mrs. HANSEN. How far can that go without conflicting with our basic civil rights?

Mr. COULTER. Madam Chairman, I wouldn't have an answer to that.

Mrs. HANSEN. Supposing other minorities wanted a special fund to be set aside for their use only. This would not, as I understand, comply with the constitutional interpretation of the Civil Rights Act.

Mr. COULTER. I think that is right.

Mrs. HANSEN. We are on a collision course.

Mrs. COULTER. We could very well be, Madam Chairman.

Mrs. HANSEN. The feeling has been by the reservation Indians that they have no objection to helping all Indians but they did not want their limited funding stretched ad infinitum to provide services to urban Indians.

URBAN INDIANS—BUDGETARY CONCERNS

If the Federal Government is going to recognize the court decision that urban Indians are entitled to the benefits of the Synder Act, a substantial budgetary recommendation must be entertained by this committee. Instead of an appropriation of $550 million, it would be necessary, I would guess, to provide approximately $1 billion annually. If this $1 billion is provided for the Indians, then I foresee other minorities demanding special funding.

Mr. Wiles, please inform those architects of policy at BIA to be able to explain the situation if the Snyder Act were applied to all Indians in terms of dollars for the current fiscal year.

Mr. WILES. Madam Chairman, may I understand your request. You want to know what their best guess is as to how much money would be needed if the Synder Act were applied?

Mrs. HANSEN. Yes. The question you have to answer is when the Federal Government guarantees the welfare payments and education payments, does this remove liability of the State to furnish these same services?

The question would be how much does that mean in terms of dollars for the 50 States.

Mr. WILES. Let me be sure I understand, Mrs. Hansen.

EXAMPLE OF FUNDING COMPLEXITIES

Mrs. HANSEN. For example, a school district is receiving at the present time Johnson-O'Malley funds. Forty miles down the road there is another school district and they have Indian youngsters who have been receiving State aid. In my own State, 47 percent of the amount of money that my school district receives is from the State of Washington. This is an equalization fund.

If the Federal Government is going to meet the school costs for these Indians, this school district is likely to receive a decrease in funding from the State. That is one example.

WELFARE PAYMENTS

You also have States which are now assuming the full burden of welfare costs. In this instance would the urban Indian in my State receive welfare from the State of Washington, or would the entire welfare check be paid by the BIA? These are the two major problems that are involved, as I see them.

Mr. WILES. What I was thinking of here, Madam Chairman, is what effect, if any, would this have on, say, Chicago and Los Angeles, if you want that, too.

Mrs. HANSEN. The decision on the Snyder Act has been made in one of the courts, certainly. I think the committee is faced with this problem.

DETERMINATION OF POLICY

Are we moving toward the time of a total broad determination? What will be the cost of that total determination?

I would like the Solicitor's Office to supply the committee an opinion as to the effect of a broadly interpreted Synder Act and its relationship to the Civil Rights Act and our treaty obligations.

Mr. COULTER. Could I make one comment?

Mrs. HANSEN. Yes.

Mr. COULTER. I would expect, Madam Chairman, that an opinion of that nature is going to be a very extensive opinion.

Mrs. HANSEN. I understand.

Mr. COULTER. It might take some time to develop. I won't guess the time. It's a broad question and it has never been examined.

Mrs. HANSEN. Hasn't the time come when it must be examined?

Mr. COULTER. Yes, I think it's an appropriate time to examine that question.

Mrs. HANSEN. If it had been examined at the time full Indian citizenship was guaranteed, it would have been better.

Mr. COULTER. Yes, I would agree with that.

Mrs. HANSEN. It should have been examined, certainly at the time the civil rights bill was passed.

Mr. COULTER. Yes.

SNYDER ACT

Mr. WILES. Madam Chairman, as I recall this Snyder Act from memory, it's an awfully broad piece of legislation. I believe it says something along this line—Ray, correct me if I am wrong—from time to time the Secretary of the Interior may expend such appropriations as the Congress may make for the benefit of Indians as follows: It lists welfare, education, irrigation. This is a very, very broad piece of legislation.

Mrs. HANSEN. I understand.

Mr. COULTER. The Snyder Act is an extremely broad piece of legislation.

Mr. MCDADE. Is that the authority for the $25 million that we had in the budget?

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Mrs. HANSEN. No. They have asked for specific legislation in this regard.

Mr. WILES. You are right, Madam Chairman.

LABOR-MANAGEMENT RELATIONS

Mrs. HANSEN. What are the details of your requested increase of $50,000 for labor-management relations?

Mr. COULTER. Yes, I wanted to comment on that. We have had a tremendous growth in labor-management relations in the Department. At the risk of being boring, I would like to cite a few statistics.

In 1962, Madam Chairman, there were 24 units in the Department of the Interior which were covered by labor-management agreements. In 1973 we had 208 units covered. In 1962 there were 3,631 employees covered by these agreements. Today, in 1973, we have 23,164.

The problems that have been raised have been substantial. We are constantly now engaged in negotiations and prenegotiations, mediation of agreements, impasse resolutions and a number of other things.

Up to date we have met this responsibility by assigning attorneys on a piecemeal basis, as we could, to handle these problems. But with the growth in this area, we will require additional legal support for the labor-management relations program in the Department. If my understanding is correct, the Secretary's Office will also be expanding their operations in this field.

RIVERSIDE, CALIF.

The item of $37,000 is for additional staff in Riverside, Calif., which is a field office. If you will recall, last year we abolished our regional office in Los Angeles and we picked the work up at Phoenix and at our Riverside office. We substantially reduced our personnel out there, but we find we will need an additional attorney at Riverside to handle the work out there. That consists primarily, by the way, of reclamation work, the lower Colorado problems with Mexico, the salinity problem, the Indian work in that field, and the Bureau of Land Management problems.

GALLUP, N. MEX.

With respect to the last item, we have had a field office at Gallup, N. Mex., on the books for a number of years and never filled that position at Gallup.

Mrs. HANSEN. Why?

Mr. COULTER. We felt that we could handle the workload out of our office in Albuquerque. We have done so for a number of years. The Gallup, N. Mex., office was designed originally to serve the Navajo Indian Reservation, Mrs. Hansen. We have had some very definite pressure on the workload out there to reestablish that office at Gallup.

Mrs. HANSEN. Are the Indians demanding that this office be reestablished?

Mr. COULTER. Yes. I don't think you can say it's the Indians as much as it's the BIA personnel out there at the area office who require the services of an attorney. Obviously, these services stem from requests of the Navajo Tribe that need legal scrutiny.

Mrs. HANSEN. Do these relate to treaty relationships?

Mr. COULTER. They relate to a host of things, Mrs. Hansen, that among others.

Mrs. HANSEN. Water rights?

Mr. COULTER. I was going to mention water rights. We have some land problems out there. We have funding problems of one kind or another that are constantly arising out on the Navajo Reservation.

CONTRACT ASSOCIATION WITH INDIANS

Mrs. HANSEN. We are moving, as you are well aware, to a contract association with the Indians. Do the Indian tribes themselves have adequate legal staffs to insure proper protection of their rights?

For example, contracts are being let to run hospitals, schools, and reclamation projects. Suppose accusations are made by one group of Indians against another. Will you be the arbiters of these problems?

Mr. COULTER. I would hope not, Mrs. Hansen. Whether or not we would handle that problem. I don't know. In answer to your first question, with regard to the sufficiency of legal services among the various tribes. I couldn't answer that question, really. My guess is that it would have to be a case-by-case analysis to find out.

Mrs. HANSEN. You do intend to reopen the Gallup office?

Mr. COULTER. Yes; we do intend to reopen the Gallup office.

Mrs. HANSEN. Do you presently have an office in Gallup?

Mr. COULTER. Yes; we have quarters there. We also have some furniture there already that we can utilize.

JUSTIFICATION MATERIAL

Mrs. HANSEN. We will insert justification pages 1 through 7 in the record at this point.

[The pages follow:]

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SOLICITOR

Salaries and Expenses

Appropriation 1972	$6,526,000		
Supplemental appropriation, 1972	274,000		
Second supplemental appropriation, 1972	167,000		
Total appropriation, 1972		6,967,000	
Transferred to "Salaries and Expenses," Office of the Secretary		-400,000	
Total available, 1972		6,567,000	
Appropriation, 1973	7,000,000		
Supplemental appropriation, 1973	360,000		
Total appropriation, 1973		7,360,000	
Transferred to General Services Administration for rent		-9,002	
Total available, 1973		7,350,998	

Summary of Increases and Decreases, 1974

	Base for 1974	Increase 1974	
Legal Services:			
Annualization of supplemental appropriation for Mine Health and Safety	---	72,002	
Printing and publication of Indian Civil Rights works	---	300,000	
Two attorneys for Labor-Management relations	---	50,000	
One attorney, one secretary for Riverside, California field office	---	37,000	
One attorney, one secretary for Gallup, New Mexico field office	---	40,000	+499,002
Net Increase, 1974			499,002
Budget Estimate, 1974			7,850,000

OFFICE OF THE SOLICITOR
Salaries and Expenses

Activity	F.Y. 1972 Amount Available	Fiscal Year 1973 Total Appropriation	Fiscal Year 1973 Transfers 1/	Fiscal Year 1973 Adjusted Amount Available
Legal Services	$6,564,162	$7,360,000	$-9,002	$7,350,998
Unobligated balance lapsing	2,838	---	---	---
Total	6,567,000	7,360,000	-9,002	7,350,998

1/ $9,002 transferred to General Services Administration for rent.

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Adjusted Amount Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973
Legal Services	$6,564,162	$7,350,998	$7,850,000	$+499,002
Unobligated balance lapsing.....	2,838	---	---	---
Total	6,567,000	7,350,998	7,850,000	+499,002

Legal Services: Fiscal Year 1973, $7,350,998; fiscal year 1974, $7,850,000; increase $499,002. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1) $+ 72,002	-	432,000	16	Annualization of supplemental appropriation for Mine Health and Safety
(2) +300,000	-	300,000	-	Printing of Indian Civil Rights works
(3) + 50,000	-	-	-	Two attorneys for Labor-Management relations
(4) + 37,000	-	-	-	One attorney and one secretary for Riverside, Calif. field office
(5) + 40,000	-	-	-	One attorney and one secretary for Gallup, New Mexico field office
+499,002	-			

Cost Factors Involved in Increases

(1) Annualization of $360,000 supplemental appropriation in fiscal year 1973 for Mine Health and Safety.

(2) Printing and publication of works produced in Indian Civil Rights under the Civil Rights Act of 1968.

(3) Salaries and related expenses for two attorney manyears in area of Labor-Management relations.

(4) Salaries and related expenses for one attorney and one secretary for the Riverside, California field office.

(5) Salaries and related expenses for one attorney and one secretary for the Gallup, New Mexico field office.

Justification

The estimate for fiscal year 1974 for the Office of the Solicitor is $7,850,000, an increase of $499,002 over the fiscal year 1973 adjusted appropriation.

Annualization - Mine Health and Safety Supplemental

The Office of the Solicitor has received, in conjunction with the supplemental appropriation received by the Office of Hearings and Appeals, a supplemental appropriation for fiscal year 1973 of $360,000 to meet the demands now facing this Office's Division of Mine Health and Safety. The annualization of this amount for fiscal year 1974 represents an increase of $72,002. As was explained in the Office's supplemental request justification, the demands now facing the Office in the area of mine health and safety are most urgent. If full year funding

for fiscal year 1974 is not granted the implementation and administration of the act will be greatly furstrated.

Indian Civil Rights Printing

A second major difficulty in the Office of the Solicitor exists in the work of our Indian Civil Rights Task Force, which is carrying out the Congressional mandate of the 1968 Civil Rights Act to research, prepare, and publish works on several extremely important aspects of Indian Law. To do this, an increase of $300,000 is necessary in fiscal year 1974 for printing. At present, the updating of Kappler's Indian Affairs, Laws, and Treaties and the compilation of the official opinions of the Solicitor relating to Indian Affairs have been completed and now require printing. It is estimated that $201,000 will be necessary to print Kappler's and $99,000 for the Solicitor's Opinions.

On March 13, 1972, Senator Ervin introduced Senate Bill No. 3331 to amend the 1968 Civil Rights Act so as to authorize the Secretary of the Interior and the Office of the Solicitor to seek an appropriation for publication costs. That bill was referred to the Office of Management and Budget, the Department of Justice and the Department of the Interior for comment, and affirmative reports were received. However, these reports were not received in sufficient time, and the bill died with the adjournment of the last Congress. Senator Ervin is expected to re-introduce the bill in the near future. When that is done, and comment is again received from Justice, Interior and Office of Management and Budget, the bill should proceed rapidly and when passed will authorize the Solicitor to seek funds for the publication costs.

These requested figures are based on cost estimates obtained from the Government Printing Office for the 1,000 copies which are needed by the Department of the Interior for its own use and for distribution to Federally recognized Indian tribes and tribal organizations. Additional copies for the Congress and for Federal depository libraries will automatically be printed by G.P.O.; other Federal agencies will be able to order, at their own expense, whatever copies they desire; and the Superintendent of Documents will estimate the number of copies required for sale to the public and place an order for that amount. Accordingly, only the costs for the first 1,000 copies are to be borne by Interior and considered for purposes of this request.

The first five volumes of Kappler's are to be printed by the "camera copy" method at a cost of $62,000. This is to be straight duplication of the original five volumes, all of which are long out of print and in great demand, and which Congress specifically directed the Solicitor's Office to have reprinted. The last two volumes are new, having been researched and prepared by the Task Force. Because they are original works, the composition costs are significantly greater. They are to be printed by the "hot metal" process at a cost of $139,000, for a total cost of $201,000 for Kappler's.

The Solicitor's Opinions will comprise approximately 7,500 pages of copy. The optimum method of publication, both as to cost and as to ease of use, is five volumes in looseleaf binders printed by the "cold type" process. Total cost for the 1,000 copies is $99,000 ($75,000 for composition, $11,000 for printing, and $13,000 for binding).

Therefore, we are requesting the following sums for printing:

First five volumes, Kappler's	$62,000
New two volumes, Kappler's	139,000
Five volumes, Solicitor's Opinions	99,000
Total	$300,000

This $300,000 item is non-recurring and will be removed from the fiscal year 1975 base. However, this office will submit a new request in fiscal year 1975 for funds to cover the printing of the other two works currently in progress in this Indian Civil Rights area.

Labor-Management Relations

The Solicitor's Office is requesting an increase of $50,000 to fund two positions for attorneys which are necessary to handle the rapidly expanding legal demands of the Department with regard to labor-management relations. The Director of Personnel has requested such assistance, pointing out that the scope and nature of the Department's labor-management relations program has now expanded to the point where close cooperation and collaboration between the Office of Personnel and a qualified legal staff is necessary.

The Labor-Management Relations Program results from EO 11491, as amended by EO 11616, which has significantly altered the field of labor-management relations in government and produced a tremendous increase in the number of cases arising in this field. Examples of these cases are:

Cases before the Federal Mediation and Conciliation Service
Cases before the Federal Service Impasses Panel
Cases before the Federal Labor Relations Council
Cases before the Assistant Secretary of Labor
Cases before courts
Agency appearances before third parties
Preparation for negotiations
Consultations with heads of Bureaus and Offices
Interpretations of complex labor relations rules, Federal sector, National Labor Relations Board and court decisions
Job actions, demonstrations, work interruptions

In order for the Department to be able to carry out its Labor-Management program adequately, the Solicitor's Office will have to devote two attorneys to his function.

Attorney, GS-14	$21,960
Attorney, GS-13	18,737
Total Salaries	40,697
Benefits	3,663
Travel	3,100
Office supplies & other services	2,540
TOTAL	$50,000

Riverside, California

A new field office at Riverside, California was established during fiscal year 1973 to handle workload formerly handled by the now abolished Regional Office at Los Angeles. The new office at Riverside was immediately staffed with three attorneys from the Los Angeles office and one secretary. These attorneys have been fully occupied with problems relating to Indian law, public lands law, the Colorado River, and desert recreation lands. However, it appears that this staff can not also handle the workload generated by the Boulder City Regional Office of the Bureau of Reclamation. That office has requested a lawyer full-time to assist it in re-negotiating a number of complex power contracts that are now reaching their expiration dates. The Solicitor's Office is therefore requesting an increase of $37,000 to fund one additional attorney and one additional secretary in fiscal year 1974.

Attorney, GS-14	$21,960
Secretary, GS-6	8,153
Total salaries	30,113
Benefits	2,687
Travel	2,000
Office supplies & other services	2,200
TOTAL	$37,000

Gallup, New Mexico

The headquarters of the Bureau of Indian Affairs and the superintendent of the Bureau of Indian Affairs at Window Rock, Arizona, have requested that we reopen our field office at Gallup, New Mexico. They believe the full-time services of a lawyer to be essential to the superintendent.

The Navajo Indian Reservation is the largest in the United States and the Navajo Tribe is one of the most progressive and economically active. Further, the recently-begun process of granting full autonomy to the Navajo Tribe will doubtless produce a myriad of legal problems. In addition, numerous significant problems have arisen in conjunction with the Navajo-Hopi Joint Use Area. Any of these is sufficient to require a lawyer for BIA in the Window Rock-Gallup area and the Solicitor's Office has an obligation to assist the Bureau in its efforts to be more responsive to the needs of the Indian people.

Attorney, GS-14	$21,960
Secretary, GS-6	8,153
Total Salaries	30,113
Benefits	2,687
Travel	1,500
Law books	3,600
Other supplies & office services	2,100
TOTAL	$40,000

Personnel Summary

	1972 Actual	1973 Estimate	1974 Estimate
Total number of permanent positions.....	348	370	370
Full time equivalent of other positions....	4	4	4
Average paid employees.....	333	355	361
Average GS grade.....	10.4	10.4	10.4
Average GS salary.....	$16,936	$16,804	$16,958

ITEMIZATION OF ESTIMATE

Appropriation Title: Salaries and Expenses Office of the Solicitor

	Actual 1972	Estimate 1973	Estimate 1974	Increase (+) or Decrease (-)
Program and Financing:				
Total obligations	$6,564,162	$7,350,998	$7,850,000	$+499,002
Unobligated balance lapsing	2,838	---	---	---
New obligational authority	6,567,000	7,350,998	7,850,000	+499,002
New Obligational Authority:				
Appropriation	6,967,000	7,360,000	7,850,000	+490,000
Transferred to other accounts	-400,000	-9,002	---	+ 9,002
Appropriation adjusted	6,567,000	7,350,998	7,850,000	+499,002
Object Classification				
11 Personnel compensation	5,570,345	5,971,998	6,113,000	+141,002
12 Personnel benefits	484,615	536,000	550,000	+ 14,000
21 Travel and transportation of persons	96,354	210,000	225,000	+ 15,000
22 Transportation of things	3,652	24,000	26,000	+ 2,000
23 Rent, communication and utilities	160,428	227,000	231,000	+ 4,000
24 Printing and reproduction	23,964	29,000	334,000	+305,000
25 Other services	104,961	219,000	226,000	+ 7,000
26 Supplies and materials	74,056	89,000	94,000	+ 5,000
31 Equipment	45,787	45,000	51,000	+ 6,000
Total obligations	6,564,162	7,350,998	7,850,000	+499,002

PERSONNEL STATISTICS

Mrs. HANSEN. What is your present authorized position level?

Mr. COULTER. Our authorized position level at the present time is 370. Our ceiling level is 360.

Mrs. HANSEN. This is for fiscal year 1973?

Mr. COULTER. Yes; it is.

Mrs. HANSEN. What is your 1974 ceiling level?

Mr. COULTER. That would be the same.

Mrs. HANSEN. What is your present employment?

Mr. COULTER. We have presently employed 334.

That figure of 334 will be supplemented a little bit, Mrs. Hansen. As I recall we will have six new attorneys and several clerical personnel coming on board for Mine Health and Safety.

Mrs. HANSEN. How does your Mine Health and Safety work relate to that of the Office of Hearings and Appeals in the Bureau of Mines? What is the effect on your operation of the recent court injunction on the assessment of penalties?

RELATIONSHIP WITH OFFICE OF HEARINGS AND APPEALS

Mr. COULTER. That is two questions. On the first one, our relationship with the Office of Hearings and Appeals, it is a relationship that is very close in the sense that we have to provide the lawyers to handle the hearings that are scheduled. Consequently, we do have our workload in the Division of Mine Health and Safety which is directly connected with the ability of the Office of Hearings and Appeals to schedule hearings on the assessment procedure. So there is a direct relationship. There is also a direct relationship in answer to the second part of your question with regard to the assessment procedure that is employed by the Bureau of Mines.

We have the responsibility of providing them with any assistance legally they might need in a preliminary assessment.

COURT DECISION ON MINE HEALTH AND SAFETY ASSESSMENTS

In answer to the third part of your question, the effect of the recent decision in the District of Columbia, I might parenthetically note that we asked that decision be appealed by the Department of Justice.

We feel that the court was wrong and that it should be appealed to obtain a reversal of the court. However, if that opinion stands we will have to revise the procedures in the Department of Interior.

Basically what that opinion held was that in the assessment procedure that is being operated by the Bureau of Mines, they did not afford the operator a chance to protest because they did not provide him with any findings of fact. All they did was say, in effect, a violation has occurred and this is your assessment.

The court said if you utilize this approach, then you must make findings of fact and make them available to the operator and give him an opportunity to protest to that assessment office on the amount of the penalty.

EFFECT ON PROCEDURE

Mrs. HANSEN. Will this slow the procedure?

Mr. COULTER. Yes, it could slow the procedure down, because we have not been doing this. We have not been issuing findings of fact at that stage.

Mrs. HANSEN. When will you issue findings of fact?

Mr. COULTER. When we go to a full hearing—an APA hearing—and at that point the findings of fact and the conclusions are made by the administrative law judge and from that point the operator has two appeals from there. He can go to the Board of Mine, Health and Safety Appeals, and from there he can go to the district court.

We do not feel, and we have indicated to the Justice Department, that the opinion of the court is correct. The assessment procedure in the Bureau of Mines was set up on two bases, Mrs. Hansen, originally. It is conceived as a method of expediting the administrative process. So where you have an operator that has a small fine it would be easy to dispose of without going through a full APA hearing.

Secondly, it would give the operator an opportunity to take care of a small fine, something in the nature of a traffic ticket. If he wished he could just pay it and forget it.

The $50 is not worth going to a full hearing. At the same time the system preserved to the operator his right to a full hearing on any assessment, if it was $1 or $10,000. We felt that this would be a method of expediting the administrative process and affording the operator a chance to pay the fine without incurring additional expense by way of lawyers and time consuming operations before an APA Hearing Board.

Now what the court has done to us is in effect said that procedure we have employed is adequate and proper as long as you do the following steps. In other words, as long as you issue findings of fact and as long as you give him the right to protest at that stage in the game.

We have under consideration in the Department at the present time some revised procedures that we could put into effect. These have to go before the Under Secretary and the Secretary before they are available.

We have a problem in putting revised procedures into effect at the present time, vis-a-vis the appeal. We do not want to prejudice that appeal by putting in revised procedures right now. That is a problem that will have to be resolved.

EFFECT ON SOLICITOR'S WORKLOAD

Mrs. HANSEN. How much will this increase the solicitor's workload?

Mr. COULTER. It is hard to say.

If we have to go to a full APA hearing on every one of these, Mrs. Hansen, it will probably triple or quadruple our load. It will be a substantial increase. When you talk about a full APA hearing, you are talking about a lawyer, and clerks being in court to try thousands of cases.

Mrs. HANSEN. And a court stenographer.

Mr. COULTER. Yes, plus an administrative law judge for each one of these.

Mrs. HANSEN. Plus the cost of the transcript.

Mr. COULTER. Yes; you are talking about some rather tremendous figures.

Our backlog, Mrs. Hansen, at the present time with regard to civil penalties is about 3,000 cases. So that even with the preliminary procedure in the Bureau of Mines we still have a backlog of about 3,000 cases. They are coming in at the rate of something like 200 a week.

So you can see that we have a tremendous caseload involved here. Some of these, of course, I might just mention to you, are not tried before an APA examiner. It is like any other lawsuit, you get right up to the courthouse and they settle out of court and they don't want to go through it. So you settle quite a few of them.

On the other hand, the caseload is growing and I see no reason to expect that it will diminish.

CONCLUSION

Mrs. HANSEN. Thank you very much, Mr. Coulter.

May I express my appreciation and the committee's appreciation for your very able testimony.

Mr. MCDADE. I would just like to compliment Mr. Coulter on his well-prepared presentation. It was very well done.

Mr. COULTER. Thank you very much.

Mrs. HANSEN. Mr. Veysey?

INDIAN RESERVATIONS AND ZONING

Mr. VEYSEY. I have one brief question, if I may. I have Indian reservations in my district, and the problem comes up as to the status of the law as to what the Indians can do on their reservation and what the city and county government can do with respect to zoning and ordinances of that type.

Has there been any resolution of that particular issue? For example, in the Palm Springs area, where the Indians say we are going to build a high rise, and the city says no, you are in the city and you are not.

Mr. COULTER. The Palm Springs Reservation is a very difficult situation because it is unique. My answer to you would be that the Supreme Court has pretty well defined these in these two cases I mentioned—the *Arizona* case and the *New Mexico* case—and they have pretty well concluded that the rights that a State or local government might have on a given Indian reservation are only to the extent that the Congress has given the State or local government any rights on an Indian reservation.

Mr. VEYSEY. To what extent have we given them any rights?

Mr. COULTER. It varies.

If you take Public Law 280, and those States that have accepted Public Law 280 and the Indian tribes that have done so, there is the right of a State in those instances to enforce criminal laws on the Indian reservations.

The answer to your question cannot be given in broad, general terms, Congressman. It has to be given on a specific case-by-case basis.

Generally the answer is contained in those Court decisions.

Mr. VEYSEY. Thank you very much.

Mrs. HANSEN. Thank you very much again, Mr. Coulter.

Mr. COULTER. Thank you very much.

WEDNESDAY, APRIL 4, 1973.

OFFICE OF THE SECRETARY

WITNESSES

RICHARD R. HITE, DEPUTY ASSISTANT SECRETARY
FRANCIS M. WILES, DIRECTOR, OFFICE OF BUDGET
RICHARD BAKER, BUDGET ANALYST, DIVISION OF FISCAL SERVICES
JAMES M. DAY, DIRECTOR, OFFICE OF HEARINGS AND APPEALS
ELBURT F. OSBORN, DIRECTOR, BUREAU OF MINES
JAMES E. SLATER, BILATERAL ACTIVITIES OFFICER, OFFICE OF INTERNATIONAL ACTIVITIES, OFFICE OF THE SECRETARY
J. W. (PAT) O'MEARA, DIRECTOR, OFFICE OF SALINE WATER
KENNETH L. LAY, DEPUTY UNDER SECRETARY FOR ENERGY

Mrs. HANSEN. The next agency to appear is the Office of the Secretary and our principal witness is the committee's old friend, Mr. Hite, the Deputy Assistant Secretary.

GENERAL STATEMENT

I am sure you have a general statement, Mr. Hite. Please insert the statement in the record and summarize it for us or read it, as you wish.

Mr. HITE. Madam Chairman, it is a pleasure to appear before the committee again. I do have a prepared statement which I believe you have and I will read the statement for the record, if I may.

Mrs. HANSEN. Very well.

The statement will be inserted in the record at this point.

[The statement follows:]

Madam Chairman, the fiscal year 1974 appropriation request for the Office of the Secretary, selected Department-wide staff functions, and research, both domestic and foreign, totals $50,789,000. This amount includes the funding for saline water research which had in previous years been separately justified. We are requesting funds for a new central energy research and development fund to provide the Department with renewed impetus in combating the continuing energy shortages. The fiscal year 1974 request for these items represents an increase of $3,656,900 over the fiscal year 1973 appropriation of $47,132,100 for these activities.

SALARIES AND EXPENSES

The fiscal year 1974 appropriation request for the Office of the Secretary, "Salaries and expenses" is $15,895,000, an increase of $641,602 over the amount available for fiscal year 1973. This appropriation finances the activities directly supporting the operation of the Secretariat which includes the Secretary, Under Secretary, four Program Assistant Secretaries, specialized departmental staffs and administrative support functions.

REQUESTS FOR INCREASED FUNDING

We are requesting an increase of $230,000 for new program initiatives. This includes:

For travel for departmental participation in the United Nations Law of the Sea Conference, $30,000. The Department with its responsibility to protect our valuable offshore mineral resources must be adequately represented at these meetings. The number of meetings at which the Department should be represented will increase significantly in 1974.

Also, $200,000 and six additional positions to improve the Department's budget program structure and initiate a performance measuring system. This program initiated on a tentative basis, in fiscal year 1973 has proven to be successful. We are requesting additional funding to make this activity a permanent part of our budgetary process.

In fiscal year 1973, the Office of the Secretary was granted 74 new positions for its many responsibilities. The associated funding requested did not represent the full year annual cost for these positions. We are requesting this year, an increase of $200,000 to provide full year funding of this approved staff. The major portion of this increase is distributed to three program areas:

Office for Equal Opportunity	$63,500
Program policy activities	39,900
Administrative management responsibilities	84,100

We are requesting an additional $211,602 for workload and nondiscretionary items to adequately support the Office of the Secretary in fiscal year 1974.

SECRETARIAL ORGANIZATIONAL CHANGES

Since the submission of the fiscal year 1974 budget, major changes have occurred in the organizational makeup of the Office of the Secretary. The changes are not reflected in the budget document before the committee for consideration. However, the purposes for which we are requesting fiscal year 1974 funding do not change.

Specifically, the organizational changes are as follows:

(1) The consolidation of the Department's congressional liaison, legislation; and information activities under an Assistant Secretary for Congressional and Public Affairs, Mr. John H. Kyl.

(2) The consolidation of the activities formerly assigned to the Assistant Secretary for Program Policy and those of the Departmental Budget Office under an Assistant Secretary for Program Development and Budget. Dr. Laurence E. Lynn, Jr. has been nominated by the President for this position.

Concurrently, the former position of Assistant Secretary—Management and Budget is redesignated Assistant Secretary—Management to reflect the deletion of budgetary responsibilities.

(3) The abolishment of the Assistant Secretary for Water and Power Resources and the Assistant Secretary for Public Land Management.

(4) Colocating the Department's electric power and fossil fuel energy program with its mineral responsibilities under an Assistant Secretary—Energy and Minerals, Mr. Stephen A. Wakefield.

(5) Colocating the water resources development and research with its land management responsibilities under an Assistant Secretary for Land and Water Resources, Mr. Jack O. Horton.

(6) Assigning the responsibility for direction of the Bureau of Outdoor Recreation to Assistant Secretary for Fish and Wildlife and Parks, Mr. Nathaniel P. Reed.

(7) Placing the Commissioner of Indian Affairs and the Office of Territories in an organizational location in which they will report directly to the Secretary. Additionally, the Department has proposed legislation to elevate the Commissioner of Indian Affairs to the level of an Assistant Secretary.

In addition to these changes, several organizational realinements were made in our administrative management activities. These changes: namely, the reassignment of ADP and management information system development from the Office of Survey and Review to the Office of Management Consulting; the combining of the Secretary's budget, fiscal, and personnel operating responsibilities under a new subactivity titled "Secretarial Operations"; and reassigning the Department's overview of international activities have been incorporated in our fiscal year 1974 budget justification.

In addition to the "Salaries and expenses" appropriation, we are also here to discuss programs funded from appropriations for "Departmental operations", "Special foreign currency program," "Saline water research," and "Central energy research and development."

Departmental Operations

The fiscal year 1974 request for the Office of the Secretary, "Departmental operations" is $5,737,000, an increase of $1,000,888 over fiscal year 1973. This account finances the activities of the Office of Hearings and Appeals, the Natural Resources Library, the Johnny Horizon antilitter program which was transferred from the Bureau of Land Management, and a proposed Federal Government contribution to help stage the Ninth World Energy Conference.

OFFICE OF HEARINGS AND APPEALS

An appropriation of $3,628,000 is requested for the Office of Hearings and Appeals, an increase of $300,888 over fiscal year 1973; $200,000 of this amount is to annualize the fiscal year 1973 supplemental of $400,000 for additional administrative law judges and related support for the coal mine health and safety program; $37,200 is requested as a result of congressional elevation of these position to GS–16, with the remaining funds being used for within-grade step increases, reduction of lapse, and other increased support costs.

NATURAL RESOURCES LIBRARY

An appropriation of $1,189,000 is requested for the Natural Resources Library, a decrease of $20,000 from fiscal year 1973. Last fiscal year the Department was granted $235,000 to accelerate its purchasing, indexing, and control of needed library materials. We propose in fiscal year 1974 to continue this program, utilizing approximately $133,000 for this purpose. In addition we plan to increase library staffing to provide interpretive support and assistance to its valuable collections.

JOHNNY HORIZON PROGRAM

The Johnny Horizon program was transferred to the Secretariat, effective July 1, 1972, to permit greater involvement of other bureaus of the Department and to stimulate increased participation by other agencies and private organizations. An increase of $20,000 above the $200,000 fiscal year 1973 level is requested. This amount will enable the Department to develop additional antilitter materials necessary to make its expanded program thrust a success.

WORLD ENERGY CONFERENCE

An appropriation of $700,000 is being requested for the U.S. Government's share (one-third of $2 million) of the cost of staging the Ninth World Energy Conference to be held in Detroit, Mich., in September 1974. Although this Conference will not be held until fiscal year 1975, the organization committee must determine firm funding commitments and may seek support for expenses incurred prior to Conference date. In addition, special appropriation language is being proposed to allow payment of Conference expenses in fiscal year 1975 from any unused portion of the $700,000 request.

Partial Government funding of this Conference is not new. The third Conference held in 1936 was supported by congressional appropriation. (See Joint Resolution 350, approved Aug. 26, 1935.) Other countries which have staged this Conference have received appropriate levels of financial support from their Government, in recognition of the value and importance that it received.

Energy needs and problems are universal. Over 3,000 participants from 66 foreign nations will attend, submit technical papers, and exchange methods and ideas on all aspects of the energy field. Results of this Conference could well lead to solving energy problems, both in the United States and abroad.

Special Foreign Currency Program

The Department's fiscal year 1974 special foreign currency request is $1,630,000, an increase of $1,130,000 over fiscal year 1973, to carry out contract research utilizing currencies of Poland and Yugoslavia that are excess to the U.S. Government's normal requirements. The Department has had some difficulty in getting

funds released due to the small amount available and fast drawdown of these excess currencies. Research reports from first year funding have been beneficial to the Department's programs. We are confident that these funding problems can be resolved and that this complementary research effort, with congressional support, should be continued.

SALINE WATER RESEARCH PROGRAM

An appropriation of $2,527,000 is requested for fiscal year 1974 for a redirected saline water research effort. In addition, $6,675,000 is planned to be available from fiscal year 1973 carryover funds.

Research and development on freezing processes are programed at $400,000 and on sea water membrane processes at $2,250,000. The balance of the fiscal year 1974 program ($6,552,000) will provide for administering the programs, operations of the Fountain Valley, Calif., and Wrightsville Beach, N.C., field facilities. All other field facilities are scheduled to be closed.

The fiscal year 1974 research effort will be directed toward advancing the technology in the best potential freezing processes, investigating new processes that appear most promising, and accelerating applied research on current technology in the area of sea water membranes.

CENTRAL ENERGY RESEARCH AND DEVELOPMENT

The Department is requesting the establishment of a central energy research and development fund in the amount of $25 million. This request will be used to encourage and support research and development programs involving nonnuclear energy production, processing, transportation, utilization, and conservation of energy.

The support of innovative energy research and the study of new approaches to energy problems are often hindered by the commitments made to research projects, plus the time lag associated with changing institutional perspectives. This fund would allow needed longer term research and development to continue while providing the Department with the means of placing new, short time frame problems with institutions that can best cope with them.

This fund will be used for specific projects identified by the Department and reviewed by the Department's Energy Board chaired by the Secretary. Proposals on nonnuclear energy research, with emphasis on near-term, may be submitted by industry, universities, or Government agencies. Projects approved by the Department will be forwarded to the Congress. When the potential of a new approach has been established, the Department will revert to normal budgeting procedures for its continued support, in the event it is determined to be in the national interest to continue Federal, as opposed to private, funding. Project funding will be provided by the Department directly to contractors or to other Federal agencies with technical management capability and will not be used to build up internal research staffs.

SUMMARY

This statement covers in general terms the programs for which we are requesting funds for fiscal year 1974. Representatives of the Department, with expertise in the specific program areas, are here today to provide more detailed information and to answer any detailed questions you may have.

Mr. HITE. The fiscal year 1974 appropriation request for the Office of the Secretary, selected departmentwide staff functions, and research, both domestic and foreign, totals $50,789,000. This amount includes the funding for saline water research which had in previous years been separately justified.

PLACEMENT OF BUDGET REQUEST FOR SALINE WATER

Mrs. HANSEN. What was the Department's rationale for transferring the Office of Saline Water to the Office of the Secretary?

Mr. HITE. Mrs. Hansen, the administration's approved funding level for the Office of Saline Water represented a rather dramatic reduction. Consequently, there was a constriction of the personnel in the Office.

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In the organizational configuration in which we were at the time the budget was formulated, it was deemed the best management procedure to run the Office and the research program from the Secretary's immediate office. It is a program as opposed to a staff service. In our conversations with OMB and others in the administration, it was felt that this program deserved the Secretary's close attention.

Mrs. HANSEN. Close attention, so, therefore, OMB greatly reduced the program?

Mr. HITE. Mr. O'Meara who is with us today will be able to articulate the rationale behind that reduction. It represents the elimination of Federal involvement in distillation and other programs which we believe have been taken to the maximum extent that Federal research can.

Mrs. HANSEN. My question was, why was this program transferred to the Office of the Secretary, rather than to some other activity more or less directly associated with water?

Mr. HITE. Yes, Madam Chairman; I am sure we will get into this later, but I would like to explain to the committee the reason that the budget is in the form that it is now, as opposed to our reorganized structure.

At the time that we cast the budget, the Secretary's plans on reorganization had not come to fruition. As we go down the line and readjust or reconstitute the Assistant Secretary's offices, we would propose to put the direction of the Office of Saline Water under the Assistant Secretary for Land and Water.

Mrs. HANSEN. The increase in the Secretary's budget is a major increase.

Mr. HITE. Yes, this budget and the figure of $50 million as opposed to $47 million in 1973, is misleading because it does contain the 1973 funding, some $26 million for saline water. It is netted out in 1974 against the $25 million we are asking for in the central energy R. & D. fund.

[Discussion off the record.]

PROPOSED RESTRUCTURING OF THE BUREAU OF MINES

Mr. MCDADE. If the chairman will yield, I talked to you about this on the telephone, the reorganization in the Bureau of Mines is not a reorganization, but a complete dismantling of the Bureau.

Mr. HITE. It is a separation of the functions that currently constitute the function of the Bureau.

Mr. MCDADE. It is an abolition of the Bureau of Mines as we have known it and as it existed.

Mr. HITE. That is correct.

Mrs. HANSEN. Who conceived the current program configurations?

Mr. HITE. Who constructed the reorganization?

Mrs. HANSEN. Yes.

Mr. HITE. Mrs. Hansen, the reorganization was conceived by the Secretary in its basic elements. Other people worked out the details. No firm decision has been made on the proposal on the Bureau of Mines. Please let me emphasize that.

Mrs. HANSEN. I hope you have received the message that you are not going to do anything in this regard without this committee's approval.

Mr. HITE. I understand that, Mrs. Hansen, and it would not be the Secretary's intent to do this without coming to a meeting of the minds with the committee.

Mrs. HANSEN. Mr. McDade and the committee have very strong feelings on this subject.

REORGANIZATION OF THE OFFICE OF THE SECRETARY

Mr. HITE. I guess you have the latest reorganization chart we issued.

Mrs. HANSEN. Next year you will have a new reorganization chart.

Mr. HITE. Mrs. Hansen, I think you would concede that when management changes, when key positions change in an organization that philosphies on how to conduct operations change. Certainly no management philosophy that we had before us has been perfect.

Mrs. HANSEN. There is not any assurance that this is going to be, either.

Mr. HITE. Absolutely. We feel that this is the posture in which the Secretary and the Under Secretary and key people in the Department will operate most comfortably.

Mr. VEYSEY. Madam Chairman, is this the organization as it is now or as it is proposed?

Mr. HITE. No, sir, that is the proposed organization. I think, sir, that the critical point on that chart before you would be the fate, if you will, of the Bureau of Mines.

I believe the balance of the realinement of the other functions is fairly noncontroversial.

Mr. VEYSEY. That would be under the Assistant Secretary for Land and Water Resources.

TIMING OF DEPARTMENTAL REORGANIZATIONAL PLANS

Mrs. HANSEN. The timing of reorganizational plans do not always concur with the committee's timing.

It is unfortunate to have Department personnel appear before the committee and justify a budget and then the committee hears those items are being changed, reorganized, et cetera.

Mr. HITE. This is true. Mrs. Hansen. It puts you in a very awkward position. It also puts us in an awkward position. Please understand, when you go into a major reorganization such as this there is really no appropriate time. The budget as you well know within the administration is formulated during the period of October through December. When the President's budget is cast into stone, so to speak, in December we have to come to you with these figures.

Mrs. HANSEN. Your budget has been cast in proposals and not stone.

Mr. HITE. Insofar as the presentation of the Secretary's budget, it is more or less immutable once the Public Printer puts the book together. As far as the method of presentation to you, Mrs. Hansen, is concerned, what I am saying when the the die is cast ——

Mrs. HANSEN. You have no choice, I understand.

Mr. HITE. Then the Secretary's thoughts on reorganization were very relevant to the new executives that were being brought on board by the President and the Secretary to direct the Department. For this reason his evolving thoughts on organization followed the budget. For the committees' edification and accommodation I have an object class breakdown which may help to cross-walk this budget and to what we are trying to portray.

As long as we are on this, I would like to emphasize that we do not intend to load up the Secretary's account. Everything under the Assistant Secretary's line on that chart would be justified to you separately. The Office of Water Research, and back again—although it may be inconsistent—to the Office of Saline Water. We would justify that next year as a separate account. The various entities which we propose under the Director of Research and Development would be justified separately.

Mr. MCDADE. This chart shows no change in the original reorganization—and I use that term very loosely—for the Bureau of Mines. You are submitting a new chart, is that right?

Mr. HITE. That is right.

It just goes into a little more detail. This is a proposal, because under that Director of Research and Development we have itemized an Office of Metallurgical Research and an Office of Mining Research.

Mr. MCDADE. It still represent the abolition of the Bureau as we know it today.

Mr. HITE. Yes, sir, and this is as we propose it. I just wanted to make it a little more clear.

CO-LOCATING ACTIVITIES UNDER THE ASSISTANT SECRETARY FOR CONGRESSIONAL AND PUBLIC AFFAIRS

Mrs. HANSEN. The most intriguing item is the placement of your communications activity. It is under the jurisdiction of the congressional liaison.

Mr. HITE. That seems to me to be an appropriate place.

The Assistant Secretary for Congressional Liaison and Public Affairs would have the Office of Communications, the Legislative Council, and the legislative liaison functions. We are not asking for any more funding to carry on these activities.

Mrs. HANSEN. Please proceed with your general statement, Mr. Hite.

Mr. HITE. Yes, ma'am.

To continue, we are requesting funding in this budget for a new central energy research and development fund to provide the Department with renewed impetus in combating the continuing energy shortages.

COMMITTEE'S REQUEST FOR A COAL POLICY

Mrs. HANSEN. A year ago the committee in its report requested that your Department and the administration establish a national coal policy before spending further money on coal research. If strip mining is going to be abolished or greatly restricted, it seemed to us before we acted on the coal research budget we ought to have a national coal policy. To date the committee has received not one word.

Mr. HITE. Yes, ma'am.

Mr. WILES. You are right, Madam Chairman, there has not been one.

Mr. HITE. I can only say you are right.

Mrs. HANSEN. That is why I ask, what good is another energy program going to do?

Mr. HITE. This fund, Mrs. Hansen—and Dr. Lay will be able to explain this more clearly—it is a contingent fund to take advantage of innovations in research which we cannot foresee in the budget.

Any projects which were underwritten by this fund would be cleared through the committee.

Mr. MCKAY. Madam Chairman, in light of that, why set up another fund for immediate research when the items mentioned in the justifications apply to the Office of Coal Research anyway?

Why don't you give it to them and let them do the work?

Mr. HITE. We have specific projects funded in the Office of Coal Research.

Mrs. HANSEN. You have proposals.

The committee told the Department a year ago to develop a national coal policy. You are asking the committee to spend approximately $52 million on coal research when it may be completely irrelevant if the administration and the Congress determines another policy.

This morning's paper has an excellent column about some of the energy problems which we discussed in great detail last week. We deliberately scheduled our energy hearings late so that the President would have an opportunity to issue his energy message.

I think it is the desire of the Congress and the President to move in a coordinated direction in the solution of this very critical problem.

Yet I understand it may be May before the energy message is sent to Congress.

Mr. LAY. And it may be sooner.

Mrs. HANSEN. The committee cannot in good conscience mark up a budget that involves technological research programs such as contained in the Office of Coal Research, Bureau of Mines, Geological Survey, and the Bureau of Land Management, without having an overall policy. The country will be the loser if we do not have a coordinated approach.

The Congress is accused of being foot draggers. This committee has worked continually to eliminate that kind of image.

While we may not agree in every detail with the administration, it is the hope that we can make a unified, joint attack on our energy problems.

Mr. LAY. May I address that, Madam Chairman?

Mrs. HANSEN. Please do.

TIMING OF PRESIDENT'S ENERGY MESSAGE

Mr. LAY. First we also would have liked to have had the energy message out a little sooner, and I will be the first to concede that.

It has taken more time to work it out than we thought it would. It will be coming out in the very near future. I think I can assure you of that. It will be a comprehensive, coordinated energy policy. It will deal with coal and all other fossil fuels, nuclear, geothermal, and oil shale. I can certainly understand your problem. It will be hard for you to make budget decisions before it is out.

Mrs. HANSEN. The committee is not going to make those decisions until the energy message is sent to Congress.

Mr. LAY. It will be out shortly. As to your specific questions on coal, I think the problem is easily understood. I can talk in general terms to our policy this morning. In the United States something on the order of 80 to 85 percent of our remaining fossil fuels is in the form of coal. Currently about 16 to 18 percent of our requirements is satisfied by coal. There is a great disparity there. If you look at the next decade or two, the only apparent hope for relieving our energy problem as far as domestic fuels is concerned has to be in the coal area. The big problem right now has been that utilities in order to meet the environmental standards, have been shifting out of coal and into foreign oil. Our policy is to develop technologies—and I am speaking not only to the conversion technology although that is one of the major ones, but also mining and health and safety technologies—that will allow us to utilize a much larger part of our coal and still meet our environmental objectives. That is very briefly stated, but that is our policy.

Mrs. HANSEN. That is correct. You have to come to grips with two problems. You have to resolve the problem of the effect every development will have on the environment.

Mr. LAY. That is right.

Mrs. HANSEN. After sitting on this committee year after year, and realizing that this country was growing shorter and shorter on technical people in the field of metallurgy and in mining—many Members on both sides of the aisle last year sponsored a bill to increase funding and research in this field. What do you think happened to that bill? It was vetoed.

Mr. LAY. I am sorry, Madam Chairman, I cannot speak to that. I am not familiar with it.

Mrs. HANSEN. About 135 mining engineers per year are being trained in the United States. About 4,000 per year are being trained in the Soviet Union. Congress decided it was time to increase our technology in this area.

FUNDING REDUCTION FOR MINE HEALTH AND SAFETY

Mr. MCDADE. If the chairman will yield, the health and safety account you mentioned is an important part of this total package and is proposed to be cut in the budget before us by $3.7 million.

Mr. LAY. But it has increased five to sevenfold the last four years.

It is my understanding that the research center has been completed.

Mr. WILES. No, the $3 million Mr. McDade is talking about. That is $13 million for the academy.

Mr. MCDADE. The increases are in manpower cost for health and safety.

The increases have come because you have new duties under the act to provide manpower. You propose that we agree to a budget cut in excess of $3 million that is directly related to research funds in health and safety. I do not understand that.

Mr. WILES. The reduction is $3.7 million; $1 million of that is moved from Coal Health and Safety Research to Metal and Non-Metal Mine Research and the other $2,700,000 is a cut in the research program.

Mr. MCDADE. It is $2.7 million out of coal?

Mr. WILES. Yes, sir.

Mr. MCDADE. Where we have had the tremendous history of fatalities. We saw the production of coal increase but the fatalities per man-hour of production are still there.

Mr. LAY. The budget increased from $2.6 million in fiscal year 1969 to $28 million in fiscal year 1974.

Mr. MCDADE. You are aware of the Health and Safety Act?

Mr. LAY. Yes.

Mr. MCDADE. You are aware how much of that budget goes to that?

Mr. LAY. Yes.

Mr. MCDADE. Most of it is right there.

If you look at the deaths per man-hour in the coal industry you see they have remained relatively constant until we began appropriating money and you began to do research. Now you can see a decline for the first time in this country in deaths per man-hour and the administration proposes a cut. I don't understand that.

Mrs. HANSEN. Please proceed, Mr. Hite.

Mr. HITE. To continue, Mrs. Hansen, the fiscal year 1974 requests for these items which I have enunciated represents an increase of $3,656,900 over the fiscal year 1973 appropriation of $47,132,100 for these activities.

FUNDING REQUEST FOR SALARIES AND EXPENSES

With respect to salaries and expenses, the fiscal year 1974 appropriation request for the Office of the Secretary is $15,895,000, an increase of $641,602 over the amount available for fiscal 1973. This appropriation finances the activities directly supporting the operation of the Secretariat, which includes the Secretary, Under Secretary, four program Assistant Secretaries, specialized departmental staffs and the administrative support functions. We are requesting an increase of $230,000 for new program initiatives. Specifically, $30,000 for travel for departmental participation in the United Nations Law of the Sea Conference. The Department with its responsibility to protect our valuable offshore mineral resources must be adequately represented at these meetings.

The number of meetings at which the Department should be represented will increase significantly in 1974.

Secondly, $200,000 and six additional positions are requested to improve the Department's budget program structure and initiate a performance measuring system.

This program, initiated on a tentative basis in fiscal 1973, has proven to be successful.

Mrs. HANSEN. Who is the Department's Budget Program Director?

Mr. HITE. Mr. Wiles has a deputy director, David Seyler, who is in charge of this function. We started it this year, as we testified that we would, Mrs. Hansen.

Mrs. HANSEN. Last year's witness has left the Department.

Mr. HITE. Yes, Mr. Bodman is no longer with the Department, Mrs. Hansen. In carrying on this worthwhile effort the small group that we have is developing a program package structure for internal analysis for the Department. I do not mean to imply that we are recreating the PPB syndrome. This effort is strictly for the Secretary and the Secretariat's internal analysis. I feel that Mr. Wiles and his basic budget

group with their responsibility to service four subcommittees on the budget, the Office of Management and Budget and the various bureaus of the Department, are burdened to the point where they cannot undertake, within the current staff resources, this program packaging and foster this link between the operating and budget elements.

PERFORMANCE MEASUREMENT SYSTEM

Mrs. HANSEN. What are you going to use as a performance measurement system?

Mr. WILES. They are working on that. There could be a lot of different performance measurement systems.

Mrs. HANSEN. Give us some examples.

Mr. WILES. For example, in timber a million board feet cut, or in soil and moisture, the number of detention dams. There could be any number of measurement systems. That is what they are working on. It is complicated when you go to the whole spectrum of the Department's programs.

Mrs. HANSEN. In other words, you want to determine how effective your input is in terms of performance.

Mr. HITE. Exactly.

Mrs. HANSEN. I am sure you will discover that your input is not effectively meeting the needs of the United States today.

Mr. HITE. I am sure you are correct, Mrs. Hansen. The thrust of this group will be toward improving our budget decisions and to examine the various output measurements that the Bureau has utilized. I am sure some output measurement systems are quite good. Some are deficient. We would hope that through this effort we will upgrade our budget decision evaluation process for the benefit of the Secretary and to qualitatively improve the budget development in future years.

Mrs. HANSEN. The committee has increased the Department's budget at various times, but those items have generally all been impounded.

Mr. HITE. Madam Chairman, we commend the committee for their actions in reshaping our budget and recognizing the priorities in the Department. It is regrettable that fiscal constraints sometimes force the administration into awkward postures.

Mrs. HANSEN. You may proceed, Mr. Hite.

NEW POSITIONS

Mr. HITE. In fiscal year 1973, the Office of the Secretary was granted 74 new positions for its responsibilities. The associated funding requested did not represent the full annual cost for these positions. Therefore, we are requesting this year an increase of $200,000 to provide full year funding of this approved staff.

Mrs. HANSEN. Why didn't it represent the full year?

Mr. HITE. We projected three-quarter year cost because we felt we could not fill the positions. I will go into later testimony where this increase is distributed.

Additionally, we are requesting an additional $211,602 for workload and nondiscretionary items to adequately support the Office of the Secretary in fiscal year 1974.

Madam Chairman, I have a section in this proposed statement which deals with organization changes, which I can defer for your further questioning, if you desire.

Mrs. HANSEN. Please review it for us.

DEPARTMENTAL OPERATIONS

Mr. HITE. With respect to departmental operations, in the fiscal year 1974 request for the Office of the Secretary, Departmental Operations, we requested $5,737,000.

Mrs. HANSEN. Please insert in the record at this point your total Office of Secretary funding from 1960 through 1974.

Mr. HITE. Yes, we will be happy to do that.

[The information follows:]

SALARIES AND EXPENSES, OFFICE OF THE SECRETARY
HISTORY OF APPROPRIATIONS 1960 - 1974

Fiscal Year	Permanent Positions	Total Available Appropriation	Net Increase	Explanation of Major Increases: Pay Cost	Transfers	Other
1974 Est.	689	$15,895,000	$ 641,602	$ ---	$ ---	$ 641,602
1973 Est.	683	15,253,398	2,360,666	432,000	-41,702	1,970,368
1972	609	12,892,732	-208,343	734,000	-1,802,268	859,925
1971	635	13,101,075	2,222,575	909,000	629,075	684,500
1970	600	10,878,500	2,186,272	902,000	63,800	1,220,000
1969	539	8,692,228	1,417,728	454,000	-62,772	900,956
1968	517	7,274,500	767,600	233,000	393,000	141,600
1967	457	6,506,900	1,951,700	167,000	1,341,000	443,700
1966	372	4,555,200	190,700	105,000	-2,000	87,700
1965	345	4,364,500	509,100	254,000	---	255,100
1964	339	3,855,400	375,350	---	-3,000	378,350
1963	316	3,480,050	95,050	132,050	-2,000	-35,000
1962	318	3,385,000	487,000	200,000	---	287,000
1961	291	2,898,000	191,100	175,000	---	16,100
1960	294	2,706,600				

MAJOR PROGRAM INCREASES ARE AS FOLLOWS:

F.Y. 1974 (Est.) $200,000 for full year funding of the 74 new positions approved in fiscal year 1973; $200,000 for Budget System and Evaluation Staff; $30,000 for Departmental travel to Law of the Sea Conference; $211,602 for workload and nondiscretionary increases.

F.Y. 1973 (Est.) $177,768 for full funding of Field Coordination; $372,100 for Contract Compliance; $165,300 for Program Policy; $368,000 for development of a management information system; $295,400 for Survey and Review; $153,000 for Management Operations; $276,800 for cost increases and other small increases; $536,000 for 1972 supplemental annualization, offset by $274,000 employment reduction and $100,000 reduction in travel. Net transfers include $41,702 to GSA for rent.

F.Y. 1972 Net transfers include consolidation of Contract Compliance, $1,153,000; Office of Legislation, $400,000 and Territorial Administration, $395,000 transferred to the Office of the Secretary offset by Hearings and Appeals and Library activities; $3,746,100 being transferred to the Departmental Operations account. Appropriated increases include $445,000 for the Office for Equal Opportunity; $300,000 for the Office of Hearings and Appeals; $319,100 reduction for annualization of Reorganization Plans 3 and 4, and a supplemental during 1972 of $500,000 for Program Policy and Administrative management activities; $220,000 for second supplemental for pay cost.

F.Y. 1971	$1,246,000 was transferred in establishing the Office of Hearings and Appeals; $643,000 from the Office of the Solicitor and $603,000 from the Bureau of Land Management; $589,500 additional appropriation for Hearings and Appeals activities; Reduction of $608,949 due to Reorganization Plans Numbers 3 and 4 of 1970.
F.Y. 1970	$200,000 for Natural Resources Library, $110,000 for Office of Budget; $252,100 for Audit Activities; $121,000 for Office of the Under Secretary.
F.Y. 1969	$674,200 for Natural Resources Library - Funding change from Working Capital Fund.
F.Y. 1967	Transfer of $1,263,000 for consolidation of Audit Activities; $210,000 for Assistant Secretary for Water Quality.

Mr. HITE. Our request is $5,737,000, an increase of $1,000,888 over fiscal year 1973. This account finances the activities of the Office of Hearings and Appeals, the Natural Resources Library, the Johnny Horizon antilitter program which was transferred from the Bureau of Land Management, and a proposed Federal Government contribution to help stage the Ninth World Energy Conference.

We are also here to justify the special foreign currency program.

The Department's fiscal year 1974 special foreign currency request is $1,630,000, an increase of $1,130,000 over fiscal year 1973, to carry out contract research utilizing currencies of Poland and Yugoslavia that are excess to the U.S. Government normal requirements. The Department has had some difficulty in getting funds released due to the small amount available and the fast drawdown of these excess currencies. Research reports from the first year funding have been beneficial to the Department's programs. We are confident that these funding problems can be resolved and this complementary research effort, with congressional support, should be continued.

With respect to our saline water research program, an appropriation of $2,527,000 is requested for fiscal year 1974 for a redirected saline water research effort. In addition, $6,675,000 is planned to be available from fiscal year 1973 carryover funds.

Research and development on freezing processes are programed at $400,000 and on sea water membrane processes at $2,250,000. The balance of the fiscal year 1974 program, $6,552,000, will provide for administering the programs, operations of the Fountain Valley, Calif., and Wrightsville Beach, N.C., field facilities. All other field facilities are scheduled to be closed.

Mrs. HANSEN. On that point, please inform Mr. O'Meara that the committee will want to know the disposition of the field facilities. Are they to be sold, leased, or what?

Mr. HITE. Yes, ma'am.

The fiscal year 1974 research effort will be directed toward advancing the technology in the best potential freezing processes, investigating new processes that appear most promising, and accelerating applied research on current technology in the area of sea water membranes.

The Department is requesting the establishment of a central energy research and development fund in the amount of $25 million. This request will be used to encourage and support research and development programs involving nonnuclear energy production, processing, transportation, utilization, and conservation of energy.

Mrs. HANSEN. The committee will adjourn until 1 p.m.

Mr. HITE. Thank you, Madam Chairman.

AFTERNOON SESSION

REORGANIZATION OF THE SECRETARY'S OFFICE

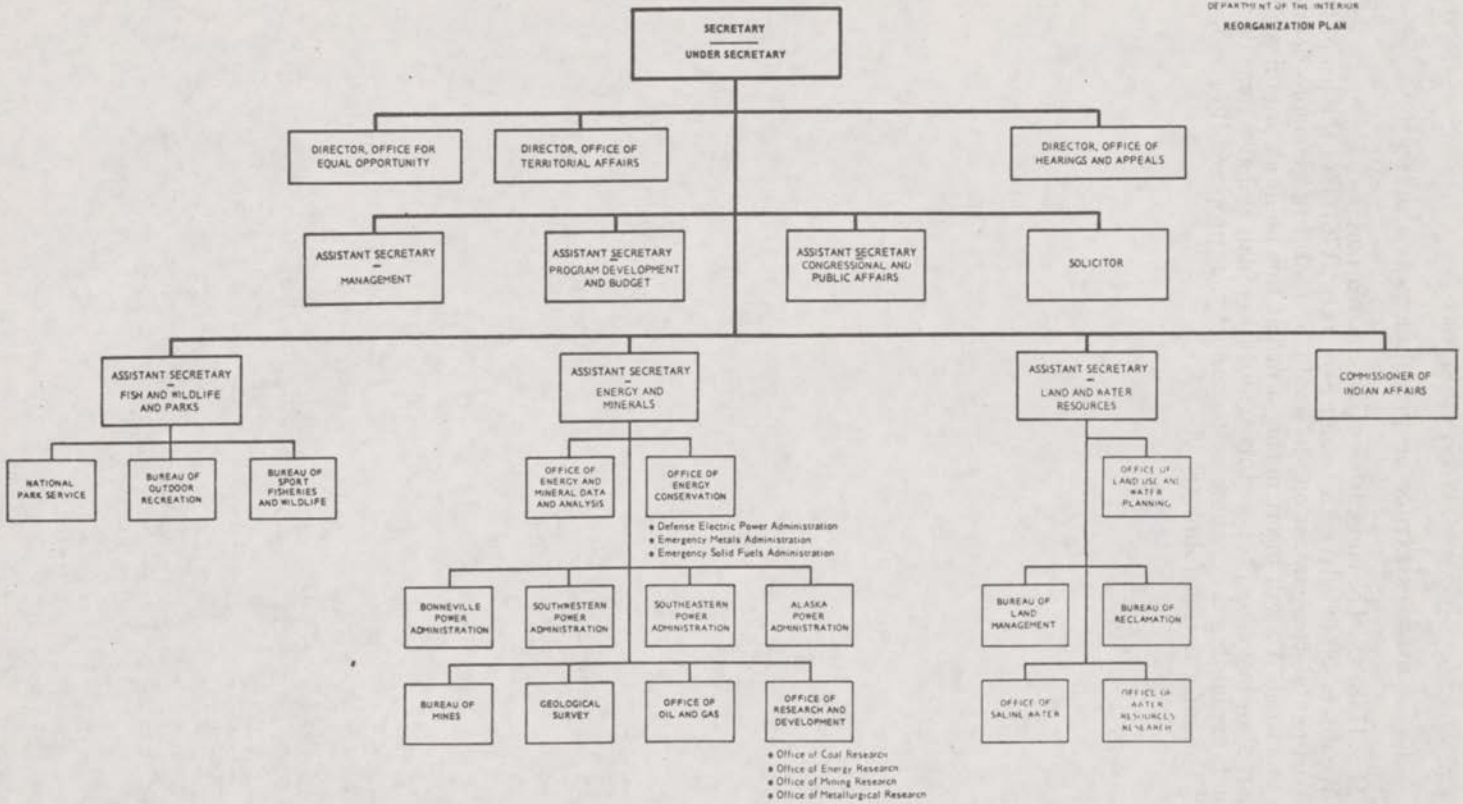
Mrs. HANSEN. The committee will come to order.

We discussed briefly with Under Secretary Whittaker the proposed departmental reorganization. It would be useful to get more details at this time. We will insert in the record at this point an organization chart showing your proposed reorganization plan and also some documents explaining the changes as they affect your proposed 1974 budget.

[The information follows:]

DEPARTMENT OF THE INTERIOR

REORGANIZATION PLAN



OFFICE OF THE SECRETARY
SALARIES AND EXPENSES

Analysis of Increases (Revised to Reflect Secretarial Reorganization)

Activity/Subactivity	F.Y. 1973 (Adjusted) Appropriation Positions	F.Y. 1973 (Adjusted) Appropriation Funds	F.Y. 1974 Increases: Annualization of 1973 Program Increases	F.Y. 1974 Increases: Maintain Current Level of Operations	F.Y. 1974 Increases: Program Inc. New Positions and Related Funding	F.Y. 1974 Increases: Total Increases Positions	F.Y. 1974 Increases: Total Increases Funds	F.Y. 1974 Appropriation Request Positions	F.Y. 1974 Appropriation Request Funds
1. Departmental Direction:									
Immediate Office of the Secy....	17	$ 551,300	$ ---	$ 3,000	$ ---	--	$ 3,000	17	$ 554,300
Office of the Under Secretary...	16	375,700	---	3,000	---	--	3,000	16	378,700
Field Coordination.....	24	572,277	---	6,223	---	--	6,223	24	578,500
Office for Equal Opportunity....	95	2,097,388	63,500	24,112	---	--	87,612	95	2,185,000
Assistant Secretary - Congressional and Public Affairs.....	54	1,040,100	5,500	10,500	---	--	16,000	54	1,056,100
Immediate Office.....	(3)	(76,100)	---	(500)	---	--	(500)	(3)	(76,600)
Congressional Liaison.....	(10)	(223,000)	---	(2,000)	---	--	(2,000)	(10)	(225,000)
Office of Communications.....	(14)	(297,800)	---	(4,000)	---	--	(4,000)	(14)	(301,800)
Office of Legislation.....	(27)	(443,200)	(5,500)	(4,000)	---	--	(9,500)	(27)	(452,700)
Assistant Secretary - Program Development and Budget.....	77	1,827,100	32,200	7,800	200,000	6	240,000	83	2,067,100
Immediate Office.....	(11)	(276,700)	(2,100)	(1,200)	---	--	(3,300)	(11)	(280,000)
Program Coordination.....	(11)	(271,100)	(5,200)	(2,200)	----	--	(7,400)	(11)	(278,500)
Environmental Project Review..	(20)	(462,200)	(17,400)	(3,100)	---	--	(20,500)	(20)	(482,700)
Economic Analysis.....	(10)	(200,600)	(7,500)	(1,300)	---	--	(8,800)	(10)	(209,400)
Office of Budget.....	(20)	(485,500)	---	---	(200,000)	(6)	(200,000)	(26)	(685,500)
Accounting Management and Policy.....	(5)	(131,000)	---	---	---	--	---	(5)	(131,000)
Subtotal.....	283	6,463,865	101,200	54,635	200,000	6	355,835	289	6,819,700
2. Program Direction and Coord.:									
Assistant Secretary -									
- Energy and Minerals.....	37	895,700	---	5,600	30,000	--	35,600	37	931,300
- Land & Water Resources.....	24	585,700	7,700	3,700	---	--	11,400	24	597,100
- Fish & Wildlife & Parks.....	17	372,800	7,000	3,000	---	--	10,000	17	382,800
Office of Territorial Affairs...	13	363,900	---	2,100	---	--	2,100	13	366,000
Office of Indian Affairs.....	8	216,300	---	1,200	---	--	1,200	8	217,500
Subtotal.....	99	2,434,400	14,700	15,600	30,000	--	60,300	99	2,494,700

OFFICE OF THE SECRETARY
SALARIES AND EXPENSES

(Cont'd.)

Analysis of Increases

Activity/Subactivity	F.Y. 1973 (Adjusted) Appropriation Positions	F.Y. 1973 (Adjusted) Appropriation Funds	F.Y. 1974 Increases: Annualization of 1973 Program Increases	F.Y. 1974 Increases: Maintain Current Level of Operations	F.Y. 1974 Increases: Program Inc. New Positions and Related Funding	Total Increases Positions	Total Increases Funds	F.Y. 1974 Appropriation Request Positions	F.Y. 1974 Appropriation Request Funds
3. Administrative Management:									
Assistant Secretary - Management.	7	$ 193,300	$ ---	$ ---	$ ---	--	$ ---	7	$ 193,300
International Activities.....	6	155,800		1,100	---	--	1,100	6	156,900
Secretarial Operations.....	37	602,300		5,000	---	--	5,000	37	607,300
Survey and Review.....	128	2,724,814	51,400	29,586	---	--	80,986	128	2,805,800
Management Operations.....	60	925,600	9,700	20,000	---	--	29,700	60	955,300
Management Consulting.....	27	857,900	20,000	4,000	---	--	24,000	27	881,900
Personnel Management.....	36	649,400	3,000	10,000	---	--	13,000	36	662,400
Subtotal.....	301	6,109,114	84,100	69,686	---	--	153,786	301	6,262,900
4. General Services.....	--	246,019	---	71,681	---	--	71,681	--	317,700
GRAND TOTAL.....	683	15,253,398	200,000	211,602	230,000	6	641,602	689	15,895,000

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DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
SALARIES AND EXPENSES

COMPARISON OF BUDGET ACTIVITIES AND SUBACTIVITIES AS PRESENTED IN THE F.Y. 1974 BUDGET AND AS PROPOSED UNDER SECRETARIAL REORGANIZATION

Activity/Subactivity	F. Y. 1974 Budget Request Positions	F. Y. 1974 Budget Request Funds	F.Y. 1974 Proposed Secretarial Reorganiz. Positions	F.Y. 1974 Proposed Secretarial Reorganiz. Funds	Change Increase (+), Decrease (-) Positions	Change Increase (+), Decrease (-) Funds
1. Departmental Direction:						
Immediate Office of the Secy..	27	$ 779,300	17	$ 554,300	-10	$ -225,000
Office of the Under Secretary.	16	378,700	16	378,700	--	---
Field Coordination.....	16	443,500	24	578,500	+8	+135,000
Office for Equal Opportunity..	95	2,185,000	95	2,185,000	--	---
Office of Communications.....	14	301,800	--	---	-14	-301,800
Office of Science Adviser.....	5	137,500	--	---	-5	-137,500
Office of Legislation.....	27	452,700	--	---	-27	-452,700
Assistant Secretary - Program Policy.....	57	1,372,800	--	---	-57	-1,372,800
Immediate Office.....	(7)	(167,300)	--	---	(-7)	(-167,300)
Program Coordination.....	(13)	(328,500)	--	---	(-13)	(-328,500)
Environmental Project Review	(20)	(482,700)	--	---	(-20)	(-482,700)
Regional Planning.....	(7)	(184,900)	--	---	(-7)	(-184,900)
Economic Analysis.....	(10)	(209,400)	--	---	(-10)	(-209,400)
Assistant Secretary - Program Development and Budget.....			83	2,067,100	+83	+2,067,100
Immediate Office.....			(11)	(280,000)	(+11)	(+280,000)
Program Coordination.....			(11)	(278,500)	(+11)	(+278,500)
Environmental Project Review.....			(20)	(482,700)	(+20)	(+482,700)
Economic Analysis.....			(10)	(209,400)	(+10)	(+209,400)
Office of Budget.....			(26)	(685,500)	(+26)	(+685,500)
Accounting Management and Policy.....			(5)	(131,000)	(+5)	(+131,000)
Assistant Secretary - Congressional and Public Affairs...			54	1,056,100	+54	+1,056,100
Immediate Office.....			(3)	(76,600)	(+3)	(+76,600)
Congressional Liaison.....			(10)	(225,000)	(+10)	(+225,000)
Office of Legislation.....			(27)	(452,700)	(+27)	(+452,700)
Office of Communications...			(14)	(301,800	(+14)	(+301,800)
Subtotal - Departmental Direction.....	257	6,051,300	289	6,819,700	+32	+768,400

COMPARISON OF BUDGET ACTIVITIES AND SUBACTIVITIES AS PRESENTED IN THE F.Y. 1974 BUDGET AND AS PROPOSED UNDER SECRETARIAL REORGANIZATION (Cont'd.)

Activity/Subactivity	F. Y. 1974 Budget Request Position	Funds	F.Y. 1974 Proposed Secretarial Reorganiz. Positions	Funds	Change Increase (+), Decrease(-) Positions	Funds
2. Program Direction and Coord:						
Assistant Secretary - Water and Power Resources.....	25	633,400	--	---	-25	-633,400
Assistant Secretary - Mineral Resources.....	22	532,200	--	---	-22	-532,200
Assistant Secretary - Energy and Minerals.....			37	931,300	+37	+931,300
Immediate Office.....			(32)	(793,800)	(+32)	(+793,800)
Office of the Science Adviser.....			(5)	(137,500)	(+5)	(+137,500)
Assistant Secretary - Public Land Management.....	26	700,500	--	---	-26	-700,500
Assistant Secretary - Land and Water Resources.....			24	597,100	+24	+597,100
Immediate Office.....			(17)	(412,200)	(+17)	(+412,200)
Regional Planning.....			(7)	(184,900)	(+7)	(+184,900)
Assistant Secretary - Fish and Wildlife and Parks.....	15	332,800	17	382,800	+2	+50,000
Office of Territories.....	--	---	13	366,000	+13	366,000
Office of Indian Affairs.....	--	---	8	217,500	+8	217,500
Subtotal - Program Development and Coordination.....	88	2,198,900	99	2,494,700	+11	+295,800

COMPARISON OF BUDGET ACTIVITIES AND SUBACTIVITIES AS PRESENTED IN THE F.Y. 1974 BUDGET AND AS PROPOSED UNDER SECRETARIAL REORGANIZATION (Cont'd.)

Activity/Subactivity	F. Y. 1974 Budget Request Positions	F. Y. 1974 Budget Request Funds	F.Y. 1974 Proposed Secretarial Reorganiz. Positions	F.Y. 1974 Proposed Secretarial Reorganiz. Funds	Change Increase (+), Decrease (-) Positions	Change Increase (+), Decrease (-) Funds
3. Administrative Management:						
Assistant Secretary - Management and Budget.....	13	362,300	--	---	-13	-362,300
Assistant Secretary - Management.....	--	---	7	193,300	+7	193,300
International Activities.....	6	156,900	6	156,900	--	---
Secretarial Operations.....	37	607,300	37	607,300	--	---
Survey and Review.....	139	3,015,500	128	2,805,800	-11	-209,700
Office of Budget.....	26	685,500	--	---	-26	-685,500
Management Operations.....	60	955,300	60	955,300	--	---
Management Consulting.....	27	881,900	27	881,900	--	---
Personnel Management.....	36	662,400	36	662,400	--	---
Subtotal - Administrative Management.....	344	7,327,100	301	6,262,990	-43	-1,064,200
4. General Services.....	--	317,700	--	317,700	--	---
GRAND TOTAL.....	689	15,895,000	689	15,895,000	--	---

EXPLANATION OF CHANGES

Immediate Office of the Secretary

The reduction of 10 positions and $225,000 represents the reassignment of the Department's Congressional Liaison Activities to the newly established Assistant Secretary - Congressional and Public Affairs.

Field Coordination

The increase of 8 positions and $135,000 represents the addition of a staff assistant to each of the Field Representatives. Last fiscal year it was proposed to establish regional administrative offices in areas where the Department had a concentration of administrative activities. Secretary Morton has determined that the most economical way to have administrative presence in the field was to assign the responsibility to the Field Representatives in each Region and provide him with additional staff support.

Funding for this effort comes from two areas. $56,300 and 2 positions is budgeted under the Assistant Secretary - Management and Budget. These resources funded the Office of the Deputy Assistant Secretary - Field Operations which was discussed during last year's Congressional Hearings. The additional 6 positions and $78,700 is budgeted under Survey and Review for Regional Administrative Offices. These funds were approved in the Committee Reports that accompanied the fiscal year 1973 appropriation.

Office of Communications

This Office has been reassigned and is now under the supervision of the Assistant Secretary - Congressional and Public Affairs.

Office of the Science Adviser

This Office has been reassigned to the Assistant Secretary - Energy and Minerals. It is proposed that this Office will form the nucleus of the Office of Research and Development.

Office of Legislation

This Office has been reassigned and is now under the supervision of the Assistant Secretary - Congressional and Public Affairs.

Assistant Secretary - Congressional and Public Affairs

This Assistant Secretariat includes the Assistant Secretary position and related staff support which comes from the abolished Assistant Secretary for Water and Power ($76,600 and 3 positions). Added to this staff are the reassigned functions, positions, and related funds from the following offices:

1. Congressional Liaison.....($225,000 and 10 positions)
2. Communications.....($301,800 and 14 positions)
3. Legislation.....($452,700 and 27 positions)

Assistant Secretary - Program Policy

This Assistant Secretariat, the staff offices of program coordination, environmental project review, and economic analysis will remain under the newly designated Assistant Secretariat - Program Development and Budget. $184,900 and 7 positions has been transferred to the Assistant Secretary - Land and Water Resources to reflect the reassignment of the regional planning function. $50,000 and 2 positions were reassigned to Assistant Secretary - Fish and Wildlife and Parks to reflect the added responsibility for direction of the Bureau of Outdoor Recreation.

Assistant Secretary - Program Development and Budget

This renamed Assistant Secretariat consists of the staff offices of Program Coordination, Environmental Project Review, and Economic Analysis. In addition, it includes the Office of Budget, and the Office of Accounting Management and Policy from Survey and Review, and 4 positions and $112,700 transferred from the Assistant Secretary - Management and Budget to reflect the realignment of Budget and Accounting Policy responsibilities.

Assistant Secretary - Water and Power Resources

This Assistant Secretariat has been abolished with its positions and resources distributed as follows:

1. Assistant Secretary position and 2 supporting positions amounting to $76,600 for the newly established Assistant Secretary for Congressional and Public Affairs.

2. Staff assistance for the direction of power activities (Bonneville Power, Southeastern, Southwestern, Alaska, and Defense Electric) to the Assistant Secretary - Energy and Minerals - 10 positions and $261,600.

3. Staff assistance for the direction of water activities (Bureau of Reclamation, Office of Water Resources Research, and Saline Water Research) to the Assistant Secretary - Land and Water Resources - 12 positions and $295,200.

Assistant Secretary - Mineral Resources

All of these resources are now under the Assistant Secretary - Energy and Minerals.

Assistant Secretary - Energy and Minerals

This Assistant Secretariat consists of all resources formally under the Assistant Secretary - Mineral Resources ($532,200 and 22 positions) plus the staff assistance needed to direct the additional power responsibilities (10 positions and $261,600). In addition, the Office of the Science Adviser (5 positions, and $137,500) will form the nucleus of the Office of Research and Development under the supervision of this Assistant Secretary.

Assistant Secretary - Public Land Management

This Assistant Secretariat's functions have been reassigned as follows:

1. Assistant Secretary and 2 support positions plus 2 positions for the direction of the Bureau of Land Management to the Assistant Secretary - Land and Water Resources - 5 positions and $117,000.

2. 13 positions and $366,000 for the establishment of a staff office for Territorial Affairs. 11 positions and $326,000 was transferred to this Assistant Secretary when the Office of Territories was abolished. The additional 2 positions were transferred from the Office of Assistant Secretary - Public Land Management where they provided assistance in direction of the Territories.

3. 8 positions and $217,500 represents the staff effort in direction of the Department's Indian programs.

Assistant Secretary - Land and Water Resources

This Assistant Secretariat includes the Assistant Secretary position for Public Land Management and related staff support and assistance in directing the Bureau of Land Management ($117,000 and 5 positions). Added to this is the staff assistance for direction of the Department's Water Resources Programs ($295,200 and 12 positions). In addition the resources for Regional Planning previously included under the Assistant Secretary - Program Policy have been included to reflect the reassignment of this function.

Assistant Secretary - Fish and Wildlife and Parks

Added to this Assistant Secretariat is $50,000 and 2 positions to reflect the added responsibility for the direction of the Bureau of Outdoor Recreation which previously reported to the Assistant Secretary - Program Policy.

Office of Territories

This staff office is composed of those resources for the direction of the Department's territorial responsibilities previously included under the Assistant Secretary - Public Land Management.

Office of Indian Affairs

This staff office is composed of those resources for the direction of the Department's Indian Affairs responsibilities previously under the Assistant Secretary - Public Land Management. Legislation is proposed to elevate this Office to the Assistant Secretariat level.

Assistant Secretary - Management and Budget

Resources of this Assistant Secretariat have been distributed as follows:

1. $56,300 and 2 positions to the Field Coordination activity as earlier explained.

2. $112,700 and 4 positions to the Assistant Secretary - Program Development and Budget for direction and supervision of the Office of Budget and Accounting Policy.

3. $193,300 and 7 positions for the Assistant Secretary - Management.

Assistant Secretary - Management

This Office represents the resources estimated to be required to direct the Department's Management activities.

Survey and Review

The reduction in this subactivity represents the reassignment of funds and positions to Field Coordination as previously explained ($78,700 and 6 positions) and the reassignment of the Office of Accounting Management and Policy ($131,000 and 5 positions) to the Assistant Secretary - Program Development and Budget.

ADJUSTMENTS TO THE SECRETARY'S IMMEDIATE OFFICE
FISCAL YEAR 1974

	Revised Level Secretary's Immediate Office	Transferred To Asst. Secretary Congressional & Public Affairs	Original Level Secretary's Immediate Office
Personnel compensation.....	$427,100	$184,100	$611,200
Personnel benefits.....	35,600	16,700	52,300
Travel.....	33,500	9,300	42,800
Transportation of things....	1,000	---	1,000
Rents, communications and and utilities.....	8,900	3,800	12,700
Printing and reproduction...	19,600	3,600	23,200
Other services.....	16,000	4,300	20,300
Supplies.....	6,600	2,200	8,800
Equipment.....	6,000	1,000	7,000
Total.....	554,300	225,000	779,300
Permanent Positions.....	17	10	27
Professional.....	(11)	(6)	(17)
Clerical.....	(6)	(4)	(10)

CO-LOCATING OF RESOURCES FOR THE FUNCTIONS ASSIGNED TO
THE FIELD COORDINATION
FISCAL YEAR 1974

		Transferred From		
	Field Coordination	Asst. Secretary Mgmt. & Budget	Survey and Review	Field Coordination
Personnel compensation.....	$415,000	$41,700	$65,000	$308,300
Personnel benefits.....	35,400	3,500	5,000	26,900
Travel.....	66,000	3,000	4,000	59,000
Transportation of things.....	2,000	---	---	2,000
Rents, communications and utilities.....	19,500	2,500	3,000	14,000
Printing and reproduction....	9,500	1,000	---	8,500
Other services.....	19,700	3,000	1,700	15,000
Supplies.....	7,200	1,400	---	5,800
Equipment.....	4,200	200	---	4,000
Total.....	578,500	56,300	78,700	443,500
Permanent positions.....	24	2	6	16
Professional.....	(8)	---	---	(8)
Clerical.....	(16)	(2)	(6)	(8)

CO-LOCATING OF RESOURCES FOR FUNCTIONS ASSIGNED TO THE
ASSISTANT SECRETARY - CONGRESSIONAL AND PUBLIC AFFAIRS
FISCAL YEAR 1974

	Asst. Secretary Congressional Public Affairs	Transferred From			
		Asst. Secretary Water & Power	Congressional Liaison	Communications	Legislation
Personnel compensation.....	$882,800	$62,500	$184,100	$258,100	$378,100
Personnel benefits.....	77,700	5,500	16,700	22,200	33,300
Travel.....	19,400	5,000	9,300	2,300	2,800
Transportation of things...	---	---	---	---	---
Rents, communications, and utilities.....	15,200	800	3,800	2,000	8,600
Printing and reproduction..	23,700	600	3,600	7,400	12,100
Other services.....	20,500	1,200	4,300	4,900	10,100
Supplies.....	11,800	500	2,200	3,400	5,700
Equipment.....	5,000	500	1,000	1,500	2,000
Total.....	1,056,100	76,600	225,000	301,800	452,700
Permanent Positions.....	54	3	10	14	27
Professional.....	(20)	(2)	(6)	(6)	(6)
Clerical.....	(34)	(1)	(4)	(8)	(21)

DISTRIBUTION OF RESOURCES PREVIOUSLY ASSIGNED TO THE
ASSISTANT SECRETARY - PROGRAM POLICY
FISCAL YEAR 1974

	Asst. Secretary Program Policy	Transferred to: Asst. Secretary Land & Water (Regional Planning)	Transferred to: Asst. Secretary Fish & Wildlife & Parks BOR Direction	Transferred to: Asst. Secretary Program Dev. & Budget
Personnel compensation.....	$1,119,100	$138,000	$39,000	$942,100
Personnel benefits.....	93,000	11,700	3,100	78,200
Travel.....	58,000	14,300	4,400	39,300
Transportation of things.....	3,700	500	---	3,200
Rents, communications and utilities.....	26,000	5,500	500	20,000
Printing and reproduction.....	16,000	3,100	500	12,400
Other services.....	25,000	6,300	2,000	16,700
Supplies.....	13,000	2,000	500	10,500
Equipment.....	19,000	3,500	----	15,500
Total.....	1,372,800	184,900	50,000	1,137,900
Permanent positions.....	57	7	2	48
Professional.....	(36)	(4)	(1)	(31)
Clerical.....	(21)	(3)	(1)	(17)

CO-LOCATING OF RESOURCES FOR FUNCTIONS ASSIGNED TO THE
ASSISTANT SECRETARY - PROGRAM DEVELOPMENT & BUDGET
FISCAL YEAR 1974

	Asst. Secretary Program Dev. & Budget	Transferred from: Program Policy	Office of Budget	Asst. Secretary Mgmt. & Budget	Accounting Policy
Personnel compensation.....	$1,689,500	$942,100	$548,600	$91,000	$107,800
Personnel benefits.....	144,000	78,200	48,700	7,700	9,400
Travel.....	65,300	39,300	13,500	5,000	7,500
Transportation of things.....	3,200	3,200	---	---	---
Rents, communications and utilities.....	35,400	20,000	10,400	3,000	2,000
Printing and reproduction.....	17,100	12,400	3,200	1,000	500
Other services.....	69,200	16,700	49,200	1,300	2,000
Supplies.....	17,200	10,500	3,900	2,000	800
Equipment.....	26,200	15,500	8,000	1,700	1,000
Total.....	2,067,100	1,137,900	685,500 1/	112,700	131,000
Permanent positions.....	83	48	26	4	5
Professional.....	(55)	(31)	(19)	(2)	(3)
Clerical.....	(28)	(17)	(7)	(2)	(2)

1/ Includes 6 positions and $200,000 increase requested for fiscal year 1974.

CO-LOCATING OF RESOURCES FOR FUNCTIONS ASSIGNED TO THE
ASSISTANT SECRETARY - ENERGY AND MINERALS
FISCAL YEAR 1974

	Asst. Secretary Energy & Minerals	Transferred From: Asst. Secretary Mineral Resources	Transferred From: Asst. Secretary Water & Power Resources	Transferred From: Office of the Science Adviser
Personnel compensation.....	$750,200	$420,000	$216,700	$113,500
Personnel benefits.....	64,300	36,100	18,500	9,700
Travel.....	79,000 1/	53,000 1/	14,500	11,500
Rents, communications and utilities.....	4,100	2,300	1,500	300
Printing and reproduction..	8,900	6,000	2,400	500
Other services.....	12,900	7,500	4,900	500
Supplies and materials.....	7,400	4,600	1,800	1,000
Equipment.....	4,500	2,700	1,300	500
Total.....	931,300	532,200	261,600	137,500
Permanent positions.....	37	22	10	5
Professional.....	(19)	(11)	(5)	(3)
Clerical.....	(18)	(11)	(5)	(2)

1/ Includes $30,000 increase for Law of the Sea Program.

CO-LOCATING OF RESOURCES AND FUNCTIONS FOR ASSISTANT SECRETARY
LAND AND WATER RESOURCES
FISCAL YEAR 1974

		Transferred From		
	Asst. Secretary Land and Water Resources	Asst. Secretary Public Land Management	Asst. Secretary Water & Power	Program Policy (Regional Planning)
Personnel compensation.....	$492,200	$102,500	$251,700	$138,000
Personnel benefits.....	41,400	8,100	21,600	11,700
Travel.....	31,400	3,100	14,000	14,300
Transportation of things.....	500	---	---	500
Rents, communications and utilities.....	7,600	700	1,400	5,500
Printing and reproduction....	5,400	500	1,800	3,100
Other services.....	10,900	1,600	3,000	6,300
Supplies.....	3,700	500	1,200	2,000
Equipment.....	4,000	---	500	3,500
Total.....	597,100	117,000	295,200	184,900
Permanent positions.....	24	5	12	7
Professional.....	(12)	(2)	(6)	(4)
Clerical.....	(12)	(3)	(6)	(3)

DISTRIBUTION OF BUDGET RESOURCES FROM ABOLISHMENT OF THE ASSISTANT SECRETARY - PUBLIC LAND MANAGEMENT

FISCAL YEAR 1974

		Transferred to		
	Asst. Secretary Public Land Management	Office of Territorial Affairs	Commission of Indian Affairs	Asst. Secretary Land & Water Resources
Personnel compensation.....	$565,900	$282,500	$180,900	$102,500
Personnel benefits.....	48,700	21,100	19,500	8,100
Travel.....	44,000	31,600	9,300	3,100
Transportation of things.....	---	---	---	---
Rents, communications, and utilities.....	10,200	8,200	1,300	700
Printing and reproduction.....	5,300	4,200	600	500
Other services.....	15,800	11,800	2,400	1,600
Supplies.....	7,200	4,800	1,900	500
Equipment.....	3,400	1,800	1,600	---
Total.....	700,500	366,000	217,500	117,000
Permanent positions.....	26	13	8	5
Professional.....	(12)	(7)	(3)	(2)
Clerical.....	(14)	(6)	(5)	(3)

ADJUSTMENTS TO ASSISTANT SECRETARY FOR FISH AND WILDLIFE AND PARKS
FISCAL YEAR 1974

	Revised Level Asst. Secretary Fish & Wildlife & Parks	Increase for Direction of the Bureau of Outdoor Recreation	Original Level for Asst. Secretary Fish & Wildlife & Parks
Personnel compensation.....	$301,500	$39,000	$262,500
Personnel benefits.....	26,000	3,100	22,900
Travel.....	22,400	4,400	18,000
Transportation of things.....	---	---	---
Rents, communications and utilities.....	10,800	500	10,300
Printing and reproduction.....	2,900	500	2,400
Other services.....	11,300	2,000	9,300
Supplies and materials.....	4,500	500	4,000
Equipment.....	3,400	---	3,400
Total.....	382,800	50,000	332,800
Permanent positions.....	17	2	15
Professional.....	(9)	(1)	(8)
Clerical.....	(8)	(1)	(7)

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DISTRIBUTION OF RESOURCES PREVIOUSLY ASSIGNED TO THE
ASSISTANT SECRETARY - MANAGEMENT AND BUDGET
FISCAL YEAR 1974

		Transferred To		
	Assistant Secretary Management & Budget	Asst. Secretary Management	Assistant Secretary Prog. Development & Budget	Field Coordination
Personnel compensation.....	$282,200	$149,500	$91,000	$41,700
Personnel benefits.....	24,000	12,800	7,700	3,500
Travel.....	19,300	11,300	5,000	3,000
Transportation of things...	---	---	---	---
Rents, communications and utilities.....	10,000	4,500	3,000	2,500
Printing and reproduction..	3,900	1,900	1,000	1,000
Other services.....	12,000	7,700	1,300	3,000
Supplies and materials.....	5,400	2,000	2,000	1,400
Equipment.....	5,500	3,600	1,700	00
Total.....	362,300	193,300	112,700	56,300
Permanent positions.....	13	7	4	2
Professional.....	(6)	(3)	(2)	(--)
Clerical.....	(7)	(4)	(2)	(2)

ADJUSTMENTS TO SURVEY AND REVIEW - F.Y. 1974

	Revised Level Survey & Review	Transferred to Program Dev. and Budget Accounting Mgmt. Policy	Transferred to Field Coordination	Original Level Survey & Review
Personnel compensation.....	$2,068,800	$-107,800	$-65,000	$2,241,600
Personnel benefits.....	164,000	-9,400	-5,000	178,400
Travel.....	348,100	-7,500	-4,000	359,600
Transportation of things.....	10,900	---	---	10,900
Rents, communications and utilities.....	23,500	-2,000	-3,000	28,500
Printing and reproduction.....	20,900	-500	---	21,400
Other services.....	136,300	-2,000	-1,700	140,000
Supplies.....	18,400	-800	---	19,200
Equipment.....	14,900	-1,000	---	15,900
Total.....	2,805,800	-131,000	-78,700	3,015,500
Permanent positions.....	128	-5	-6	139

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
SALARIES AND EXPENSES

(Revised to Reflect Secretarial Reorganization)

ESTIMATED OBLIGATIONS BY SUBACTIVITY AND OBJECT CLASS, FISCAL YEARS 1973 and 1974

Activity/Subactivity	Fiscal Year	Personnel Compensation	Personnel Benefits	Travel	Trans-portation of Things	Rents Comm. & Utilities	Print-ing & Reprod.	Other Services	Supplies and Materials	Equip-ment	Total	Posi-tions
1. Departmental Direction:												
(a) Immediate Office of the Secretary	1973	$424,500	$35,200	$33,500	$ 1,000	$ 8,900	$19,600	$16,000	$ 6,600	$ 6,000	$ 551,300	17
	1974	427,100	35,600	33,500	1,000	8,900	19,600	16,000	6,600	6,000	554,300	17
(b) Office of the Under Secy...	1973	307,200	26,300	20,900	---	4,800	4,100	5,700	2,700	4,000	375,700	16
	1974	309,800	26,700	20,900	---	4,800	4,100	5,700	2,700	4,000	378,700	16
(c) Field Coordination.....	1973	409,700	34,700	66,000	2,000	18,977	9,500	19,700	7,200	4,500	572,277	24
	1974	415,000	35,400	66,000	2,000	19,500	9,500	19,700	7,200	4,200	578,500	24
(d) Office for Equal Oppor....	1973	1,424,400	125,500	280,300	59,500	80,388	14,500	58,000	20,600	34,200	2,097,388	95
	1974	1,517,000	133,000	300,000	25,000	80,000	17,000	68,000	25,000	20,000	2,185,000	95
(e) A/S - Congressional and Public Affairs.....	1973	870,100	76,400	19,400	---	15,200	21,700	20,500	11,800	5,000	1,040,100	54
	1974	882,800	77,700	19,400	---	15,200	23,700	20,500	11,800	5,000	1,056,100	54
(f) A/S - Prog. Dev. & Budget.	1973	1,512,200	128,000	50,600	3,200	29,900	15,200	44,100	14,100	29,800	1,827,100	77
	1974	1,689,500	144,000	65,300	3,200	35,400	17,100	69,200	17,200	26,200	2,067,100	83
Subtotal.....	1973	4,948,100	426,100	470,700	65,700	158,165	84,600	164,000	63,000	83,500	6,463,865	283
	1974	5,241,200	452,400	505,100	31,200	163,800	91,000	199,100	70,500	65,400	6,819,700	289
2. Program Direction & Coord.:												
(a) A/S - Energy & Minerals...	1973	746,800	64,100	49,000	---	3,800	8,300	12,000	7,200	4,500	895,700	37
	1974	750,200	64,300	79,000	---	4,100	8,900	12,900	7,400	4,500	931,300	37
(b) A/S - Land & Water Res....	1973	479,200	40,100	31,300	500	7,600	5,400	12,400	3,700	5,500	585,700	24
	1974	492,200	41,400	31,400	500	7,600	5,400	10,900	3,700	4,000	597,100	24
(c) A/S - Fish & Wildlife and Parks.....	1973	295,100	25,400	21,700	---	9,800	2,500	9,400	3,900	5,000	372,800	17
	1974	301,500	26,000	22,400	---	10,800	2,900	11,300	4,500	3,400	382,800	17
(d) Office of Territorial Aff.	1973	281,200	21,000	30,900	---	8,200	4,200	11,800	4,800	1,800	363,900	13
	1974	282,500	21,100	31,600	---	8,200	4,200	11,800	4,800	1,800	366,000	13
(e) Office of Indian Affairs..	1973	180,000	19,400	9,100	---	1,300	600	2,400	1,900	1,600	216,300	8
	1974	180,900	19,500	9,300	---	1,300	600	2,400	1,900	1,600	217,500	8
Subtotal.....	1973	1,982,300	170,000	142,000	500	30,700	21,000	48,000	21,500	18,400	2,434,400	99
	1974	2,007,300	172,300	173,700	500	32,000	22,000	49,300	22,300	15,300	2,494,700	99

(Cont'd.)

ESTIMATED OBLIGATIONS BY SUBACTIVITY AND OBJECT CLASS, FISCAL YEARS 1973 and 1974

Activity/Subactivity	Fiscal Year	Personnel Compensation	Personnel Benefits	Travel	Transportation of Things	Rents Comm. & Utilities	Printing & Reprod.	Other Services	Supplies and Materials	Equipment	Total	Positions
3. Administrative Management:												
(a) A/S - Management.....	1973	$147,400	$12,500	$11,300	$ ---	$ 4,500	$ 1,900	$ 7,700	$ 2,000	$ 6,000	$ 193,300	7
	1974	149,500	12,800	11,300	---	4,500	1,900	7,700	2,000	3,600	193,300	7
(b) International Activities..	1973	131,100	15,700	2,000	---	1,000	1,000	3,000	1,000	1,000	155,800	6
	1974	132,000	15,900	2,000	---	1,000	1,000	3,000	1,000	1,000	156,900	6
(c) Secretarial Operations....	1973	511,400	43,000	2,000	---	3,500	4,800	25,300	5,900	6,400	602,300	37
	1974	516,000	43,400	2,000	---	3,500	4,800	25,300	5,900	6,400	607,300	37
(d) Survey and Review.....	1973	2,023,900	158,500	328,300	12,500	23,414	20,900	109,000	18,400	29,900	2,724,814	128
	1974	2,068,800	164,000	348,100	10,900	23,500	20,900	136,300	18,400	14,900	2,805,800	128
(e) Management Operations.....	1973	724,600	63,200	22,400	2,000	13,400	13,700	53,300	14,500	18,500	925,600	60
	1974	754,600	65,800	22,400	2,000	13,500	13,700	53,300	15,000	15,000	955,300	60
(f) Management Consulting.....	1973	521,500	44,600	32,500	2,000	10,200	7,000	220,700	6,800	12,600	857,900	27
	1974	546,200	47,000	32,500	2,000	10,200	7,000	223,000	7,000	7,000	881,900	27
(g) Personnel Management.....	1973	555,400	48,300	7,700	---	2,300	7,800	19,500	4,500	3,900	649,400	36
	1974	567,100	49,300	8,000	---	2,300	7,800	19,500	4,500	3,900	662,400	36
Subtotal.....	1973	4,615,300	385,800	406,200	16,500	58,314	57,100	438,500	53,100	78,300	6,109,114	301
	1974	4,734,200	398,200	426,300	14,900	58,500	57,100	468,100	53,800	51,800	6,262,900	301
4. General Services.....	1973	---	24,000	5,000	---	134,719	15,000	56,000	5,000	6,300	246,019	--
	1974	---	21,500	6,000	---	180,200	20,000	76,000	7,000	7,000	317,700	--
GRAND TOTAL, SALARIES AND EXPENSES.....	1973	11,545,700	1,005,900	1,023,900	82,700	381,898	177,700	706,500	142,600	186,500	15,253,398	683
	1974	11,982,700	1,044,400	1,111,100	46,600	434,500	190,100	792,500	153,600	139,500	15,895,000	689

Mrs. HANSEN. Do you want to discuss the reorganization for the committee?

Mr. HITE. Mrs. Hansen, I would like to make the point that this is being accomplished under Reorganization Plan No. 3 of 1950, which accrues all the responsibilities of the Department to the Secretary. We feel, therefore, that this is within the Secretary's purview to accomplish.

However, I would like further to emphasize that no critical part of this reorganization will be accomplished without further consultation with the committees, both the House and Senate.

Mrs. HANSEN. Will you also consult with the authorizing committee?

Mr. HITE. I believe so. Yes, Mrs. Hansen; we will.

CHANGES IN THE DEPARTMENTAL DIRECTION ACTIVITIES

Mrs. HANSEN. You have proposed no changes in the structure of the Office of the Secretary and Under Secretary.

Mr. HITE. That is correct, Mrs. Hansen, no change except for the Director of the Office of Territorial Affairs. This was previously under the Assistant Secretary for Public Land and Management.

Mrs. HANSEN. Your chart just shows the Secretary and Under Secretary in the top square. There is no use spending good money drawing charts if the committee can't use them.

Mr. HITE. There is one change, that is, the congressional liaison function, that was formerly integral to the Secretary's Office, now is pulled out.

OFFICE OF EQUAL OPPORTUNITY

Mrs. HANSEN. Has there been any changes in the Office of Equal Opportunity.?

Mr. HITE. No change there, Mrs. Hansen.

Mrs. HANSEN. No changes except in the level of funding.

Mr. HITE. That is correct. We are annualizing positions. We are not asking for any more positions this year. We feel we have staffed out the organization.

Mrs. HANSEN. The budgeted level for this program has been increasing.

Mr. HITE. Yes, Ma'am. If you remember with respect to contract compliance, this is a nationwide organization. We have seven industries which the Department of Labor has mandated.

OFFICE OF TERRITORIAL AFFAIRS

Mrs. HANSEN. The Office of Territorial Affairs replaces the former Office of Territories.

Mr. HITE. That is correct, Mrs. Hansen.

Mrs. HANSEN. This involves the Virgin Islands, Guam, American Samoa, and the Trust Territory of the Pacific Islands.

Mr. HITE. That is correct.

Mrs. HANSEN. Are there any changes in the Office of Hearings and Appeals?

Mr. HITE. The Director is Mr. James Day, who is with us today. There is no change in the status of this office.

Mrs. HANSEN. Who was the Director of Territories and who is the new Director of the Office of Territorial Affairs?

Mr. HITE. The same individual, Mrs. Hansen, Stanley Carpenter, who was Deputy Assistant Secretary for Territories under Assistant

Secretary of Public Land Management, will continue as Director of the Office of Territorial Affairs.

Mrs. HANSEN. Who is the Assistant Secretary for Management?

Mr. HITE. It's vacant at this point in time.

Mrs. HANSEN. Why?

Mr. HITE. A nominee has not been selected.

Mrs. HANSEN. Why?

Mr. HITE. I can't really say, Mrs. Hansen. I would, but I don't know why a selection hasn't been made. I presume a qualified nominee has not passed the Secretary's qualifications.

Mrs. HANSEN. How much was budgeted for this position?

Mr. HITE. The position is level IV.

Mrs. HANSEN. I never saw a position that existed without telephone, furniture, et cetera.

Mr. HITE. The staff is represented by me as deputy and the support personnel.

Mrs. HANSEN. Why don't they nominate you for Assistant Secretary?

Mr. HITE. I don't aspire to the position.

Mrs. HANSEN. You don't?

Mr. HITE. No.

Mrs. HANSEN. Do you think Assistant Secretaries are too temporary?

Mr. HITE. There is merit in that.

ASSISTANT SECRETARY FOR PROGRAM DEVELOPMENT AND BUDGET ASSISTANT SECRETARY FOR MANAGEMENT

Mrs. HANSEN. Why are you separating your functions into an Assistant Secretary for Program Development and Budget and Management?

Mr. HITE. Mrs. Hansen, the big difference is that under the previous structure we had an Assistant Secretary for Management and Budget. We have taken Mr. Wiles' office from under the Assistant Director for Management and moved it to the Assistant Secretary for Program Development and Budget in order to colocate programing and budget development.

The Assistant Secretary for Program Development and Budget contains those elements which were previously under Assistant Secretary Larson, plus the Office of Budget and the Office of Accounting Management and Policy.

Mrs. HANSEN. Who is the Assistant Secretary?

Mr. HITE. The nominee is Laurence Lynn.

Mrs. HANSEN. What is his background?

Mr. HITE. He came to us from Health, Education, and Welfare, where he was Assistant Secretary for Planning and Evaluation. He has had some further experience in Government.

Mrs. HANSEN. What is the request for this office?

Mr. HITE. He is a nominee and has not yet been confirmed, Mrs. Hansen. The total for this office is $2.67 million.

Perhaps I should for the record answer your other question. The total budget for Assistant Secretary for Management is $193,300.

Mrs. HANSEN. The Assistant Secretary has not been confirmed?

Mr. HITE. No, he has not.

Mrs. HANSEN. Why?

Mr. HITE. Because hearings haven't been set. We expect them next week.

ASSISTANT SECRETARY FOR CONGRESSIONAL AND PUBLIC AFFAIRS

Mrs. HANSEN. You have an Assistant Secretary of Congressional and Public Affairs. He is confirmed.

Mr. HITE. Yes.

Mrs. HANSEN. He is a former member of Congress.

Mr. HITE. Mr. Kyle is our Assistant Secretary for Congressional and Public Affairs.

Mrs. HANSEN. What is his total budget?

Mr. HITE. His total budget is $1.56 million.

Mrs. HANSEN. How much of that is for press relations? I think you will recall last year by direction of the administration you had cuts in public relations.

Mr. HITE. That is correct. Within that amount of $1.56 million, Mrs. Hansen, $301,800 is attributable to the Office of Communications.

Mrs. HANSEN. Who will be the new Solicitor?

Mr. HITE. We have a nominee. It is Mr. Kent Frizzell. His confirmation hearings are scheduled for next week. Mrs. Hansen.

Mrs. HANSEN. Under the jurisdiction of the Assistant Secretary for Fish and Wildlife and Parks, is the National Park Service, BOR, and the Bureau of Sports Fisheries and Wildlife. Have all those officials been confirmed and operating?

Mr. HITE. Yes, that is correct.

ASSISTANT SECRETARY FOR LAND AND WATER RESOURCES

Mrs. HANSEN. Has the Assistant Secretary for Land and Water Resources been confirmed?

Mr. HITE. Yes, Assistant Secretary Jack Horton has been confirmed, appointed, and is in business.

Mrs. HANSEN. What does the Office of Land Use and Water Planning encompass?

Mr. HITE. Mrs. Hansen, this is a small group of seven positions, formerly integral to the Assistant Secretary for Program Planning. This was an entity that was in being concerned with national land use planning.

Mrs. HANSEN. Why was this office formerly in the office of the Assistant Secretary for Program Development?

Mr. HITE. The concept of the organization, which we are moving from, was that the Assistant Secretary for Program Planning would be the coordinating unit for the Department as well as the policy-evolving unit. These people, with their mission of land use planning, coordinate the efforts of the Bureau of Land Management and the Bureau of Reclamation, and as such were thought to be properly placed at that time under Assistant Secretary Larson. Under this revamped structure, what the Secretary is trying to move toward, Mrs. Hansen, is an Assistant Secretary for Land and Water Planning, a "Mr. Land and Water Planning," if you will, and an Assistant Secretary with all the tools for energy development.

Mrs. HANSEN. Under the jurisdiction of the Assistant Secretary for Energy and Minerals is the Geological Survey, Office of Oil and

Gas, Bureau of Mines, Office of Research and Development, and the Office of Energy Conservation. As you are well aware BLM is under the Jurisdiction of the Assistant Secretary for Land and Water Resources.

Mr. HITE. Yes, ma'am.

Mrs. HANSEN. BLM is involved in the leasing of the Outer Continental Shelf and the onshore lands. Do you think the BLM has nothing to do with energy? I used to be involved in drawing of charts when I took economics and management in college. I discovered what often happens is you have more managers than you know what to do with. You have all chiefs and no Indians.

I look at your chart and I am somewhat puzzled because you have the Office of Land Use and Water Planning, the Office of Saline Water, Office of Water Research under the same Secretary as the Bureau of Land Management. BLM has the functions of leasing based upon the information obtained from the Geological Survey. Isn't this correct?

Mr. HITE. That is correct, Mrs. Hansen.

Mrs. HANSEN. Who will do the integrating and coordinating?

Mr. LAY. I don't think that is quite right. The leasing function will stay under the Assistant Secretary for Land and Water Resources. In other words, the Bureau of Land Management will continue to do the leasing of offshore and onshore public lands. Obviously, there has to be quite a bit of coordination between those two Assistant Secretaries to set policy. Of course, what it comes down to is that OCS leasing policy in most instances will be a departmental decision, and, of course, a secretarial decision.

But the actual decisions on the leases, and so on, will stay within the Bureau of Land Management.

Mrs. HANSEN. I understand. As you are well aware, if the information supplied hasn't cleared from Geological Survey, we will say, into the Secretary, there are going to be some disasters along the way as far as decisions.

Mr. LAY. No, ma'am. We realize that, and we are trying to develop procedures that will prevent that. Our concern was if you took those public lands that are largely energy and put them under the energy person, then you have the problem of administering the nonenergy activities on those lands. It seemed to us it was much cleaner to leave all of those public lands under the Bureau of Land Management.

PROPOSED ASSISTANT SECRETARY FOR INDIANS

Mrs. HANSEN. The Commissioner of Indian Affairs is listed separately on your chart. I understand you are proposing an Assistant Secretary for Indians.

Mr. HITE. That is correct, Mrs. Hansen. Legislation has been submitted to the Congress.

Mrs. HANSEN. Is Mr. Franklin the Acting Director?

Mr. HITE. He is in the capacity of Assistant to the Secretary for Indian Affairs and is carrying the authority of the Commissioner.

I would like to point out, Mrs. Hansen, that we feel that whether it's a Commissioner or an Assistant Secretary of Indian Affairs, this organizational placement is better because he has direct access to the Secretary.

Mrs. HANSEN. I couldn't agree with you more. That has been part of your problem.

Mr. HITE. That is correct.

ASSISTANT SECRETARY FOR ENERGY AND MINERALS

Mrs. HANSEN. Who is the Assistant Secretary for Energy and Minerals?

Mr. LAY. That is Mr. Steven Wakefield. I am Deputy Under Secretary. I am John Whittaker's Deputy for Energy.

Mr. HITE. Mr. Wakefield was formerly a Deputy Assistant Secretary under Hollis Dole. He has been confirmed and appointed. He is functioning as Assistant Secretary for Energy and Minerals.

Mrs. HANSEN. The Office of Energy and Mineral Data Analysis is the Office in which you have some grandiose idea of transferring part of the Bureau of Mines?

Mr. HITE. That is right, Mrs. Hansen. This is a reorganization plan. This would represent the data evaluation people.

Mrs. HANSEN. Did Dr. Osborn convey the committee's message?

Mr. HITE. Yes, I got the message, Mrs. Hansen. Speaking clinically of this thing, if I may, the philosophy here of trying to functionalize these elements would be to——

Mrs. HANSEN. What are you going to do with the Geological Survey?

Mr. HITE. It remains.

Mr. LAY. I want to make two or three points, if I could.

Mrs. HANSEN. Please do.

DEFICIENT DATA COLLECTION AND ANALYSIS

Mr. LAY. First, our thinking is that the new Energy and Minerals Data Analysis Group would be a much stronger data analysis and collection activity than we currently have. Our idea is to give that group much greater responsibility and authority than they currently have in the Bureau of Mines.

Again speaking quite frankly, from the standpoint of policymaking, we have inadequate data. We have inadequate information and inadequate analysis on both energy and minerals. This does not mean that the Bureau of Mines is not doing a good job. They are just not doing enough of the right kind of a job. We do not have timely information.

Mrs. HANSEN. Has part of this been the result of the budget composition?

Mr. LAY. Possibly. But we do not have good, timely, information on such things as inventories, supplies, and different production activity on coal, oil, and gas, the whole energy sphere. The idea is to create in one office as best we can—and it's mainly a matter of taking the activities now going on in the Bureau of Mines and expanding those—a capability for setting up what could be referred to as a system of energy accounts.

Mr. MCDADE. You could put that capability just as readily within the Bureau of Mines and retain its identity.

Mr. LAY. You could, or you could move it completely outside the Bureau of Mines and leave the Bureau of Mines the way it is.

Mr. McDade. But you don't do that. You separate it.

Mr. Lay. There are several alternatives.

Mrs. Hansen. Why can't you continue your data acquisition in the Bureau of Mines? I concur with Mr. McDade. I think that is more practical at this time. Nobody denies that you need a better system of evaluation. I think it's the committee's feeling that a lot of the information you have now comes from industry.

Mr. Lay. We have two or three problems. One is we need more independent data and particularly on the thing you are talking about on reserves, oil and gas reserves. We need a more timely energy information system, which we don't have. Quite often when we are looking for critical data from which to make policy we have to go back for 2 or 3 months to get the most recent data. We need a much better analytical capability, maybe including some policy models.

The type of models where we can ask questions and get good responses—this is what happens if you do this—those are the kinds of things we have to be in a position to do if we are going to make good energy policies.

Mr. McDade. But there is no reason you can't do all of those within the U.S. Bureau of Mines.

Mr. Lay. What I am telling you is——

Mr. McDade. You can beef up its capability.

ALTERNATIVES OF DATA COLLECTION

Mr. Lay. There are several alternatives. What I am attempting to tell you is that we arrived at this alternative as being the most efficient way of getting these things done. There are other alternatives.

I would like to make one other point. Obviously it's a key question when you make the decision, as you put it, to split off, to separate the R. & D., the coal R. & D. or mineral R. & D., and the minerals data collection. Quite obviously the type of capability we are talking about does not only relate to the minerals and coal research. We are looking for capability that will help us develop overall energy strategies, R. & D. strategies, not only for coal, not only for minerals but for oil, for gas and nuclear. So this is a much more expansive capability than we currently have.

Mr. McDade. That is fine, but we would like to see you beef it up to do what you need to do. We don't necessarily want to see you abolish the Bureau of Mines in doing it.

Mr. Lay. I agree with that, but we have the other problem. We don't want to get into a debate this morning because this will be discussed with you in detail before it's done.

Mrs. Hansen. I think you had better decide on the details because the committee is not going to appropriate funds unless those decisions have been made.

Mr. Lay. No, ma'am. I understand that. That is again very reasonable. For the same reason that the Bureau of Mines has so much credibility in the coal country of Pennsylvania, it may not have that much credibility in some other sectors.

What I am trying to impress upon you is that we are trying to develop is an overall energy data collection and analysis capability, something that not only the Department of the Interior can use but also other agencies, other departments, the White House, OMB, and

the Congress. For anybody who wants to get good energy data and good energy analysis, this is the place they come to.

Mr. McDade. You can do it, as I said and as you agreed, exactly the way you are doing it now, improve in the Bureau of Mines without any difficulty.

Mr. Lay. I think it's feasible.

Mr. McDade. Sure it's feasible.

Mr. Lay. Again I am telling you that we evaluated that alternative. We say this alternative is better. We think we can do it more efficiently.

Mr. McDade. You try this, moving those little squares around and you try taking it through the floor of the House of Representatives or the Senate or anyplace else. When we have to agree that the Bureau of Mines is being abolished, as it has been known, as it has been in existence—that is in effect what we are doing here—lots of luck.

Mr. Lay. I understand your problem.

Mr. McDade. I don't know whether you do or not.

Mr. Lay. No, sir. That is not true.

I am trying to bring our thinking to your attention.

Mrs. Hansen. Why are you advocating that the trans-Alaska pipeline be built before you have complete information?

Mr. Lay. I do not think I understand the relationship.

Mrs. Hansen. You say that you have so little information on energy, and yet you decided firmly that the trans-Alaska pipeline can proceed.

Mr. Lay. We are talking about different time frames here.

What I was relating is that we are now in April and we are making some policy on gasoline this summer and fuel oil this winter and we do not have as much timely data and analysis as we would like to have.

BASIC SOURCE OF STATISTICAL INFORMATION

Mr. McDade. The basic statistical source of our oil requirements is the Bureau of Mines.

Mr. Hite. Yes.

Mr. McDade. The basic justification for building the pipeline is because we need the oil. That is what the Department said. Where did you get that conclusion? You got it from data acquired from the U.S. Bureau of Mines as presently constituted.

As the chairman says, if that is not right, your whole proposition is wrong.

Mr. Lay. That is not correct. We are talking about a span of a 10-year period when we are talking about the Alaskan pipeline. It does not take the same precision when you are talking about nationwide shortages and you are talking about worldwide supplies and you are talking about a 10-year time frame as it does when you are trying to balance supplies and demand over the next few months. I assure you we have adequate information to know we need the North Slope oil.

Mr. Hite. In any event, we will be discussing this with you in further detail.

All Dr. Lay and I can do is lay out the rationale.

OFFICE OF ENERGY CONSERVATION

Mrs. HANSEN. What does the Office of Energy Conservation consist of?

Mr. LAY. It has been thought for some time that energy conservation is an area that has not been receiving adequate attention anywhere in the Federal Government.

As you know, studies were done last year by the Office of Emergency Preparedness which show there is great potential for saving energy through different methods of conservation. What we are proposing to do is develop an office which will try to centralize this effort.

ENERGY CONSERVATION

Mrs. HANSEN. There have been various proposals to save energy. One is to not allow individuals to drive their cars to work.

Another is to establish a toll on the bridges before entering the District of Columbia.

We have had numerous other proposals. You could turn off all the lights for various periods. I am sure the Office of Emergency Preparedness is perfectly well aware of the fact that the more lights you turn off in the city the more crime you have.

Mr. LAY. There were a number of different proposals, some of which were a little more realistic than the ones you mentioned.

Mrs. HANSEN. I am bringing up part of what was discussed in a recent news story.

Mr. LAY. I think you are right and they probably overestimated the savings because some of the suggestions were unrealistic.

Increasing house insulation does help. We know that.

Mrs. HANSEN. According to the news article we need to build houses with better insulation.

Mr. LAY. Yes, ma'am; more insulation helps. Labeling appliances is another thing that has been talked about. A lot of appliances are a lot more efficient than others.

Mrs. HANSEN. Why is that not being done?

Mr. LAY. It has never been attempted. It is mainly a matter of setting up standards that are reasonable as far as measuring energy efficiencies is concerned.

Such things as mass transit, which the President is attempting to do.

Mrs. HANSEN. The other day I read a very interesting article on mass transit. I support mass transit.

The city of St. Louis is now forced to close their mass transit because of lack of use.

Mr. LAY. I think that is true in some areas. I don't doubt it.

I think if we look at this thing over a very long time frame our alternatives to mass transit are not very attractive. In many areas we are reaching the saturation point in automobile traffic.

Mr. MCDADE. Do you need that office to know that? We know that today.

Mr. LAY. No, sir. Our thought is that there ought to be a focal point in the Federal Government that could start pulling together all the knowledge and put together programs to educate the people.

Mrs. HANSEN. I thought OEP was involved in this area?

Mr. LAY. OEP no longer exists and all they did was an initial study trying to evaluate the potential of energy conservation.

We are trying to implement a program to achieve some of this potential.

Mr. HITE. We are talking about a very small group.

Mr. LAY. A very small group, an office of six people. This would be an office in the Federal Government attempting to pull together all of the conservation programs.

ENERGY CONSERVATION IN BUILDING CONSTRUCTION

Mr. VEYSEY. Madam Chairman, I attended a conference recently on this question of energy conservation and there are a great many things to be done. The insulation of houses is one aspect, and we are building houses. But even more important is the fad of building public buildings as sort of glass monuments.

It takes 40 percent more energy to cool them as well as to heat them in summer and winter if they are built with much glass. Architects are just becoming aware of that and it is time that this be carried through to the people who make the policy decisions.

Mr. LAY. One of the things to keep in mind is that if we look at the energy problem between now and 1980 there are not too many even promising contributions that can be made other than conservation.

Mrs. HANSEN. I could not agree with you more.

Mr. LAY. We think it is important.

Mr. MCDADE. Other than conservation, I cannot let that stand. You mean to tell me that all of the money we are asking to spend on gasification is not going to make a contribution?

Mr. LAY. That is true from the total energy needs. Coal gasification will not be very significant between now and 1980.

Mr. MCDADE. How about trans-Alaska pipeline?

Mr. LAY. The way it is proceeding, it won't be completed much before 1980.

Mr. VEYSEY. Even if it was it would not close the gap.

ENERGY CONSERVATION IN TRANSPORTATION

Mr. MCDADE. I have heard a lot of people say that even with optimum efforts on conservation, unless you were able to get General Motors to reduce the horsepower in the engines and so on, and get mass transit, you will not make any important impact at all.

Mrs. HANSEN. How can you conserve on energy when we are getting less miles to a gallon of gasoline because of the air pollution devices?

Mr. MCDADE. How can you conserve on energy when we are running the shuttles up and back to New York?

How much more energy does it require to take people to New York by shuttle vis-a-vis the Metroliner?

It takes a good deal more by shuttle.

Mr. LAY. Those are the things that we should develop some policies on, and we have not in the past.

Mrs. HANSEN. I am a member of the Transportation Subcommittee. The other day we were discussing Amtrak. We have long railroad corridors in the United States which are perfectly able to carry people.

The problem is making this form of transportation attractive to the public. What is Amtrak doing about the situation?

Mr. LAY. I have nothing to do with Amtrak policies.

Mrs. HANSEN. You will have an Office of Energy Conservation. Somebody will have to work with Amtrak.

Mr. LAY. Certainly these are the type of things we will be looking at. I do not think I can sit here this morning and tell you how we are going to make Amtrak attractive.

Mrs. HANSEN. You will have to work jointly with the other departments such as Transportation, Department of Defense, et cetera, on what conservation means in a multiplicity of ways.

Mr. LAY. Certainly.

Mrs. HANSEN. Why are you not interested in Amtrak?

The National Park Service is deeply interested in reducing excess car usage.

Couldn't you work with the Department of Transportation to develop tours and trips into the national parks of the West? This would eliminate not only the cars in the park but would eliminate that much gasoline being consumed to and from?

Mr. LAY. That is an excellent proposal and it is something that we can consider.

Mrs. HANSEN. You have to consider all these alternatives.

Mr. LAY. Yes, ma'am.

[Discussion off the record.]

Mr. HITE. Madam Chairman, we understand the serious reservations you have with respect to these elements of the Bureau of Mines, but with respect to the Energy Conservation Office which we have just been discussing, this is an innovation which does seem to have some merit. This is coming out of the Assistant Secretary's Office.

Mrs. HANSEN. We are calling to your attention some of the thoughts of the committee.

Mr. HITE. This is coming out of our own base, if we still have a base.

Mrs. HANSEN. That remains to be seen.

Mr. HITE. We are not carving that out of a bureau or asking for additional positions.

Mrs. HANSEN. The Bonneville PA structure will remain intact?

Mr. HITE. Yes.

Mrs. HANSEN. How about the field structure?

Mr. HITE. Of Bonneville? There is no change.

CLOSING OF RECLAMATION FIELD FACILITIES

Mrs. HANSEN. The Bureau of Reclamation is moving their central office to Boise, Idaho, as I understand.

I also understand you plan to close the Salem and Spokane offices.

Mr. HITE. The Salem office will stay open, Mrs. Hansen. Regrettably the one in Spokane will be closed.

Mrs. HANSEN. You think this will be the case at this moment?

Mr. HITE. Under current planning.

The reason for this is that the emphasis in that particular office has been on irrigation.

Mrs. HANSEN. Why Boise?

Mr. HITE. I cannot answer that, Mrs. Hansen.

Mr. WILES. That is the Reclamation Bureau's regional office. That is there now.

Mrs. HANSEN. How many people do you have in Spokane?

Mr. WILES. There are currently 30 people in the Spokane office.

Mr. HITE. The proposal by the Bureau of Reclamation is to centralize its planning function in each region to make it more flexible, and over the gamut of this centralization we will reduce 200 man-years of effort.

Mrs. HANSEN. Why was the Salem office originally scheduled to be closed?

Mr. HITE. I was not aware that it was scheduled for removal. I'll clarify that, but my most recent information is that Spokane will be closed.

Mrs. HANSEN. Why is the Salem office to remain open?

Mr. HITE. We are maintaining a liaison staff in Salem to facilitate our coordination with the States of Washington and Oregon.

The information I got on Spokane was that the emphasis there was on investigations of projects directed primarily toward irrigation, specifically East High and East Bank and Horse Haven. Investigations on those projects will be terminated.

This is why the office would be closed.

Mrs. HANSEN. How much do you propose to spend in Boise?

Mr. HITE. I will have to supply that. I am not prepared to answer.

[The information follows:]

Although consolidating the planning function in Boise, reclamation will continue to serve planning needs within the State of Washington. Thereby, expenditures in fiscal year 1974, through services provided by our Division of Planning of the regional office in Boise amounting to $955,000 and the Boise field branch amounting to $474,000, will result in an estimated total expenditure of $1,429,000.

Mrs. HANSEN. Will you also supply what is going to happen to the people in the offices you are transferring?

Mr. HITE. I shall, Mrs. Hansen.

[The information follows:]

The 30 employees who are involved in the closing of the Spokane office will be processed in strict accordance with Civil Service Commission reduction-in-force regulations. The majority of these employees will be offered positions elsewhere in the region as close to their present grade and duties as possible. The Bureau has assured me that it is doing everything possible to minimize the adverse affects on any of the individuals.

Mr. HITE. We have proposed through the Bureau of Reclamation, as a result of this reorientation of planning to reduce 200 man-years of effort within the planning functions of the Bureau of Reclamation. I don't know how that pertains to this specific instance but I will provide that.

Mrs. HANSEN. The Southwest Power Administration will not change?

Mr. HITE. That is correct; no change.

Mrs. HANSEN. How about the Alaska Power Administration?

Mr. HITE. No change.

Mrs. HANSEN. The Bureau of Mines restructuring is still under discussion.

Mr. HITE. That is under discussion.

Mrs. HANSEN. It is going to continue in that manner for a period of time.

Mr. HITE. I would envision that, yes, ma'am.
Mrs. HANSEN. Geological Survey?
Mr. HITE. No change.
Mrs. HANSEN. Office of Oil and Gas?
Mr. HITE. That remains the same.

OFFICE OF RESEARCH AND DEVELOPMENT

Mrs. HANSEN. The new Office of Research and Development will contain the Office of Coal Research.
Mr. HITE. That is right.
Mrs. HANSEN. What are you going to do with the Office of Coal Research?
Mr. HITE. This would be maintained within.
Mrs. HANSEN. What does the Office of Energy Research, Office of Mining Research, Office of Metallurgical Research consist of?
Mr. HITE. These are the research elements of the Bureau of Mines which we have been discussing.
Mr. MCDADE. I don't understand this. This puts the Office of Coal Research in with the Bureau of Mines.
Mr. HITE. There would be four sub-offices under the Director of Energy Research and Development.
Mrs. HANSEN. How much more is this going to cost?
Mr. HITE. We don't envision it costing any more than the sums we have presented in this year's budget.
Mr. MCDADE. Here again this little square contemplates the other arm of the U.S. Bureau of Mines as presently constituted.
Mr. HITE. Yes, sir.
The nucleus of the Office of Director of Research and Development would be the positions and the funds we currently have devoted to the Science Adviser's Office.
Mr. MCDADE. What have you done with him?
Mr. HITE. We do not have a science adviser at present. Only two of those five positions are filled.
Mr. MCDADE. Don't you need the science adviser now more than ever before?
Mr. HITE. We feel he would perform the function here of directing the energy research and development effort. Yes, we do need him, in this capacity particularly.
Mr. MCDADE. But you do not have him?
Mr. HITE. No, sir.
Mr. MCDADE. No suggestions?
Mr. HITE. Not to my knowledge.
Mr. MCDADE. We haven't got any energy message yet.
Mr. HITE. As Dr. Lay indicated, it is imminent.

SECRETARIAL OFFICE REFURBISHMENT

Mrs. HANSEN. What further redecorating in the executive suites will be required by this reorganization?
Mr. HITE. Mrs. Hansen, I sincerely hope there won't be any. As I committed to you at the time of the Under Secretary's appearance, prior to any redecorating efforts over a reasonable threshold—that is, standard drapes, painting, and things of that nature—any refurbishment we will report to the committee before it is done.

Mr. McDade. We have a lot of research functions right now in the Office of the U.S. Bureau of Mines connected with Health and Safety.

Mr. Hite. Yes, sir.

Mr. McDade. Where do they go?

Mr. Hite. They would stay with Health and Safety.

Mr. McDade. Does that mean in the Bureau of Mines, where you are going to have enforcement?

Mr. Hite. Yes.

Mr. McDade. You would spin off all the research activities for Health and Safety that now exist within the Bureau of Mines and put them over in the enforcement section.

Mr. Hite. Those that are currently under the surveillance of the Director of Health and Safety; yes, sir.

[Discussion off the record.]

RESPONSIBILITIES OF ASSISTANT SECRETARY FOR MANAGEMENT AND ASSISTANT SECRETARY FOR PROGRAM DEVELOPMENT AND BUDGET

Mrs. Hansen. Please outline for us the general responsibilities of your Assistant Secretary for Management and the Assistant Secretary for Program Development and Budget.

Mr. Hite. The Assistant Secretary for Management will have all those functions which were previously under the Asssistant Secretary for Management and Budget with the exception of the Departmental Budget Office and the Accounting Management and Policy Section which was created last year.

They will move to the Assistant Secretary for Program Development and Budget.

Remaining—and I can enumerate them for you—for the Assistant Secretary for Management will be our Office of Survey and Review, Office of Management Operations, Office of Management Consulting, the Office of Personnel Management, Office of International Activities, and our Office of Secretarial Operations, which is the handling of the Secretary's account.

NEWSPAPER ARTICLE ON AGENCY MANAGEMENT POSITIONS

Mrs. Hansen. I have a news clipping entitled "The Malek Men Will Be Real Muscle Men."

This appeared in the February 19, 1973 issue of the Evening Star by Mr. Cramer:

> If you are a Federal employee working in a Cabinet Department it is time you are thinking highly respectful thoughts about the man who will take over soon as your agency's administrative assistant secretary. In the new scheme of things—

and he gives an exception—

> he is destined to become a mighty powerful guy. He's due to become your agency's top man in the real sense of the phrase. He will be President Nixon's man in your agency. More specifically he will be Malek's man, the personal choice of Frederick Malek, Deputy Director of the Office of Management and Budget who has been assigned by Nixon to bring the bureaucracy under firmer White House control. Traditionally, administrative secretaries have been responsible for internal agency housekeeping, personnel and budgets, though in many departments the control over the latter has been more formal than natural. But the new word is Malek's men will be muscle men, says a knowledgeable bureaucrat:

"In the new system, the Administrative Secretary will be the denominator in each agency—the control point through which the administration will steer his particular part of the bureaucracy".

Mr. HITE. Do you wish me to comment?

Mrs. HANSEN. Yes.

Mr. HITE. Mrs. Hansen, undoubtedly Mr. Malek and Budget Director Ash will exert considerable influence on the operations of all departments as all budget directors do. However, I have no reason to believe that the Assistant Secretary for Management in the Department of Interior will be the personal selection——

Mrs. HANSEN. What is going to be his relationship to OMB and your former Assistant Secretary, Mr. Bodman?

Mr. HITE. First let me say I have no reason to believe and the Secretary has no reason to believe that the Assistant Secretary for Management will be a nominee who is forced into the Department without the Secretary's approval. With respect to his relationship to Assistant Secretary Bodman, it is my best information from former Assistant Secretary Bodman directly that he will not retain or maintain his affiliation with the Office of Management and Budget. He has opted to exercise some of the other alternatives available to him, probably in the private sector. So I do not think that relationship will pertain. I really do not know what his plans are, but he did tell me that directly.

ASSISTANT TO THE SECRETARY FOR ARTS AND DIRECTOR OF CULTURE AFFAIRS

Mrs. HANSEN. I have another news release on the new arts and culture post in Interior. Why does Interior need such a person as Special Assistant to the Secretary?

Mr. HITE. The Secretary has deemed it appropriate to nominate an Assistant for Cultural Affairs.

Mrs. HANSEN. The Department's cultural affairs involve Wolf Trap Farm Park, the Kennedy Center, and Ford Theater. These are all under the jurisdiction of the National Park Service.

Mr. HITE. That is correct.

Mrs. HANSEN. Is the new special assistant a Park Service employee?

Mr. HITE. No, she is not.

Mrs. HANSEN. Do you plan to transfer funding from the Park Service?

Mr. HITE. No.

The funding will come from the Secretary's Office. The nominee or the designee, Miss Pamela Coe, is currently employed in the Office of Communications, and the money and the position will come from that source to underwrite her new function. It will not cause an increase in the Secretary's account, either position or money. She would advise him directly on cultural aspects of these functions which you mentioned, the Ford Theater, the Wolf Trap Farm, Kennedy Center, and would perform liaison functions with the Park Service.

Mrs. HANSEN. They all have boards of directors.

Mr. HITE. That is correct. She will work closely with the boards of directors.

Mrs. HANSEN. You are asking for no additional funds?

Mr. HITE. No, Madam Chairman.

Mrs. HANSEN. I thought the Indian Arts and Crafts Board was under the jurisdiction of the BIA.

Mr. HITE. No.

EMPLOYMENT OF WOMEN

Mrs. HANSEN. Interestingly enough in all your proposals I do not notice any women.

Mr. HITE. Our top executive recruiter coming on board April 15 will be a woman.

Mrs. HANSEN. Who?

Mr. HITE. Mrs. Jean Hawkins.

Mrs. HANSEN. What will she do?

Mr. HITE. We have an executive recruitment program, as do all parts of government at this point in time, and she will supplant our current executive recruiter.

Mrs. HANSEN. Who is your current recruiter?

Mr. HITE. Mr. Guy Simpler.

Mrs. HANSEN. Why is he leaving the Department?

Mr. HITE. He is moving to another department, but I really do not know what his specific plans are.

Mrs. HANSEN. You have one woman out of x number of high level positions?

Mr. WILES. We also have the Director of the Library.

Mr. HITE. You met her last year.

Mr. WILES. She will be under the Assistant Secretary for Management but she is in charge of the whole library operation.

Mrs. HANSEN. She is so important that you did not bring her with you to testify?

Mr. HITE. We have a significantly larger number of ladies at GS–15 than we had in past years.

Mrs. HANSEN. I still have not gotten a very good answer as to exactly why you need a special assistant on arts and culture.

Mr. HITE. The Secretary is interested in progress on these fronts, Mrs. Hansen, and he feels he needs a personal adviser to work directly with him and in turn to perform a conduit or liaison function with the boards of directors of these entities.

Mrs. HANSEN. On June 15, 1972, you proposed to use $80,000 to upgrade and enlarge the executive dining room in Interior. The committee did not approve of this proposal.

What is the current status?

Mr. HITE. The project is dead, Mrs. Hansen.

We have not proceeded with that since your advice.

INTERIOR DEPARTMENT'S ENERGY BOARD

Mrs. HANSEN. On November 6, 1972, you announced the creation of an Interior Department Energy Board. What is the function of this Board?

What is the relationship between the Board and the energy-related operating agencies in Interior?

Mr. HITE. I will defer to Mr. Lay, if I may.

Mr. LAY. The Energy Board is largely just an internal organizational mechanism through which we can pull together all of our energy activities.

Mrs. HANSEN. Who are the members of the Board?

Mr. LAY. The Secretary is the Chairman.

The Under Secretary is the Vice Chairman, and the Assistant Secretary for Energy and Minerals, the Assistant Secretary for Land and Water Resources, and the Assistant Secretary for Program Development and Budget are all members.

It gets involved in energy activities that cross Assistant Secretary jurisdictional lines. I mentioned OCS leasing policy.

Mrs. HANSEN. Each of these people in turn bring technical knowledge to the Energy Board?

Mr. LAY. Yes, ma'am.

It will also be a fairly important instrument in implementing the central energy R. & D. fund concept.

NONREIMBURSABLE DETAILS

Mrs. HANSEN. Please insert in the record a tabulation indicating all Bureau personnel who have been detailed on a nonreimbursable basis to the Office of the Secretary during fiscal year 1973.

Mr. HITE. We will insert that for the record, Mrs. Hansen. There may be some, but they don't come to mind.

[The information follows:]

NON-REIMBURSABLE DETAILS TO THE OFFICE OF THE SECRETARY
FISCAL YEAR 1973

Office and Position Title	Grade	Bureau	Period	Amount	Purpose
Immediate Office					
Secretary.....	GS-9	Indian Affairs	7/1 - 1/73	$8,600	Provide Secretarial assistance to the Immediate Office
Congressional Liaison					
Secretary.....	GS-7	National Park Service	7/1 to Present	7,850	Provide secretarial assistance, follow through on Congressional inquiries assuring that requests are directed to the proper information source and that departmental responses are completed timely.
Secretary.....	GS-7	Sport Fish & Wildlife	7/1 to Present	7,850	
Congressional Liaison Aid.	GS-6	Land Management	7/1 to Present	7,100	
Congressional Liaison Aid.	GS-5	Land Mangement	7/1 to Present	6,350	
Management Operations					
Correspondence Specialist..	GS-11	Indian Affairs	7/1 to Present	11,500	Supervision, control and distribution of mail.
Information Receptionist...	GS-6	Land Management	7/1 to Present	7,100	Provide information, visitor assistance and issue temp. building passes
Information Receptionist...	GS-6	Outdoor Rec.	7/1 to Present	7,100	
Information Receptionist...	GS-5	Park Service	7/1 to Present	6,350	
Information Receptionist...	GS-4	Reclamation	7/1 to Present	5,700	

Mrs. HANSEN. Give us a similar tabulation for the White House.
Mr. HITE. We will, Mrs. Hansen.
[The information follows:]

NON-REIMBURSABLE DETAILS TO THE WHITE HOUSE
AND OTHER EXECUTIVE OFFICES
F.Y. 1973

Office and Position Title	Grade	Bureau	Period	Amount
WHITE HOUSE				
Secretary	GS-6	Office of the Secretary	7/1 - 2/17	$6,000
Confidential Assistant	GS-7	Office of the Secretary	7/1 - 1/6	5,400
OTHER EXECUTIVE OFFICES				
Interdepartmental Council to Coordinate Federal Juvenile Deliquency Programs				
Secretary	GS-7	Office of the Secretary	9/22 - Present	4,800
National Commission on Marijuana and Drug Abuse				
Research Assistant	GS-12	Geological Survey	7/1 - Present	12,400
Federal Property Review Board				
Special Assistant	GS-15	Office of the Secretary	9/1 - Present	17,200
Secretary	GS-9	Office of the Secretary	8/30 - Present	7,400
Secretary	GS-9	Office of the Secretary	10/1 - Present	6,400
Confidential Assistant	GS-9	Office of the Secretary	8/14 - Present	8,100

CONSULTANTS

Mrs. HANSEN. As you well remember, Congressman Steed, the chairman of the Treasury, Post Office, General Government Appropriations Subcommittee and other chairmen are trying very hard to keep track of the fiscal relationship between departments and the executive branch. Also insert in the record a listing of all consultants employed by Interior during fiscal year 1972 and those employed thus far in fiscal year 1973, indicating the purpose, the cost, and the length of the contract.

[The information follows:]

DEPARTMENT OF THE INTERIOR

Recapitulation of Consultant
Service Limitation
June 30, 1972

Actual Obligations as of June 30, 1972

Office of the Secretary and Other Departmental Offices...	$135,970
Bureau of:	
Sport Fisheries and Wildlife.....	---
Geological Survey.....	3,345
Indian Affairs.....	35,633
Land Management.....	---
Mines.....	47,943
National Park Service.....	30,546
Outdoor Recreation.....	1,440
Reclamation.....	9,816
Bonneville Power Administration.....	11,850
Total--Department of the Interior.....	$276,543
Consultant's limitation for Fiscal Year 1972.....	$300,000

OFFICE OF THE SECRETARY
STATEMENT OF CONSULTANTS

July 1, 1971 through June 30, 1972

Name of Individual	Per Diem Rate	Actual Obligation	Nature of Work Performance
Warren F. Brecht	$121	$605	Advise and consult the Secretary on Administrative matters within the Department.
Elizabeth P. Farrington	121	14,886	Advise and consult the Secretary on problem areas within the Department.
Louis B. Jennings	121	8,231	Advise and consult the Secretary on problem areas within the Department.
Andrew H. Samson	58	2,726	Advise the Secretary on major areas of communication.
James B. Ruch	121	4,237	Advise the Assistant Secretary for Fish Wildlife and Parks on complex conservation and environmental plans within the Department.
James F. Sorenson	114	869	Advise and consult the Secretary on National Energy Study and Policy.
Ronald T. Speers	118	13,688	Assist the Ass't Secretary for Fish and Wildlife and Parks on controversial areas within the Department.
John W. Larson	121	1,695	Advise and consult the Secretary on Programs within the Department.
Ronald C. Tracy	100	300	Advise and consult in the area of laws and regulations regarding endangered species.
Copp Collins	121	7,989	Advise and consult the Secretary on problem areas within the Department.

Name of Individual	Per Diem Rate	Actual Obligation	Nature of Work Performance
James H. Isbell	$121	$26,753	Advise and consult concerning Indian Affairs in Alaska.
Solomon F. Bramble	58	7,250	Assist the Secretary on utilization of aircraft and related matters.
Thomas C. H. Webster	121	3,510	Evaluate water resources development and planning activities.
Webster Otis	121	11,378	Assist Ass't Secretary for Program Policy in development of program system.
Oren S. Frost	121	484	Advises on publication policy within the Department.
Tobias V. Welo	100	1,900	Advise and consult Ass't Secretary-Water and Power Resources on problem areas.
Judith Ayers	60	11,236	Advise and consult in area of Natural Resources Publication.
Leigh Ratiner	114	5,240	Advise and consult on ocean resources. Also is representative of Interior Department at U.N. Seabed Conference.
Charles G. Emley, Jr.	121	2,299	Advises Ass't Secretary - Management and Budget on administrative matters.
Andrew Barr	127	381	Advises Ass't Secretary - Management and Budget on administrative matters.
Charles Ruby	100	3,400	Conducts review of Department's aircraft operating and maintenance practices.
Dennis Fletcher	121	1,452	Renders advice on financial management system of Trust Territories.
Cecil Haver	127	5,461	Advises on ecomomic evaluation of Bonneville Power Administration.
	TOTAL	$135,970	

ADDRESS ONLY THE DIRECTOR,
BUREAU OF SPORT FISHERIES
AND WILDLIFE

United States Department of the Interior
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
WASHINGTON, D.C. 20240

AUG 9 1972

Memorandum

To: Assistant Secretary - Management and Budget

From: Director, Bureau of Sport Fisheries and Wildlife

Subject: Consultant Allocation FY-72

This is to advise that the allocation for consultant services in the amount of $1,000 for FY 1972 was not used.

Samuel Benjamin

Department of the Interior
Geological Survey
Consultants - Fiscal Year 1972

Name of Individual	Per Diem Rate	Actual Obligations to 6/30/72	Nature of Work Performed
Miller, Warren W.	$136.56	$273.12	Atomic Energy Regulations governing operation of nuclear reactors required a Reactor Operations Committee composed of persons having expertise of the highest order in the nuclear field in order to provide AEC-required surveillance and guidance to Reactor staff and to assure integrity of the operations. Dr. Pigford served as Chairman, and Drs. Miller and O'Dell as members of the Survey's Reactor Operations Committee, an integral part of this Bureau's TRICA Reactor Administration. Committee provided an additional measure of security in reactor operations and reviewed hazards associated with Reactor experiments. The primary area of jurisdiction of Committee was safety evaluation of incore nuclear reactor experiments and periodic review and evaluation of physical integrity of the core. Committee was concerned with those experiments which by their unusual nature, inherent hazards and unprecedented complexity could endanger the health, life and property in and around the nuclear facility.
Pigford, Thomas H.	136.56	273.12	
O'Dell, Ralph D.	136.56	273.12	
Press, Frank	$128.00	$256.00	Advisory panel for the National Center for Earthquake Research. They provided guidance to the Center for earthquake prediction programs.
Crowell, John	100.00	200.00	
Johns, Richard S.	100.00	100.00	
Clough, Ray W.	138.46	138.46	
Leighton, F. Beach	138.46	276.92	
Allen, Clarence	100.00	200.00	
Bromery, Rudolph W.	$138.46	$553.84	Mr. Bromery was advisor on program to interest black students in earth sciences.

Name of Individual	Per Diem Rate	Actual Obligations to 6/30/72	Nature of Work Performed
Lewis, Phillip H., Jr.	$100.00	$200.00	Consultants employed by the U.S.G.S. whose services were needed for the Department's NATURE program.
Bullard, Clark, III	100.00	200.00	
McHarg, Ian L.	100.00	200.00	
Williams, Donald L.	100.00	200.00	

Amount of limitation allocated	$6,600.00
Amount of limitation obligated	$3,344.58
Unused balance of allocation	$3,255.42

Bureau of Indian Affairs

DEPARTMENT OF THE INTERIOR

Consultants Fiscal Year 1972

Name of Individual	Per Diem Rate	Actual Obligations to 6/30/72	Nature of Work Performed
Wilfred B. Antell	$ 75.00	$ 2,380	To provide technical advice and authoritative information on definable segments of Indian population to be used in affecting Indian education.
John Borbridge	75.00	925	
Ned A. Hatathli	75.00	1,425	
John C. Rainer, Jr.	75.00	1,590	
Joseph B. Carter	75.00	300	Provided training and orientation for a selected group of adult educators who will be charged with initiating pilot learning centers.
James M. Cox	85.00	170	Served as a liaison between the Bureau and Indian tribal leaders whose reservations are selected for the pilot RAP development.
Wayne D. Criddle	85.00	170	Provided expertise in Irrigation Engineering to the Pyramid Lake Reservation in the Phoenix Area.
Everett A. Dupris	65.00	780	Served as members of the Selection Panel for the Tribal Affairs Management Program.
Glen G. Galbraith	65.00	845	
Henry Montague, Sr.	65.00	325	
Douglas M. Fellows	100.00	3,300	Worked with schools to provide guidance, resulting in the support by industry of technical education of Indian youths.
Royal B. Hassrick	65.00	130	Coordinator for the Indian portion of the Exhibition in London, England.

Bureau of Indian Affairs

DEPARTMENT OF THE INTERIOR

Consultants Fiscal Year 1972 (continued)

Name of Individual	Per Diem Rate	Actual Obligations to 6/30/72	Nature of Work Performed
Nicholas J. Oganovic	$ 49.00 ($121 less annuity)	$ 343	Consultant and adviser to the Bureau and Indian groups for the operation of a training center at Brigham City.
Julian Smith	85.00	1,710	Liaison between the BIA and the Bureau of Prisons, U.S. Board of Pardons and Paroles and State and local units to provide services to Indian parolees.
Daniel W. Thaxton	90.00	21,240	Assisted the Eight Northern Pueblos Enterprises, Inc. with the formation of a construction company.
Total Obligations.....		35,633	
Bureau's Limitation.....		35,800	

Enclosure to
FMM 70-31

DEPARTMENT OF INTERIOR

Land Management
Bureau or Office

Consultants Fiscal Year 1972

Name of Individual	Per Diem Rate	Actual Obligations to 6/30/72	Nature of Work Performed
None*	-0-	-0-	

*The Bureau of Land Management was committed to pay 1/3 of the salary costs of Charles H. Prien hired as a consultant by the Bureau of Mines. It appears that the Bureau of Mines has reported the entire amount on their report. Accordingly, the Bureau's request for limitation was predicated upon this supposition.

Amount of Limitation Allocated	$ 2,800.00
Amount of Limitation Obligated	-0-
Unused Balance of Allocation	$ 2,800.00

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Bureau of Mines

ACTUAL OBLIGATIONS OF .NSULTANTS' EXPENDITURES

FOR FISCAL YEAR 1972

Name	Per Diem Rate	Actual Obligation 7/1/71-6/30/72	Nature of Services Rendered
Delmer Beck	$ 50.00	$ 150.00	Mr. Beck was a member of the Lignite Advisory Committee. The Committee provided consultative functions in connection with administration of the act which authorized establishment of a research laboratory in the North Dakota lignite area.
Alphonso P. Boxley	93.00	1,793.00	Mr. Boxley provided the engineering and mine-management guidance needed to insure that the results of research were adaptable in mines and had a high probability for acceptance by the mining industry. He shared in the development and implementation of the Pittsburgh Mining and Safety Research Center's programs on control of roof in underground coal mines.
Lawrence P. Britts	61.34	3,741.74	Mr. Britts prepared various program documents for the expansion and further development of the personnel management alcoholism program for the Bureau of Mines and the Department of the Interior. He developed policy regulations, treatment programs, and guidelines used in the rehabilitation phase of the program in areas such as medical needs, psychotherapy, psychiatric evaluations, and hospitalization.

Name	Per Diem Rate	Actual Obligation 7/1/71-6/30/72	Nature of Services Rendered
Albert M. Cooley	50.00	50.00	Mr. Cooley was a member of the Lignite Advisory Committee. The Committee provided consultative functions in connection with administration of the act which authorized establishment of a research laboratory in the North Dakota lignite area.
Joseph D. Doherty	57.88	115.76	Mr. Doherty provided expert judgment on coal and coal processing to maintain progress on the various Morgantown Coal Research Center programs. He reviewed reports and manuscripts prepared both off and on the station when the subject matter dealt with the fields of coal chemistry and utilization. He made critical appraisals of the data and overall direction of the various projects to arrive at recommendations for further testing and research.
James P. Durkin	83.60	752.40	Mr. Durkin served as a consultant to the Assistant Director--Mineral Position Analysis. He advised on tax law and financial analysis as applied to established criteria to judge the economic stability of segments of the mineral industry.
Paul H. Emmett	93.28	279.84	Dr. Emmett was a consultant in the development of a research program to investigate the wider use of the abundant rare earth metals as catalysts in a variety of chemical reactions, petroleum and hydrocarbon gas reforming and fuel cell applications. He reviewed

Name	Per Diem Rate	Actual Obligatio. 7/1/71-6/30/72	Nature of Services Rendered
Paul H. Emmett (continued)			the status of catalysis technology and programs which were undertaken at the Reno Metallurgy Research Center to develop a detailed laboratory research program. He acted as a consultant to the Reno and other Energy Research groups regarding catalytic problems and opportunities.
John D. Greenhalgh	72.08	6,559.28	Mr. Greenhalgh served as a consultant to the Director and the Office of the Deputy Director--Health and Safety in evaluating electrical engineering problems and responsibilities encountered in carrying out the provisions of the Federal Coal Mine Health and Safety Act of 1969.
L. Trowbridge Grose	50.00	100.00	Mr. Grose was a member of the Lignite Advisory Committee. The Committee provided consultative functions in connection with administration of the act which authorized establishment of a research laboratory in the North Dakota lignite area.
Mazie B. Gutshall	75.00	5,142.33	Mrs. Gutshall advised on the interrelationship of Federal and State mine inspection programs. She studied implications of state inspection programs and recommended the best ways of utilizing state inspection staffs in the accomplishment of mine safety objectives.

Name	Per Diem Rate	Actual Obligation 7/1/71-6/30/72	Nature of Services Rendered
Albert M. Keenan	100.00	1,800.00	Mr. Keenan served as a member of a committee of three mining experts to evaluate and analyze the guidelines, regulations, and enforcement activities of the Bureau and made independent expert recommendations on these areas to the Assistant Secretary--Mineral Resources.
John D. Morgan, Jr.	121.28	15,281.28	Dr. Morgan advised the Director on near-term and long-range evaluation of the supply and demand relationships for mineral resources. He advised on minerals and the multibillion dollar mineral industry including economic, resource supply, demand and depletion, problems of environmental impact, science, engineering and technology, trade, and all other aspects. He advised mineral supply specialists in their efforts in such disciplines as economics, and mining and petroleum engineers for a variety of special studies, defining objectives and parameters, providing advice on in-progress guidance and acceptability of final products.
Charles Mottley	93.28	1,026.08	Dr. Mottley served as a consultant and adviser to the Director in the field of operational research to improve research operations in the Bureau. This covered special significant, controversial or critical areas of mineral research and development. He drew on mathematical, statistical, and other techniques common to mathematics, engineering,

Name	Per Diem Rate	Actual Obligation 7/1/71-6/30/72	Nature of Services Rendered
Charles Mottley (continued)			physical and biological sciences in advising on solutions to research operational problems.
Charles H. Prien	100.00	6,500.00	Dr. Prien aided in the completion of the Draft Environmental Statement for the Proposed Prototype Oil Shale Leasing Program.
Robert Stefanko	120.00	1,140.00	Mr. Stefanko served as a member of a committee of three mining experts to evaluate and analyze the guidelines, regulations, and enforcement activities of the Bureau and made independent expert recommendations on these areas to the Assistant Secretary--Mineral Resources.
James Westfield	50.64	860.88	Mr. Westfield served as an adviser, technical specialist, and authority to the Deputy Director--Health and Safety and other members of the staff in the programs for the Bureau's health and safety work which are of national importance, complexity, and scope. He also served as a top adviser in the conduct of mine rescue and recovery operations following mine disasters.
John E. Willson	100.00	2,650.00	Mr. Willson served as a member of a committee of three mining experts to evaluate and analyze the guidelines, regulations, and enforcement activities of the Bureau and made independent expert recommendations on these areas to the Assistant Secretary--Mineral Resources.
	TOTAL		$47,942.59

DEPARTMENT OF THE INTERIOR
Consultant FY. 1972

National Park Service

Name	Per Diem Rate	Actual Obligations to June 30, 1972	Nature of Work Performed
Baker, Howard W. Omaha, Nebraska	114.40	12,813	Advise and consult on matters of broad policy and program.
Bertrand, Alvin L Baton Rouge, Louisiana	98.88	198	Advise on programs involving geological, botanical, zoological and sociological sciences.
Cain, Stanley A. Ann Arbor, Michigan	98.88	-----	Advise and consult on resources management and research matters.
Curtis, Lynn A. Washington, D. C.	75.00	2,100	Police specialist.
Danson, Edward B. Flagstaff, Arisona	50.00	-----	Interpretive planning.
Leopold, A. Starker Berkeley, California	98.88	198	Advise and consult on resources management and research matters.
Lottinville, Savoie Norman, Oklahoma	75.00	-----	Publications Committee, NPS Advisory Board on National Parks, Historic Sites, Buildings and Monuments
Merz, Joseph G. Washington, D. C.	121.28	15,039	Planning and artistic design of proposed park architectural structures.
Olmstead, Charles E. Chicago, Illinois	98.88	198	Advise and consult on resources management and research matters.
Olson, Sigurd Ely, Minnesota	98.88	-----	Advise and consult on wildlife and nature area management.
Wolfe, Charles H. Duxberry, Massachusetts	105.68	-----	Advertising and public relations for NPS Centennial.
		$30,546	

DEPARTMENT OF THE INTERIOR
BUREAU OF OUTDOOR RECREATION

CONSULTANTS - F.Y. 1972
July 1, 1971 - June 30, 1972

Name of Individual	Per Diem Rate	Actual Obligations	Nature of Work Performed
Robert J. Kalter	$120.00	$1,440.00	To advise on the demand methodology to be used in developing and quantifying data on recreation needs
Harry W. Rice	$ 49.60*	None	Finalize regulations with the four major timber companies whose lands were taken to form the Redwood National Park. Since 8/2/68 when P.L. 90-545 was enacted creating the Park, boundaries have been surveyed and timber lands have been cruised and appraised. Review of the reports from the Contractor were necessary before negotiations can be made for payment to the timber companies.
Roland J. Schaar	$ 79.44*	None	To provide for an appraisal review of the land in the Northern Redwood Purchase Unit as required by the Departmental Appraisal Handbook. Review claims for severance damages arising out of the Legislative taking for Redwood National Park.

* Retired annuitant

Limitations	$1,600.00
Obligations	1,440.00
Balance	$ 160.00

DEPARTMENT OF THE INTERIOR

Consultants Service Limitation - Fiscal Year 1972

Bureau of Reclamation

Name of Individual	Per Diem Rate	Actual Obligations F. Y. 1972	Nature of Work Performed
John D. Entenga	$121.28	$ 485	Advisory Board on environmental planning.
Mitchell A. Wilder	121.28	485	Advirosy Board on environmental planning.
Harold T. Nelson 1/	23.00	440	U. S. Representative to the Columbia River Interstate Compact Commission.
Berlen C. Moneymaker 1/	25.00	373	Geologic consultant service on anchor dams and reservoir.
R. A. Clark	127.92	1,279	Assist in design storm work for Butte Dam-Central Arizona Project.
E. O. Larson 1/	71.36	871	Federal Representative on Bear River Commission, Member of Great Basin Staff of State-Federal Interagency Committee.
Hugh P. Dugan 1/	65.52	984	Chairman, Upper Colorado River Commission
C. E. Anderson	121.28	364	Application of atmospheric water technique applicable to BOR program.
W. E. Howell	121.28	485	Application of atmospheric water technique applicable to BOR program.
John R. Riter 1/	39.36	158	To advise on scientific and engineering aspects of water resources planning activities.

Consultants Service Limitation - Fiscal Year 1972

Bureau of Reclamation	Per Diem Rate	Actual Obligations F. Y. 1972	Nature of Work Performed
Leon F. Maca 1/	$ 50.72	$ 254	Consultant and Technical Advisor, U. S. Section of the International Souris-Red River Engineering Board.
Clyde M. Reed, Jr.	---	56	Service as U.S. Commissioner on the Canadian River Compact Commission.
Walter Randall	127.92	768	Advice on techniques in completing a Geothermal test well and program of testing.
Dominguez B. Agguire	127.92	512	Advice on techniques in completing a Geothermal test well and program of testing.
Stanley I. Auerbach	127.92	256	To advise Bureau on environmental/ ecological aspects of its activities.
W. Frank Blair	127.92	256	To advise Bureau on environmental/ ecological aspects of its activities.
W. Thomas Edmonston	127.92	256	To advise Bureau on environmental/ ecological aspects of its activities.
George J. Eicher	127.92	256	To advise Bureau on environmental/ ecological aspects of its activities.
William J. Hargis, Jr.	127.92	256	To advise Bureau on environmental/ ecological aspects of its activities.
George Sprugel	127.92	256	To advise Bureau on environmental/ ecological aspects of its activities.
Bernard P. Bellport	42.56	766	Special assignments.
Total		$9,816	

1/ Annuitant

F.Y. 1972 CONSULTANT SERVICES

DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION

nsultant	Per Diem Rate	Obligations to June 30, 1972	Nature of Work Performed
ter L. Bellaschi	$100	$7,500 1/	Conducted comprehensive study on need to perform multiple temperature rise design tests for power transformers with a dual 55/65°C temperature rating, and submitted specific recommendations resulting in economies. Conducted extensive and comprehensive study to evaluate need for front-of-wave routine test requirement for three-phase 115-kv power transformer rated 12 mva and larger and basic impulse requirements for this class of equipment, and submitted recommendations resulting in improvements in basic requirements. Conducted a study of major equipment performance and failures of power transformers and reactors rated 765 kv and provided guidelines for future EHV equipment specifications. Reviewed and updated basic electrical clearances and insulation levels for 525-kv and 765-kv equipment specifications and substation design. Provided recommendations for test code and procedure for short-circuit tests of power transformers. Rendered assistance to Southwestern Power Administration relating to probable cause of failure and repair of a power transformer and performed other consulting services as requested.
mes R. Eaton	$100	$1,000	Conducted a study to determine the feasibility of using compressed air as a dielectric in gas insulated cable systems and recommended manufacturers with capability of doing research and testing to verify the feasibility of such a compressed gas cable system.
lliam A. Lewis	$100	$2,500	Continued study of evaluating various mathematical models available for representing machines and generating plants in dynamic studies of system performance. Performed extensive study on methods of representing system loads in transient stability studies of large systems, and submitted recommendations.

Includes $200 reimbursed by Southwestern Power Administration.

onsultant	Per Diem Rate	Obligations to June 30, 1972	Nature of Work Performed
ames E. Van Ness	$85	$850	Continued studies on methods to increase the scope of digital programs for analyzing the response of a-c power systems including studies related to the development of a generalized input for the linear analysis program.
TOTAL		$11,850	

mount of Limitation Allocated	$12,000
mount of Limitation Obligated	11,850
nused Balance of Obligation	$ 150

DEPARTMENT OF THE INTERIOR

STATEMENT SHOWING DEPARTMENT'S FISCAL YEAR 1973
CONSULTANT LIMITATION, ACTUAL OBLIGATIONS
THROUGH DECEMBER 31, 1972, AND BALANCE OF LIMITATION

FISCAL YEAR 1973

Departmental Consultant Limitation (F. Y. 1973).....		$300,000
Obligations through December 31, 1972:		
Office of the Secretary and Other Departmental Offices.....	$47,624	
Geological Survey.....	2,172	
Bureau of Indian Affairs.....	6,120	
Bureau of Mines.....	10,345	
Bureau of Reclamation.....	12,093	
National Park Service.....	15,654	
Bonneville Power Administration.....	7,187	
Bureau of Outdoor Recreation.....	2,303	
Total Obligations through December 31, 1972.....		103,498
Balance of Limitation.....		$196,502

OFFICE OF THE SECRETARY
REPORT OF CONSULTANTS

July 1, 1972 through December 31, 1972

Name of Individual	Per Diem Rate	Actual Obligation	Nature of Work Performance
Cecil B. Haver	$127	$10,163	To provide advice & consultation on an economic evaluation of Bonneville Power Administration.
Boyd Rasmussen	127	115	To advise & consult Secretary on special problems and programs relating to land utilization programs within the Department.
James Isbell	121	242	To advise & consult with Assistant Secretary for PLM on activities and programs in Alaska.
Charles Ruby	100	400	To assist Assistant Secretary-Management & Budget in conducting a review of the Department aircraft operating & maintenance practices.
Donald C. Roodeen	85	5,868	To advise and consult Secretary on various program areas within the Department.
Darlington Denit	92	57	To advise & consult on special problems & programs relating to Survey & Review programs for the Department
Everett Keech	118	531	To advise & consult with Assistant Secretary-Management & Budget in the administrative area.
Allan Mendleson	127	2,414	To advise & consult in the development of a policy for mining of deep sea mineral resources.
Hugh Johnson	50	250	To advise & consult Assistant Secretary-MR on mineral and energy policy.
Sub Total		$20,040	

JOHNNY HORIZON PROGRAM

Name of Individual	Per Diem Rate	Actual Obligation	Nature of Work Performance
Hugh Swofford	$ 98	$13,060	To provide advice & consultation & to review & evaluate effectiveness of Interior's message relating to its program to keep America clean.
Eugene Ettenburg	100	6,771	To provide design & consultation relating to Johnny Horizon program.
Sub Total		$19,831	
WATER RESOURCES RESEARCH			
Warren Hall	127	$ 127	To advise & consult Water Resources Research on all water research programs.
OFFICE OF OIL AND GAS			
Robert B. Ashley	127	$ 5,034	To consult with Director of Oil and Gas covering primary and secondary petroleum storage capacity and inventory and major consumer storage capacity.
Sub Total		$45,032	
Thomas A. Hughes	72	$ 2,592 1/	Bonneville Power Administration activities.
Grand Total		$47,624	

1/ Reimbursable to Bonneville Power Administration.

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Consultants Fiscal Year 1973

Consultant	Per Diem Rate	Actual obligations to 12/31/72	Nature of work performed.
Pigford, Thomas H.	136.56	273.12	Atomic Energy Regulations governing operations of nuclear reactors require a Reactor Operations Committee composed of persons having expertise of the highest order in the nuclear field to provide AEC-required surveillance and guidance to reactor staff and to assure integrity of operations. Dr. Pigford serves as Chairman, and Dr. Miller as a member of the Survey's Reactor Operation Committee, an integral part of this Bureau's TRICA Reactor Administration. The Committee provides an additional measure of security in reactor operations and reviews hazards associated with reactor experiments. The primary area of jurisdiction of the Committee is safety evaluation of incore nuclear reactor experiments and periodic review and evaluation of the physical integrity of the core. The Committee is concerned with those experiments which by their unusual nature, inherent hazard and unprecedented complexity could endanger the health, life and property in and around the nuclear facility.
Miller, Warren W.	136.56	273.12	
		546.24	
Allen, Clarence	138.46	270.92	Advisory panel for National Center for Earthquake Research. The panel will provide guidance to the Center for Earthquake Research Program.
Crowell, John	138.46	270.92	
Johns, R.H.	138.46	270.92	
Leighton, F.B.	138.46	270.92	
Press, Frank	138.46	270.92	
Whitmen, R.D.	138.46	270.92	
		1,625.52	
TOTAL		2,171.76	

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DEPARTMENT OF INTERIOR
BUREAU OF IN. AFFAIRS

Consultants - Fiscal Year 1973

Name of Individual	Purpose	Obligated 12-31-72
Joseph B. Carter	Initiating pilot learning centers.	$ 300.00
James M. Cox	RAP development program	---
Wayne D. Criddle	Indian water rights	765.00
Frazier Kellog	Technical consulting services	---
Adlowe L. Larson	Hearings on Navajo Traders	---
Julian Smith	Prisoner-Parole program	340.00
Albert J. Snow	Science coordinator	2,475.00
Daniel W. Thaxton	Formation of Construction Co.	1,980.00
Everett J. Dupris	Tribal Affairs Management program	260.00
Glenn F. Galbraith		---
Henry Montague, Sr.		---
Joseph David, Sr.	Indian Reindeer Committee	---
Henry E. Ivanoff		---
August F. Reetz, Jr.		---
Edward S. Shavings		---
15 Consultants	Members of the National Education Advisory Committee (12 days @$75 ea.)	---
Total.....		6,120.00

Bureau allocation: $36,000

ACTUAL OBLIGATIONS OF CONSULTANTS' EXPENDITURES

FOR FISCAL YEAR 1973

Bureau of Mines

Name	Per Diem Rate	Actual Obligation 7-1-72 - 12-31-72	Nature of Services Rendered
James P. Durkin	$127.92 less $46.45 annuity	$4012.80	Mr. Durkin served as consultant to the Assistant Director--Mineral Position Analysis. He advised on tax law and financial analysis as applied to established criteria to judge the economic stability of segments of the mineral industry.
Mazie B. Gutshall	$75.00	$1500.00	Mrs. Gutshall advised on the inter-relationship of Federal and state mine inspection programs. She studied implications of state inspection programs and recommended the best ways of utilizing state inspection staffs in the accomplishment of mine safety objectives.
Albert M. Keenan	$100.00	$650.00	Mr. Keenan served as a member of a committee of three mining experts to evaluate and analyze the guidelines, regulations, and enforcement activities of the Bureau and made independent expert recommendations on these areas to the Assistant Secretary--Mineral Resources.
Charles Mottley	$107.68 less $15.09 annuity	$279.84	Dr. Mottley served as consultant and adviser to the Director in the field of operational research to improve research operations in the Bureau of Mines.

Name	Per Diem Rate	Actual Litigation 7-1-72 - 12-31-72	Nature of Services Rendered
1/ Charles H. Prien	$100.00	$2100.00	Dr. Prien served as consultant and adviser to the Director in the completion of the Draft Environmental Statement for the Proposed Prototype Oil Shale Leasing Program.
Thomas A. Ratliff, Jr.	$93.00	$639.38	Mr. Ratliff provided consulting advisory services to the Chief, Pittsburgh Technical Support Center.
Robert Stefanko	$120.00	$360.00	Mr. Stefanko served as an expert to evaluate and analyze the guidelines, regulations, and enforcement activities of the Bureau and made recommendations on these areas to the Assistant Secretary--Mineral Resources.
James Westfield	$127.92 less $74.03 annuity	$253.20	Mr. Westfield served as adviser, technical specialist, and authority to the Deputy Director--Health and Safety and others in programs for Health and Safety work which are of national importance, complexity, and scope. He also served as top adviser in conduct of mine rescue and recovery operations following a mine disaster.

1/ Includes $700 chargeable to Bureau of Land Management.

Bureau of Mines

Name	Per Diem Rate	Actual Obligation 7-1-72 - 12-31-72	Nature of Services Rendered
John E. Willson	$100.00	$550.00	Mr. Willson served as a member of a committee of three mining experts to evaluate and analyze the guidelines, regulations, and enforcement activities of the Bureau and made independent expert recommendations on these areas to the Assistant Secretary--Mineral Resources.
		TOTAL	$10,345.22

DEPARTMENT OF THE INTERIOR

Consultants Fiscal Year 1973

Bureau of Reclamation	Per Diem Rate	Actual Obligations 7/1-12/31/72	Nature of Work Performed
Bernardo D. Aguirre	$128	$ 1,791	Advice on techniques in completing a geothermal test well and program of testing.
Walter Randall	128	2,302	Will evaluate straigraphic section penetration in the Bureau of Reclamation deep test well.
Marlen C. Moneymaker	25	325	Geologic consultant services on Anchor Dam and Reservoir.
John D. Entenza	128	767	Advisory Board on Environmental Planning.
John B. Jackson	128	511	Advisory Board on Environmental Planning.
Mitchell A. Wilder	128	384	Advisory Board on Environmental Planning.
Emil F. Schadick	128	4,605	Drilling expert - Geothermal research.
Wallace L. Chadwick	128	384	To review the condition of the American Falls Dam.
Julian Hinds	128	256	To review the condition of the American Falls Dam.
Donald L. Thompson	128	768	Advise on State and local developments in relation to resource planning activities.
Total		$12,093	

DEPARTMENT OF THE INTERIOR
National Park Service
CONSULTANTS - F.Y. 1973

Name	Per Diem Rate	7/1-12/31/72 Obligation	Nature of Work Performed
ALLEN, Durward L. Lafayette, Indiana	$127.92	-	Advise and consult on resources management and research matters
BAKER, Howard W. 2/ Omaha, Nebraska	127.92/ 58.08	3,369	Advise and consult on matters of broad policy and program
BERTRAND, Alvin Baton Rouge, Louisiana	98.88	-	Advise on programs involving geological, botanical, zoological and sociological sciences
CAIN, Stanley A. Ann Arbor, Michigan	98.88	-	Advise and consult on resources management and research matters
CROSS, Stuart G. San Francisco, California	127.92	2,558	Advise and consult on matters related to National Park Foundation
DANSON, Edward B. Flagstaff, Arizona	50.00	-	Interpretive planning
GARRISON, Inger Grand Canyon, Arizona	50.00	450	Advise and consult on developing action programs of living history interpretations, arts, crafts and cultural demonstrations
LOTTINVILLE, Savoie Norman, Oklahoma	75.00	-	Publications Comm., NPS Adv. Bd. on Nat'l Parks, Hist. Sites, Bldgs. & Monuments
MERZ, Joseph C. Washington, D. C.	121.28	7,640	Planning and artistic design of proposed park architectural structures

1/ Or termination, whichever occurs first

2/ Rehired Annuitant

DEPARTMENT HE INTERIOR
National k Service
CONSULTANTS - F.Y. 1973

Name	Per Diem Rate	7/1-12/31/72 Obligation	Nature of Work Performed
OLMSTED, Charles Chicago, Illinois	98.88	-	Advise and consult on resources management and research matters
OLSON, Sigurd Ely, Minnesota	98.88	-	Advise and consult on wildlife and nature area management
PASSONEAU, Joseph R. Washington, D. C.	121.28	1,637	Advise and consult on architectural design quality
LEOPOLD, A. Starker Berkeley, California	98.88	-	Advise and consult on resources management and research matters
TOTAL		15,654	

F.Y. 1973 Consultant Services

Department of Interior

Bonneville Power Administration

	Per Diem Rate	Obligations to Dec. 31, 1972	Nature of Work Performed
Peter L. Bellaschi	$125.00	$5,750.00	Conducted a comprehensive study to determine practical mva rating for proposed future 1,200/550-kv transformers and reported feasible mva rating and technical requirements. Performed extensive evaluation of present UHV developments both here and abroad. Determined electrical clearance and other critical electrical parameters essential for 1,200-kv station design, and completed a preliminary 1,200-kv station layout. Rendered assistance upon request in other specific problems and performed consulting services as requested.
Lawrence E. Karrer	$125.00	$125.00	Acted in the capacity of advisor to the BPA Engineering Review Board.
William A. Lewis	$125.00	$1,187.50	Completed studies on evaluation of modeling of loads used for transient stability studies and recommended methods to obtain field verifications. Commenced studies to identify and evaluate the technical problems associated with utilizing a railroad right-of-way for a 500-kv line.

F.Y. 1973 Consultant Services (Cont.)

	Per Diem Rate	Obligations to Dec. 31, 1972	Nature of Work Performed
James R. Eaton	$125.00	$125.00	Reviewed and commented on objectives for a proposed 1,000 - 1,200-kv prototype test line and discussed an assignment to outline a testing program to meet the objectives.
1/ Total Obligations as of 12/31/72		$7,187.50	

1/ Does not include consultant services of Thomas A. Hughes - 36 days @ $72, totaling $2,592 reimbursable from Office of the Secretary.

DEPARTMENT OF THE INTERIOR
BUREAU OF OUTDOOR RECREATION

Consultants--Fiscal Year 1973
Obligations to Dec. 31, 1972

Name of Individual	Per Diem Rate	Days Worked	Obligations	Nature of Work Performed
G. Douglas Hofe, Jr.	$127.92	18	$2,302.56	Mr. Hofe's services were needed to provide continuity in the planning for the 10th Anniversary celebration of the Outdoor Recreation Resources Review Commission Report. In addition, Mr. Hofe, as former Director, had responsibility for the negotiation of settlements with timber companies whose lands were legislatively taken for the Redwood National Park. He provided technical assistance to the Department of Justice in its preparation of pre-trial materials related to the Court Claims petitions filed by the companies.

Mrs. HANSEN. Please insert in the record justification pages 1 through 37.

[The pages follow:]

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
SALARIES AND EXPENSES

HIGHLIGHT STATEMENT

The fiscal year 1974 appropriation request for the account "Salaries and Expenses", Office of the Secretary is $15,895,000, an increase of $641,602 over the amount appropriated for fiscal year 1973.

Maintaining Current Level of Operations

An increase of $411,602 is needed to maintain the current level of support for existing staff operations. This amount consists of $200,000 to fund, on an annual basis, the 74 new positions authorized and partially funded during fiscal year 1973. The remaining $211,602 is requested for within-grade step increases and other unavoidable increased costs for which little or no additional funding has been provided over the past several years.

Program Increase

Program increases of $230,000 are requested in the following areas:

. Mineral Resources - $30,000 is requested for travel for Departmental participation in the United Nation's Law of the Sea Conference.

. Office of Budget - $200,000 and six additional positions is requested to improve the Departmental budget program structure and initiate a performance measurement system.

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
SALARIES AND EXPENSES

Appropriation, 1972	$13,975,000	
Supplemental appropriation, 1972	500,000	
Second supplemental appropriation, 1972	220,000	
Total appropriation, 1972		$14,695,000
Transferred to other accounts		-3,750,268
Transferred from other accounts		+1,948,000
Net transfers, 1972		-1,802,268 1/
Total available, 1972		12,892,732
Appropriation, 1973		15,295,100
Transferred to other accounts		-41,702 2/
Total available, 1973		15,253,398

Summary of Increases and Decreases, 1974

Increases:	Base 1974	Increase 1974	
Annualization of 1973 program increases	$1,651,968	$+200,000	
Maintain current level of operations	13,601,430	+211,602	
Program Increases:			
Program Direction and Coordination:			
Increased travel cost for Departmental participation in United Nation's Law of the Sea Conference	---	+30,000	
Administrative Management:			
To provide for a budget system and evaluation staff	---	+200,000	
Net Increase, 1974			+641,602
Budget Estimate, 1974			15,895,000

1/ See page 3 for fiscal year 1972 transfers.
2/ See page 3 for fiscal year 1973 transfers.

1/ Fiscal Year 1972 Transfers:

Transferred to Other Accounts:			
Departmental Library and Hearings and Appeals Activities transferred to "Departmental Operations," Office of the Secretary		$-3,746,100	
Transferred to "Operating Expenses, Public Buildings Service," General Services Admin.		-4,168	
Subtotal, Transferred to Other Accounts			$-3,750,268
Transferred From Other Accounts:			
Appropriation transfer for consolidation of Governmentwide contract compliance responsibilities from the following Bureaus and Offices:			
Bureau of Land Management, "Management of Lands and Resources"	$+320,800		
Bureau of Indian Affairs, "General Administrative Expenses"	+156,700		
Bureau of Outdoor Recreation, "Land and Water Conservation Fund"	+36,200		
Geological Survey, "Surveys, Investigations and Research"	+70,800		
Bureau of Mines, "Health and Safety"	+70,100		
Bureau of Sport Fisheries and Wildlife, "Management and Investigations of Resources"	+49,000		
National Park Service, "Management and Protection"	+120,000		
Office of Saline Water, "Saline Water Conversion"	+36,200		
Bureau of Reclamation, "General Administrative Expenses"	+230,200		
Bonneville Power Administration, "Construction" $+43,000			
"Operation and Maintenance" +20,000	+63,000	+1,153,000	
Transfer of Office of Legislation from "Salaries and Expenses," Office of the Solicitor		+400,000	
Transfer of General Admin. from "Administration of Territories," Office of Territories		+395,000	
Subtotal, Transferred from Other Accounts			+1,948,000
Net Transfers, 1972			-1,802,268

2/ Fiscal Year 1973 Transfers:

Transferred to Other Accounts:			
Transferred to "Operating Expenses, Public Bldg. Service," General Services Admin.		-41,702	
Net Transfers, 1973			-41,702

SALARIES AND EXPENSES, OFFICE OF THE SECRETARY

Analysis by Activities

Activity	F.Y. 1972 Amount Available	Fiscal Year 1973		
		Total Appropriation	Transfers 1/	Adjusted Amount Available
1. Departmental Direction.....	$ 4,910,751	$ 6,059,300	$-172,135	$ 5,887,165
2. Program Direction and Coordination.....	2,092,858	2,146,900	---	2,146,900
3. Administrative Management..	5,620,471	6,821,100	+152,214	6,973,314
4. General Services.....	246,251	267,800	-21,781	246,019
Unobligated Balance Lapsing	22,401	---	---	---
Total.....	12,892,732	15,295,100	-41,702	15,253,398

1/ Transfer $155,800 from Departmental Direction (Program Policy) to Administrative Management (International Activities).
Transfer to GSA for Space Rental as follows:

Departmental Direction.....	$16,335
Administrative Management.....	3,586
General Services.....	21,781
	41,702

SALARIES AND EXPENSES, OFFICE OF THE SECRETARY

Analysis by Activities

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Adjusted Amt. Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973 Total	Page Reference
1. Departmental Direction....	$ 4,910,751	$ 5,887,165	$ 6,051,300	$+164,135	S&E-7
2. Program Direction and Coordination.....	2,092,858	2,146,900	2,198,900	+52,000	S&E-17
3. Administrative Management.	5,620,471	6,973,314	7,327,100	+353,786	S&E-21
4. General Services.....	246,251	246,019	317,700	+71,681	S&E-32
Unobligated Balance Lapsing	22,401	---	---	---	
Total.....	12,892,732	15,253,398	15,895,000	+641,602	

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OFFICE OF THE SECRETARY
SALARIES AND EXPENSES

Analysis of Increases

Activity/Subactivity	F.Y. 1973 (Adjusted) Appropriation Positions	F.Y. 1973 (Adjusted) Appropriation Funds	F.Y. 1974 Increases: Annualization of 1973 Program Increases	F.Y. 1974 Increases: Maintain Current Level of Operations	F.Y. 1974 Increases: Program Inc. New Positions and Related Funding	Total Increases Positions	Total Increases Funds	F.Y. 1974 Appropriation Request Positions	F.Y. 1974 Appropriation Request Funds
1. Departmental Direction:									
Immediate Office of the Secy...	27	$ 774,300	$---	$ 5,000	$ ---	--	$ 5,000	27	$ 779,300
Office of the Under Secy	16	375,700	---	3,000	---	--	3,000	16	378,700
Field Coordination.....	16	437,277	---	6,223	---	--	6,223	16	443,500
Office for Equal Opportunity...	95	2,097,388	63,500	24,112	---	--	87,612	95	2,185,000
Office of Communications.....	14	297,800	---	4,000	---	--	4,000	14	301,800
Office of Science Adviser.....	5	137,500	---	---	---	--	---	5	137,500
Office of Legislation.....	27	443,200	5,500	4,000	---	--	9,500	27	452,700
Program Policy.....	57	1,324,000	39,900	8,900	---	--	48,800	57	1,372,800
Subtotal.....	257	5,887,165	108,900	55,235	---	--	164,135	257	6,051,300
2. Program Direction and Coord:									
Water and Power Resources.....	25	629,400	---	4,000	---	--	4,000	25	633,400
Mineral Resources.....	22	498,200	---	4,000	30,000	--	34,000	22	532,200
Public Land Management.....	26	696,500	---	4,000	---	--	4,000	26	700,500
Fish and Wildlife, and Parks...	15	322,800	7,000	3,000	---	--	10,000	15	332,800
Subtotal.....	88	2,146,900	7,000	15,000	30,000	--	52,000	88	2,198,900
3. Administrative Management:									
Assistant Secretary - Management and Budget.....	13	362,300	---	---	---	--	---	13	362,300
International Activities.....	6	155,800	---	1,100	---	--	1,100	6	156,900
Secretarial Operations.....	37	602,300	---	5,000	---	--	5,000	37	607,300
Survey and Review.....	139	2,934,514	51,400	29,586	---	--	80,986	139	3,015,500
Office of Budget.....	20	485,500	---	---	200,000	6	200,000	26	685,500
Management Operations.....	60	925,600	9,700	20,000	---	--	29,700	60	955,300
Management Consulting.....	27	857,900	20,000	4,000	---	--	24,000	27	881,900
Personnel Management.....	36	649,400	3,000	10,000	---	--	13,000	36	662,400
Subtotal.....	338	6,973,314	84,100	69,686	200,000	6	353,786	344	7,327,100
4. General Services.....	--	246,019	---	71,681	---	--	71,681	--	317,700
GRAND TOTAL.....	683	15,253,398	200,000	211,602	230,000	6	641,602	689	15,895,000

1. DEPARTMENTAL DIRECTION

Analysis by Subactivities

Subactivity	F.Y. 1972 Amount Available	Fiscal Year 1973		
		Total Appropriation	Transfers 1/	Adjusted Amt. Available
(a) Office of the Secretary.....	$ 774,556	$ 774,300	$ ---	$ 774,300
(b) Office of the Under Secretary.....	339,492	375,700	---	375,700
(c) Field Coordination.....	268,800	439,500	-2,223	437,277
(d) Office for Equal Opportunity.	1,654,313	2,111,500	-14,112	2,097,388
(e) Office of Communications.....	313,678	297,800	---	297,800
(f) Office of the Science Adviser.....	102,674	137,500	---	137,500
(g) Office of Legislation.....	413,935	443,200	---	443,200
(h) Program Policy.....	1,043,303	1,479,800	-155,800	1,324,000
Total.....	4,910,751	6,059,300	-172,135	5,887,165

1/ Transfer to GSA for Space Rental.
Transfer $155,800 from Departmental Direction (Program Policy) to Administrative Management (International Activities).

1. DEPARTMENTAL DIRECTION

Analysis by Subactivities

Subactivity	F.Y. 1972 Amount Available	F.Y. 1973 Adjusted Amt. Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973 Total
(a) Office of the Secretary...	$ 774,556	$ 774,300	$ 779,300	$ +5,000
(b) Office of the Undef Secretary.....	339,492	375,700	378,700	+3,000
(c) Field Coordination.....	268,800	437,277	443,500	+6,223
(d) Office for Equal Opportunity.....	1,654,313	2,097,388	2,185,000	+87,612
(e) Office of Communications..	313,678	297,800	301,800	+4,000
(f) Office of the Science Adviser.....	102,674	137,500	137,500	---
(g) Office of Legislation.....	413,935	443,200	452,700	+9,500
(h) Program Policy.....	1,043,303	1,324,000	1,372,800	+48,800
Total.....	4,910,751	5,887,165	6,051,300	+164,135

1. DEPARTMENTAL DIRECTION

(a) Immediate Office of the Secretary: Fiscal year 1973, $774,300; fiscal year 1974, $779,300; increase, $5,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+5,000	---	$779,300	27	Additional funding for within-grade step increase costs.

The Immediate Office of the Secretary provides the direct staff assistance to the Secretary in carrying out the overall direction and coordination responsibilities for the Department. In addition, top level assistance is necessary to coordinate the planning and development of new legislative proposals; to oversee the staff work essential to redirect or change the emphasis of policies and programs to better carry out the responsibilities of the Department; and finally to perform the necessary day-to-day administrative activities of the office. This office includes an Immediate Staff (17 positions) and Congressional Liaison (10 positions).

An increase of $5,000 is requested to provide funding for within-grade step increases and other support costs associated with maintaining the current level of support for this office.

(b) Office of the Under Secretary: Fiscal year 1973, $375,700; fiscal year 1974, $378,700; increase, $3,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+3,000	---	$378,700	16	Additional funding for within-grade step increase costs.

The Under Secretary assists the Secretary in the discharge of his duties and, in his absence, performs his functions. With the exception of certain matters reserved by the Secretary, the Under Secretary has the full authority of the Secretary. He is directly assisted by an immediate staff of 15.

An increase of $3,000 is requested to provide funding for within-grade step increases and other support costs associated with maintaining the current level of support for this office.

(c) Field Coordination: Fiscal year 1973, $437,277; fiscal year 1974, $443,500; increase, $6,223. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+6,223	---	$443,500	16	Additional funding for within-grade step increases and communication costs.

At the present time there are eight Field Representatives, and related clerical support, under the supervision of the Secretary. The Field Representatives are presently located in the following cities: San Francisco, California; Portland, Oregon; Albuquerque, New Mexico; Chicago, Illinois; Anchorage, Alaska; Boston, Mass.;

Denver, Colorado; and Atlanta, Georgia. The principal functions of these important staff officers are as follows:

- Maintain active liaison with appropriate Federal, state, inter-state and private interests.
- Provide continual surveillance in the field for the Secretary over the entire range of the Department's program activities.
- Coordinate matters of program and policy in the field where more than one bureau or program is involved.
- Serve as Chairmen of the Field Committees established in their respective regions. Field Committees are composed of regional directors or other higher ranking officials appointed by heads of bureaus or offices to foster Departmental policy objectives by improving coordination at the field level.

An increase of $6,223 is requested to provide funding for within-grade step increases and other support costs associated with maintaining the current level of support for these eight field offices.

(d) Office for Equal Opportunity: Fiscal year 1973, $2,097,388; fiscal year 1974, $2,185,000; increase, $87,612. The increase consists of:

	Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1)	$+63,500	---	---	---	Annualization cost of 19 additional positions authorized for fiscal year 1973.
(2)	+24,112	---	$2,185,000	95	Additional funding for current staff support
	87,612	---			

Cost Factors Involved in Increases

(1) Five additional man-years of employment, $112,200 consisting of $88,100 for salaries and benefits and $24,100 for travel and other supportive costs offset by $48,700 in nonrecurring reductions in transportation of things and equipment.

(2) Within-grade step increases, $12,000; additional travel, $5,000; and $7,112 for other support costs.

The Office for Equal Opportunity provides top level management and direction of the Department's equal opportunity programs which are carried out in compliance with the Civil Rights Act of 1964 (P.L. 88-352), related statutes and applicable Executive Orders. The functions of the Office include the following activities:

- Developing, implementing and coordinating the Department's equal opportunity policies and programs.
- Directing compliance and investigative activities relating to recipients or subrecipients of the Department's financial assistance programs.
- Directing compliance and investigative activities relating to Governmentwide contractors and subcontractors in six major industries and in the state of Alaska.

Equal Employment Opportunity Program - The Office for Equal Opportunity provides the leadership in assuring that women and minority group employees and those seeking employment in the Department have an equal chance to participate fully in the total range of Departmental employment irrespective of occupational category or grade level. Plans and programs for fiscal year 1974 include:

- Coordinating a Departmental affirmative Equal Employment Opportunity Program which requires action by each bureau and office to ensure equal opportunity in employment and in all education and training activities connected with employment that enhance employees' opportunities to develop to their highest potential. Plans include emphasis in the special interest program areas, i.e., the Federal Women's Program and the Spanish Surnamed Program.

- Coordinating, in addition to a national Departmental program, such regional affirmative action programs as are necessary to ensure action in each geographical area in which the bureaus and offices of the Department are located, as required by the Equal Employment Opportunity Act of 1972. Such regional programs shall be based on equal employment opportunity conditions of the region involved.

- Conducting a series of Equal Employment Opportunity awareness seminars for the Bureaus' field managers and supervisors, assuring that they have full knowledge of Equal Employment Opportunity program requirements and their responsibilities.

Federal Assistance Program - Title VI Civil Rights Act of 1964 - The Office for Equal Opportunity conducts an inspection program of projects receiving financial assistance from the various programs administered by the Department. Recreation projects, irrigation projects, and hydroelectric projects are some of the facilities that will be reviewed to assure that programs are being operated on an open basis.

Governmentwide Contract Compliance Program - The Department of Labor's Office of Federal Contract Compliance has assigned the Department of the Interior Governmentwide Contract Compliance responsibilities for the following seven industries:

1. The Fishing Industry
2. The Mining Industry
3. Crude Petroleum, Natural Gas, Petroleum Refinery and Related Industries
4. Rubber and Plastic Products
5. Pipeline Transportation
6. Hotels and Other Lodging Places
7. Automobile Accessory Stores and Retail Gasoline Stations

In addition, the Department has been assigned responsibility for the entire Contract Compliance Program for the state of Alaska, as well as its own construction sites. The assignment includes approximately 3,400 facilities.

The Department in fiscal year 1972 consolidated all of its Contract Compliance program resources in the Office of the Secretary. In addition, increased appropriations for fiscal year 1973 provided most of the needed resources to carry out the priority workload. The $87,612 increase requested in fiscal year 1974 will provide the necessary funding of staff to carry out this priority workload. Of this increase, $63,500 is for the full year funding of the 19 additional positions granted in 1973. An additional $24,112 is requested for within-grade step increases and other support costs associated with maintaining the Office's current level of operations.

There are, however, two variables that may affect priorities and future funding requirements. They are (1) the proliferation of the Office of Federal Contract

Compliance approved area or "Hometown" plans to integrate the construction industry and (2) the construction of the proposed Trans-Alaska pipeline. Both of these items have high priority in the Office of Federal Contract Compliance and potentially amount to many new job opportunities for minorities and in the case of the pipeline, particularly Native Alaskans. The Department will closely evaluate this additional developing workload to determine if increased funding is warranted.

(e) Office Communications: Fiscal year 1973, $297,800; fiscal year 1974, $301,800; increase, $4,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+4,000	---	$301,800	14	Additional funding for within-grade step increase costs.

The Office of Communications performs basic information services for the Secretary, all other offices in the Secretariat, and for several bureaus and offices that have limited or no information staffs. The office responds to requests for information from the press, radio and television networks, individual radio and television stations, and numerous popular, resource-oriented, and special magazines, as well as other publications, concerning Departmental programs and policies. It also coordinates, edits, and rewrites material originating in the several larger bureaus that have formal information staffs. It also has overview responsibilities for the nationwide Johnny Horizon Program, created to give national impetus to cleaning up the Nation's environment with emphasis upon Bicentennial goals. Other basic services that are provided by the Office of Communications include reviewing, editing, and coordinating publications prepared throughout the Department; writing press releases and speeches concerning activities and projects of a Departmentwide nature; preparing special publications; reviewing and coordinating motion pictures and exhibits; managing a central photographic laboratory; and publishing the Conservation Yearbook.

An increase of $4,000 is requested to provide funding for within-grade step increases and other support costs associated with maintaining the current level of support for this office.

(f) Office of the Science Adviser: Fiscal year 1973, $137,500; fiscal year 1974, $137,500; no change.

The Office of the Science Adviser is responsible to the Secretary for direct assistance and advise on scientific and technological affairs, administrative matters affecting the conduct of research and development programs, and policy questions with significant scientific or technologic components. The Science Adviser represents the Secretary and the Department in activities of the Federal Council for Science and Technology, the National Academy of Sciences, the National Academy of Engineering; interagency scientific bodies and numerous similar organizations, both governmental and private. The Science Adviser conducts or supervises ad hoc staff work which assembles and digests scientific and technological background material for the Secretary's information. He coordinates studies cutting across the normal Departmental lines and, similarly, coordinates or maintains an overview of research and development activities (particularly at their inception) which involve several lines of command. Plans for fiscal year 1974 include the coordination of research projects utilizing excess foreign currencies (P.L. 480 funds) in the countries of Poland and Yugoslavia as outlined in the Office of the Secretary's fiscal year 1974 excess foreign currency budget request.

(g) Office of Legislation: Fiscal year 1973, $443,200; fiscal year 1974, $452,700; increase, $9,500. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+9,500	---	$452,700	27	$5,500 for annualization cost of two positions authorized in fiscal year 1973 and $4,000 for within-grade step increases.

The Office of Legislation supervises the preparation and is responsible for the unification and coordination of the Department's legislative program and its presentation to the Office of Management and Budget and the Congress. The Legislative Counsel consults with the Secretarial Offices, the Solicitor, and bureau officials in the determination of policy incident to proposed or pending legislation of importance with respect to policy involved in reports on legislation or recommendations for Presidential approval or veto of enrolled bills. The Office reviews all legislative documents submitted by bureaus and offices, prepares coordinated reports, and coordinates and arranges departmental representation at Congressional hearings. It is responsible for establishing and maintaining contacts on legislative information for use within the Department, and generally serves as a clearinghouse on legislative matters.

An increase of $5,500 is requested to provide full funding of the two additional positions authorized in fiscal year 1973. In addition, $4,000 is requested for within-grade step increases and other unavoidable costs associated with normal operations.

(h) Program Policy: Fiscal year 1973, $1,324,000; fiscal year 1974, $1,372,800; increase, $48,800. The increase consists of:

	Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1)	$+39,900	---	---	---	Annualization cost of 10 additional positions authorized for fiscal year 1973.
(2)	+ 8,900	---	$1,372,800	57	Additional funding for current staff support.
	48,800	---			

Cost Factors Involved in Increases

(1) Two additional man-years of employment, $39,900 consisting of $42,900 for salaries and benefits and $7,800 for travel and support costs offset by $10,800 in a nonrecurring reduction in equipment.

(2) $5,900 for within-grade step increases and $3,000 for travel and other support costs.

Office of Assistant Secretary - Program Policy - The Immediate Office of the Assistant Secretary - Program Policy provides Secretarial direction and supervision over the Bureau of Outdoor Recreation, the Office of Program Development and Coordination, the Office of Environmental Project Review, the Office of Regional Planning, and the Office of Economic Analysis.

The Office of International Activities, previously included under this activity, was reassigned and is now under the supervision of the Assistant Secretary - Management and Budget.

The Assistant Secretary for Program Policy conducts a system of continuing evaluation of budget and policy matters and systematic review of bureau and office submissions presented by the respective Assistant Secretaries for the current budget cycle to select those programs which demand Secretarial attention because of their national concern, legislative requirements, precedent setting nature, or because the issues and activities involved cross disciplinary lines (such as, outer continental shelf leasing, geothermal development, predator control, etc.); and to follow through to assure either implementation of agreed-on policy, or the airing of issues for discussion in a wide forum, such as in public hearings or discussions with the Congress. This Office has already proceeded with its 1975 budget cycle, and initiated the primary analyses required in support of major Departmental program issues. In addition the Office is responsible for analyzing the relationship of Departmental issues to the national economic situation and policy, and providing the cost analyses of interdisciplinary alternatives on major issues.

Office of Program Development and Coordination - The Office of Program Development and Coordination is responsible for the development, integration and coordination of a broad range of interdisciplinary and interagency activities. It develops proposes and evaluates major program initiatives for the consideration of the Secretary. It reviews the Departmental program for implied policy content and consistency with Departmental policy. It analyzes Departmental program and policy alternatives and the coordination of all analytical studies and program proposals.

The major coordination responsibilities are to monitor and as appropriate, coordinate important issues identified by the Administration, Congress, and the Secretary. Further, it maintains a current overview of all programs and provides staff support in setting priorities, work schedules, assignments, and controls required for timely and effective accomplishment of the responsibilities of the Assistant Secretary - Program Policy.

Office of Regional Planning - The Office of Regional Planning assists in identifying Departmental planning priorities and for initiating actions to satisfy these priorities. These priorities relate to the Department's activities in land, water and other natural resource planning and management. Special emphasis is placed on cooperation with and assistance to state and local governments and regional planning and development authorities.

The Office has primary staff responsibility for (1) national land use policy and related legislation; (2) coordination of Department activities in support of Federal and state resource planning; (3) the Secretary's position as Chairman of the Water Resources Council, River Basin Planning, and the National Water Resource Assessment; (4) the Department's role in programs pursuant to Title V of the Economic Development Act; and (5) policy assistance for the Resources and Land Information System.

Environmental Project Review - The Office of Environmental Project Review analyzes and reports for the Secretary on the environmental impact of major proposed projects. This review encompasses not only projects initiated by the Department but also those of other agencies which are submitted to Interior for comment. The staff coordinates and establishes overall policy and guidance for the preparation and review of all environmental impact statements under consideration by the Department. The staff of this office is comprised of scientists, engineers, and resources managers as well as other environmental specialists with broad interdisciplinary backgrounds.

The principal responsibility of this office is to provide guidance to bureaus and offices in meeting the Department's responsibilities under the National Environmental Policy Act and under Executive Orders 11507 and 11514. In this regard the office reviews as to substance and procedure all draft and final environmental statements prepared within the Department. In fiscal year 1972 the Department prepared 118 draft and 35 final statements. Major areas which are of prime responsibility of Interior include such activities as public lands management, park and wilderness proposals, water resources projects, power plants and energy proposals, and fish and wildlife management. In fiscal year 1973 the Department expects to prepare 330 draft and 420 final statements.

In addition the office is responsible for the coordination and preparation of the Department's review comments on proposed projects and environmental statements involving other agencies. Because of its expertise in natural resources and cultural matters, the Department is called upon to review virtually all environmental statements that are prepared by other Federal agencies. In fiscal year 1972 the Department formally reviewed about 1,100 draft statements and informally reviewed about 900 draft statements at field level. In fiscal year 1973 the Department expects to review from 2,000 to 2,500 draft statements. Special attention is being directed at coordination with other agencies such as the Atomic Energy Commission, the Corps of Engineers, and the Department of Transportation which have similar problems and the statements from which entail a large portion of our review workload.

Economic Analysis - The Office of Economic Analysis provides in-depth analysis of the Department's own programs and of other broader natural resource and environmental activities affecting Interior. An example of such a study is "An Economic and Security Analysis of the Trans-Alaska Pipeline," a three volume effort exploring the implications of the development of North Slope oil. The office also directs analyses and prepares option papers to assist the Secretariat in development of Departmental programs, and on major decisions which require the preparation of environmental impact statements. The staff reviews the standards and methods employed Departmentwide for economic analyses and serves as the central contact for other Federal agencies on national economic matters. In addition, this office performs or directs specialized Departmental analysis and reporting, and serves as consultants to other technical staffs throughout the Department.

Additional Funding for Current Staff - An increase of $48,800 is requested for fiscal year 1974. Of this increase $39,900 is for the full year funding of the 10 additional positions granted in 1973. An additional $8,900 is requested for within-grade step increases and other supportive costs associated with maintaining the office's current level of operations. The following table displays the position and funding levels for fiscal year 1973 and 1974 and a distribution of the requested increase:

PROGRAM POLICY

LISTING OF FUNDS AND POSITIONS BY FUNCTION FOR FISCAL YEAR 1973, 1974 AND DISTRIBUTION OF INCREASES

	F.Y. 1973 Presently Available		F.Y. 1974 Estimate		Distribution of Increases			
					Total		Annualization of 1973 Inc	Current Staff Support
	Positions	Funds	Positions	Funds	Positions	Funds	Funds	Funds
Immediate Office.....	7	$164,000	7	$167,300	--	$3,300	$2,100	$1,200
Program Coordination.....	13	321,100	13	328,500	--	7,400	5,200	2,200
Environmental Project Review...	20	462,200	20	482,700	--	20,500	17,400	3,100
Regional Planning.....	7	176,100	7	184,900	--	8,800	7,700	1,100
Economic Analysis.....	10	200,600	10	209,400	--	8,800	7,500	1,300
Total.....	57	1,324,000	57	1,372,800	--	48,800	39,900	8,900

2. PROGRAM DIRECTION AND COORDINATION

Analysis by Subactivities

Subactivity	F.Y. 1972 Amount Available	Fiscal Year 1973 Total Appropriation	Transfers	Adjusted Amt. Available
(a) Water and Power Resources...	$ 598,854	$ 629,400	$ ---	$ 629,400
(b) Mineral Resources.....	493,359	498,200	---	498,200
(c) Public Land Management.....	708,261	696,500	---	696,500
(d) Fish and Wildlife and Parks.	292,384	322,800	---	322,800
Total.....	2,092,858	2,146,900	---	2,146,900

Subactivity	F.Y. 1972 Amount Available	F.Y. 1973 Adjusted Amt. Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973 Total
(a) Water and Power Resources...	$ 598,854	$ 629,400	$ 633,400	$+4,000
(b) Mineral Resources.....	493,359	498,200	532,200	+34,000
(c) Public Land Management.....	708,261	696,500	700,500	+4,000
(d) Fish and Wildlife and Parks.	292,384	322,800	332,800	+10,000
Total.....	2,092,858	2,146,900	2,198,900	+52,000

2. PROGRAM DIRECTION AND COORDINATION

(a) Water and Power Resources: Fiscal Year 1973, $629,400; fiscal year 1974, $633,400; increase, $4,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$ +4,000	---	$633,400	25	Additional funding for within grade step increase costs.

The Immediate Office of the Assistant Secretary - Water and Power Resources discharges the duties of the Secretary with respect to the operations and development of water and power resources. The Assistant Secretary exercises Secretarial direction and supervision over the Office of Saline Water, the Office of Water Resources Research, the Bureau of Reclamation, Bonneville Power Administration, Alaska Power Administration, the Southeastern Power Administration, and the Southwestern Power Administration. He also administers the Underground Electric Power Transmission Research Program and is responsible for carrying out the national defense functions of the Secretary with respect to electric power and water resources. These latter activities are carried out by the Defense Electric Power Administration.

The Defense Electric Power Administration is responsible for the electric power and water resources emergency preparedness activities assigned by Executive Order 11490 to the Department of the Interior. It is through the activities of this office that the Secretary exercises emergency plans and preparedness programs in the event of a national emergency.

The Department, in a joint funding relationship with the Office of Emergency Preparedness, develops and maintains in a readiness condition for a national emergency an orgainization capable of directing the Nation's electric power and water resources to meet military and essential civilian requirements and plans measures to maximize the economic recovery of these resources.

An increase of $4,000 is requested to provide funding for within-grade step increases and other costs associated with maintaining the current level of support for this office.

(b) Mineral Resources: Fiscal year 1973, $498,200; fiscal year 1974, $532,200; increase, $34,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Positions	Explanation
(1) $+4,000	---	$532,200	22	Additional funding for current staff support.
(2) +30,000	---	---	--	Travel for Departmental participation in the United Nation's Law of the Sea Conference.
+34,000	---			

The Office of the Assistant Secretary - Mineral Resources discharges the duties of the Secretary with respect to the development and utilization of mineral resources. He exercises Secretarial direction and supervision over the Bureau of Mines, Geological Survey, Office of Oil and Gas, and the Office of

Coal Research. In addition, it is proposed that this Assistant Secretary be responsible for the coordination, administration, and selection of projects that will be funded under the proposed Central Energy Research and Development Fund. He is also responsible for carrying out the national defense functions of the Secretary with respect to minerals and solid fuels.

The Department, in a joint funding relationship with the Office of Emergency Preparedness, develops and maintains in a readiness condition for a national emergency, an organization capable of directing the Nation's mineral and solid fuel resources to meet military and essential civilian requirements and plans measures to maximize the economic recovery of the industry. In addition, this small staff is engaged in implementing the provisions of the Mining and Minerals Policy Act and the National Materials Policy Act.

The Office of the Assistant Secretary - Mineral Resources has also assumed responsibility for developing and recommending Interior's goals for ocean resource and marine pollution policies and strategies for achieving them. This importantly includes implementing through legislation the results of the 1973-1974 United Nations Conference on the Law of the Sea which is developing the rights of nations including the United States to exploit the ocean mineral resources beyond the limits of national jurisdiction and will restrict and limit those rights through process of international negotiation.

This conference will require the increasing participation by the Department during fiscal year 1974. Since the Department has the principal responsibility to protect the preferential interest of the U.S. in exploitation of offshore mineral resources, it must be adequately represented at all meetings, conferences, attache briefings, and consultations concerning the law of the Sea. In addition, the United States Representative in the Committee negotiating a treaty to govern the mineral resources of the seabed is an Interior Department official.

An increase of $30,000 is requested for travel to allow Departmental officials to participate in meeting and conferences associated with law of the sea matters. This amount represents the minimum amount required to fulfill the Department's responsibility toward achieving the objectives outlined in the President's Oceans Policy. In addition, $4,000 is requested to provide funding for within-grade step increases and other costs associated with maintaining the current level of support for this office.

(c) Public Land Management: Fiscal year 1973, $696,500; fiscal year 1974, $700,500; increase, $4,000. The increase consists of:

Increase (+) or Decrease (-)		Total		
Amount	Positions	Program	Positions	Explanation
$+4,000	--	$700,500	26	Additional funding for within grade step increase and other support costs.

The Assistant Secretary - Public Land Management discharges the duties of the Secretary with respect to public land management and utilization, Indian affairs, and territorial affairs. He exercises Secretarial direction and supervision over the Bureau of Land Management, Bureau of Indian Affairs, the Trust Territory of the Pacific Islands and American Samoa. He is also responsible for carrying out the Secretary's statutory responsibilities with regard to Guam and the Virgin Islands and all other noncontiguous territories under the jurisdication of the Secretary.

An increase of $4,000 is requested to provide funding for within-grade step increases and other costs associated with maintaining the current level of support for this office.

(d) Fish and Wildlife and Parks: Fiscal year 1973, $322,800; fiscal year 1974, $332,800; increase, $10,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+10,000	--	$332,800	15	$7,000 for annualization cost of 3 positions authorized in FY 1973 and $3,000 for within grade step increases.

The Assistant Secretary for Fish and Wildlife and Parks discharges the duties of the Secretary with respect to the development, conservation, and utilization of fish, wildlife, and national parks of the Nation. He exercises secretarial direction over the Bureau of Sport Fisheries and Wildlife and the National Park Service.

During recent years the programs in the conservation and use of natural resources have expanded greatly. Of particular importance are new or expanded programs in environment abatement and the protection of estuarine areas, endangered species, and parks and recreational opportunities.

An increase of $10,000 is requested for fiscal year 1974. Of this amount $7,000 is for full funding of the increased staff approved for fiscal year 1973. The remaining $3,000 is requested to provide for within-grade step increases and other costs associated with maintaining the current level of support for this office.

3. ADMINISTRATIVE MANAGEMENT

Analysis by Subactivities

Subactivity	F.Y. 1972 Amount Available	Fiscal Year 1973 Total Appropriation	Transfers 1/	Adjusted Amt. Available
(a) Assistant Secretary - Management and Budget.....	$ 253,140	$ 362,300	$ ---	$ 362,300
(b) International Activities.....	---	---	+155,800	155,800
(c) Secretarial Operations.....	---	---	+602,300	602,300
(d) Survey and Review.....	2,679,508	3,351,300	-416,786	2,934,514
(e) Office of Budget.....	745,384	817,400	-331,900	485,500
(f) Office of Management Operations.....	738,793	925,600	---	925,600
(g) Office of Management Consulting.....	320,927	444,700	+413,200	857,900
(h) Office of Personnel Management.....	882,719	919,800	-270,400	649,400
Total.....	5,620,471	6,821,100	+152,214	6,973,314

1/ Administrative realignment of organizational roles and responsibilities are explained in the following justification material.

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3. ADMINISTRATIVE MANAGEMENT

Analysis by Subactivities

Subactivity	F.Y. 1972 Amount Available	F.Y. 1973 Adjusted Amt. Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973 Total
(a) Assistant Secretary - Management and Budget.....	$ 253,140	$ 362,300	$ 362,300	$ ---
(b) International Activities.....	---	155,800	156,900	+1,100
(c) Secretarial Operations.....	---	602,300	607,300	+5,000
(d) Survey and Review.....	2,679,508	2,934,514	3,015,500	+80,986
(e) Office of Budget.....	745,384	485,500	685,500	+200,000
(f) Office of Management Operations.....	738,793	925,600	955,300	+29,700
(g) Office of Management Consulting.....	320,927	857,900	881,900	+24,000
(h) Office of Personnel Management.....	882,719	649,400	662,400	+13,000
Total.....	5,620,471	6,973,314	7,327,100	+353,786

3. ADMINISTRATIVE MANAGEMENT

(a) Assistant Secretary - Management and Budget: Fiscal year 1973, $362,300; fiscal year 1974, $362,300; no change.

The Office of the Assistant Secretary - Management and Budget discharges the duties of the Secretary with respect to the administrative management functions of the Department. Overall program direction and coordination is provided by this office for eight specialized staff organizations which operate with a Departmentwide scope and responsibility. These specialized activities include internal audit and accounting systems development, budget planning and execution, management and organization survey, personnel management, general administrative services, library services, and the coordination of the Department's International Activities. The Office of Assistant Secretary - Management and Budget consists of 13 positions.

During fiscal year 1973 the Assistant Secretary - Management and Budget realigned the organizational roles and responsibilities of the various functions within the management and budget area to make them more responsive to the mission of financial control and management service to the Department. This realignment included the establishment of two new staff offices - The Office of Secretarial Operations, and the Office of Accounting Management Policy. Also, responsibility for establishment of the Department's management information system and ADP policy and coordination were reassigned from the Office of Survey and Review to the Office of Management Consulting. In addition, the Office of International Activities, previously under Program Policy, was placed under the supervision of the Assistant Secretary - Management and Budget.

(b) Office of International Activities: Fiscal year 1973, $155,800; fiscal year 1974, $156,900; increase, $1,100. The increase consists of:

Increase (+) or Decrease (-)		Total	Total	
Amount	Positions	Program	Positions	Explanation
$+1,100	---	$156,900	6	Additional funding for within-grade step increase costs.

The Office of International Activities is responsible for the development and coordination of the international affairs of the Department. The office is responsible for identifying and fostering both short and long range program objectives of the Department in the international activities field; for coordinating departmental objectives with those of the Department of State and other Federal agencies; and for carrying out special assignments on a wide range of international activity program matters. In addition, starting in fiscal year 1972, the Office of the Secretary is engaged in the coordination of selected research projects to be performed by two foreign nations utilizing excess foreign currencies. The Office of International Activities serves as the non-technical coordinating staff to insure that this cooperative effort fosters improved relations with these nations.

An increase of $1,100 is requested to provide funding for within-grade step increases and other support costs associated with maintaining the current level of support for these important functions.

(c) Office of Secretarial Operations: Fiscal year 1973, $602,300; fiscal year 1974, $607,300; increase, $5,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+5,000	---	$607,300	37	Additional funding for within grade step increase costs.

The Office of Secretarial Operations consists of the Division of Personnel Services and the Division of Fiscal Services. These Division were reassigned from the Office of Personnel Management and the Office of Budget respectively. The Office of Secretarial Operations provides budgetary, financial, and personnel services for the Office of the Secretary. In addition, the office provides these services, on a reimbursable basis, for the Office of the Solicitor, Coal Research, Office of Oil and Gas, and the Office of Water Resources Research, as well as several independent offices and commissions. The following funding adjustments were made in establishing the Office of Secretarial Operations:

Transferred from	Amount	Positions
Office of Personnel Management.....	$270,400	16
Office of Budget.....	331,900	21
Total.....	602,300	37

An increase of $5,000 is requested to provide funding for within-grade step increases and other costs associated with maintaining the current level of support for this office.

(d) Survey and Review: Fiscal year 1973, $2,934,514; fiscal year 1974, $3,015,500; increase $80,986. The increase consists of:

	Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1)	$+51,400	---	---	---	Annualization cost of 11 additional positions authorized for FY 1973.
(2)	+29,586	---	$3,015,500	139	Additional funding for current staff support.
	+80,986	---			

Cost Factor Involved in Increase

(1) Two additional man-years of employment, $51,100 consisting of $28,100 for salaries and benefits and $13,000 for travel; $25,300 for payment to other agencies for contract audits. These increases are offset by a $15,000 nonrecurring decrease in equipment.

(2) Within grade step increases, $22,300; travel and other support costs, $7,286.

As a result of the realignment of roles and responsibilities within administrative management the budget subactivity for Survey and Review is composed of the following functions:

1) Regional Administrative Office

2. Accounting Management and Policy
3. Audit, Inspection and Investigations, and Contract Policy

1. Regional Administrative Office - As a result of the pressing need to establish a greater Departmental Administrative management presence in the field, Regional Administrative Offices have been established in Denver, Colorado; Portland, Oregon; San Francisco, California; Albuquerque, New Mexico; and Atlanta, Georgia. These individuals (Regional Directors) will concentrate their efforts on identifying, planning, and installing common administrative systems and procedures of benefit to several bureaus. Several obvious areas of potential consolidation include ADP operations, payroll and personnel services, procurement and general administrative support activities.

2. Accounting Management and Policy - The Office of Accounting Management and Policy was established to provide primary focus upon development and maintenance of uniform accounting policy and system requirements for Departmentwide financial accounting and reporting. The Office exercises technical control, coordination, and guidance over all financial management systems development and improvement efforts throughout the Department to insure that system changes occur in an orderly evolutionary fashion.

Substantial effort for fiscal year 1973 was directed toward the Departmental policy to develop a minimum of Departmentwide accounting systems which would provide uniformity of data and meet the requirements of the Comptroller General. A plan covering the analysis of all accounting activities within the Department has been developed to establish such uniform systems. During fiscal year 1974, recommendations contained in the above plan identifying opportunities for accounting systems improvements and elimination of expensive duplication of effort and lack of uniformity of financial data have been scheduled for implementation. The establishment and implementation of the Departmental directive for accounting systems improvement is expected to advance the quality of financial activities throughout the Department.

3. Audit, Inspection and Investigations, and Contract Policy -
(a) Audit Activities - The Department conducts a Departmentwide program of internal, contract, and grant auditing. With respect to internal auditing, emphasis is placed upon the review of functional and operational program areas susceptible to improved efficiency, waste-abatement and other forms of cost reduction. Contract and grant auditing pertains chiefly to compliance with the terms of the contracts and grants and the propriety and validity of expenditures. To illustrate the magnitude of these requirements under this activity the workload includes:

- Approximately 135 Departmental locations which maintain records, generate expenditures, or are accountable for Government property in a substantive degree.

- Collection responsibilities of the Department from sale of power, oil and gas leasing, grazing lands, Indian resources, timber sales, and recreation fees. The receipts are approximately $1.6 billion a year.

- One hundred and six Indian housing authorities.

- Cost and pricing data submitted with contractor's proposal for negotiated contracts or amendments to fixed-price contracts involving more than $100,000.

- Governmentwide audit and indirect cost negotiations under the provisions of OMB Circular A-88. Interior has been designated as the cognizant audit agency for 11 educational institutions.

- Cost allocation plans submitted by state and local governments under the provisions of OMB Circular A-87.

- Grants or financial assistance to states under the provisions of the Johnson O'Malley Act, the National Historic Preservation Act, and the Federal Coal Mine and Safety Act.

Since there are deadlines on certain types of work, particularly in the contract area, the audit time available gravitates to these areas by necessity resulting in the audit of the Department's financial activities to lag far behind the minimal three years required of expenditure and receipt records.

During fiscal year 1972, we issued 87 internal and 230 contract and grant audit reports. These audits were performed for 19 different Interior bureaus and offices and four other Federal agencies. In addition, three Federal agencies performed contract and grant audits for the Department on a reimbursable basis.

Over $7.1 million of costs claimed under contracts and grants (Federal share) were questioned in the audit reports. More than $1.2 million was disallowed by contracting officers and grantor agencies through reductions in reimbursement claims or adjustments to project costs as a result of the audits.

While internal audit points suggested during the period show potential dollar savings of about $1 million, many additional significant benefits are realized which are either one-time savings or are savings of a continuing nature. These internal audits emphasize improvements in systems and procedures which result in greater efficiency and economy but often are not fully or readily measurable in financial terms.

(b) Inspection and Investigations - The Office of Survey and Review is responsible for the direction of Department investigative activity as to complaints of serious misconduct or operating irregularities or in other cases (as the Secretary may direct) in which a formal investigation requiring trained special agent techniques is considered appropriate.

In addition, the office directs compliance activities other than those involving employment opportunities including establishment and enforcement of ethical standards and related procedures in official employment behavior and operating practices. This includes the coordination of internal Bureau inspection activities complimentary to such compliance efforts and the review and recommendation of disciplinary action or other decisions in regard to investigative findings or disclosures through audit, inspection, or compliance processes.

(c) Contract Policy - The Office of Survey and Review is responsible for the formulation of procurement policy for the Department, for the development of the Interior Procurement Regulations which supplement and implement the Federal Procurement. Oversees procurement activities, and provides assistance to those bureaus and offices where procurement practices are in need of improvement. The diversity of programs and the multiple management within the Department requires an expanded capability at the Secretariat level to assure consistency of procurement policy and of procurement practice within the bureaus. A significant responsibility within this concept is to assist those bureaus whose contracting practices have been deficient. Recent experiences in the Department have necessitated more constructive guidance from the Secretarial level to assure the promulgation of appropriate procurement procedures and to assure adherence in practice to these procedures.

Funding Adjustments - As a result of the realignment of organizational roles and responsibilities the following funds and positions were transferred from the Office of Survey and Review.

Transferred to	Amount	Positions
Office of Management Consulting for:		
ADP equipment acquisition and utilization	$ 45,200	2
Development of the Department's Management Information System -		
- Staff	168,000	7
- Contract Funds	200,000	--
Total	413,200	9

Additional Funding for Current Staff - An increase of $77,400 is requested for fiscal year 1974. Of this amount $51,400 is for the full year funding of the nine audit positions and two contract policy positions approved for fiscal year 1973. The additional $26,000 is requested for within-grade step increases and other supportive costs associated with maintaining the office's current level of operations.

(e) Office of Budget: Fiscal year 1973, $485,500; fiscal year 1974, $685,500; increase, $200,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+200,000	6	$685,500	26	To provide for a budget system and evaluation staff.

Cost Factors Involved in Increase

$156,000 for salaries and benefits of 6 new positions; $10,000 for travel, $20,000 for contractual services and $14,000 for equipment and other support costs.

The Office of Budget has the primary staff responsibility in the Department for budgeting and related financial administration. The Office of Budget develops overall Departmental policy and procedures and provides Departmental direction, review and coordination for all phases of the budget process. It is the Department's budgetary and financial liaison on appropriations and funds matters with the Office of Management and Budget, the Appropriations Committees of the Congress, the Treasury Department and others. The Office reviews the content of all budgetary material, including proposals for supplementary budget requests and for reprogramming of funds, and fiscal and financial reports prepared by the format and procedures. It also maintains control of the limitations imposed by the Congress and by the Office of Management and Budget on the funds appropriated and the positions allotted to the Department.

Budget Systems and Evaluation Staff - During the current year the nucleus of the Budget Systems and Evaluation Staff was created in the Office of Budget with the establishment of a new Deputy Director. The primary responsibility of the Budget Systems and Evaluation Staff is to establish an improved Departmental budget program structure and initiate a performance measurement system to assist in the effective and efficient management of the Department's programs. The importance of this effort to the long-range improvement of the Department's budget planning, evaluation, and execution systems necessitated the initiation of activities on an interim, minimal basis this year awaiting approval of additional resources. At the present time we are relying on personnel detailed from other components of the Secretariat and bureaus to launch limited activities in this important

area. However, we cannot expect to continue to meet the responsibilities of this effort utilizing personnel on loan from other offices and must provide a small, permanent staff element dedicated soley to this large undertaking.

The Budget Systems and Evaluation Staff, working closely with the bureaus and offices, will initiate a program to strengthen the Department's budgetary process by concentrating on the following activities:

- Develop and maintain a budget program structure for the Department as a whole.
- Establish program objectives and measurement criteria for improved in-depth evaluation of individual program performance.
- Develop procedures, Departmental management and financial reporting requirements, and supporting systems to implement the Department's program structure and performance measurement activities.
- Establish an improved mechanism for selecting high priority programs for emphasized management review and improvement.
- Coordinate the Department's participation in the joint Office of Management and Budget, General Accounting Office, and Civil Service Commission productivity measurement project.

To provide for a small, highly competent staff necessary to direct, coordinate, and monitor the Department's efforts in these areas, we are requesting an increase of $200,000 for fiscal year 1974.

The additional personnel requested will be used as follows:

- Three professionals to concentrate on the joint effort to develop an improved Departmental budget program structure and performance measurement system. These staff members will serve as the designated project leaders and technical experts to direct and coordinate the efforts of the bureaus, specialized staff offices of the Secretariat, and outside professional experts, as required, for the initiation and development of these projects. This small staff will be the focal point for the Department's efforts in this area and will assure that a coordinated and properly integrated Departmental system is finally implemented.
- One professional staff member is necessary to coordinate and assist in the development of a Departmental reporting structure and related supporting systems as required for implementation of the program structure and performance measurement activities.
- Two clerical personnel are required to support the general workload generated by the professional staff.

In addition to $156,000 required for the direct staff increases requested, the following supportive costs are necessary: $20,000 to provide necessary specialized and technical outside assistance to aid in the development of the program and performance measurement system; $10,000 for essential travel to field installations; and $14,000 for equipment and other support costs.

Funding Adjustments - As a result of the realignment of organizational roles and responsibilities the Division of Fiscal Services was reassigned from the Office of Budget to the Office of Secretarial Operations. Accordingly 21 positions and $331,900 has been reallocated to that office.

(f) Office of Management Operations: Fiscal year 1973, $925,600; fiscal year 1974, $955,300; Increase, $29,700. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+29,700	---	$955,300	60	Necessary funding for current staff support.

Cost Factors Involved in Increase

$9,700 to annualize 8 new positions authorized in fiscal year 1973, $20,000 for within-grade step increases and other support costs.

The Office of Management Operations has primary staff responsibility for all administrative services, property management, records management, communications, space management, security and protective services, and emergency preparedness activities at the Departmental level. It also provides certain centralized administrative services for bureau and office headquarters and other offices located in the Washington metropolitan area. These services include automatic data processing, space, duplicating, communications, visitor information, and storage and shipping. The office also provides administrative services such as mail, file, messenger, and procurement for the Office of the Secretary, the other Departmental Offices, and several independent offices and commissions.

The Department was granted an additional $104,600 and 5 positions for fiscal year 1973 for its newly established Division of Records and Protective Services. In addition, three positions and $48,400 was granted for the Correspondence Control function. An increase of $29,700 is requested for fiscal year 1974 for within-grade step increases and other supportive costs associated with maintaining the office's current level of operation. Of this amount $9,700 would be used for annualization of the 1973 program increases.

(g) Office of Management Consulting: Fiscal year 1973, $857,900; fiscal year 1974, $881,900; increase, $24,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+24,000	---	$881,900	27	Necessary funding for current staff support.

Cost Factors Involved in Increase.

$29,600 for salaries and benefits, and other support costs to annualize the cost of 7 new positions authorized in fiscal year 1973 and provide for within-grade step increases offset by a $5,600 nonrecurring reduction in travel.

The Office of Management Consulting is responsible for providing a highly qualified, objective and responsive consulting services to Department management to promote more effective and efficient operations of the Department. Specific functions of the office include:

- Conducting project-oriented management consulting studies throughout the Department related to organization planning and analysis, staffing analysis, long-range management planning, and analysis of procedural and paperwork operations.

- Monitors, coordinates and reviews management studies carried out by bureaus or offices, and develops a skilled Departmentwide

management consulting workforce; promotes improved management practices and organization throughout the Department.

- Designs and develops Departmentwide management information systems, including the application of quantitative methods.

- Provides guidance and review for use of management consulting services throughout the Department.

- Administers Departmental direction over automatic data processing policy, long-range planning, standards and procedures, equipment specifications and systems procurement; and coordinates the efficient use of ADP resources Departmentwide.

- Provides for Secretarial delegations of authority, and Departmentwide programs for management of directives, reports, and committee activities; and coordinates the implementation of Presidential Orders, Office of Management and Budget Circulars, and other agency directives.

- Provides for development of intergovernmental and interagency coordination policies and procedures for the Department.

- Represents the Department to the Office of Management and Budget, the Congress, and other Federal agencies, in matters pertaining to functions assigned to this office.

As a result of the realignment of organizational roles and responsibilities the Departmental ADP functions and responsibilities for development of a Departmental management information system have been reassigned from the Office of Survey and Review to the Office of Management Consulting. Accordingly, the resources for this office include 9 positions and $413,200 for these activities.

An increase of $24,000 is requested for fiscal year 1974 for within-grade step increases and other supportive costs associated with maintaining the office's current level of operation. Of this amount $20,000 would be used to annualize the cost of seven additional positions granted in fiscal year 1973 for development of a Departmentwide management information system.

(h) Office of Organization and Personnel Management: Fiscal year 1973, $649,400; fiscal year 1974, $662,400; increase, $13,000. The increase consists of:

Increase (+) or Decrease (-)		Total	Total	
Amount	Positions	Program	Positions	Explanation
$+13,000	---	$662,400	36	Necessary funding for current staff support.

Cost Factors Involved in Increase

$10,000 for within-grade step increases and $3,000 for annualization of two positions authorized in fiscal year 1973.

The Office of Organization and Personnel Management is responsible for providing Departmental leadership and staff guidance in all matters pertaining to personnel and organization management and administration. Policies, standards, objectives and programs are designed to establish and maintain an adequate, highly qualified and efficient workforce for the accomplishment of the Department's programs. The office gives direction and overall review to the constituent bureaus in the

Department with regard to their organization arrangements and personnel utilization through comprehensive and all inclusive personnel management programs, which include position management, position classification, labor management relations, employee conduct, wage and pay administration, employee and organization performance and work measurement, recruitment, placement, manpower planning, employee training and development, employee relations, employee health, occupational standards, personnel issuance systems, procedures and records. The office coordinates and evaluates bureau organization arrangements, personnel and organization and employee performance improvement programs, and provides Departmental leadership for executive development and training.

As a result of the realignment of organizational roles and responsibilities the Division of Personnel Services, consisting of 16 positions and $270,400, was reassigned to the Office of Secretarial Operations.

For fiscal year 1974, an increase of $13,000 is requested for within-grade step increases and other supportive costs associated with maintaining the office's current level of operations. Of this amount $3,000 would be used to annualize the cost of two additional positions granted in fiscal year 1973 for labor management relations.

4. GENERAL SERVICES

Analysis by Activities

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Amount Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973
Total.....	$246,251	$246,019	$317,700	$+71,681

General Services: Fiscal year 1973, $246,019; fiscal year 1973, $317,700; increase, $71,681. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+71,681	--	$317,700	---	Increased costs of FTS, postage, and commercial services required by the Office of the Secretary.

The activity "General Services" covers general expense items which are not practicable to distribute to the various activities of the Office of the Secretary. These items consists of:

General printing costs

Communications, including regular telephone costs (except field offices); FTS, commercial long distance, telegraph, and postage

Congressional travel for review of estimate in the field

Share of health service costs, stores and shipping costs, and other miscellaneous costs prorated over the Department

Operation of motor vehicles used by the Secretary and others in the Office of the Secretary

Some general purchases of equipment

Other miscellaneous expenses of a general nature

Employees compensation costs

Shown below is an itemization by object class of the funds requested for general services:

	1972 Actual	1973 Estimate	1974 Estimate
12 Personnel benefits	$28,207	$24,000	$21,500
21 Travel and transportation of persons	1,882	5,000	6,000
23 Rent, communications, and utilities	172,722	134,719	180,200
24 Printing and reproduction	9,310	15,000	20,000
25 Other services	24,170	56,000	76,000
26 Supplies and materials	4,164	5,000	7,000
31 Equipment	5,796	6,300	7,000
Total	246,251	246,019	317,700

An increase of $71,681 is requested for fiscal year 1974. The increase reflects the current level of costs for those general expense activities which are not feasible to distribute to the various operating units within the Office of the Secretary.

PERSONNEL SUMMARY

	1972 Actual	1973 Estimate	1974 Estimate
Total number of permanent positions	609	683	689
Full-time equivalent of other positions	20	20	20
Average paid employment	569	665	680
Average GS grade	10.1	10.2	10.2
Average GS salary	$16,323	$16,401	$16,519
Average salary of ungraded positions	$9,507	$10,670	$10,670

ITEMIZATION OF ESTIMATE

Appropriation Title: Salaries and Expenses — Office of the Secretary

	1972 Actual	1973 Estimate	1974 Estimate	Increase (+) or Decrease (-)
Program and Financing:				
Total obligations	$12,870,331	$15,253,398	$15,895,000	$+641,602
Unobligated balance lapsing	22,401	---	---	---
Budget authority	12,892,732	15,253,398	15,895,000	+641,602
Budget Authority:				
Appropriation	14,695,000	15,295,100	15,895,000	+599,900
Transferred to other accounts	-3,750,268	-41,702	---	+41,702
Transferred from other accounts	+1,948,000	---	---	---
Appropriation (adjusted)	12,892,732	15,253,398	15,895,000	+641,602
Object Classification:				
11 Personnel compensation	9,836,440	11,545,700	11,982,700	+437,000
12 Personnel benefits	834,870	1,005,900	1,044,400	+38,500
13 Benefits for former personnel	15,907	---	---	---
21 Travel and transportation of persons	903,662	1,023,900	1,111,100	+87,200
22 Transportation of things	23,627	82,700	46,600	-36,100
23 Rent, communications and utilities	381,550	381,898	434,500	+52,602
24 Printing and reproduction	156,774	177,700	190,100	+12,400
25 Other services	457,118	706,500	792,500	+86,000
26 Supplies and materials	100,445	142,600	153,600	+11,000
31 Equipment	159,938	186,500	139,500	-47,000
Total Obligations	12,870,311	15,253,398	15,895,000	+641,602

(Revised)
3/1/73

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
SALARIES AND EXPENSES

ESTIMATED OBLIGATIONS BY SUBACTIVITY AND OBJECT CLASS, FISCAL YEARS 1973 and 1974

Activity/Subactivity	Fiscal Year	Personnel Compensation	Personnel Benefits	Travel	Transportation of Things	Rent Com. & Utilities	Printing & Reprod.	Other Services	Supplies and Materials	Equipment	Total	Positions
1. Departmental Direction:												
(a) Office of the Secretary.....	1973	$ 606,800	$ 51,700	$ 42,800	$ 1,000	$ 12,700	$23,200	$ 20,300	$ 8,800	$ 7,000	$ 774,300	27
	1974	611,200	52,300	42,800	1,000	12,700	23,200	20,300	8,800	7,000	779,300	27
(b) Office of the Under Secretary.	1973	307,200	26,300	20,900	---	4,800	4,100	5,700	2,700	4,000	375,700	16
	1974	309,800	26,700	20,900	---	4,800	4,100	5,700	2,700	4,000	378,700	16
(c) Field Coordination.....	1973	303,300	26,200	59,000	2,000	13,477	8,500	15,000	5,800	4,000	437,277	16
	1974	308,300	26,900	59,000	2,000	14,000	8,500	15,000	5,800	4,000	443,500	16
(d) Office for Equal Opportunity..	1973	1,424,400	125,500	280,300	59,500	80,388	14,500	58,000	20,600	34,200	2,097,388	95
	1974	1,517,000	133,000	300,000	25,000	80,000	17,000	68,000	25,000	20,000	2,185,000	95
(e) Office of Communications....	1973	254,500	21,800	2,300	---	2,000	7,400	4,900	3,400	1,500	297,800	14
	1974	258,100	22,200	2,300	---	2,000	7,400	4,900	3,400	1,500	301,800	14
(f) Office of Science Adviser.....	1973	113,500	9,700	11,500	---	300	500	500	1,000	500	137,500	5
	1974	113,500	9,700	11,500	---	300	500	500	1,000	500	137,500	5
(g) Office of Legislation.....	1973	371,300	32,600	2,800	---	8,600	10,100	10,100	5,700	2,000	443,200	27
	1974	378,100	33,300	2,800	---	8,600	12,100	10,100	5,700	2,000	452,700	27
(h) Program Policy.....	1973	1,074,300	89,000	53,300	3,700	25,500	15,100	21,400	11,900	29,800	1,324,000	57
	1974	1,119,100	93,000	58,000	3,700	26,000	16,000	25,000	13,000	19,000	1,372,800	57
Total Departmental Direction..	1973	4,455,300	382,800	472,900	66,200	147,765	83,400	135,900	59,900	83,000	5,887,165	257
	1974	4,615,100	397,100	497,300	31,700	148,400	88,800	149,500	65,400	58,000	6,051,300	257
2. Program Direction and Coord:												
(a) Water and Power Resources.....	1973	527,200	45,300	33,500	---	3,700	4,800	9,100	3,500	2,300	629,400	25
	1974	530,900	45,600	33,500	---	3,700	4,800	9,100	3,500	2,300	633,400	25
(b) Mineral Resources.....	1973	418,100	36,000	23,000	---	2,000	5,400	6,600	4,400	2,700	498,200	22
	1974	420,000	36,100	53,000	---	2,300	6,000	7,500	4,600	2,700	532,200	22
(c) Public Land Management.....	1973	563,200	48,400	43,000	---	10,200	5,300	15,800	7,200	3,400	696,500	26
	1974	565,900	48,700	44,000	---	10,200	5,300	15,800	7,200	3,400	700,500	26
(d) Fish and Wildlife, and Parks..	1973	256,100	22,300	17,300	---	9,300	2,000	7,400	3,400	5,000	322,800	15
	1974	262,500	22,900	18,000	---	10,300	2,400	9,300	4,000	3,400	332,800	15
Total Program Direction and Coordination.....	1973	1,764,600	152,000	116,800	---	25,200	17,500	38,900	18,500	13,400	2,146,900	88
	1974	1,779,300	153,300	148,500	---	26,500	18,500	41,700	19,300	11,800	2,198,900	88

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
SALARIES AND EXPENSES

(Cont'd.)

ESTIMATED OBLIGATIONS BY SUBACTIVITY AND OBJECT CLASS, FISCAL YEARS 1973 and 1974

Activity/Subactivity	Fiscal Year	Personnel Compensation	Personnel Benefits	Travel	Transportation of Things	Rent Comm. & Utilities	Printing & Reprod.	Other Services	Supplies and Materials	Equipment	Total	Positions
3. Administrative Management:												
(a) Assistant Secretary - Management and Budget	1973	$ 279,500	$ 23,700	$ 19,300	$ ---	$ 10,000	$ 3,900	$ 12,000	$ 5,400	$ 8,500	$ 362,300	13
	1974	282,200	24,000	19,300	---	10,000	3,900	12,000	5,400	5,500	362,300	13
(b) International Activities	1973	131,100	15,700	2,000	---	1,000	1,000	3,000	1,000	1,000	155,800	6
	1974	132,000	15,900	2,000	---	1,000	1,000	3,000	1,000	1,000	156,900	6
(c) Secretarial Operations	1973	511,400	43,000	2,000	---	3,500	4,800	25,300	5,900	6,400	602,300	37
	1974	516,000	43,400	2,000	---	3,500	4,800	25,300	5,900	6,400	607,300	37
(d) Survey and Review	1973	2,196,700	172,900	339,800	12,500	28,414	21,400	112,700	19,200	30,900	2,934,514	139
	1974	2,241,600	178,400	359,600	10,900	28,500	21,400	140,000	19,200	15,900	3,015,500	139
(e) Office of Budget	1973	405,600	35,700	3,500	---	5,400	2,200	29,200	1,900	2,000	485,500	20
	1974	548,600	48,700	13,500	---	10,400	3,200	49,200	3,900	8,000	685,500	26
(f) Management Operations	1973	724,600	63,200	22,400	2,000	13,400	13,700	53,300	14,500	18,500	925,600	60
	1974	754,600	65,800	22,400	2,000	13,500	13,700	53,300	15,000	15,000	955,300	60
(g) Management Consulting	1973	521,500	44,600	32,500	2,000	10,200	7,000	220,700	6,800	12,600	857,900	27
	1974	546,200	47,000	32,500	2,000	10,200	7,000	223,000	7,000	7,000	881,900	27
(h) Personnel Management	1973	555,400	48,300	7,700	---	2,300	7,800	19,500	4,500	3,900	649,400	36
	1974	567,100	49,300	8,000	---	2,300	7,800	19,500	4,500	3,900	662,400	36
Total Administrative Management	1973	5,325,800	447,100	429,200	16,500	74,214	61,800	475,700	59,200	83,800	6,973,314	338
	1974	5,588,300	472,500	459,300	14,900	79,400	62,800	525,300	61,900	62,700	7,327,100	344
4. General Services	1973	---	24,000	5,000	---	134,719	15,000	36,000	5,000	6,300	246,019	
	1974	---	21,500	6,000	---	180,200	20,000	76,000	7,000	7,000	317,700	
Total Appropriation	1973	11,545,700	1,005,900	1,023,900	82,700	381,898	177,700	706,500	142,600	186,500	15,253,398	683
	1974	11,982,700	1,044,400	1,111,100	46,600	434,500	190,100	792,500	153,600	139,500	15,895,000	689

DEPARTMENT OF THE INTERIOR
EXPLANATION OF LANGUAGE CHANGES

Office of the Secretary - Salaries and Expenses

Proposed Change:

For necessary expenses of the Office of the Secretary of the Interior, including teletype rentals and service, and not to exceed $2,000 for official reception and representation expenses, [and purchase of one passenger motor vehicle for replacement only, $15,295,100] $15,895,000.

Explanation of Language Change:

This provision is being deleted since it is no longer needed. The above provision permitted the Office of the Secretary to purchase for replacement only one passenger motor vehicle during fiscal year 1973. This authority will not be needed again for the next several years.

Office of the Secretary - Departmental Operations

Proposed Change:

For necessary expenses for certain operations that provide departmentwide services, [$4,066,000] $5,737,000, of which not to exceed $700,000 to remain available until expended, shall be available for payment of contributions to the World Energy Conference.

Explanation of Language Change:

Although the Ninth World Energy Conference will not be held until September 1974 (F.Y. 1975) the organizing committee must determine firm funding commitments. We are for this reason requesting the appropriation in fiscal year 1974. Secondly, should this request meet with Congressional approval, the conference's organizing committee may seek financial assistance for conference expenses incurred prior to the conference date. Finally, the "to be available until expended" provision will allow payment of conference expenses in fiscal year 1975 from any unused portion of the $700,000 fiscal year 1974 authorization.

Office of the Secretary - Central Energy Research and Development Fund

Proposed Change:

For necessary expenses to encourage and support research and development programs involving non-nuclear energy production, utilization or conservation, $25,000,000 to remain available until expended. (Reorganization Plan No. 3 of 1950 (43 U.S.C. 1451).)

Explanation of Language Change:

The proposed appropriation language for this account will provide a central source of support to further encourage and stimulate more timely non-nuclear energy research and development.

ANNUALIZATION OF FISCAL YEAR 1973 INCREASES

Mrs. HANSEN. You identify an increase of $200,000 for "Annualization of 1973 Program Increases."

What are the 1973 programs that were increased, and what is the 1973 amount and the 1974 request for these programs?

Mr. HITE. One of the programs that was increased, Madam Chairman, was the Office for Equal Opportunity, 19 positions, and we are asking $63,500 to support that in 1974, additionally.

FACILITIES SUPERVISED

Mrs. HANSEN. At this point in the record, please insert the number of facilities you supervise per year.

Mr. HITE. We will provide it for the record, if we may.

[The information follows:]

The Department of the Interior expects to complete approximately 960 in-depth onsite contract compliance reviews in fiscal year 1974. In addition, the Department expects to review 8,400 selected sites in 40 States under title VI responsibilities.

Mr. HITE. The increase on equal opportunity for those additional positions for 1973 was $372,100. We are asking for an additional $63,500 in 1974 to bring the total program to $435,600.

Mrs. HANSEN. You have expanded a great many contract compliance orders.

Mr. HITE. Yes.

We have seven specific industries to monitor as designated by the Labor Department and the entire State of Alaska in the equal opportunity contract compliance field.

Mrs. HANSEN. And the agencies within your Department that are contracting agencies, such as the Bonneville Power Administration.

Mr. HITE. Yes, ma'am.

NEW POSITIONS FILLED IN 1973

Mrs. HANSEN. How many of the 74 increased positions authorized for 1973 have been filled? You can provide a detailed list by program for the record.

Mr. BAKER. Specifically we would have to provide it for the record, Madam Chairman.

[The information follows:]

STATUS OF NEW POSITIONS AUTHORIZED IN FISCAL YEAR 1973

Office	New positions	Filled or committed
Field Coordination	6	6
Equal Opportunity	19	10
Legislation	2	1
Assistant secretary, Program Policy	10	10
Assistant secretary, Fish and Wildlife and Parks	3	3
Survey and Review	17	12
Management Operations	8	5
Management Consulting	7	4
Personnel Management	2	2
Total	74	53

INCREASED FUNDING TO MAINTAIN CURRENT OPERATING LEVELS

Mrs. HANSEN. You show an increase of $211,602 to "maintain current levels of operation." What factors necessitate this increase?

Mr. BAKER. Most of that, I think $117,000 is for step-increase costs that we anticipate will occur in 1974 for which we need funding. There is approximately $47,000 for FTS costs. They are going up at an alarming rate.

Mr. HITE. This is the Federal Telecommunication System cost.

Mr. BAKER. These costs have increased 309 percent since 1965.

Mrs. HANSEN. Why?

Mr. BAKER. Usage is one reason.

Mr. HITE. GSA tells us that in addition to usage the cost of service has increased due to the increased cost of the network which includes both labor and equipment, tariffs, and salaries and related expenses of their people who coordinate the system.

Mrs. HANSEN. At this point in the record also insert exactly how much your telephone costs have increased, how much your postage costs have increased, and how much your travel costs have increased.

Mr. HITE. We will be happy to provide that.

[The information follows:]

DEPARTMENT OF THE INTERIOR
FEDERAL TELECOMMUNICATIONS COSTS

1965 - 1974

Fiscal Year	Cost	Increase over Previous Year	
		Cost	Percent
1974 (est.).....	$5,192,100*	$ 545,600*	11.74%*
1973 (est.).....	4,646,500*	1,232,800*	36.11%*
1972.....	3,413,700*	75,200*	2.25%*
1971.....	3,338,500	866,115	35.00%
1970.....	2,472,385	338,385	15.86%
1969.....	2,134,000	279,300	15.00%
1968.....	1,854,700	156,791	9.00%
1967.....	1,697,909	262,032	18.00%
1966.....	1,435,877	165,383	13.00%
1965.....	1,270,494	---	--

Increase - 1974 vs. 1965:

Cost	Percent
$3,921,606	309%

* Excludes Bureau of Commercial Fisheries and Federal Water Quality Administration.

POSTAGE COSTS

1965 - 1973

Fiscal Year	Cost	Increase over Previous Year	
		Cost	Percent
1973 (est.).....	$3,366,000	$ $161,000	5.0%
1972.....	3,205,000	336,000	11.7%
1971.....	2,869,000	225,000	8.5%
1970.....	2,644,000	193,000	7.9%
1969.....	2,451,000	401,000	19.6%
1968.....	2,050,000	117,000	6.1%
1967.....	1,933,000	114,000	6.3%
1966.....	1,819,000	48,000	2.7%
1965.....	1,771,000	---	--

Increase - 1973 vs. 1965

Cost	Percent
$1,595,000	90%

TRAVEL AND TRANSPORTATION COSTS

Travel and transportation costs have risen sharply in the last five years. In 1968, a two week trip from Washington, D. C. to Denver and return would have cost approximately $420. That same trip at today's air fares and per diem rates would cost $560, an increase of 33% as shown below:

	1968	1973
Air fare.....	$200	$220
Per diem 13 1/4 days @ $25.00.....		330
Per diem 13 1/4 days @ $16.00.....	212	
Miscellaneous.....	8	10
Total.....	420	560

Major increases have also been experienced in transfers of duty stations. A transfer of a family of four from Washington, D. C. to Denver in 1968 would cost approximately $1,410. Today this same transfer would cost approximately $7,320, an increase of 400% as shown below:

	1968	1973
Per diem - employee 4 1/4 days @ $16.00.....	70	---
Per diem - employee 5 1/4 days @ $25.00.....	---	130
Per diem - family 5 1/4 days @ $50.00.....	---	260
Travel mileage- 1,630 mi. @ 6¢.....	100	---
Travel mileage- 1,630 mi. @ 12¢.....	---	200
Temporary quarters 30 days- 4 people.....	---	1,250
Shipment of household goods 5,000 lbs @ $19.25..	960	---
Shipment of household goods 11,000 lbs @ $19.25.	---	2,120
Storage of household goods 5,000 lbs. @ $5.55.....	280	---
Storage of household goods 11,000 lbs. @ $5.55.....	---	610
Real Estate Cost - Average.	---	2,500
Additional allowance and miscellaneous expenses....	---	250
Estimated total.....	1,410	7,320

Mrs. HANSEN. I am still debating the adequacy of the budget this year.

Most agencies budgets have cuts in various programs with the exception of a few. Telephone, postage, rental, and transportation costs have all increased. So that a budget that shows a cut or is even the same as last year is of necessity being cut.

Mr. HITE. That is correct.

CONSOLIDATION OF FIELD COORDINATION AND REGIONAL ADMINISTRATIVE ACTIVITIES

Mrs. HANSEN. At the present time there are eight field representatives and related clerical support under the supervision of the Secretary. They are located in the following cities: San Francisco, Portland, Albuquerque, Chicago, Anchorage, Boston, Denver, and Atlanta. How much more personnel do you have to have to maintain this service and what is the cost per regional office?

Mr. HITE. Mrs. Hansen, we will provide for the record the cost by regional office.

[The information follows:]

RESTRUCTERING OF FIELD COORDINATION RESULTING FROM
SECRETARIAL REORGANIZATION
F. Y. 1974

Object Class	Original Budget Request	Revised Request Resulting from Reassignment of Admin. Duties	Increase for Administrative Responsibilities
Personnel compensation....	$308,300	$415,000	$106,700
Personnel benefits.....	26,900	35,400	8,500
Travel.....	59,000	66,000	7,000
Transportation of things..	2,000	2,000	---
Rents, communications and utilities.....	14,000	19,500	5,500
Printing and reproduction.	8,500	9,500	1,000
Other services.....	15,000	19,700	4,700
Supplies and materials....	5,800	7,200	1,400
Equipment.....	4,000	4,200	200
Total.....	443,500	578,500	135,000
Permanent positions.....	16	24	8

DISTRIBUTION OF F.Y. 1974 BUDGET REQUEST BY GEORGAPHIC LOCATION

Location	Funds	Positions
San Francisco, Calif.....	$71,500	3
Portland, Oregon.....	71,400	3
Albuquerque, New Mexico.....	71,400	3
Des Plaines, Illinois.....	71,400	3
Anchorage, Alaska.....	78,600	3
Boston, Massachusetts.....	71,300	3
Atlanta, Georgia.....	71,500	3
Denver, Colorado.....	71,400	3
Total.....	578,500	24

Each field office will be headed by a field representative assisted by two supporting personnel.

Mr. HITE. I would like at this time to go into the revamped field structure that the Secretary sees, if I may. I think you can understand this readily. There are basically the eight locations for the field representatives, and there has been, in the past, one individual for clerical support at each one of these locations.

Last year we came to you and asked you to approve the establishment of a regional management and budget structure. You approved this concept and appropriated the money to use to constitute this network. It has not proved to be a very viable operation. There were too many conflicts with the field representatives.

Mrs. HANSEN. As you recall the committee had doubts about that proposal.

Mr. HITE. As you observed at the time and you were gracious enough to allow us the latitude to attempt to prove this innovation.

The Secretary has proposed to take the six positions that you authorized last year and the related funding plus the two positions that were in the immediate office of the Assistant Secretary for Management and Budget—that was the Deputy in Denver and the clerical support space—put these eight spaces into his field representative network. Each office will be composed of a field representative at grade 15, as they are now.

Mrs. HANSEN. What is the salary of a GS 15?

Mr. HITE. It ranges from $26,000 to $34,000.

A field representative, a staff assistant at grade GS–11 or 12, and clerical support. It is the Secretary's philosophy that if these people have management and budget problems that they can resolve for the headquarters, assist the bureaus in the field, it can be done out of one office and done less expensively. So we would propose to obtain your approval, Madam Chairman, for the utilization of these spaces.

I wanted to bring that to light for you. We have an object class breakdown for your further review, which would display the costs and deployment of these 24 positions.

Mr. EVANS. You are requesting a total of $443,500 and 16 positions to staff eight field offices across the country. Are there any other persons performing similar duties for the Department as a whole and being paid by one of the bureaus or offices such as the Bureau of Mines, for example?

Mr. HITE. No, sir, these individuals are the Secretary's personal representatives in the field. It is their responsibility to coordinate matters of programs and policy in their respective region when more than one bureau or program is involved. In addition, as I have indicated, they will now be responsible for any administrative problems that may arise.

In fiscal year 1973 Congress authorized total secretarial funding for this activity. Prior to that, expenses were jointly funded by the Secretary's Office and the various bureaus—the Bureau of Mines being one of those.

REALINEMENT OF BIA STRUCTURE

Mrs. HANSEN. Congressman Steed brought to my attention the other day a proposal in the Department to abolish all area Indian offices.

Mr. HITE. That is not correct, to my knowledge.

Mrs. HANSEN. As you will recall, the committee had many questions on the area offices in certain categories. We did not think there should

be area offices with different standards of education. We did urge you to have a good central department of education. We have also urged you to combine in certain areas. It is in this context I asked you this question of Congressman Steed on the proposal to close area offices.

I think he is speaking of Oklahoma.

Mr. HITE. Mrs. Hansen, there is a reorganization proposal with respect to the Bureau of Indian Affairs which would reduce the number of positions and people in the central office; that is, Washington and those elements of the central office in Albuquerque and Denver. And move those positions out into the area offices.

From time to time there certainly has been some talk questioning the necessity of two area offices in Oklahoma, in answer to your specific question. At this point in time there is no thought being given to revamping the area structure. I won't say that we cannot go down in a phase II when we get a Commissioner and when things are more crystalized to revamp the field structure. Right now we are only talking about the central office.

Mrs. HANSEN. Congressman Steed wanted me to reflect to you the feeling that you must maintain the ability to reach the Indians in the area for discussions of their problems in technical matters. He wants you to take this into consideration before any decision is made.

Mr. HITE. I appreciate that.

TRAVEL REQUIREMENTS FOR THE LAW OF THE SEA CONFERENCE

Mrs. HANSEN. You are requesting an increase of $30,000 for travel for departmental participation in the United Nations Law of the Sea Conference. Where is this Conference to be held? How many departmental people will be involved?

Mr. HITE. The focal point of the law of the sea activity in the Department is in the Office of Assistant Secretary for Energy and Minerals. There will be at least three lengthy conferences pertaining to law of the sea this year, one scheduled for 8 weeks in Geneva, one in Chile, one in New York. There may be others.

Mrs. HANSEN. One in Chile?

Mr. HITE. I am not sure why the locations are selected as they are. This is a United Nations effort. In addition to the spearhead of our efforts in the law of the sea there would be a bureau participation from the Geological Survey or BLM or others.

Mrs. HANSEN. This pertains to all our offshore rights.

Mr. HITE. Yes, ma'am.

Mrs. HANSEN. It pertains to mineral exploration under the sea, as well as fishing.

Mr. HITE. That is correct.

The State Department has the lead for the United States, but subordinate to that the Department has the basic responsibility for exploitation of the mineral resources under the sea and the Outer Continental Shelf considerations. So we have a very important role.

In fiscal year 1974 our role will be stepped up with respect to participation in these conferences. Hence the request for the additional travel money. We would say there will be no more than five representatives from the Department at either one of these overseas conferences.

Mrs. HANSEN. Very frankly, I am glad to see you are participating. I hope we have very skillful people represented because the problem is increasing, as you are well aware. There are difficulties between groups of fishermen fishing on the northwest coast and the northeast. Certainly you have some mineral exploration programs that are going to be discussed that could affect the United States for a long time.

Mr. HITE. Very definitely.

Mr. LONG. What is your estimate of cost overruns on your contracts in fiscal year 1973 as compared to fiscal year 1972?

Mr. HITE. The preponderance of the Department's contracting activities relate to firm fixed-price contracts where a cost overrun is highly unlikely in the normal sense of the term. Cost reimbursable contracts are limited principally to research and development activities and to reimbursement paid Indian tribes for handling general assistance programs administered by the Bureau of Indian Affairs. Overruns can and do occasionally occur in these latter activities but they differ materially from overruns associated with development and/or acquisition of hardware and supplies. Because of the relative insignificance of cost overruns within the Department, no attempt is made to accumulate data on its occurrence.

DEPARTMENTAL OPERATIONS

Mrs. HANSEN. We will insert justification pages 1 through 16 in the record at this point.

[The pages follow:]

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
DEPARTMENTAL OPERATIONS

HIGHLIGHT STATEMENT

The fiscal year 1974 appropriation request for the account "Departmental Operations", Office of the Secretary is $5,737,000, an increase of $1,001,000 over the amount available for fiscal year 1973. This appropriation account is composed of the following activities:

- Office of Hearings and Appeals - $3,628,000 is requested for fiscal year 1974. Included in this amount is $200,000 to annualize the supplemental approved by Congress in fiscal year 1973 for additional hearing examiners.

- Natural Resources Library - $1,189,000 is requested for fiscal year 1974. The major emphasis in this activity includes a redistribution of resources to strengthen the Library staff.

- Johnny Horizon Program Office - $220,000 is requested for fiscal year 1974. This anti-litter program was moved from the Bureau of Land Management in fiscal year 1973 in order to permit greater involvement of other bureaus of the Department and to stimulate increased participation by other agencies and outside private organizations.

- World Energy Conference - $700,000 is requested to provide for the Federal Government's contribution to the Ninth World Energy Conference to be held in the United States in September 1974. This conference will bring together representatives from 67 nations to share technical information on energy matters and discuss key problems in the energy field.

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
DEPARTMENTAL OPERATIONS

Appropriation, 1972	$ ---	
Supplemental appropriation, 1972 authorizing transfer from "Salaries and Expenses," Office of the Secretary	3,746,100	
Transferred to "Operating Expenses, Public Buildings Service,"General Services Admin...	-129,200	
Transferred from "Salaries and Expenses, Office of Oil and Gas	+70,000	
Net Transfers/Total available, 1972		$3,686,900
Appropriation, 1973	4,066,000	
Supplemental appropriation, 1973	400,000	
Total appropriation		4,466,000
Transferred to other accounts:		
Transferred to "Operating Expenses, Public Buildings Service," General Services Administration	-2,888	
Transferred from other accounts:		
Transferred from "Salaries and Expenses," Office of Oil and Gas	+73,000	
Transferred from "Construction and Maintenance," Bureau of Land Management	+200,000	
Net transfers, 1973		+270,112
Total available, 1973		4,736,112

Summary of Increases and Decreases, 1974

	Base for 1974	Increase 1974	
Office of Hearings and Appeals:	$3,327,000		
Annualization of 1973 supplemental and new positions		200,000	
Increase current staff support		100,888	
Natural Resources Library:	1,209,000		
Savings due to redistribution of resources		-20,000	
Johnny Horizon Program Office:	200,000		
Increased involvement in anti-litter program		20,000	
World Energy Conference:	---		
Federal Government's contribution to energy conference		700,000	
Net Increase, 1974			+1,000,888
Budget Estimate, 1974			5,737,000

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
DEPARTMENTAL OPERATIONS

Analysis by Activity

Activity	F.Y. 1972 Amount Available	Fiscal Year 1973		
		Total Appropriation	Transfers	Adjusted Amount Available
1. Office of Hearings and Appeals...	$2,705,872	$3,257,000	$+70,112 1/	$3,327,112
2. Natural Resources Library.....	931,386	1,209,000	---	1,209,000
3. Johnny Horizon Program Office....	---	---	+200,000 2/	200,000
Unobligated balance lapsing....	49,642	---	----	---
Total.....	3,686,900	4,466,000	+270,112	4,736,112

1/ Transferred from "Salaries and Expenses," Office of Oil and Gas .. $73,000
Transferred to GSA for rent..... -2,888

2/ Transferred from "Construction and Maintenance", Bureau of Land Management..... 200,000

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Adjusted Amt. Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973	Page Reference
1. Office of Hearings and Appeals..	$2,705,872	$3,327,112	$3,628,000	$+300,888	DO-4
2. Natural Resources Library.....	931,386	1,209,000	1,189,000	-20,000	DO-7
3. Johnny Horizon Program Office...	---	200,000	220,000	+20,000	DO-10
4. World Energy Conference.....	---	---	700,000	+700,000	DO-12
Unobligated balance lapsing...	49,642	---	---	---	
Total.....	3,686,900	4,736,112	5,737,000	+1,000,888	

1. OFFICE OF HEARINGS AND APPEALS

Office of Hearings and Appeals: Fiscal year 1973, $3,327,112; fiscal year 1974, $3,628,000; increase, $300,888. The increase consists of:

	Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1)	$+100,888	---	$3,628,000	160	Additional funding for the current authorized staff.
(2)	+200,000	---	---	---	Annualization of 1973 supplemental.
	+300,888	---			

Cost Factors Involved in Increases

(1) $44,800 for within grade step increases and reduction of lapses; $37,200 for P.L. 92-303 pay increases; and $18,888 for other support costs.

(2) Provides for full year funding of the 17 additional positions authorized in the 1973 Supplemental appropriation.

The Office of Hearings and Appeals provides a secretarial office which consolidates the quasi-judicial responsibilities of the Department of the Interior. Administrative Law Judges and formal boards of appeals render decisions in cases pertaining to: (a) contract disputes; (b) oil import quota appeals; (c) Indian probate matters; (d) public and acquired lands and their resources; (e) submerged offshore lands of the outer continental shelf; (f) mine health and safety; (g) personnel grievances and appeals; (h) environmental impact; (i) enforcement of the importation and transportation of rare and endangered species; (j) environmental quality; and (k) uniform relocation assistance and real property appeals. The Director of the Office of Hearings and Appeals may assign Administrative Law Judges for the purpose of holding rule-making hearings and he may also assign Administrative Law Judges or establish ad hoc boards of appeal to meet special requirements of disputes not falling under one of the previously listed categories. Decisions of the boards are final for the Department.

The fiscal year 1974 budget request for the Office of Hearings and Appeals is $3,628,000, an increase of $300,888 over the current year. The increase provides for $100,888 to continue programs initiated in the last two fiscal years. Included in this increase is $45,300 to cover within-grade pay increases and to permit the filling of vacancies not fully funded during the current year, $37,200 to meet uncontrollable pay increases resulting from the enactment of P.L. 92-303 automatically regrading Administrative Law Judges from Grade 15 to Grade 16, $10,000 for necessary field travel costs to conduct hearings, and $8,388 for other services. In addition, the estimate includes $73,000 adjustment to reflect the transfer of the Oil Import Appeals Board to the Office of Hearings and Appeals. The remaining $200,000 is required to annualize the 1973 supplemental, which provided for only partial year funding.

We are not requesting additional personnel or increases for new program activities for fiscal year 1974. We are merely providing for the proper continuation of existing programs in the budget year.

Contract Appeals - The Interior Board of Contract Appeals reduced its pending caseload by approximately one-third during fiscal year 1972. The present caseload of over fifty cases includes several major disputes which involve voluminous records, lenghty hearings and several millions of dollars each. These cases will continue to require most of the Board's attention.

Oil Import Quota Appeals - The Oil Import Appeals Board considers petitions on appeals from persons affected by oil import regulations. The Board membership is composed of one representative from each of three Departments; Interior, Commerce and Justice. The Interior member serves as the Chairman and the Board is housed and administered by the Department of the Interior. The Oil Import Appeals Board was tranferred to the Office of Hearings and Appeals in December, 1971. This move was made in order to:

(a) Further the Department's objective of consolidating all quasi-judicial activities within one Departmental office;

(b) better define the separation of functions between the Board and the Office of Oil and Gas. Also this transfer further insulates the Board Chairman from the appearance of pressures from the Office of Oil and Gas as well as other Departmental officials;

(c) provide improved support services and facilities not previously available to the Board.

Despite a heavy increase in the number of appeals, the Board's disposition of cases during fiscal year 1972 remains adequate. We are, however, concerned with the increasing workload in this area and are maintaining a close scrutiny over this situation. Additional legal support may be required in the near future in support of the Board's operations.

Public Lands - Since the Office of Hearings and Appeals was organized in 1969, the hearings backlog in public land cases has been reduced from twenty-one months to twelve months. We hope to reduce this backlog even more, but the need to meet the tremendous increase in coal mine safety cases, coupled with budgetary constraints, may preclude any further reductions in the near future. The backlog in appeals to the Interior Board of Land Appeals has also been reduced to approximately one year. This is due largely to a reorganization of the Board's method of operation. We are carefully reviewing the implications of the increasing emphasis placed on the evaluation of the environmental and ecological impact on all areas of public land use. In addition, we still expect 1,000 or more cases to be forthcoming pursuant to the Alaska Native Claims Act and as a result of the Trans Alaska Pipeline. However, as we pointed out last year, we are not requesting additional staff to meet these potential cases until we can more accurately forecast the workload.

Indian Probate - The probate hearing backlog has been reduced from eighteen months, which existed two years ago, to less than nine months. Even though this condition is still short of our ultimate goal of no more than six months of pending workload, we cannot forsee the meeting of this goal in the near future because increased caseloads in other areas, particularly coal mine safety, has necessitated assigning additional cases to our Indian Probate Administrative Law Judges. The Interior Board of Indian Appeals is keeping current on its caseload.

Mine Health and Safety - The Federal Coal Mine Health and Safety Act of 1969 and the Federal Metal and Nonmetallic Mine Safety Act affect approximately 25,000 mines and 385,000 employees in mines throughout the United States. The caseload under the Metal and Nonmetallic Mine Safety Act has

not yet developed. The caseload resulting from the Coal Mine Health and Safety Act has been impressive for the past two years. Even so, the caseload did not accelerate dramatically until the last few months of fiscal year 1972. As a direct result of the tremendous influx of new cases and the continuing high level of new cases filled, the Department requested a supplemental appropriation during the current fiscal year. The nine Administrative Law Judges and eight supporting staff provided by this supplemental should permit us to maintain the present backlog of cases, which in only a few months more than doubled. We are hopeful and fully expect that this additional staffing plus the assignment of most of our Administrative Law Judges to this important area, as other program demands permit, will allow us to regain control of this nearly unmanageble backlog. However, until we have had an opportunity to further evaluate workload trends and our ability to handle the caseloads, we do not know if we will be able to bring this hearings backlog within reasonable bounds with only our present complement of Administrative Law Judges.

This tremendous increase of hearings cases will ultimately affect the number of appeals to the Interior Board of Mine Operations Appeals. At the present time, the Board is disposing of cases in a reasonable length of time. We will continue to closely monitor the caseloads both for hearings and for appeals to the Board. Notwithstanding, if the present staffing levels are not adequate or if the influx of cases, as previously mentioned, continues to accelerate, additional staffing will be required in order for the Department to meet its responsibilities.

Other Programs - The remaining quasi-judicial responsibilities mentioned above are being disposed of promptly. In addition to the normal program responsibilities, the Office of Hearings and Appeals is being called upon with increasing frequency to hold public fact finding hearings following disasters such as those occuring at the Sunshine Silver Mine, Kellogg, Idaho.

2. NATURAL RESOURCES LIBRARY

Natural Resources Library: Fiscal year 1973, $1,209,000; fiscal year 1974, $1,189,000; Decrease, $20,000. The decrease consists of:

	Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1)	$+81,900	---	$1,189,000	58	Full funding of current authorized staff.
(2)	+24,800	---	---	---	Increased costs of books subscriptions, and periodicals.
(3)	-126,700	---	---		Reduction in contractual services.
	-20,000				

Cost Factor Involved in Increases

(1) 6 additional man-years of employment @ $13,650
(2) Provide for the 15 to 20% annual increase in the cost of library materials.
(3) Reduction in contractual services to provide for (1) and (2) above.

The Natural Resources Library is the basic and archival source for scholars, industry, and state officials throughout the United States concerned with problems involving conservation, Indians, minerals, energy, resources, lands, parks, recreation, reclamation, desalination, water, fisheries, and other significant areas of the environment. It provides the following services to Department employees, and within limits to other Federal agencies, state and local governments, educational institutions and the general public:

- Information Services - Reference services are provided by assembling information and data, and by interpreting the collection for users doing scientific, technical, legal, and administrative research. Over 8,000 requests for reference assistance will have been handled during the fiscal year, an increase of 30 percent over the previous year.

- Locating and Lending Services - Loan services are provided to make library materials readily available to employees with a minimum of delay--including the provision of photo-copies when necessary. During fiscal year 1973 the staff will have processed over 17,000 requests to borrow material from bureau field offices, bureau libraries, other Federal agencies and universities. 5,500 of these requests will not be available in the Library's collection and will thus have to be located and borrowed from other libraries before being provided to Library clientele, which shows an improvement in the development of the collection over past performance of about five to six percent. During this period, more than 20,000 items will be circulated to Departmental employees; and in addition another 20,000

individuals will have visited the Natural Resources Library to use its literature resources site.

. The Collection - The Natural Resources Library has a collection numbering approximately 750,000 volumes. Fifteen percent of the collection is book material; 55 percent is serial and periodical literature. Maps, microtext, photographs, manucripts, and technical reports comprise the remaining 30 percent of the collection.

Status of Program

In February 1972 a new Director of the Office of Library Services was appointed and corrective action was undertaken to make the Library more responsive to the Department's steadily increasing requirements for access to current information and research literature. Special emphasis was given to the demands made by the people working on improving the quality of the environment and other natural resources program.

The organization of the Library was realigned along functional lines to achieve more effective work flow and improve library services. The realignment also made it possible to focus a greater portion of the man-hours available on assisting and upgrading the services rendered to field and regional Departmental personnel. We are proposing a redistribution of $81,900 for 1974 to permit the filling of unfunded vacancies to permit us to continue these important efforts.

With the increased funding for fiscal year 1973, it was possible to initiate corrective action to alleviate deficiencies in the periodical research literature, the bibliographic control of Interior publications, and the inventory and control of serials and periodicals. Approximately $33,000 will be devoted to these efforts in fiscal year 1974. $50,000 is also included for the continuation of the purchase of doctorial theses.

In summary we are proposing to continue the operation of the Natural Resources Library in fiscal year 1974 at a level of $20,000 below the appropriation for the current year. We are therefore planning the following course of action for fiscal year 1974.

. To continue the effort to bring the Departmental research publications under bibliographic control and complete the inventory of periodicals but at a lesser dollar level of activity.

. To continue to seek every means of economizing in order to release funds which can be applied to continue to correct the deficiencies in the book and periodical collections, thereby maintaining the value of the research collections.

. Continue to improve the quality of the staff and management of the Library so that a high level of effective responsiveness to the demands for library and information services by patrons, both outside and within the Department, is met.

Listed in the following table is the proposed fiscal year 1974 application of the program increases granted in the fiscal year 1973 appropriation.

	F.Y. 1973	F.Y. 1974	Increase (+) or Decrease (-)
Backlog of essential books and materials	$40,000	$25,000	$-15,000
Doctorial theses	100,000	50,000	-50,000
Backlog of periodicals	20,000	8,300	-11,700
Bibliographic control of Interior publications	50,000	20,000	-30,000
Inventory and control of serials and periodicals	25,000	5,000	-20,000
Subtotal	235,000	108,300	-126,700
Application of Decrease:			
Full funding of current authorized staff	---	81,900	+81,900
Increases costs of books, periodicals and serials	---	24,800	+24,800
Total	235,000	215,000	-20,000

3. JOHNNY HORIZON PROGRAM OFFICE

Johnny Horizon Program Office: Fiscal year 1973, $200,000; fiscal year 1974, $220,000; increase, $20,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+20,000	---	$220,000	7	Development of new anti-litter materials.

The Johnny Horizon Program was established by Public Law 91-419, approved September 25, 1970, to foster the use of the character "Johnny Horizon" as the symbol for public service anti-litter programs to maintain the beauty and utility of the Nation's public lands. The program was initiated by the Bureau of Land Management and achieved success in encouraging anti-litter activity primarily on the public lands under its domain. As a result of this initial success, Secretary Morton determined that the Johnny Horizon program should be increased in scope to permit greater involvement of other bureaus of the Department and to stimulate increased participation by other agencies and outside private organizations. Accordingly, the program was assigned to the Secretariat effective July 1, 1972.

Because of its broad appeal, the expanded program is already gaining new interest from other government departments and agencies, as well as Interior Bureaus, as potential co-sponsors. Examples of this increased support are as follows:

- The American Revolution Bicentennial Commission has officially recognized the Johnny Horizon '76 Program as the environmental awareness activity in furtherance of, and as a part of, the National Bicentennial. The Department has already taken steps to give the program a timely and appealing new theme and thrust - "Let's Clean Up America for our 200th Birthday." We believe that a closer tie of this program into the nation's approaching bicentennial commemoration will add a powerful plus to our goal of spurring Americans to increased environmental action.

- The General Services Administration and the Civil Service Commission have become official co-sponsors, pledging full and active cooperation with the Johnny Horizon '76 Program, joining in sponsorship with the U.S. Postal Service, the Corps of Engineers, and the Tennessee Valley Authority.

- Each major Interior Bureau has detailed plans for active cooperation with the new program.

The Media interest in this program is substantial. Secretary Morton has appeared on national TV shows and detailed the new program as has Burl Ives, for years - a strong and active supporter of Johnny Horizon. Mr. Ives has appeared on the Johnny Carson and the Dick Cavett shows to introduce millions of TV viewers to the Johnny Horizon program. He has also staged Johnny Horizon "environmental awareness" concerts in Oregon, New York and California.

Major department store special events promotions built around Johnny Horizon, in Buffalo, Houston and Philadelphia have been viewed by millions of people. In addition, many community, school, fraternal, civic, church, and Boy and Girl Scouts educational and cleanup activities are being built around the new Johnny Horizon "76 theme."

Currently, and into fiscal year 1974, most Americans will become aware of the new Johnny Horizon "76 theme," via mass media, trade associations, civic organization, environmental concerts, community cleanups, personal appearances by a long list of cooperating stars such as Burl Ives, Sonny and Cher, Carol Burnett, as well as public service announcements on 5,000 radio and 400 TV stations. In addition, more than 70 separate useful and needed printed materials - including a wide range of "how-to" booklets are and will be available to citizens, students and interested groups in urban, suburban and rural areas. Much of this material will be self-liquidating in cost through cooperation with acceptable sponsoring agencies, business, and service organizations.

With the increasing interest and emphasis in the Johnny Horizon Program, new anti-litter, environmental and conservation education information must be developed. An increase of $20,000 is requested to enable the Department to develop posters, displays, information pamphlets, package materials, etc., required to reach a wide variety of target audiences in America that are necessary in making this important program a success.

4. WORLD ENERGY CONFERENCE

World Energy Conference: Fiscal year 1973, -0-, fiscal year 1974, $700,000; increase, $700,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+700,000	---	$700,000	---	Proposed contribution to the Ninth World Energy Conference.

Cost Factors Involved in Increase

Approximately 1/3 of the estimated costs ($2,000,000) of the Ninth World Energy Conference.

The World Energy Conference consists of National Committees, each made up of executives, engineers, scientists and specialists, in industry and Government, who are professionally concerned with energy in the various forms. At present there are 67 nations represented by individual National Committees. Additional memberships are pending.

A significant benefit of the World Energy Conference is the worldwide cooperation of nations, large and small, highly industrialized or in earlier stages of economic development. Their purpose is to share technical information on energy matters and to work for the mutual progress of mankind.

At the major conferences, held every 3 years, and at the annual meetings of the International Executive Council, in the standing and ad hoc committees, the various nations work together. Representatives observe the world problems throughout the world because meetings are held in many places and include technical study tours.

History of the Conference

The World Energy Conference was organized in London in 1924 when, upon British invitation, energy leaders gathered for what was appropriately called the First World Power Conference. A permanent organization was established on a proposal made by representatives from the United States. The plan called for general conferences every 6 years and for sectional meetings on specific subjects as often as deemed necessary.

The Second World Power Conference was held in Berlin in 1930. The third conference was held in Washington, D. C., in 1936 and was supported by a congressional appropriation of $75,000. (See Joint Resolution 350 approved August 26, 1935). Soon afterward the war intervened. In 1950 the fourth conference was held in London, followed by Vienna in 1956, Melbourne in 1962, Moscow in 1968 and Bucharest in 1971. At Moscow basic changes were made in the organization: the name was changed to World Energy Conference, the sectional meetings were discontinued and the general meetings were given greater emphasis and accelerated to a 3-year schedule. Significantly, the objectives of the organization were redefined to include a direct interest in the application of energy to economic development.

The World Energy Conference is based in the structure of National Committees. Each must be fully representative of energy endeavors within it boundaries and enjoy the active participation of those with the highest responsibilities for energy development, transformation and utilization. With this kind of expertise and support, the World Energy Conference is in a unique position to influence, in a constructive way, world energy patterns and national energy development.

1974 Conference in Detroit

The United States National Committee is preparing for the Ninth World Energy Conference which will be held in Detroit in September 1974. This will be the second general meeting to be held in the United States, the first having been convened in Washington, D. C., in 1936. It will be well into the 21st Century before the opportunity comes again.

The title of the 1974 World Energy Conference, "The Economic and Environmental Challenges of Future Energy Requirements," is uniquely responsive to the President's challenge as contained in his Clean Energy Message of July 4, 1971. The theme of the Conference recognizes the balance that must be achieved between economy and the environment if energy utilization is to continue to serve man and contribute to his material progress. Approximately 250 technical papers from 85 nations and international organizations will give consideration to costs as well as to technological methods and the social value of the environmental conditions it desires to achieve.

The Organizing Committee for the 1974 Conference is led by Stephen D. Bechtel, Jr., Chairman, Consumers Power Company who has established, in addition to a structure of subcommittees, a National Advisory Council. The Council includes top-flight men from our foremost electric and natural gas utility companies; petroleum and coal organizations; railroad and transportation companies; U.S. Government and public power entities; and leaders from major automotive, engineering, banking and communications firms--all interested and involved in the energy field.

The 1974 Conference will permit the United States to make a landmark contribution to world understanding of energy matters and to peaceful cooperation in economic growth.

Financing the Conference

A tentative budget, established for the Fiftieth Anniversary meeting of the World Energy Conference delineates that costs will approximate $2 million for the major international event.

The Organizing Committee earnestly believes it desirable and appropriate for the United States Government to offer significant financial support to the 1974 World Energy Conference and it respectfully suggests that the level of support should approximate one-third of the Conference budget, with the other two-thirds to be financed by participants and industry.

Summary

The Department of the Interior believes financial support of the United States Government is justified for these reasons:

1. The World Energy Conference is a unique and responsible international organization of 67 nations from both the free world and iron curtain countries. Noncommercial and nonpolitical in nature and structure, it affords the United States a strong opportunity to build relationships with key persons in industry and and Government on a worldwide basis. The World Energy Conference has a demonstrated record of effective international collaboration in energy matters.

2. The Fiftieth Anniversary World Energy Conference theme -- "The Economic and Environmental Challenges of Future Energy Requirements" -- is in direct response to President Nixon's Clean Energy Message of June 1971.

3. The 1974 World Energy Conference addresses itself to an issue of great U.S. public concern, and allows the Government to reaffirm and to demonstrate again its commitment to solve the problems inherent in that concern.

4. Through memberships on its U.S. planning bodies (U.S. National Committee, Organizing Committee, National Advisory Council), and through active participation in the Conference itself, there is a strong blend of involvement, cooperation and contribution by U.S. representatives of both Government and private industry.

5. The Conference focuses on the supply, economic and environmental issues of the serious energy crisis facing the United States. This country will be benefited in its search for solutions to this crisis through the gathering of technological and economic information by leading scientists and industrialists of 67 nations and the discussion, debate and broad-scale dissemination of the analyses and findings.

6. The World Energy Conference affords the United States a quality platform to display the range and depth of its technological development and to strengthen its leadership role in the world community. As host of this prestigious gathering of energy leaders from 66 foreign nations, the United States will have this opportunity-- for the last time in this century--to demonstrate its experience, expertise and capabilities in the energy field.

7. Of the anticipated 4,500 conference participants, 3,000 are expected to come from 66 foreign nations. Intimate exposure of these key persons to U.S. technological achievements-- through discussions, presentations and programmed visits to facilities-- offers strong potential to aid U.S. trade and foreign commerce on a solid, long-term basis.

8. Precedent exists for U.S. Government financial support of a conference of this nature. Numerous meetings have been supported financially by the Government during the past decade, and in 1936, the United States offered financial aid to the World Power Conference meeting held in Washington, D. C.

9. The 1974 World Energy Conference offers a unique vehicle to encourage interaction of knowledgeable U.S. practitioners with their counterparts in foreign nations.

10. Secondary to the technical program itself, but of great value, are the cultural exchange benefits which flow from the tours, visits, and special events planned as part of the 6-day meeting.

11. Recent World Energy Conferences held in Australia, Russia and Romania, have received appropriate levels of financial support from their Government, in recognition of the value and importance of the World Energy Conference to those nations.

PERSONNEL SUMMARY

	1972 Actual	1973 Estimate	1974 Estimate
Total number of permanent positions	201	225	225
Full-time equivalent of other positions	10	9	9
Average paid employment	187	206	221
Average GS grade	10.1	10.2	10.2
Average GS salary	$16,323	$16,401	$16,519

ITEMIZATION OF ESTIMATE

Appropriation Title: Departmental Operations — Office of the Secretary

	1972 Actual	1973 Estimate	1974 Estimate	Increase (+) or Decrease (-)
Program and Financing:				
Total obligations	$3,637,258	$4,736,112	$5,737,000	$+1,000,888
Unobligated balance lapsing	49,642	---	---	---
Budget authority	3,686,900	4,736,112	5,737,000	+1,000,888
Budget Authority:				
Appropriation	3,746,100	4,466,000	5,737,000	+1,271,000
Transferred to other accounts	-129,200	-2,888	---	+2,888
Transferred from other accounts	+70,000	+273,000	---	-273,000
Appropriation (adjusted)	3,686,900	4,736,112	5,737,000	+1,000,888
Object Classification:				
11 Personnel compensation	2,787,013	3,230,600	3,506,000	+275,400
12 Personnel benefits	226,762	257,400	276,000	+18,600
21 Travel and transportation of persons	93,626	202,900	227,000	+24,100
22 Transportation of things	2,089	27,000	27,000	---
23 Rent, communications and utilities	95,146	100,912	101,000	+88
24 Printing and reproduction	20,650	90,000	105,000	+15,000
25 Other services	215,591	461,000	1,195,000	+734,000
26 Supplies and materials	108,208	139,000	150,000	11,000
31 Equipment	88,173	227,300	150,000	-77,300
Total Obligations	3,637,258	4,736,112	5,737,000	+1,000,888

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY

DEPARTMENTAL OPERATIONS

ESTIMATED OBLIGATIONS BY SUBACTIVITY AND OBJECT CLASS, FISCAL YEARS 1973 and 1974

Activity/Subactivity	Fiscal Year	Personnel Compensation	Personnel Benefits	Travel	Trans-portation of Things	Rent Comm. & Utilities	Print-ing & Reprod.	Other Services	Supplies and Materials	Equip-ment	Total	Posi-tions
1. Hearings and Appeals.....	1973	$2,455,100	$193,400	$167,500	$21,000	$77,912	$41,000	$303,200	$45,000	$23,000	$3,327,112	160
	1974	2,645,000	209,500	191,500	21,000	78,000	42,000	375,200	45,800	20,000	3,628,000	160
2. Natural Resources Library.....	1973	670,200	54,200	12,600	1,000	17,800	9,000	150,300	92,500	201,400	1,209,000	58
	1974	755,700	56,700	12,700	1,000	17,800	15,000	100,300	102,700	127,100	1,189,000	58
3. Johnny Horizon Program Office.....	1973	105,300	9,800	22,800	5,000	5,200	40,000	7,500	1,500	2,900	200,000	7
	1974	105,300	9,800	22,800	5,000	5,200	48,000	19,500	1,500	2,900	220,000	7
4. World Energy Conference.....	1973	---	---	---	---	---	---	---	---	---	---	--
	1974	---	---	---	---	---	---	700,000	---	---	700,000	--
Total Departmental Operations.....	1973	3,230,600	257,400	202,900	27,000	100,912	90,000	461,000	139,000	227,300	4,736,112	225
	1974	3,506,000	276,000	227,000	27,000	101,000	105,000	1,195,000	150,000	150,000	5,737,000	225

OFFICE OF HEARINGS AND APPEALS

Mrs. HANSEN. You are requesting an increase of $100,888 for current authorized staff in the Office of Hearings and Appeals. Please justify this request.

Mr. HITE. Mrs. Hansen, we are honored by the presence of Mr. James Day.

Mr. DAY. It is for within grade step increases that we expect to grant within the coming year and for the additional amount of money that it requires to pay the administrative law judges who were increased to GS–16 last year.

Mrs. HANSEN. How many do you have on board?

Mr. DAY. We have hired three out of the nine authorized under the supplemental.

Mrs. HANSEN. When will all nine be aboard?

Mr. DAY. All nine will be aboard by May 13.

Mrs. HANSEN. What is your backlog?

Mr. DAY. My backlog as of Monday was 3,405 cases in Coal Mine Health and Safety.

Mrs. HANSEN. When do you expect to eliminate this blacklog?

Mr. DAY. With the increase in the number of Administrative Law Judges plus a new penalty assessment system, I hope to keep current. Once we have the new judges aboard, we hope to reduce the backlog at the rate of about 20 percent per year unless the court issues an adverse ruling again.

Mrs. HANSEN. I must say that is not a bright picture.

You are requesting an increase of $200,000 for annualization of 17 additional positions provided in the 1973 supplemental. How many of the 17 have been hired?

Mr. DAY. All positions have been committed. We have all except 8 on board out of the 17 authorized.

Mrs. HANSEN. Have the other nine been hired?

Mr. DAY. The other nine have been hired. They are in Washington and are working hard. The other eight are in the process of leaving their jobs and coming to work for us. It's very difficult to get administrative law judges. As a general rule, they want anywhere from 60 to 90 days' notice, and their departments insist on the amount of advance notice before they leave their present jobs, for obvious reasons. They are working on cases. Before they can come to us, they have to finish the cases that they have been assigned. It has been difficult getting them.

Mrs. HANSEN. What has been the effect on your office of the recent court injunction on penalty assessments?

Mr. DAY. We don't know at this moment because the injunction was based only on the penalty assessment system. We don't receive the cases until they actually come to hearing. If the court throws out the assessment system and we have to hear all the cases, it will mean an increase in cases in our office of about 150 percent. We are waiting for the appeal of that decision. If the ruling is not in our favor, we hope to devise a new assessment system that will satisfy the court's injunction.

NATURAL RESOURCES LIBRARY

Mrs. HANSEN. You are requesting a reduction of $20,000 for the Natural Resources Library. What does this involve?

Mr. HITE. Mrs. Hansen, last year, fiscal 1973, the library entered into some $235,000 worth of contract services to reduce their backlog of various volumes and periodicals.

Mrs. HANSEN. What firms were the contracts with?

Mr. HITE. Various firms. I will have to supply it for the record.

Mrs. HANSEN. Why did you contract this work?

Mr. HITE. These firms with whom we contract are focal points in the library field for volumes as they are issued and they can pick up these backlogs of rare books or essential books much more quickly than the library could on its own.

Mrs. HANSEN. Please insert a list in the record with whom you contracted and the amount involved.

Mr. HITE. Yes, I will.

[The information follows:]

STATUS OF LIBRARY CONTRACTS

Backlog of Essential Books - estimate, $40,000; to date an estimated $30,000 of this work has been completed. A listing of some of the major suppliers follows:

J. W. Edwards	$2,135
Rowan and Littlefield	2,400
Mansell Information Service	15,500
Congressional Information Service	4,900
Various Others	5,065
Total	30,000

Doctorial Theses - estimate, $100,000; University Microfilms, Ann Arbor, Michigan is the only source of supply of Doctorial Thesis. Selection of these theses that are applicable to Interior's programs have been made.

Backlog of Periodicals - estimate, $20,000; this project is completed, items have been identified and orders have been placed. Following is a list of major suppliers:

Swets Zeitlinger	$10,500
Institute for Scientific Information	6,885
Other Miscellaneous Publishers	2,615
Total	20,000

Bibliographic Control of Interior Publications - $50,000; A $50,000 contract has been awarded to Tracor/Jitco, Inc. for this project.

Control of Serials and Publications - Negotiations are in the final stages for awarding the contract.

Mr. HITE. The $235,000 worth of contract work has been reduced to $108,000 this year.

Mrs. HANSEN. Why?

Mr. HITE. Because we know a large part of the backlog has been overcome. Thus, some of these contract services have been eliminated.

Mrs. HANSEN. You didn't think that the $20,000 could be spent in the Bureau of Indian Affairs where they desperately need libraries.

Mr. HITE. That may be balanced off in the Bureau of Indian Affairs appropriation. I am not sure. We contracted for such things, Mrs. Hansen, as a backlog of essential books and materials, such as doctoral theses. We have a periodical backlog and items of this nature.

Mrs. HANSEN. Do you buy doctoral theses?

Mr. HITE. Relevant doctoral theses, Madam Chairman.

Mrs. HANSEN. Who determines whether they are relevant or not?

Mr. HITE. Our library staff would determine whether the fields are relevant to us. I don't think a substantive determination would be made on the quality of the thesis itself. We would accept the institution's judgment. The point I am trying to make, Mrs. Hansen, is that in reducing this contractual effort to a level of $108,000 for fiscal 1974, we did divert some of that money to increase salaries. Our authorized strength in the library is 58 positions. We have filled at this point in time only 39.

Mrs. HANSEN. Why?

Mr. HITE. Madam Chairman, I came to you a couple of years ago and I said that the library was in a bad management situation. As a result of bringing on a new librarian, Mrs. Huffer, who we were fortunate to get from the Smithsonian Institution, a lot of revampment of the operation has taken place. In so doing, a lot of people opted to leave their jobs to take other jobs. This wasn't any kind of a reduction in force or a forced retirement situation or anything that was inequitable from a personnel sense.

Nevertheless, the staff of the library decreased from the 58 filled positions at that time to 39. Mrs. Huffer has over the last year structured the library in an orderly fashion. She has done an outstanding job. We are now ready to staff up. Nevertheless, we can at least reduce the cost of this operation by a modest $20,000 in fiscal 1974.

Mrs. HANSEN. Why didn't you bring Mrs. Huffer with you today to testify in her own behalf?

Mr. HITE. She has done such a good job I thought I could probably handle it.

JOHNNY HORIZON ANTILITTER PROGRAM

Mrs. HANSEN. An increase of $20,000 is requested for the Johnny Horizon antilitter program. What is the status of the program? Have you been able to see any improvement in the condition of our public lands as a result of the money spent on this program? Why don't you take some Johnny Horizon sacks out to the National Zoo?

Mr. HITE. In answer to the last question first, I would be happy to, Mrs. Hansen.

Mrs. HANSEN. Did you read the letter in the Washington Post this morning? I think it would be a great tribute to send some Johnny Horizon bags out to the zoo and invite the public to use them. The litter in public places and in every city east of the Mississippi doesn't

result because the Government is littering. It's because people don't seem to care that this is their land.

Mr. HITE. Actually, I think that is a great idea.

Mrs. HANSEN. Send the bags with the compliments of the committee and invite the public to participate in keeping the zoo clean.

Mr. HITE. Upon my return to the Department, I will speak to Mr. Wahlquist, who heads up this department.

Mrs. Hansen, progress in this area of cleaning up our land is kind of an intangible thing. It's hard to measure.

Mrs. HANSEN. It isn't too intangible. Please insert in the record the total amount of money that will be spent by all bureaus in the clean-up of litter.

Mr. HITE. We will provide that, Mrs. Hansen.

[The information follows:]

CLEAN-UP LITTER COSTS—1973 AND 1974

ESTIMATED COSTS OF THE ANTILITTER PROGRAM FOR THE DEPARTMENT OF THE INTERIOR FOR FISCAL YEARS 1973 AND 1974

[In thousands of dollars]

	Johnny Horizon program	Other programs	Total
Fiscal year 1973	617	4,538	5,155
Fiscal year 1974	624	4,693	5,317

Mr. HITE. Effective last July 1, Secretary Morton recognized the progress that had been made by the Johnny Horizon program and the interest that had been generated by the program by centralizing it in his Office in order that we could get departmentwide participation by all bureaus in the program.

We have really captivated the imaginations of a lot of public figures and we have gotten some good, gratis, if you will, advertisement of this program. It has paid off, I think. We distribute, as you know, the litter bags, et cetera.

Mrs. HANSEN. I think it has more than paid off. Groups all over the country are asking for these so that they can distribute them and use them.

Mr. BAKER. We are getting between 200 and 300 inquiries per day on this program.

Mr. HITE. Mrs. Hansen, the $20,000 increase is simply to underwrite the operation of the office, the seven positions which constitute the central headquarters of Johnny Horizon program. The Bureaus purchase the materials which they disseminate.

Mrs. HANSEN. Do any of the departments which have public land, such as BLM have any kind of small penance box or fee collection place for the litter bags?

Mr. HITE. Not to my knowledge.

Mrs. HANSEN. Don't you think you should be moving in that direction?

Mr. HITE. It would be a good idea.

Mrs. HANSEN. I think you will discover that the budget for litter cleanup is fantastic. It's a horrendous figure.

Mr. HITE. I think we have a good focus on the program now. It's certainly not my idea. The Secretary's idea of the slogan of cleaning up America by 1976 for our Bicentennial program, I think, provides us with a real target to make material progress.

WORLD ENERGY CONFERENCE

Mrs. HANSEN. You are requesting $700,000 for the World Energy Conference. This contribution is not authorized. What is the status of authorizing legislation?

Mr. HITE. Mrs. Hansen, we feel that Public Law 87-256, which is entitled, "An Act Promoting Better Mutual Understanding Among the Peoples of the World Through Educational and Cultural Exchange" provides the President with the authority to delegate through Executive order the responsibility for participating and underwriting such a conference to a department of Government. This has been done before for example, through delegations to Commerce, and to the United States Information Agency.

We feel that if our concept here is correct—and I have asked for a solicitor's opinion on this matter. The question of authority did come up in the Senate yesterday. I did not have the solicitor's opinion. I will have it quickly.

Mrs. HANSEN. Where is this conference to be scheduled?

Mr. HITE. This conference is scheduled in September 1974 for Detroit, Mich.

Mrs. HANSEN. I thought it wasn't scheduled until 1975?

Mr. HITE. It's fiscal year 1975. We are asking for the money now with authority in the language to carry over through 1975 in order that we may enter into commitments.

Mrs. HANSEN. Considering the way money is impounded, we couldn't make a commitment such as this.

Mr. HITE. What I am saying, Mrs. Hansen, is we are suggesting it be no-year money and not lapse at the end of fiscal year 1974.

Mrs. HANSEN. Next year you will probably be informing the committee that these funds are low priority and have been impounded.

Mr. HITE. Mrs. Hansen, this is kind of a unique program.

Mrs. HANSEN. The committee's projects that were impounded were unique also.

Mr. HITE. They certainly were, Mrs. Hansen. I feel that we are entering into a joint venture here, the total cost of which is $2 million. The way the assessments, if you will, were apportioned is this: The Government would underwrite one-third and the participants would underwrite a third. Then the Federal sector would come to roughly $700,000. If I am correct in citing the public law, if the funds were appropriated, then we would get the necessary Executive order. I think by incorporating this in his budget, the President has evidenced his support of it and offered it for your judgment.

Mrs. HANSEN. There is a possibility that a point of order will be raised on this unless there is an Executive order issued prior to bringing our bill to the floor.

Mr. HITE. OK, Mrs. Hansen.

I understand you and we will have to take action on that.

Mrs. HANSEN. The Pennsylvania Avenue Development Corp. requested funds in the supplemental. Their bill passed in October of 1972 and as of yet no member of the Commission has been appointed. The Bicentennial Commission is operating without an authorization.

Mr. HITE. I am aware of that.

Mrs. HANSEN. The committee does not want any additions to this list.

Mr. HITE. An Executive order then is certainly a necessary prelude.

Mrs. HANSEN. Also a Solicitor's opinion.

Mr. HITE. We will have a Solicitor's opinion, which I will insert in the record.

[The opinion follows:]

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SOLICITOR,
Washington, D.C., April 13, 1973.

To: The Secretary.
From: Solicitor.
Subject: World Energy Conference.

During the course of hearings on the Interior Department Appropriations Act, 1974, before the Senate Appropriations Subcommittee, Senator Bible questioned the propriety of Federal participation in the World Energy Conference scheduled to be held in Detroit, Mich., in September 1974.

The estimated expense of the Conference is $2 million and the President has included the sum of $700,000 in his fiscal year 1974 budget to cover the cost of U.S. participation in the Conference as the host country.

The Conference, as planned by the National Advisory Council, will not be only a technical and scientific meeting but will include also educational and cultural activities.

The Mutual Educational and Cultural Exchange Act of 1961 provides that its purpose:

> "* * * is to enable the Government of the United States to increase mutual understanding between the people of the United States and the people of other countries by means of educational and cultural exchange; to strengthen the ties which unite us with other nations by demonstrating the educational and cultural interests, developments, and achievements of the people of the United States and other nations, and the contributions being made toward a peaceful and more fruitful life for people throughout the world; to promote international cooperation for education and cultural advancement; and thus to assist in the development of friendly, sympathetic and peaceful relations between the United States and the other countries of the world." (22 U.S.C. sec. 2451).

In addition to authorizing the President to provide for educational and cultural exchange between American citizens and nationals of foreign countries the act authorizes the President, among other things, to provide for:

> "(5) promoting and supporting medical, scientific, cultutral and educational research and development;
>
> * * * * * * *
>
> "(7) U.S. representation at international nongovernmental educational, scientific, and technical meetings;
>
> "(8) participation by groups and individuals from other countries in educational, scientific, and technical meetings held under American auspices in or outside the United States * * *." (22 U.S.C. sec. 2452(b)).

The authority granted by the Congress in the Mutual Educational and Cultural Exchange Act of 1961 is directed to the President. The President by Executive order has delegated various functions vested in him by that act to the Secretary of State, the Director of the U.S. Information Agency, the Secretary of Commerce, and the Secretary of Health, Education, and Welfare. The President's inclusion in his 1974 budget of a request for $700,000 to be appropriated to the Department of the Interior to help defray the cost of the World Energy Conference to be held in September 1974 in Detroit, Mich., is clear evidence of his support of the Conference and of the role the Department of the Interior will have in such Conference.

Of course, the President will have to make an appropriate delegation to the Secretary of the Interior. However, the Congress need not rely upon an anticipated delegation of authority from the President. It may, if it wishes, make the availability of the appropriation contingent upon a delegation by the President.

It should be pointed out that the Mutual Educational and Cultural Exchange Act requires the President to submit any delegation of authority to the Speaker of the House of Representatives and the Committee on Foreign Relations of the Senate and that 60 days must pass after such submittal before the delegation of authority may be implemented.

RAYMOND C. COULTER,
Deputy Solicitor.

Mr. HITE. Assuming we can do this, just as an additional comment, Mrs. Hansen, these World Energy Conferences are held every 3 years and are underwritten by the host country as a matter of procedure in most instances. We underwrote one in 1936 when it was held in Washington.

Mrs. HANSEN. I understand.

Mr. LONG. How much is each of the other participants in the World Energy Conference contributing?

Mr. HITE. As indicated earlier, we expect the funding to come from three sources: private industry, conference participant, and the proposed Federal Government contribution of $700,000.

Industry contributions are well on their way. As of October 31, 1972, cash received and pledges amounted to $261,325. The remaining $600,000 is expected to be derived from registration fees of the estimated 4,500 participants. It is estimated that 3,000 of these participants will be from other nations.

Mr. LONG. The organizing committee for the 1974 World Energy Conference believes the U.S. Government should pay for one-third of the conference budget. Has the host country paid one-third of the costs in the past? If not, what percentages have the host countries paid?

Mr. HITE. The data that we have on prior conferences indicate that the host country has contributed more than one-third of the cost of the Conference. In 1962 the Conference was held in Melbourne and was attended by 1,530 delegates. The total Conference funding was $315,000 with $63,000 coming from the participants and $252,000 or 80 percent being contributed by the Australian Government. The 1968 Conference was held in Moscow at a funding level of $1 million. $174,000 was contributed by the 3,050 participants with $826,000 or 83.6 percent being contributed by the Russia Government. The last conference held in Bucharest in 1971 was funded at $800,000. 2,400 participants contributed $161,000 with the remaining $639,000, 80 percent coming from the Romanian Government.

Mr. LONG. Will the large oil-producing countries of the Middle East be represented at the Conference?

Mr. HITE. The oil producing countries of the Middle East have not chosen to be a member of the World Energy Conference with the exception of Iran. In past conferences five or six nonmember countries have attended. Hopefully, these oil-producing countries will attend the Conference in 1974.

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Mr. McDade. Is there anything in the justifications to indicate what sort of commitments you are going to make with the $700,000? What are you going to spend the money for?

Mr. Hite. Mr. McDade, I have here a listing which I will offer for the record which would indicate the types of activities which we feel the Federal Government may legitimately underwrite in support of the publication of technical papers, for instance, the underwriting of salaries of some portion of the technical staff of the conference, formulation of the technical program, apportionment of the publications pursuant to the conference, salaries of the editorial staff and the editorial office, publications of summaries, the independent national brochure—I have some 20 items listed here, Mr. McDade.

[The list follows:]

WORLD ENERGY CONFERENCE
SELECTED CONFERENCE EXPENSES WHICH COULD
BE PARTIALLY FUNDED FROM THE PROPOSED
FEDERAL GOVERNMENT CONTRIBUTION

Selected Conference Expenses	Estimated Amount
General Program Expenses	$29,400
Conference Daily Bulletin	9,000
Local Transportation of Participants	61,000
Rental of Facilities	110,000
Staff for Registration	88,000
World Energy Conference Program Planning	7,200
Technical Visit Design and Arrangements	14,800
Technical Visit Publications	6,600
Study Tour Design	17,100
Study Tour Management	61,000
Film Exhibit Design	10,000
Theme Film Production	106,000
Film Exhibit Management	103,000
Technical Staff Conference	38,500
Technical Paper Administration	16,000
Technical Program	8,000
Technical Publications	112,000
Editorial Staff and Related Expenses	119,000
International Brochure	11,000
Special Arrangements and Services	19,500
Total	947,100

Excerpts from Public Law 87-256 (22 U.S.C. Sec. 2451 et seq) ... " An Act Promoting Better Mutual Understanding Among the People of the World Through Educational and Cultural Exchange" that would allow the Federal Government to participate in funding of the World Energy Conference:

Section 101 (22 U.S.C. Sec. 2451). Statement of Purpose

The purpose of this Act is to enable the Government of the United States to increase mutual understanding between the people of the United States and the people of other countries by means of educational and cultural exchange; to strengthen the ties which unite us with other nations by demonstrating the educational and cultural interests, developments, and achievements of the people of the United States and other nations, and the contributions being made toward a peaceful and more fruitful life for people throughout the world; to promote international cooperation for educational and cultural advancement; and thus to assist in the development of friendly, sympathetic, and peaceful relations between the United States and the other countries of the world.

Section 102.(b) 22 U.S.C. Sec. 2452)

In furtherance of the purpose of the Act, the President is further authorized to provide for--

(5) promoting and supporting medical, scientific, cultural, and educational research and development;

(7) United States representation at international nongovernmental educational, scientific, and technical meetings;

(8) participation by groups and individuals from other countries in educational, scientific, and technical meetings held under American auspices in or outside the United States;

Section 105.(a) (22 U.S.C. 2455)

Appropriations to carry out the purposes of this Act, to remain available until expended, are hereby authorized, and this authorization includes the authority to grant, in any appropriation Act, the authority to enter into contracts, within the amounts so authorized, creating obligations in advance of appropriations.

Mr. VEYSEY. On that same point, do you have experience from other similar conferences that would lend some basis to the idea that $700,000 is the right figure?

Mr. HITE. Yes, sir. The last conference was held in Bucharest in 1971. The Romanian Government underwrote most of the conference, which came to $800,000. In addition, the participatory fees came to $161,000. They contributed $639,000 to the conference in 1971.

Mr. VEYSEY. Including devaluation of the dollar, what percentage increase in cost of living has taken place since Bucharest?

Mr. HITE. We will, Mr. Veysey, have more participants. There are 69 participating countries and many did not go to Romania. I am not saying that there is a reason for that, but it just seems that the United States would be a magnet for more countries to participate.

Mr. VEYSEY. This would be a bigger conference?

Mr. HITE. Yes, sir.

Mr. VEYSEY. You are telling me that Americans can put on a bigger conference at higher price rates for less money?

Mr. HITE. It's more money. The total conference budget is $2 million. The Department will be contributing a third.

Mr. BAKER. We are figuring in 1974 to spend about $450 for each participant. Even with the inflationary factor it is a sufficient amount.

Mr. VEYSEY. Who puts up the rest of the money?

Mr. HITE. Industry will provide a third and the participants will provide the other third.

Mrs. HANSEN. What are the other nations contributing?

Mr. HITE. They are contributing nothing, except the fees for their participants.

Mrs. HANSEN. How many nations do you expect to participate?

Mr. HITE. There are 69 nations in the conference, Mrs. Hansen. We expect the great majority of those will participate. Based on prior conferences we expect 50 to 55 member nations and 5 to 6 nonmember nations will attend.

I will provide the 69 member nations.

[The information follows:]

NATIONAL COMMITTEES OF THE WORLD ENERGY CONFERENCE

Algiers
Argentine Republic
Australia
Austria
Bangladesh
Belgium
Brazil
Bulgaria
Canada
Ceylon
Chile
Colombia
Costa Rica
Cuba
Czechoslovakia
Denmark
Finland
France
Germany (Democratic Republic of)
Germany (Federal Republic of)
Ghana
Great Britain
Greece
Hungary
Iceland
India
Indonesia
Iran
Ireland
Israel
Italy
Ivory Coast
Japan
Korea (Republic of)
Liberia
Luxembourg
Malaysia
Mexico
Morocco
Nepal
Netherlands
New Zealand
Nigeria
Norway
Pakistan
Peru
Philippines
Poland
Portugal
Romania
Sierre Leone
South Africa (Republic of)
Spain
Sweden
Switzerland
The Territories of Taiwan, Kinmen, Matsu, and Penghu of the Republic of China
Tanzania
Thailand
Trinidad and Tobago
Tunisia
Turkey
Uganda
Uuion of Soviet Socialist Republics
United Arab Republic
United States of America
Uruguay
Venezuela
Yugoslavia
Zambia

SPECIAL FOREIGN CURRENCY PROGRAM

Mrs. HANSEN. Please insert justification pages 1 through 30 in the record at this point.

[The pages follow:]

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY

HIGHLIGHT STATEMENT

SPECIAL FOREIGN CURRENCY PROGRAM

The Department's fiscal year 1974 special foreign currency request is $1,630,000, an increase of $1,130,000 over fiscal year 1973 to carry out contract research with the countries of Poland and Yugoslavia. Of the $1,630,000 requested for fiscal year 1974, $670,000 is needed for continutation of 15 research projects initiated during fiscal year 1972 and fiscal year 1973. An additional $960,000 is requested to initiate 20 new research projects. Listed below is the funding program for each country.

Country	FY 1972	FY 1973	FY 1974	Increase
Poland	$180,000	$245,000	$1,210,000	$+ 965,000
Yugoslavia	320,000	255,000	420,000	+ 165,000
Total	500,000	500,000	1,630,000	+1,130,000

These research contracts are of direct benefit to programs conducted by the Office of Saline Water, Bureau of Mines and the U.S. Geological Survey.

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
SALARIES AND EXPENSES

(SPECIAL FOREIGN CURRENCY PROGRAM)

Appropriation/Total available, 1972..... $500,000

Appropriation/Total available, 1973..... 500,000

Summary of Increases and Decreases, 1974

Research:	Base for 1974	Increase 1974
Increase in foreign currency research program.....	$500,000	$1,130,000
Budget estimate, 1974.....		1,630,000

Analysis by Activity

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Amount Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973
Research.....	$472,314	$500,000	$1,630,000	$+1,130,000
Unobligated balance carryover.....	27,686	27,686	---	-27,686
Total.....	500,000	527,686	1,630,000	1,102,314

JUSTIFICATION

Research: Fiscal year 1973, $500,000; fiscal year 1974, $1,630,000; increase, $1,130,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1) $+15,000	--	$290,000	--	Necessary funding to complete seven research projects.
(2) +30,000	--	165,000	--	Third year funding for four research projects.
(3) +110,000	--	215,000	--	Second year funding for four research projects.
(4) +960,000	--	960,000	--	Twenty new research projects proposed to be initiated during fiscal year 1974.
(5) +15,000	--	---	--	Reduction in unobligated balance.
+1,130,000	---	---	--	

The Department of the Interior proposes to expand, in fiscal year 1974, its research program utilizing excess foreign currency. This expansion results from the successful programs initiated in fiscal years 1972 and 1973. The new projects proposals stem from the team of research experts from the several bureaus of the Department when they visited the various study facilities in Poland and Yugoslavia. Discussions with representatives of those countries indicated the areas of mutual interest and study. The visitation also provided the Department a view of the capabilities of the research facilities available in those countries.

These research proposals will make it possible for the Interior agencies to benefit directly from research on problems, techniques, or natural pheonomena that can be carried on more efficiently in Poland and Yugoslavia than in the United States, and would aid the Interior agencies to fulfill better their own program responsibilities. It is recognized that in most areas of study represented by these proposals the foreign organizations have both expertise and facilities necessary for the work. There is an urgent need to carry on the research, but these organizations are hampered by the lack of funds and opportunities for contacts with western scientists working on similar research. Selection of the highest priority proposals reflect only the more urgent needs for the improvement of Interior's overall program objectives. This selection was made in close collaboration with experts at Interior facilities having related research and development responsibilities and will be periodically reviewed and updated to insure conformity with current domestic program requirements and objectives.

Although the estimated duration of many of the proposed projects extends beyond one year and it is hoped these projects will be allowed to run their full term, projects have been designed so that results of each year's research in itself will be of benefit to Departmental programs.

Research contracts with Poland and Yugoslavia are proposed as outlined below:

DEPARTMENT OF THE INTERIOR
EXCESS FOREIGN CURRENCY PROGRAM
RESEARCH CONTRACTS WITH POLAND AND YUGOSLAVIA

	Cognizant Bureau	Country	F.Y. 1972 Obligations	F.Y. 1973 Amount Available	F.Y. 1974 Request	Est. Project Duration	Est. Total Project Costs
(1) Initiation of Coal Dust Explosions	Mines	Poland	$40,000	$40,000	$40,000	1972-74	$120,000
(2) Trigger Barriers for Mine Safety	Mines	Poland	30,000	30,000	30,000	1972-74	90,000
(3) Coal Mine Hazards	Mines	Poland	40,000	40,000	40,000	1972-74	120,000
(4) Mineral Recovery from Desalination Brines	Saline Water	Poland	50,000	50,000	60,000	1972-74	160,000
(5) Liquefaction of Coal	Mines	Poland	---	55,000	100,000	1973-75	255,000
(6) Research on Base Metal Deposits in Carbonate rocks	Geo. Survey	Poland	---	25,000	50,000	1973-76	145,000
(7) Research on Mining Hydrology	Geo. Surv.	Poland	---	25,000	35,000	1973-75	95,000
(8) Comparative Research on Coal Basins and Coal Characteristics	Geo. Survey	Poland	---	---	35,000	1974-77	130,000
(9) Study of Underground Coal Gasification	Mines	Poland	---	---	50,000	1974-75	100,000
(10) Research on Coal Data Processing	Geo. Survey	Poland	---	---	30,000	1974-76	115,000
(11) Coal Gasification to Low-Sulfur, Low-Btu Gas	Mines	Poland	---	---	100,000	1974-76	400,000
(12) Chemical Removal of Sulfur from Coal	Mines	Poland	---	---	50,000	1974-76	150,000
(13) Noise Reduction Studies	Mines	Poland	---	---	30,000	1974-76	90,000
(14) New Concepts for Mine Illumination	Mines	Poland	---	---	30,000	1974-76	90,000
(15) Development of Pulsed Neutron Method of Evaluating Uranium Deposits	Mines	Poland	---	---	50,000	1974-76	150,000
(16) Development of Roof Fall Preiction Methods Based on Bore-Hole Penetrometer	Mines	Poland	---	---	40,000	1974-76	120,000

RESEARCH CONTRACTS WITH POLAND AND YUGOSLAVIA (Cont'd.)

	Cognizant Bureau	Country	F.Y. 1972 Obligations	F.Y. 1973 Amount Available	F.Y. 1974 Request	Est. Project Duration	Est. Total Project Costs
(17) Development of Coal Bump Prediction Techniques Based on Measurement of Drilling Dust Volume.....	Mines	Poland	$ ---	$ ---	$30,000	1974-76	$90,000
(18) Use of Slurry Explosives in Mining.....	Mines	Poland	---	---	30,000	1974-75	60,000
(19) Optimization of Automated Coal Mining.....	Mines	Poland	---	---	50,000	1974-76	150,000
(20) Stability of Head and Tail Entries in Longwall Coal Mines.	Mines	Poland	---	---	40,000	1974-76	120,000
(21) Microseismic Study of Longwall Mining.....	Mines	Poland	---	---	40,000	1974	40,000
(22) Pneumatic Stowing for Ground Support.....	Mines	Poland	---	---	50,000	1974	50,000
(23) Mechanical Preparation of Coal..	Mines	Poland	---	---	100,000	1974-75	200,000
(24) Metallurgical Coke from Marginal and Non-Coking Coals.....	Mines	Poland	---	---	100,000	1974-75	200,000
Total Poland Projects.....			160,000	265,000	1,210,000		3,240,000
(25) Production of Nickel from Low-Grade Nickel-Bearing Iron Ores.	Mines	Yugoslavia	30,000	---	30,000	1972-76	120,000
(26) Use of Lignite in the Reduction of Ferrous Metals.....	Mines	Yugoslavia	30,000	30,000	30,000	1972-75	120,000
(27) Research on Crustal Structure in Relation to Earthquakes, Intrusives, and Metallogenic Provinces.....	Geo. Survey	Yugoslavia	50,000	40,000	40,000	1972-75	300,000
(28) Research on Ultramafic Rocks as Related to the Exploration for Chromite and Other Economic Minerals.....	Geo. Survey	Yugoslavia	50,000	10,000	45,000	1973-77	230,000

RESEARCH CONTRACTS WITH POLAND AND YUGOSLAVIA (Cont'd.)

	Cognizant Bureau	Country	F.Y. 1972 Obligations	F.Y. 1973 Amount Available	F.Y. 1974 Request	Est. Project Duration	Est. Total Project Costs
(29) Research on Rare Metal Mineralization.....	Geo. Survey	Yugoslavia	$30,000	$30,000	$30,000	1972-74	$90,000
(30) Research on Geologic and Hydrologic Factors Affecting Urbanization and Economic Development.....	Geo. Survey	Yugoslavia	60,000	55,000	50,000	1972-76	185,000
(31) Research on Applications of Geophysics for Defining Permeability in Karstic Terrain.....	Geo. Survey	Yugoslavia	40,000	60,000	40,000	1972-74	140,000
(32) Research on Geothermal Energy and Thermal Water Resources...	Geo. Survey	Yugoslavia	---	---	40,000	1974-76	95,000
(33) Research on Geologic Controls for Non-Ferrous Metal Mineralization.....	Geo. Survey	Yugoslavia	---	---	40,000	1974-76	120,000
(34) Environmental Consideration of Water Resources in Urban Planning and Management.....	Geo. Survey	Yugoslavia	---	---	25,000	1974-76	100,000
(35) Desalination of Saline Water...	Saline Water	Yugoslavia	22,059	27,941	50,000	1972-74	100,000
Total Yugoslavia Projects....			312,059	252,941	420,000		1,600,000
Contract Administration.....			255	9,745	---		---
Total All Projects.....			472,314	527,686	1,630,000		4,840,000

(1) INITIATION OF COAL DUST EXPLOSIONS
(Poland)

Objective of Research

A research program initiated in the Polish experimental coal mine "Barbara" to study the initiation of coal dust explosions was begun in fiscal year 1972 and will continue in fiscal year 1973 with completion scheduled for fiscal year 1974. This research is of mutual interest to both Poland and the United States, and the subject mine is well qualified to carry out the research.

Goals of the Project

The conduct of full scale simulated explosions has become increasingly difficult in the facilities presently available in the United States. Information from such experimental work is badly needed in the coal mine safety program in the United States. The Polish underground galleries at the experimental mine "Barbara" can be utilized to supplement and accelerate on-going research of a smaller scale in this country. The results of such tests combined with on-going research in this country should provide means for avoiding or minimizing coal dust explosions. Emphasis will be placed on the initiation and subsequent development of full scale dust explosions from weak gas explosions. Included in the program will be studies on the initiation characteristics of new type American explosives.

Benefits

The well developed Polish technology in the field of coal mine fires and explosions will provide the United States with much needed assistance in the field of fires and explosions. Specifically, the cooperative program will be geared to apply the Polish technology already developed to the dust explosion problems which exist in the United States coal mines.

Funding

The total estimated cost for this project is $120,000 with $40,000 being available for fiscal year 1972 and fiscal year 1973. An appropriation of $40,000 is requested for fiscal year 1974 for completion of this project.

(2) TRIGGER BARRIERS FOR MINE SAFETY
(Poland)

Objective of Research

The United States and Poland have similar interests in preventing the loss of life and property from gas and dust explosions. The United States has immediate need for research and development work on barriers to arrest gas and/or dust explosions in underground coal mines. While extensive work has been done on this subject in Europe, difficulty has been experienced in the United States in developing a triggering mechanism which will insure the application of the fire extinguishant in the correct sequence of time.

Goals of the Project

The goal of this project will be to find means to arrest incipient and full-scale explosions under conditions exfsting in American coal mines. This includes barriers utilizing various extinguishants (stone, water, chemicals) and a variety of triggering mechanisms to provide the maximum efficiency. Since the mine "Barbara" has fully instrumented galleries of sufficient lengths to simulate gas and dust explosions of varying intensity, a specific research and development program can be developed in conference with Polish mine safety officials which

will meet the long-range needs of this country. This will involve the utilization of known and new barrier techniques to arrest explosions, particularly coal dust explosions, which range from an incipient stage to a fully developed high velocity explosion which results in mine disasters.

Benefits

The development of successful barriers will make available to the American coal mining industry a new technique for alleviating one of the more significant hazards in coal mining. The cooperative effort will bring to this country the expertise of Dr. Cybulski, one of the most outstanding coal mine safety investigators in the world.

Funding

The total estimated cost of this project over a three-year period is $90,000 with $30,000 being available for fiscal year 1972 and fiscal year 1973. An appropriation of $30,000 is requested in 1974 for completion of this project.

(3) COAL MINE HAZARDS
(Poland)

Objective of Research

In fiscal year 1972 a research program was initiated in Poland to review the current European practices in a number of facets of ground control, haulage, automation, and electrical hazards. Where appropriate, specific research problems are being identified and feasible methods of approach suggested.

Goals of the Project

The specific areas of mutual interest include: Development of means for detecting impending rock failure, developing means of protecting miners at the working face from rock falls, improve design criteria for entry systems to minimize roof fall, improve materials handling methods to increase effectiveness and reduce the hazards, reduce miner exposure to hazardous conditions through automation of the mining process, and means of reducing the inherent hazards that accompany the use of electric power underground. The project involves consideration of existing European technology in underground coal mines and an evaluation of their current safety programs. Also being studied are new techniques which might be applicable to American mining systems and recommendations for their application.

Benefits

The successful development of the above mentioned information will have far-reaching and beneficial effects for both countries. Because of their relationship both to the Eastern and Western technology, it is believed that Polish scientists employed will cover a wide spectrum of coal mining technology. For the most part, such coordinated information is not presently available.

Funding

The total estimated cost of this project over a three-year period is $120,000 with $40,000 being available in fiscal year 1972 and fiscal year 1973. An appropriation of $40,000 is requested in 1974 for completion of this project.

(4) MINERAL RECOVERY FROM DESALINATION BRINES
(Poland)

Objective of Research

The objective of the research is development of economically viable process for recovery of minerals from desalination plant brines.

Goal of the Project

The goal of the project will be to enhance the economic utility of desalination plant brines for applications such as (a) anti-freezing material in liquid and solid form; (b) recovery of magnesium compounds as refractory materials; (c) recovery of mixtures of sodium and magnesium compounds for industrial purposes; and (d) conceptual studies for mother liquors from a full-scale plant.

Technology has been developed on a laboratory scale to produce crystalline salt, gypsum, and purified water from saline mine drainage waters by an evaporative process which does not require chemical pretreatment. Pilot plant scale studies are being carried out, and a full-scale unit for one mine is under construction. This process yields a brine concentrated with magnesium salts. The subject investigation is concerned with the recovery and utilization of salts from this brine.

Benefits

Throughout the world desalination is becoming increasingly important as an incremental source of water supply. As generally practiced, a saline feed water is processed into an essentially pure product water stream, and a concentrated brine stream which is discharged. As desalination grows, the ecological impact of brine discharge becomes a problem of great magnitude with regard to its possible deleterious effect on the local environment. The long-range solution to this problem is to recover the salts in useful form rather than to discharge them. Unfortunately, at the present time, recovery of salts in useful form from a desalination plant involves costs which exceed their value. However, legislative restrictions on disposal and reevaluation of disposal costs to include environmental impact are causing disposal costs to rise, while technological advances are giving lower recovery costs. Thus the economic viability of recovering minerals (solid salts) from desalination plants will become increasingly favorable and will cross the break-even point at a point in time which will be dependent on widely variable local conditions.

A locality where conditions are now favorable is the upper Salesia district, where mining of coal is an important industry. The coal mines are located near small tributaries of the Odra and Vistula rivers in a region of limited fresh water supply. One of the largest sources of pollution of these rivers is saline drainage from coal mines. Use of the river water in upper Silesia is limited by its waste content. A desalination project has been undertaken to protect the streams and rivers from excessive pollution, by isolating and recovering dry salts from these brines. This will prevent major pollution of the two river basins, and the technology developed will be available for application throughout the world. It will provide an additional source of water supply at lower cost, an additional source of minerals (salts), and prevent further degradation and pollution of existing water sources.

Funding

The total estimated cost of this project over a three-year period is $160,000 with $50,000 being available for fiscal year 1972 and fiscal year 1973. An appropriation of $60,000 is requested to complete this project in 1974.

(5) LIQUEFACTION OF COAL
(Poland)

Objective of Research

A program will be initiated in fiscal year 1973 which will permit experiments in coal liquefaction which is of equal interest to Poland and the United States.

Goal of the Project

This subject has been studied extensively by coal producing nations of the world for many years. The actual goal would be to make gasoline from coal at a price competitive with that obtained from petroleum. Emphasis would be placed in the critical technical bottlenecks such as filtration.

Benefits

There is a long history of developmental effort to achieve this goal in Poland and not only would we receive benefit from this earlier work, but we would benefit from on-going research. Although we are currently placing greater emphasis on gasification of coal, we would be kept abreast of current developments and profit directly from any advances made in this technology.

Funding

An approrpiation of $100,000 is requested for FY 1974. This project was initiated in FY 1973 with funding of $55,000. Total funding requirements of $255,000 are estimated over a three year period.

(6) RESEARCH ON BASE METAL DEPOSITS IN CARBONATE ROCKS
(Poland)

Objective of Research

This project is intended to improve the knowledge of geologic features associated with, and controlling the distribution of, base metal deposits in limestone host rocks similar to those in the Mississippi Valley region of the United States and in southern Poland and to provide better guidelines for the exploration of such deposits.

Goal of the Project

Project goals include the completion of a detailed field and laboratory study of selected base metal deposits in Poland, comparison of geologic and mineralogic characteristics with similar deposits in the United States, and identification of factors that may help in exploring and appraising such deposits.

The program of work includes compilation of existing field and laboratory data, additional field work in the deposits in Poland, analytical studies of the ores and associated rocks, and joint comparison with deposits in the United States.

Benefits

The United States contains large deposits of lead and zinc in bedded limestone in the Mississippi Valley region. These have been studied extensively but clues to the discovery and exploration of such deposits could be improved by research on comparable deposits which are of importance in Poland. This

project will take advantage of the capability and knowledge that already exists in Poland to direct research on geologic features that will be helpful in understanding the U. S. deposits.

Funding

An appropriation of $50,000 is requested for FY 1974. This project was initiated in FY 1973 with funding of $25,000. Total funding requirements of $145,000 are estimated over a four-year period.

(7) RESEARCH IN MINING HYDROLOGY
(Poland)

Objective of Research

This project is intended to develop a better understanding of the effects of mining and tunneling on hydrologic and hydrogeochemical conditions and to improve the techniques and methodology for studying these conditions.

Goals of the Project

The project goals will be to complete a type area study of hydrologic and related hydrogeochemical conditions in a selected mining area in Poland and to evaluate the potential application of the techniques used in this study to problems in mining hydrology in the United States.

The work to be undertaken will include field studies and data compilation on the hydrology and hydrogeochemistry of a selected type mining area; detection and location using geophysical techniques of voids, portals, fractures, faults and collapse zones in concealed and abandoned mines that form avenues for water movement; tracing of water movement in and out of mines and deep mine workings using dyes and radioisotopes; and digital and analog modelling of the hydrologic regimen of the type mining area. Application of the analog and digital modelling and data analysis will be carried out in the laboratories of the Central Mining Institute in Katowice.

Benefits

The problems of anticipating patterns, direction and quantities of water outflow and of controlling water pollution from acid mine drainage in areas of mining and tunneling can be studied effectively by comparison with research on comparable problems in Polish mining districts. This project will take advantage of the research capacity already existing in Poland to obtain results in comparable problems of mining, tunneling, and related engineering projects in the United States.

Funding

Funding of $25,000 will start this project in fiscal year 1973. Total funding of $95,000 over a three-year period is needed. An appropriation of $35,000 is requested in 1974 for the second year of the project.

(8) COMPARATIVE RESEARCH ON COAL BASINS
AND COAL CHARACTERISTICS
(Poland)

Objective of Research

To gain more information about the relationships between coal characteristics

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and the geologic history of coal basins, and about the factors that influence composition, rank, and utilization potential of coal, through studies of three major coal fields in Poland and comparison with similar fields in the United States.

Goal of the Project

Poland has three major coal basins of Permo-Carboniferous age that have coals of different characteristics formed under different geologic environments. Project goals include a detailed comparison of the geologic factors and processes that have affected these basins; correlation and analysis of the coals and changes in characteristics in these basins; comparison with similar coals in the United States; and identification of factors that may help predict lateral changes in coal characteristics and help plan coal extraction. The project is intended to provide new information of particular relevance to the identification and understanding of coking coals and the comparison of European and American coal classification methods.

Benefits

This project will utilize the favorable opportunity that exists in Poland to study three different and dissimilar coal basins of equivalent age, and the data and expertise already existing in Poland, to develop a better understanding of the geologic factors that are related to differences in characteristics and utilization possibilities of coal. The criteria resulting from this study should be applicable in efforts to classify coal resources, to locate high quality coal, and to improve the planning for coal extraction in the United States.

Funding

Funding of $35,000 for FY 1974 is requested for this project. Total funding requirements are estimated to be $130,000 over approximately four years.

(9) STUDY OF UNDERGROUND COAL GASIFICATION
(Poland)

Objective of Research

The growing need for energy and the desire to satisfy this need from domestic resources in a manner that does not degrade the environment, provides the incentive for accelerated development of underground coal gasification technology. Underground, or in situ, coal gasification is a revolutionary technology which, if successfully developed, would provide the mechanism for extracting the energy from a coal bed without may of the problems associated with current mining practices.

Goals of the Project

Currently, the Bureau of Mines is making laboratory and field studies on underground gasification, but work by Polish engineers and scientists would complement the Bureau's work and hopefully shorten the time to commercial application of the process. One important aspect of an underground gasification system that we would recommend for research is linking boreholes by drilling passageways between them with lasers. Such a study should be limited initially to the laboratory, aimed toward evaluating the feasibility of the laser technique. Other options for linking are being considered, and it is desirable that all feasible techniques converge in time.

Benefits

Specifically, underground coal gasification would:

- eliminate the health and safety hazards involved in mining coal underground,
- reduce or completely eliminate land disruption, including subsidence,
- eliminate the cost of mining, crushing, sizing and transporting coal,
- minimize air pollution from sulfur and nitrogen oxides and water pollution from acid drainage.

Funding

The total estimated cost for this project is $100,000. An appropriation of $50,000 is requested for fiscal year 1974 to begin a two-year laboratory effort.

(10) RESEARCH ON COAL DATA PROCESSING
(Poland)

Objective of Research

To review, develop, and test statistical computerized procedures for processing and evaluating data on coal, in order to facilitate the study of interrelationships between chemical and physical properties of coal, geologic interpretation of coal deposits, and appraisal of coal resources.

Goals of the Project

This project will utilize a vast amount of available data on coal deposits in Poland to test methods of computer storage, retrieval, and analysis of the data. Using data from selected coal-bearing areas, a primary goal will be to develop a computerized display of such variables as coal bed thickness; overburden thickness; heating value; caking and coking values; tar yields; ash, sulfur, and sodium contents; thickness of non-coal layers within a minable coal bed; and other parameters. This display will then be used as a basis for (1) geological evaluation and interpretation of the data, and (2) an appraisal of reserves in various mining and utilization categories.

Benefits

Computerized processing and analysis of coal data have been applied only to a very limited extent in the United States. In the future it will be necessary to use such methods to a much greater extent, especially in assessing coal resources in relation to environmental problems, but the best procedures for doing so have yet to be determined. This project utilizes data and expertise available in Poland to test, develop, and demonstrate procedures that may then be tested and applied in the United States.

Funding

First year project funding of $30,000 is requested for fiscal year 1974. The project is expected to require a total funding of $115,000 over a three-year period.

(11) COAL GASIFICATION TO LOW-SULFUR, LOW-BTU GAS
(Poland)

Objective of Research

With increasingly stringent legal restrictions on the amount of sulfur dioxide emitted by coal and oil-fired boilers, and with the largest reserves of low-sulfur coal long distances from the major coal markets, it is imperative that other means be found to furnish low-sulfur fuel for boilers - particularly in the electric utility industry. One promising approach is to gasify high-sulfur coals with air and steam, remove the sulfur from the raw gas, and then burn the gas in boilers, or in gas turbines, for power generation.

Goals of the Project

Coal gasification technology is well advanced, but removing the sulfur compounds from the raw gas while it is hot (500°C to 900°C), presents difficult technical problems. Currently, the Bureau of Mines is working on hot-gas desulfurization, but research by Polish engineers and scientists would complement the Bureau's work and hopefully shorten the time to the development of a low-sulfur, low-Btu gas industry based on coal.

Benefits

Efforts to develop a low-sulfur, low-Btu gas process for industrial and electric utility use are burgeoning, but the weakest part of any such process, regardless of how the coal is gasified, is the hot-gas desulfurization step. Therefore, to keep pace with ancillary developments of a process, it is imperative to expand and intensify work on hot-gas desulfurization as soon as possible.

Funding

This is a new project for fiscal year 1974 with an estimated cost of $400,000 over a three-year period. An initial appropriation of $100,000 is requested for the first year funding of this project.

(12) CHEMICAL REMOVAL OF SULFUR FROM COAL
(Poland)

Objective of Research

Research for reducing sulfur content of coal by mechanical preparation methods has gone as far as one may reasonably expect in obtaining results. One may not expect significant progress by pursuing this line of research in reducing sulfur content of coal since in all cases the organic sulfur is left untouched. Therefore, attention must be focussed on new approaches to the problem. The Bureau of Mines has already started work on sulfur reduction by chemical means and is optimistic about the results. Research by Polish scientists would supplement the Bureau's work and bring additional effort toward achieving results.

Goals of the Project

Reduction of sulfur in coal is of high priority in the Bureau of Mines coal research effort, because much of the coal in the eastern coal fields are high in sulfur and the bulk of this coal is used for power generation and making coke.

Benefits

Coal accounts for perhaps as much as two-thirds of the sulfur dioxide emitted to the atmosphere. Removal of sulfur by chemical means may be an effective method

for meeting air pollution standards.

Funding

This is a new project for fiscal year 1974 with an estimated cost of $150,000 over a three-year period. An initial appropriation of $50,000 is requested for the first year funding of this project.

(13) NOISE REDUCTION STUDIES
(Poland)

Objective of Research

The Federal Coal Mine Health and Safety Act of 1969 and the subsequent regulations contain mandatory health standards that set maximum noise exposures. Current efforts are underway to control noise and provide personal protection but the extensive experience and expertise of the Polish would expedite efforts. The objective of this project is to define foreign experience and practices in underground mining noise problems including exposure indices and techniques for control and abatement of noise as well as personal protection.

Goals of the Project

Project goals in fiscal year 1974 are directed towards providing a state of the art report of current Polish and other foreign noise control experience. The work efforts in fiscal years 1975 and 1976 will include applicable work dependent on results of fiscal year 1974 task.

Benefits

Means must be provided to supply sufficient information to enable industry to comply with the mandatory standards contained in the 1969 Act. This project will provide access to the apparently extensive efforts underway in Poland.

Funding

This is a new project for fiscal year 1974 with an estimated cost of $90,000 over a three-year period. An initial appropriation of $30,000 is requested for the first year funding of this project.

(14) NEW CONCEPTS FOR MINE ILLUMINATION
(Poland)

Objective of Research

The Federal Coal Mine Health and Safety Act of 1969 requires the development of illumination standards for underground coal mines; the experience of existing illumination systems is quite pertinent and the recently developed inductive lighting system will play a key role in the development of systems for American mines. The objective of the project is to define Eastern European experience and practices in underground mine illimination including levels, light distributions, luminaries used, safety and productivity achieved and recommendations of the adaptation of any of these techniques or hardware to American coal mining.

Goals of the Project

Specific research goals include:

1) FY 74 - Prepare a state of the art report of current Polish and other foreign lighting experience.

2) FY 75 - Examine the adaptation of Polish, et al experience to American mine lighting problems. Deliver hardware (prototype or commercial) for evaluation, especially the inductively coupled ISC mine light.

3) FY 76 - Continue development of experience and performance data as well as prototype hardware for Bureau evaluation.

Benefits

This work should provide access to the apparently extensive experience and background which exists but is not compiled in usable form; also it will make available the interesting inductively coupled fixtures for evaluation in the United States. Development and evaluation of pertinent illumination experience and hardware is of high priority in the Health and Safety research program.

Funding

This is a new project for fiscal year 1974 with an estimated cost of $90,000 over a three-year period. An initial appropriation of $30,000 is requested for the first year funding of this project.

(15) DEVELOPMENT OF PULSED NEUTRON METHOD OF EVALUATING URANIUM DEPOSITS
(Poland)

Objective of Research

Presently our uranium deposits are evaluated almost exclusively by using natural gamma-ray logging techniques to provide in situ grade estimates or ore penetrated by surface and underground drill holes. The gamma rays that are measured are emitted by daughter isotopes of U-238, not U-238 itself. If groundwater preferentially dissolves and moves U-238 away from its daughters, as it often does, the deposit goes "out of equilibrium" and gamma-ray measurements fail to tell the truth about uranium ore grade. Most uranium deposits are characterized by some degree of disequilibrium, and in some cases the degree is serious enough to cause blunders in mine planning that result in waste of resources, loss of profits and inefficient mill operation of the grade of mill feed falls below the optimum level. The U.S. AEC and mining companies here and around the world have devised various methods of correcting for disequilibrium by making laboratory assays of representative samples from different locations in a deposit, but this approach is costly and suffers from statistical sampling error.

Goals of the Project

Dr. Jan A. Czubek of the Institute of Nuclear Physics in Cracow, Poland, has a better idea. He proposes taking advantage of the fact that U-238 and U-235 are fissionable isotopes, and that neutrons produced by bombarding them with neutrons from a pulsed source should provide a means of "direct" measurement of uranium content. His idea is mentioned in a paper that was edited prior to its publication in the

November-December 1971 issue of the Log Analyst: "Recent Russian and European Developments in Nuclear Geophysics Applied to Mineral Exploration and Mining." The proposed technique is discussed in detail in a publication of the Institute of Nuclear Physics, Cracow, Poland,: "Pulsed Neutron Method for Uranium Well Logging", and in a shortened version of that paper that was published under the same title in the February 1972 issue of Geophysics (v. 37, No. 1). In these reports Czubek presents a sound theoretical basis for the technique along with experimental evidence that implementation is feasible with state-of-the-art technology.

Benefits

Czubek and his associates stand a good chance of developing a successful prototype logging probe based on the induced fission principle. If, in return, we could obtain the prototype probe and/or a complete description of its design, operation and evaluation, the result would be of considerable value to the uranium mining industry in this country.

Funding

This is a new project for fiscal year 1974 with an estimated cost of $150,000 over a three-year period. An initial appropriation of $50,000 is requested for the first year funding of this project.

(16) DEVELOPMENT OF ROOF FALL PREDICTION METHODS BASED ON BOREHOLE PENETROMETER
(Poland)

Objective of Research

Roof falls account for fifty percent of the fatalities in underground coal mines. If a correlation can be established between the resistance to separation along bedding planes and if a practical method of measuring this in the mine can be developed, then it may be possible to predict roof falls.

Goals of the Project

The project will involve laboratory and underground tests using the borehold penetrometer to measure roof rock resistance to separation along bedding planes and correlating this data with measurements of roof displacement. Initial laboratory testing will be accomplished using splitting tension tests (Brazilian Tensile Test) to measure rock tensile strength along bedding planes. Underground tests will include tensile strength profiles of mine roof rock and measurements of bedding plane separation monitored by sag-measurement devices or extensometers.

Benefits

Roof fall prediction methods are of highest priority in the coal mine health and safety research program. The reduction of underground mining fatalities is the major benefit of this program.

Funding

This is a new project for fiscal year 1974 with an estimated cost of $120,000 over a three-year period. An initial appropriation of $40,000 is requested for the first year funding of this project.

(17) DEVELOPMENT OF COAL BUMP PREDICTION TECHNIQUES BASED ON MEASUREMENT OF DRILLING DUST VOLUME
(Poland)

Objective of Research

To develop a method of detecting highly stressed zones and the consequent likelihood of coal bumps by measuring the volume of dust produced in drill holes. At this time there is no satisfactory method of predicting the occurrence of coal bumps. Development of predictive methods would save lives and increase coal production.

Goals of the Project

Laboratory testing of coal samples in triaxial loading condition; underground tests in several coal seams to determine the validity of laboratory data; and development of improved testing equipment. Upon completion of the project the equipment, test data, final report, and appropriate instruction manuals will be delivered to the Bureau of Mines.

Benefits

Each year coal bumps claim a number of lives and are responsible for production losses in underground coal mines. The development of prediction techniques will increase the health and safety of miners and provide increases in coal production.

Funding

This is a new project for fiscal year 1974 with an estimated cost of $90,000 over a three-year period. An initial appropriation of $30,000 is requested for the first year funding of this project.

(18) USE OF SLURRY EXPLOSIVES IN MINING
(Poland)

Objective of Research

Until recently, there were no slurry explosives certified as permissible by the Bureau of Mines; hence, no slurry explosives were used in underground coal mines. In recent years, there has been a sudden increase and interest in the use of slurry explosives and at present there are four ammonium nitrate based slurry explosives certified as permissible by the Bureau of Mines. In view of the large number of conventional sections still operational in United States bituminous coal mines and the increased use of slurry explosives in underground coal mines, the importance of defining Eastern European experience and practices in the use of slurry explosives underground cannot be overstated.

Goals of the Project

1) A systematic research of the influence of all components of new explosives of the slurry type on detonation properties of explosives and on their safety in coal dust and methane atmospheres.

2) Investigations to be carried out both on the surface and in the actual mining environment underground.

3) The shooting effect of the various slurry explosives would be determined during these investigations, including the influence of the explosive on

the ratio of coarse to fine coal as well as delineation of critical conditions in the presence of methane and coal dust.

This research provides for cooperative data obtained in the experimental mine "Barbara" which has a number of experimental galleries ranging in lengths to 400 meters. These galleries permit investigations into incendivity and methane in coal dust on a scale approximately equal to real mine conditions. In addition, experimental headings in both coal seams and stone permit actual blasting tests on the safety of explosives in normal mining configurations.

Benefits

Development and evaluation of pertinent blasting experience and information is of high priority in the Health and Safety research program.

Funding

This is a new project for fiscal year 1974 with an estimated cost of $60,000 over a two-year period. An initial appropriation of $30,000 is requested for the first year funding of this project.

(19) OPTIMIZATION OF AUTOMATED COAL MINING
(Poland)

Objective of Research

To determine the optimal structure of mine technological process automation systems. There has been considerable work on the control structure and desired computer systems for the control of the mine transport process. Experimental devices have been fabricated and installed in an underground mine and evaluation tests have been performed under Polish mining conditions.

Goals of the Project

1) State-of-the-art retests and report on the existing automation system.

2) Conceptual elaboration of the integral automation system branch to control personnel movement and developing of sensing elements for mine ventilation automation.

3) The technological development of integral automation system devices.

This work should provide access to the apparently extensive experience and background which exists in the Polish mining community in the area of automated mining systems.

Benefits

Development and evaluation of pertinent automation experience and hardware can be instrumental in reducing hazards encountered by the miner in underground coal mining which is one of the specific requirements of the Federal Coal Mine Health and Safety Act of 1969.

Funding

This is a new project for fiscal year 1974 with an estimated cost of $150,000 over a three-year period. An initial appropriation of $50,000 is requested for the first year funding of this project.

(20) STABILITY OF HEAD AND TAIL ENTRIES IN LONGWALL COAL MINES (Poland)

Objective of Research

The amount of coal produced in the United States by longwall mining is less than 3 percent of the coal produced underground. Production by longwall mining, which is inherently safer than continuous or conventional mining systems, will increase only if certain problems associated with it are alleviated. One of these problems is in maintaining the integrity of the head and tail entries. Because Poland produces most of its coal by longwall mining, it is better able to perform research directed at longwall mining, since more experience records or case histories are available.

Goals of the Project

(a) F.Y. 74 - Survey state of art in Polish longwall coal mines. Prepare a summary report indicating the occurrence of entry stability problems, as related to mining method, extraction, geology, etc., and the remedial or support measures used.

(b) F.Y. 75 - Adapt Polish technology to American mining practice and investigate mining methods or support techniques to improve U.S. longwall practices.

(c) F.Y. 76 - Develop predictive or analytical techniques to predict entry stability problems and determine appropriate remedial support required.

Benefits

Since longwall mining and its adoption by the U.S. coal mining industry are looked upon as long-term solutions to the problem of coal mine safety, the solution to the problem of entry stability is regarded as being of high priority.

Funding

This is a new project for fiscal year 1974 with an estimated cost of $120,000 over a three-year period. An initial appropriation of $40,000 is requested for the first year funding of this project.

(21) MICROSEISMIC STUDY OF LONGWALL MINING (Poland)

Objective of Research

Unpredictable roof-falls and cave-ins have occurred in longwall caving operations in 7 underground coal mines. Such events are unpredictable in location, extent, and time of occurrence. They often result in fatalities, loss of equipment, and interruption of mining sequence resulting in increased costs.

The objective of this project is to utilize microseismic techniques to monitor longwall caving progress and to detect areas of rock breakage, roof instability or other unstable conditions near the cave area or other areas of the coal mine.

Microseismic techniques are the detection of the seismic noises generated by rock materials as they are stressed to levels approaching their strength. By using a sufficient number of sensors and data channels, the source of microseisms in the rock mass may be located. An increase rate of occurrence usually means that failure of some portion of the rock mass may be imminent.

Goals of the Project

To monitor the microseismic activity around a longwall caving panel through a complete cycle, and to identify and characterize microseisms associated with field conditions.

Benefits

The development of microseismic techniques for monitoring the stability of longwall coal mining systems will be of great benefit to the industry to improve the safety and overall efficiency of the longwall system. The results of this project will provide correlation for work of similar nature in progress in the United States.

Funding

This is a new project for fiscal year 1974. An appropriation of $40,000 is requested for this one year project.

(22) PNEUMATIC STOWING FOR GROUND SUPPORT
(Poland)

Objective of Research

Caving mining systems often create surface subsidence which may threaten lives, damage structures and disturb the natural environment. In addition, many mining systems produce waste rock which, if disposed of on surface, may create environmental hazards. A potential solution to these problems is to dispose of the waste material in the areas that will cave. Pneumatic placement is one potential method for stowing the waste material.

Goals of the Project

To produce a set of parameters for use in evaluation of the potential of pneumatic stowing as a means of ground support. It is envisioned that given the physical properties of a material, the optimum velocity, moisture, etc., can be determined to produce the maximum density of stowage.

The first phase of the project will be to conduct a literature survey and prepare a report on current European practices in pheumatic stowing. The second phase will be tests to determine the effect of velocity, moisture, material size and other factors on pack density.

Benefits

Development of pneumatic stowing parameters may reduce or eliminate surface subsidence as well as eliminate a surface waste disposal problem.

Funding

This is a new project for fiscal year 1974. An appropriation of $50,000 is requested for this one year project.

(23) MECHANICAL PREPARATION OF COAL
(Poland)

Objective of Research

Removal of surface water from coal is virtually the major coal washing problem encountered in modern preparation plants, and it accounts for a significant

part of the total cost of preparation. With coal costs increasing rapidly, cheaper means for dewatering coal would be a step toward improving the markets for coal.

Goals of the Project

Currently the Bureau of Mines is investigating dewatering, but the problem is important enough to justify complementary studies by Polish engineers, who may have some novel concepts about dewatering.

Benefits

Through the above research, economical means of processing coal would tend toward expanding the markets for coal.

Funding

This is a new project for fiscal year 1974 with an estimated cost of $200,000 over a two-year peiod. An initial appropriation of $100,000 is requested for the first year funding of this project.

(24) METALLURGICAL COKE FROM MARGINAL AND NON-COKING COALS
(Poland)

Objective of Research

To conserve and utilize more efficiently the United States reserves of premium, low-sulfur coking coals, it is desirable to find means for using marginal and non-coking coals to make coke.

Goals of the Project

Bureau of Mines' work has shown that preheating coal to a temperature slightly under the onset of plasticity significantly increases the physical strength of the coke. This work should be complemented by trying other means for pretreating coal, for example, by chemical modification through solvation. It is anticipated that such complementary research could be ideally carried out by Polish scientists.

Benefits

To develop an efficiently and economical process to produce metallurgical coke from marginal and non-coking coals.

Funding

This is a new project for fiscal year 1974 with an estimated cost of $200,000 over a two-year period. An initial appropriation of $100,000 is requested for the first year funding of this project.

(25) PRODUCTION OF NICKEL FROM LOW-GRADE NICKEL-BEARING IRON ORES
(Yugoslavia)

Objective of Research

To develop the technology for recovering nickel at economical costs from low-grade nickel bearing iron ores which not only occur in Yugoslavia, but have fairly worldwide distribution.

Goals of the Project

The successful completion of research outlined above so that sufficient technical and economical information becomes available to be able to evaluate the economical exploitation of the deposits.

Benefits

The United States is an important nickel consumer with minor domestic resources and production. The research goal, if achieved, will increase the number of nickel suppliers to the United States in addition to the two principal countries which now supply the bulk of U.S. domestic consumption.

Funding

The total estimated cost of this project over a four-year period is $120,000 with $30,000 being available for fiscal year 1972. An appropriation of $30,000 is requested for continuation of this project during fiscal year 1974.

(26) USE OF LIGNITE IN THE REDUCTION OF FERROUS METALS
(Yugoslavia)

Objective of Research

It is proposed that the subject program in Yugoslavia be continued to develop economical methods for the use of lignite in the reduction of ferrous metals.

Goals of the Project

The goal of the project would be to bring about the successful economical use of the relatively cheap metal lignite in reducing either nickel or iron to the metallic state. In spite of its wide occurrences around the world, there are a number of technical problems to be solved before lignite is used directly in metallurgical reactions.

Benefits

We have enormous deposits of low grade iron ore in Minnesota which might be reduced with plentiful lignite from North Dakota and the results of any development in the Yugoslav program would have direct application to such work.

Funding

The total estimated cost of this project over a four-year period is $120,000 with $30,000 being available for fiscal year 1972 and fiscal year 1973. An appropriation of $30,000 is requested for the third year funding of this project.

(27) RESEARCH ON CRUSTAL STRUCTURE IN RELATION TO EARTHQUAKES, INTRUSIVES, AND METALLOGENIC PROVINCES
(Yugoslavia)

Objective of Research

To develop a better understanding of crustal structure beneath mountain systems as related to the geologic processes involved in earthquakes, volcanism, and formation of ore deposits.

Goals of the Project

To complete geophysical profiles and geological interpretations along selected traverses across the Dinaride Mountains in Yugoslavia as a means of identifying the deep-crustal structure associated with earthquake, volcanic, and mineral belts.

This project is a continuation of work initiated late in fiscal year 1972. It involves the completion of work on two geophysical profiles during fiscal year 1974, the geological interpretation of geophysical data along profiles completed earlier, and the analysis of regional geologic structure. Special attention is being given to the distribution and downward extent of major faults that separate crustal blocks, and their relation to mineralization.

Benefits

Research techniques and interpretations of deep crustal structure in Yugoslavia will be helpful for comparison with, and possible improvement of, techniques and interpretations applied on comparable studies in the United States. Information on the base of the crust in Yugoslavia will aid in current research on world-wide mechanisms of continental evolution that affect North America. This project utilizes considerable information and research capacity in Yugoslavia, developed as a result of similar geophysical studies during the past several years.

Funding

Funding for this project was $50,000 in fiscal year 1972 and $40,000 in 1973. Funding of $40,000 in fiscal year 1974 is requested with the expectation that the project will be completed in fiscal year 1975 at a total funding of $300,000 over a four-year period.

(28) RESEARCH ON ULTRAMAFIC ROCKS AS RELATED TO THE EXPLORATION FOR CHROMITE AND OTHER ECONOMIC MINERALS
(Yugoslavia)

Objective of Research

This project is intended to identify factors that may explain the distribution of chromite and other minerals in ultramafic rocks, and the origin and emplacement of these rocks in relation to evolution of the earth's crust.

Goals of the Project

To complete a detailed study of selected ultramafic masses and associated rocks in Yugoslavia; establish criteria for recognizing their origin, mechanism of emplacement, and economic potential; and compare these criteria with similar rocks in the United States.

This project involves field investigation of ultramafic rocks at selected localities in central Yugoslavia supplemented by petrographic, mineralogic, and geochronologic studies of samples. A vast amount of data previously collected by the Yugoslav geologist is being compiled and evaluated, along with results of new field and laboratory work.

Benefits

An understanding of the origin and emplacement of ultramafic rocks is important to the United States, as well as Yugoslavia, because they are sources of chromite, nickel, platinum, magnesite, asbestos, and other economic minerals. This project will help establish exploration guidelines for these minerals and criteria for

interpreting the significance of ultramafic rocks to fundamental processes of volcanism, mineralization, and crustal evolution.

Funding

This project was delayed by unexpected problems encountered within the Yugoslav contracting institute which necessitated restructuring the project and changing institutes. Fiscal year 1972 funding was deferred to fiscal year 1973 and reduced to $10,000. Funding in fiscal year 1974 is requested at $45,000 and total funding requirements are estimated to be $230,000 for a five-year period.

(29) RESEARCH ON RARE METAL MINERALIZATION
(Yugoslavia)

Objective of Research

This project is intended to develop better criteria for appraising rare metal resources in granitic and associated rocks, and a better understanding of the origin and geologic associations of such deposits.

Goals of the Project

To complete detailed mineralogic, chemical, petrographic, and structural studies of granitic rocks, and associated metamorphosed and mineralized zones in the Cer and Bukulja areas of central Yugoslavia. From these studies, efforts will be made to identify the relationship between rare metal mineralization, petrographic phases of the intrusives, and structural features.

This work is a continuation of studies initiated in fiscal year 1972. It involves detailed mapping, sampling, and laboratory analysis of the rocks in selected areas within a belt of intrusive rocks that contains rare metal deposits.

Benefits

Research expertise and information concerning the rare metal province in Yugoslavia are utilized in this project to develop information and concepts that can be compared with results of similar studies in the United States. The Yugoslav rare metal province provides an opportunity to test concepts and methods that may be useful in similar provinces in the United States and elsewhere.

Funding

The total estimated cost of this project over a three-year period is $90,000 with $30,000 being available for fiscal year 1972 and fiscal year 1973. An appropriation of $30,000 is requested in fiscal year 1974 for completion of this project.

(30) RESEARCH ON GEOLOGIC AND HYDROLOGIC FACTORS AFFECTING URBANIZATION AND ECONOMIC DEVELOPMENT
(Yugoslavia)

Objective of Research

Methods and techniques of geological investigation applicable to problems of reconstruction, economic and urban development in a seismically-active region will be tested under this project for comparison with and possible use on similar projects in the United States.

Goals of the Project

Project goals will be identify and test methods that will provide coordinated geological, geophysical, and resources data needed for seismically-stable construction, urban planning, and regional development in areas severly affected by earthquakes.

This project was started in fiscal year 1972 in the Bosanska-Krajine area of Yugoslavia. Detailed geologic studies in the Bosanska-Krajine area, which was severely damaged by recent earthquakes, will be continued, with emphasis on active faulting, ground stability, and hydrologic conditions in areas especially subject to seismic damage. Compilation of resource data for construction and economic planning will be carried forward, including data on raw materials locally available for reconstruction.

Benefits

The Bosanska-Krajine area offers an opportunity to study methods, techniques, and applications of geologic research in an area of severe seismicity where economic growth and urban planning are affected by earthquake hazards similar to some areas in the western United States. This project will involve a substantial cadre of well-qualified Yugoslav geologists whose research on geologic and hydrologic effects and their minimization is a contribution to the future development of the region and a means of testing methods and techniques useful in the United States. It should serve as a model that can be applied in other areas.

Funding

Requested funding for fiscal year 1974 is $50,000 and total funding estimated for the project over a five-year period is $185,000. Funding in fiscal year 1972 was $60,000 and fiscal year 1973 was $55,000.

(31) RESEARCH ON APPLICATIONS OF GEOPHYSICS FOR DEFINING PERMEABILITY IN KARSTIC TERRAIN
(Yugoslavia)

Objective of Research

Methods of study and instrumentation related to hydrologic problems in areas of cavernous rock formations will be developed and tested, and guidelines for their use in engineering projects will be prepared.

Goals of the Project

Project goals will be to prove the utility of geophysical techniques for recognizing and mapping solution cavities and for determining underground water circulation by remote means.

This project is a continuation of work started in fiscal year 1972. Geophysical and supporting ground surveys will be carried out in selected areas of the Karst region, Yugoslavia, along with studies of ground water movement, involving the use of radioactive tracers. Drilling and geophysical logging of areas selected on the basis of previous work will be undertaken in fiscal year 1974 to test the applicability of geophysical methods.

Benefits

Geological Survey is currently developing new surface and subsurface geophysical instrumentation to determine the presence in voids of rocks and to locate and map solution caverns. The cavernous Karst region of Yugoslavia and the capabilities of Yugoslavia scientists can be used to develop and test equipment, techniques, and interpretations that can be applied in the U.S. for the design of

dams, reservoirs, and waste-disposal systems in areas of cavernous limestone.

Funding

Requested funding for fiscal year 1974 is $40,000 which will complete the funding requirements for this project. Funding in fiscal year 1972 and fiscal year 1973 was $40,000 and $60,000 respectively.

(32) RESEARCH ON GEOTHERMAL ENERGY AND THERMAL WATER RESOURCES
(Yugoslavia)

Objective of Research

This project is intended to develop and improve concepts regarding the relation of geothermal and thermal water resources to regional geologic features, to provide additional guidelines for geothermal exploration that may be helpful in the United States and elsewhere, and to test new techniques of appraising geothermal resources.

Goals of the Project

Project goals will be to identify the distribution and characteristics of geothermal resources and thermal waters, which are widespread in Yugoslavia, especially in relation to regional structural and stratigraphic units; to appraise the concepts deduced from this study in relation to geothermal exploration possibilities especially in the western United States; and to make a specific evaluation of techniques for geothermal resource appraisal.

The program will consist of mapping, sampling, and analysis of thermal springs together with collection of regional geothermal data and related geological information using selected geophysical and geochemical techniques. This will be followed by a study of the inter-relationship between thermal conditions and geologic features, comparison and evaluation with geologic parameters covering the distribution of geothermal energy and the composition of thermal waters in other countries.

Benefits

The increasing need for energy has focused attention in the United States, Yugoslavia, and many other countries on geothermal resources. Related studies of the characteristics and mineral composition of thermal waters have also become increasingly important not only as related to geothermal exploration but also as potential sources of various mineral raw materials. Yugoslavia provides an unusually good field for research on geothermal and thermal water resources because of wide distribution of geothermal and thermal water areas. This project will utilize the favorable geologic environment, interest, and technical capability that exists in Yugoslavia to augment the research that is being carried out in the United States.

Funding

This is a new project for fiscal year 1974 with an estimated cost of $95,000 over a three-year period. An initial appropriation of $40,000 is requested for the first year funding of this project.

(33) RESEARCH ON GEOLOGIC CONTROLS FOR NON-FERROUS METAL MINERALIZATION
(Yugoslavia)

Objective of Research

To identify geologic factors controlling the regional distribution of non-ferrous

mineral deposits and develop improved guidelines for exploration and appraisal of mineral districts.

Goals of the Project

This project will compile and synthesize information on the distribution, form, mineralogy, and geologic environment of lead, zinc, copper, mercury, and antimony deposits. This information will be evaluated in relation to regional structural, stratigraphic, and other geological features, in an effort to improve concepts of geologic controls for the mineralization. Changes in the composition and distribution of mineralizing agents with time will also be studied, with particular attention to relations between mineralization, metamorphism, and crustal evolution. The overall goal will be to develop or refine concepts of mineral controls that can be used to improve the search for, and appraisal of, ore deposits.

The work of this project will be based to a large extent on data already collected by Yugoslav geologists, which will be restudied in the light of new concepts of crustal evolution and augmented by field examination and analytical work at selected mineral localities.

Benefits

Yugoslav geologists have, in the past, undertaken considerable research on regional mineralization and have accumulated considerable data on the widely-scattered deposits of non-ferrous metals in that country. These data have not been studied in the light of new concepts in structural geology, however, or new information accumulating from other projects underway in that country. This project will make use of Yugoslav expertise and information to improve and test concepts that will be helpful for regional mineral investigations in the United States and elsewhere.

Fudning

This is a new project for fiscal year 1974 with an estimated cost of $120,000 over a three-year period. An initial appropriation of $40,000 is requested for the first year funding of this project.

(34) ENVIRONMENTAL CONSIDERATION OF WATER RESOURCES IN URBAN PLANNING AND MANAGEMENT (Yugoslavia)

Objective of Research

To investigate and test improved methods for evaluating water resources in relation to environmental factors in planning urban development.

Goals of the Project

This project will make detailed descriptions of water resources and environmental factors in selected metropolitan areas in Yugoslavia and utilize this information in formulating plans for development based on resource appraisal. Available water resources information on sources of water (including availability and quality), uses of water, existing and potential pollution, and disposal will be assembled and collated. Gaps in information will be supplemented by short-term collection of vital specific data. Data will then be interpreted in terms of urban water-realted problems such as water supply, waste-water disposal, land pollution susceptibility, urban runoff management, and recreational aesthetic considerations. The end result will be a series of maps, charts, and perhaps mathematical models which will enable land-use planners to evaluate the environmental consequences of alternate development plans on the total water resources.

Benefits

In the United States urban planning and management based upon resources considerations is rapidly replacing the former socio-demographic approach which has degraded our environment. Urban planning based on resource considerations will require a considerable base of new hydrologic data and new methods of interpreting the data to make them useful. At present, studies are being conducted in seven metropolitan areas to accomplish this. Such studies in one or more metropolitan areas in Yugoslavia would permit extension of our experience into a wider range of related physical features (geology, climate, topography, etc.) and permit investigations of broader applications of methods and techniques. This in turn will provide a broader comprehension of the role of water resources in environmental planning for urban areas.

Funding

This is a new project for fiscal year 1974 with an estimated cost of $100,000 over a three-year period. An initial appropriation of $25,000 is requested for the first year funding of this project.

(35) DESALINATION OF SALINE WATER
(Yugoslavia)

Objective of Research

The objective of the research is development of more efficient and economical techniques for desalination of sea and brackish waters.

Goals of the Project

The program has two major areas of effort, viz. membrane processes (reverse osmosis and osmosis) and humidification (solar distillation). In the first area the goals are to develop more productive cellulose acetate and other asymmetric membranes for reverse osmosis, and to develop membranes which will be suitable for a direct (rather than reverse) osmotic process. In the second area optimal conditions will be determined for utilization of solar energy in stills where the evaporator is separated from the heater. The practicality of using electric energy and waste heat from diesel engines will be assessed.

Benefits

Throughout the world desalination is becoming increasingly important as an alternate source of water supply for areas deficient in fresh water. The economic viability depends on the saline water source and local conditions. An area where conditions are very favorable is the coastal regions and islands of Yugoslavia. Water-permeable karstic ground, wide dispersion of the relatively small towns, long drought periods which coincide with the main tourist season, all contribute to the inadequate fresh water supply. Some towns are still supplied by rainfall catchment, and some islands are dependent on water transport by tankers. The rapid development of the tourist economy makes the problem even more severe. In some cases any further expansion of the tourist economy is practically stopped because of the problems in the fresh water supply.

Desalination is, in some cases, the most economical or the only means of fresh water supply for some islands. The specific problem related to the conditions of the application of desalination on the Yugoslav coastal region is need for economical equipment of relatively small capacity--a need found in many areas of the United States, and, indeed, throughout the world.

Funding

The total estimated cost of this project over a three-year period is $100,000 with $22,057 being available for fiscal year 1972 and $27,941 being available for fiscal year 1973. An appropriation of $50,000 is requested for the completion of this project.

ITEMIZATION OF ESTIMATE

Appropriation Title: Salaries and Expenses (Special Foreign Currency Program) — Office of the Secretary

	1972 Actual	1973 Estimate	1974 Estimate	Increase (+) or Decrease (-)
Program and Financing:				
Total obligations.....	$472,314	$527,686	$1,630,000	$1,102,314
Unobligated balance, start of year.....	---	-27,686	---	+27,686
Unobligated balance, end of year.....	+27,686	---	---	---
Budget authority (appropriation).....	500,000	500,000	1,630,000	+1,130,000
Object Classification:				
25 Other services.....	472,314	527,686	1,630,000	+1,102,314

Mrs. HANSEN. In your opening statement you refer to some difficulties in getting available funds released in this program. What is the nature of that problem?

Mr. HITE. Mrs. Hansen, we have with us today Dr. James Slater, Dr. Elburt Osborn and Dr. John Reinemund, all from the Department who have done most of the detailed work on this fund. Dr. Slater will respond.

Mr. SLATER. Thank you, Madam Chairman. The difficulties have been the rather rapid draw-down on these currencies. On June 30, 1972, there were $352 million in the excess category for Poland and $38 million for Yugoslavia. Poland now is in the area of $300 million and Yugoslavia is $7.2 million. The Treasury Department felt that we ought to take a reading on this and make sure that the draw-down wasn't coming about too fast.

The State Department, Treasury Department and other agencies participating didn't forecast this rapid draw-down so we could properly phase out these programs.

What we are trying to do now, Madam Chairman, with the $7.2 million in Yugoslavia is to have the Yugoslavs to at least match that amount so we will have in the neighborhood of $14 or $15 million available for these purposes. A Yugoslav delegation is coming over later this month to discuss this matter.

Mrs. HANSEN. Do you have any hopes that it will be resolved?

Mr. SLATER. Yes, we are assured that the moneys on the program that you authorized for 1973 will be given to us to meet our priority needs to continue this program.

Mrs. HANSEN. The Smithsonian has a long list of foreign currency projects in the same areas. Aren't they after the same dollar?

Mr. SLATER. Yes, Ma'am. It's competing with all other agencies. There are about 15 or 17 agencies in this program every year. It has been so the last several years. The Smithsonian is using the same excess foreign currency as Interior and all the other agencies.

We just started the program in 1972. We feel that we have some top priority projects. Dr. Osborn or Dr. Reinemund can speak more specifically to the technical details of these projects and the benefits we are getting out of them. Agriculture has been using these funds since 1958. HEW started shortly thereafter. We are just now beginning to benefit from the use of these excess currencies.

Mrs. HANSEN. What have been the specific results HEW has discovered?

Mr. SLATER. Frankly, I am not familiar with all their projects. In fact, this year they reduced their request considerably, but in 1973 HEW had about $25 million. This year they are down to about $2 million or $3 million. They have dropped considerably.

Mrs. HANSEN. What is your present unobligated balance in this account?

Mr. SLATER. We have about $28,000 unobligated from fiscal year 1972 out of a total of half a million dollar authorization.

From fiscal year 1973 we have $235,000 unobligated as of the present. This is entirely in Yugoslavia, where we have had this problem on the rapid draw-down.

SPECIAL FOREIGN CURRENCY REQUEST

Mrs. HANSEN. You are requesting an increase of $1.130 million for the special foreign currency program. Many of your projects were reviewed the other day by Dr. Osborn, when he appeared before the committee with the Bureau of Mines. He did an excellent job. We reviewed a number of the Polish and Yugoslavian projects. The Polish projects are largely in the coal mining area. Is this not correct?

Mr. OSBORN. Yes.

HIGHLIGHTS OF COAL MINING PROJECTS WITH POLAND

Mrs. HANSEN. Please for the record, highlight some of the major projects.

Mr. OSBORN. I would be very glad to, Mrs. Hansen and members of the committee.

Let me say first that Poland is a unique country with respect to the coal mining. It's in a position very similar to the United States in that it has an abundance of coal, a great abundance for a country that size. But it has very little oil and gas. Of course, we too are running low on oil and gas and have a very large coal reserve.

They are committed, as we are right now, to intensive research on all aspects of coal, health and safety being one of the most important, so they can mine more with fewer accidents.

I was in Poland for 4 days this past summer looking into the general competence of their research, the quality of their research people and the educational institutions in this field and the mining schools. I also went underground in some of their mines.

There is no question in my mind but that we can, and are beginning right now, this year, to benefit greatly from this contact with them. They have a Central Mining Research Institute at Katowice with about 2,000 employees which is comparable, as far as the number of people goes, to the total effort of our country.

It's a good program, but they can do better in the fields that we are especially interested in with help from us. It's doing just the type of work that we like to have done.

Mrs. HANSEN. How many of our people are working in these countries?

Mr. OSBORN. In this field?

Mrs. HANSEN. Yes.

Mr. OSBORN. We don't have any over there with them. We are monitoring this cooperative work. One of our experts spent about 2 weeks over there. We are requiring regular reports from them. Two of their top men, one who is a member of the National Academy of Science in Poland who is in the explosive research in coal, Dr. Cybulski, and his colleague were here for 2 weeks this fall visiting us and seeing our work in explosives.

We started with what we thought were top priority programs, all of them in the safety field. One program is on initiation of explosions; that is, how the ignition first occurs. We have done a lot in this field, but they can do complementary work.

Second, on trigger barriers, they call it, for extinguishing explosions. This they can do and we can't do without a great expenditure. They have an experimental tunnel which is big enough to do this type of

research. Our experimental facility isn't large enough to do what needs to be done.

A third study going on now over there is on roof control, which is the main cause of fatalities in the coal mines in the United States. They are developing new techniques for estimating the safeness of the roof. These three are going on now. Those efforts total $110,000 a year, all three of them.

A contract for a fourth project, at $55,000 this year, has just been negotiated, which is in the field of coal liquefaction which you know is very important in this country. They will be working on a small part of this conversion process which complements our work.

Mrs. HANSEN. It doesn't overlap with other projects?

Mr. OSBORN. No, it's on a specific problem related to catalysts. Meanwhile, they have our information available. We always publish everything. One of the advantages of this arrangement is that it opens up to us information not only on their work but to some extent the Russian work that they are familiar with. So we are catching up very rapidly now on what is known in central and eastern Europe in this field.

Mrs. HANSEN. Is this also true with the Yugoslavian projects?

Mr. OSBORN. Yugoslavia is a little different. I don't think that is as high priority as this coal work. It is work complementary to ours in the field of mineral preparation in iron ore and nickel ores. It's useful, but I don't think it's as important as the coal.

Mr. SLATER. We have Dr. Reinemund here from the Geological Survey, who has most of the program in Yugoslavia, if you would like to cover those benefits.

Mr. OSBORN. Mrs. Hansen, I was speaking only about the Bureau of Mines when I mentioned Yugoslavia's projects not being as important as Poland's. That was with respect to the Bureau of Mines projects. I didn't mean to say that the Geological Survey's projects in Yugoslavia were not as important as our project in Poland.

Mr. EVANS. Some of the areas for which you are requesting funds, such as coal liquefaction and coal gasification, are also being studied through extensive programs under the Office of Coal Research. Compare and contrast for me the research being done by the Office of Coal Research and Bureau of Mines, with the research you are proposing under the special foreign currency program.

Mr. OSBORN. The research proposed on coal gasification and liquefaction to be carried out in Poland is to supplement work by the Bureau of Mines and Office of Coal Research. The research seeks to provide needed technological advances in important process areas, especially those involving catalysis, which result in improved yields of products, and to prevent catalyst deactivation. In addition, work will be carried out on improved solids separation. Such information can have an application in various processes under investigation both here and abroad. A further point is that almost all the Office of Coal Research work is concerned with engineering scaleup in contrast to the chemical process research proposed.

Mrs. HANSEN. Please insert in the record, Dr. Osborn, the top priority items.

Mr. OSBORN. I will be happy to.

[The information follows:]

ORDER OF PRIORITIES FOR SPECIAL FOREIGN CURRENCY PROJECTS PROPOSED BY THE DEPARTMENT OF THE INTERIOR FOR FISCAL YEAR 1974 IN POLAND AND YUGOSLAVIA

Project title	Country	Fiscal year 1974 funds requested
Category I. Projects continuing from fiscal year 1973:		
(1) Initiation of coal dust explosions	Poland	$40,000
(6) Research on base metal deposits in carbonate rocks	do	50,000
(2) Trigger barriers for mine safety	do	30,000
(7) Research on mining hydrology	do	35,000
(3) Coal mine hazards	do	40,000
(4) Mineral recovery from desalination brines	do	60,000
(5) Liquefaction of coal	do	100,000
(27) Research on crustal structure in relation to earthquakes, intrusives, and metallogenic provinces.	Yugoslavia	40,000
(25) Production of nickel from low-grade nickel-bearing iron ores	do	30,000
(28) Research on ultramafic rocks as related to the exploration for chromite and other economic minerals.	do	45,000
(26) Use of lignite in the reduction of ferrous metals	do	30,000
(29) Research on rare metal mineralization	do	30,000
(30) Research on geologic and hydrologic factors affecting urbanization and economic development.	do	50,000
(31) Research on applications of geophysics for defining permeability in karstic terrain.	do	40,000
(35) Desalination of saline water	do	50,000
Category I total		670,000
Category II. New projects, top priority:		
(16) Development of roof fall prediction methods based on bore-hole penetrometer	Poland	40,000
(8) Comparative research on coal basins and coal characteristics	do	35,000
(20) Stability of head and tail entries in Longwall coal mines	do	40,000
(10) Research on coal data processing	do	30,000
(19) Optimization of automated coal mining	do	50,000
(22) Pneumatic stowing for ground support	do	50,000
(11) Coal gasification to low-sulfur, low-Btu gas	do	100,000
(17) Development of coal bump prediction techniques based on measurement of drilling dust volume	do	30,000
(9) Study of underground coal gasification	do	50,000
(12) Chemical removal of sulfur from coal	do	50,000
(13) Noise reduction studies	do	30,000
(14) New concepts for mine illumination	do	30,000
(23) Mechanical preparation of coal	do	100,000
(21) Microseismic study of Longwall mining	do	40,000
(18) Use of slurry explosives in mining	do	30,000
(33) Research on geologic controls for nonferrous metal mineralization	Yugoslavia	40,000
Category II total		745,000
Category III. New projects, secondary priority:		
(15) Development of pulsed neutron method of evaluating uranium deposits	Poland	50,000
(24) Metallurgical coke from marginal and noncoking coals	do	100,000
(32) Research on geothermal energy and thermal water resources	Yugoslavia	40,000
(34) Environmental consideration of water resources in urban planning and management	do	25,000
Category III total		215,000

Category III projects are regarded as important and would be eliminated only if congressional action requires a limit on the number of projects. If that action places a limit only on funds, and if that limit is not too restrictive, we might want to start all new projects, but at a reduced level for fiscal year 1974.

We are very hopeful that the Congress will approve Interior's entire fiscal year 1974 request for excess foreign currencies. It seems reasonable that before any other agency which has been expending Public Law 480 money for many years gets additional funds, Interior should receive its entire request because: (1) We just started our excess foreign currency program in 1972 and are still working on top priority projects whereas those other agencies are working well down their scale of priorities by now; (2) many of our research projects are directed at saving the lives of U.S. miners (the money is well spent if only one life is saved); (3) our work will help U.S. industry by providing opportunities to sell research equipment for the Public Law 480 work and by the research results and contacts we develop leading to export of U.S. products; (4) Public Law 480 research is programed to complement and to benefit directly U.S. domestic research, thus saving U.S. dollars and shortening the time required to produce results; and (5) Poland and Yugoslavia have experienced and com-

petent research personnel, well defined structural and metallogenic provinces, excellent facilities in our Public Law 480 research fields, and a considerable amount of data that can be utilized in carrying out this research.

DESALINATION RESEARCH IN POLAND

Mr. McDade. Will you provide an explanation of the saline water program in Yugoslavia?

Mr. Slater. The benefits, perhaps, and so on.

Mr. McDade. Yes; you are closing down a lot of our activities. I didn't know they possessed more information in the saline water field than we have. I would like to know something about it.

Mr. Slater. You would like a statement on that, as well.

Mr. McDade. Yes.

[The information follows:]

PUBLIC LAW 480 DESALINATION RESEARCH IN POLAND

The objective of the research is development of economically viable processes for recovery of minerals from desalination plant brines. Economic utility of desalination plant brines will be established for applications such as: (a) Antifreezing material in liquid and solid form; (b) recovery of magnesium compounds as refractory materials; (c) recovery of mixtures of sodium and magnesium compounds for industrial purposes; and (d) conceptual studies for utilization of mother liquors from a full-scale plant.

Technology has been developed on a laboratory scale to produce crystalline salt, gypsum, and purified water from saline mine drainage waters by an evaporation process which does not require chemical pretreatment. Pilot plant scale studies are being carried out, and a full scale unit for one mine is under construction. This process yields a brine concentrated with magnesium salts. The subject investigation is concerned with the recovery and utilization of salts from this brine.

The results from this study are published in English and made quickly available to U.S. counterparts. Penalties imposed by the Polish Government on discharging brine into rivers makes recovery of mineral byproducts from those brines economically feasible. This is an approach to pollution control that many industrialized nations are considering, and the necessary technology developed for byproduct recovery and scale control of evaporator units is being made available to us through our program. As regulations on brine discharge become more restrictive, this technology will become increasingly necessary. The project has demonstrated a new method of scale control wherein calcium sulfate (scale) is deposited onto small iron filings which are introduced into the evaporator system, rather than onto heat exchange surfaces. Various schemes for byproduct recovery have been disclosed, but not fully evaluated.

The problems are complex with many nuances. While U.S. technology is generally more advanced than Polish technology, the project has been limited to a particular area where they do have outstanding capabilities and expertise. The Polish policy of assessing penalties for discharging brine into rivers has given them an economic incentive to recover dry salts from their brines. This represents the "ultimate" in brine disposal and is the direction in which all industrial nations are slowly moving. In imposing penalties for brine discharge, the Poles are forcing their mining industry to take a leading stance among the countries of the world. We have much to learn by watching their experience. This is particularly true in view of the "energy crisis" and this country's newly recognized dependence on coal. We must realize that it takes 3,000 gallons of water to produce a ton of coke, 1,700 gallons of water to process a barrel of oil, and 80,000 gallons of water to generate a megawatt of electricity. As our more readily available fuels are depleted, extraction of energy sources will become more difficult and the figures cited will probably rise. Many of our unexploited proven reserves occur in areas in low rainfall where the ground water is quite saline. Thus, while the Polish experience has its own unique features, we can anticipate facing in the near future similar problems in the United States, and we can learn a great deal by watching their progress.

Public Law 480 Desalination Research in Yugoslavia

The objective of the research is development of more efficient and economical techniques for desalination of sea and brackish waters. The program has two major areas of effort, viz. membrane processes (reverse osmosis and osmosis) and humidification (solar distillation). In the first area the goals are to develop more productve cellulose acetate and other asymmetric membranes for reverse osmosis, and to develop membranes which will be suitable for a direct (rather than reverse) osmotic process. In the second area optimal conditions will be determined for utilization of solar energy in stills where the evaporator is separated from the heater.

Results are published in English and quickly made available to U.S. counterparts. A new solution structure—evaporation rate theory of membrane formation has been developed which has received world-wide recognition and has given significant insight into the mechanism of reverse osmosis membrane formation. While the United States is generally far ahead of Yugoslavia in desalination technology, the particular group working on this project has outstanding competence, and, in addition to making their results known to U.S. researchers, serve as a useful contact for U.S. equipment to the Yugoslav market. The project itself purchases some U.S. equipment. The investigators are aware of the capabilities of U.S. equipment and hopefully will purchase it for other (non-project) needs. In Yugoslavia there is a great potential market for desalination equipment along the Adriatic Coast, which would be a great resort area for tourists except that adequate water supplies are available at only a few locations. The economics of water for tourism use can readily be met by desalting and the Yugoslavs are very interested in further developing their coast by use of desalination plants. Through project contacts they are made aware of U.S. desalination capabilities. As a matter of fact, the U.S. Embassy, Belgrade, last year cabled the following:

> "We see important commercial opportunities both in landing substantial contracts for project planning and in follow-on sales water treatment equipment. Yugoslavs recognize U.S. preeminence in this field and some water resource leaders have in recent years already had preliminary contacts with potential U.S. supplies. We would therefore suggest that Commerce provide 'early warning' to U.S. firms."

Although Federal support for the domestic desalting program is being cut back, the benefits of the Public Law 480 program exist independent of the size of the effort being sponsored domestically. Indeed the Public Law 480 program can help supply answers to our own desalination problems, and at the same time lead to foreign markets which will help sustain a viable U.S. desalting industry.

Central Energy Research and Development

Mrs. Hansen. We will insert justification pages 1 through 3 at this point in the record.

[The pages follow:]

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
CENTRAL ENERGY RESEARCH AND DEVELOPMENT FUND

Appropriation/Total available, 1972..... -0-

Appropriation/Total available, 1973..... -0-

Summary of Increases and Decreases, 1974

Research and Development:	Base for 1974	Increase 1974
Establish a central energy research and development fund.....	-0-	$25,000,000
Budget estimate, 1974.....		25,000,000

Analysis by Activity

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Amount Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 Compared with 1973
Research and Development.....	----	----	$25,000,000	$+25,000,000
Total.....	----	----	25,000,000	25,000,000

JUSTIFICATION

Research and development: Fiscal year 1973, -0-; fiscal year 1974, $25,000,000; increase $25,000,000. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+25,000,000	---	$25,000,000	---	Proposed level of funding for Departmental research effort.

The Department is requesting the establishment of a Central Energy Research and Development Fund in fiscal year 1974 to be administered by the Office of the Secretary. The purpose of this fund is to provide a flexible, central source of support to exploit technological opportunities that may arise to deal significantly with non-nuclear energy concerns with particular emphasis on the solution of near-term problems. This requested, initial appropriation is for $25,000,000 to remain available until expended, to encourage and support research and development programs involving non-nuclear energy production, processing, transportation and utilization, and the conservation of energy.

Technological breakthroughs resulting from research and development efforts are difficult to predict. The use of this fund will reduce the delay by providing immediate funding to facilitate acceleration of those research and development efforts which begin to show significant promise after budget plans have been made.

Energy production and public interest and concern with associated technology has risen rapidly within the past few years and the areas that need to be explored today often no longer conform to traditional agency lines. The environmental impacts of energy production, the socio-economic trade-offs related to the use of differing fuels, second and third order effects of massive energy projects all offer examples of the multidisciplinary studies that now need to be pursued. This fund will permit central planning and funding for problem assessments of this type and result in a more efficient and timely approach to their resolution.

The support of innovative energy research and the study of new approaches to energy problems is often hindered by the momentum existing behind current research plus the time lag associated with changing institutional perspectives. The Central Energy Research and Development Fund would permit needed longer term research and development to continue while providing the Department with the means of placing new, short time frame problems with institutions that can best cope with them.

This fund will permit the Department to:

- take advantage of research opportunities and meet research needs that arise unexpectedly and on which further investigation should not be delayed,
- conduct research that cross-cuts individual bureau responsibilities and involve coherent management of a number of separate efforts,
- and pursue investigations of energy related areas such as fuel conservation that are not now the responsibility of one Agency.

Possible Areas of Research

Coal Conversion

Programs for converting coal to environmentally acceptable energy forms are in progress. The Department, through the Office of Coal Research and the Bureau of Mines, is developing four processes for converting coal into synthetic natural gas in collaboration with industry. This derived gas will be miscible with natural gas and transported in the natural gas pipeline systems, to be burned directly by the ultimate consumer.

A second program provides for converting coal into gas with lower thermal value than that of synthetic natural gas. This gas could be used in utility boilers or in the combined gas turbine-steam turbine cycle to produce electric power. This program, in collaboration with industry, is focused on two different methods of gasification and also involves research on high-temperature gas clean-up.

A third program, also in collaboration with industry, involves the solvent refining of coal into a low-ash, low-sulfur liquid or solid fuel that can be used to produce electric power.

Among the potential technological opportunities in these programs are breakthroughs in gasification, high-temperature gas clean-up, or, as mentioned above, the possibility of integrating processes into a multi-fuel coal conversion plant in which, for example, solvent-refined coal would be produced in liquid and solid forms together with a low-sulfur fuel oil.

Underground Coal Gasification

The potential benefits of gasifying coal in place include reduction of the health and safety hazard of the workers extracting this energy, greatly reduced environmental impact and the extraction of energy from coal deposits that would otherwise prove uneconomical. Underground gasification research has much to gain from the experience of industry in boosting recovery of underground fossil fuel resources and also stands to profit from the process. Since this area is relatively unexplored, unplanned problems and break-throughs are possible. The Department should be prepared to offer swift flexible support when the occasion arises.

Energy Conservation

Recent studies by the Office of Emergency Preparedness and other organizations have pointed out that a number of areas exist where elementary conservation measures might significantly reduce the volume of oil imports required to supply future needs. These areas include improved insulation in homes and commercial facilities, shifting of transportation modes and more efficient industrial processes and equipment. Research needs to be done on quantifying the potential benefits and the mechanisms of bringing reduction in energy usage about. The socio- economic trade offs of any actions taken in this area require detailed technology assessments.

Administration

This fund will be used for specific projects identified by the Department and reviewed by the Department's Energy Board, chaired by the Secretary. Proposals on non-nuclear energy research, with emphasis on near-term, may be submitted by industry, universities, or governmental agencies. Projects approved by the Department will be forwarded for review of the Office of Management and Budget, and the Congress. Co-sponsorship of select projects by industry and government is contemplated.

When the potential of a new approach has been established, the Department will revert to normal budgeting procedures for its continued support. Project funding will be provided by the Department directly to contractors or to other agencies with technical management capability and will not be used to build up internal research staffs. The required administrative support, including contract monitoring, will be provided by the Department with reimbursement to be made from the Fund.

ITEMIZATION OF ESTIMATE

Appropriation Title: Central Energy Research and Development Fund — Office of the Secretary

	1972 Actual	1973 Estimate	1974 Estimate	Increase (+) or Decrease (-)
Program and Financing:				
Total obligations.....	$ ---	$ ---	$25,000,000	$+25,000,000
Budget authority (appropriation).....	---	---	25,000,000	+25,000,000
Object Classification:				
25 Other services.....	---	---	25,000,000	+25,000,000

CENTRAL ENERGY R. & D. CONCEPT

Mrs. HANSEN. Will you explain the basic philosophy behind your decision to provide energy R. & D. funding separate from the operating bureaus, such as the Bureau of Mines, Geological Survey, and the Office of Coal Research?

Mr. LAY. Yes, ma'am. The main idea was to have greater flexibility in our R. & D. program. As you well know, because of the budget cycle process, oftentimes we make our budget decisions as much as 18 months or so before the actual time when that money is spent on programs.

Recently, of course, there has been a very sharp increase in overall energy R. & D., and particularly again in the fossil fuel area. We think by having these moneys uncommitted until the beginning of the fiscal year we can make our decisions such that we can remove bottlenecks and get new programs started a little faster that seem very promising in helping solve some of these energy problems.

Mrs. HANSEN. By what logic was this $25 million figure derived? What would be the impact of $10 million or $15 million instead of $25 million?

Mr. LAY. There is no sacredness in the $25 million figure, I would be misleading you if I said there was. There was a lot of discussion, both within OMB and within the Department, as to different areas that we thought might be promising candidates for this money. The $25 million figure was arrived at through these discussions.

It's basically an experimental concept. It's something that we think we can use and, hopefully, speed up some of our own research and again particularly in things like coal research which we are all working very hard on now. There is no sacredness in the figure. It could easily be $20 million, or even $30 million, or $35 million, or $15 million.

Mr. VEYSEY. Is there authorizing legislation to do this?

Mr. WILES. The Secretary has authority to do research in coal, or oil, or any kinds of minerals.

Mr. VEYSEY. This would all be what you call research?

Mr. WILES. Yes, this will be for research.

Mr. MCDADE. Doctor, I don't know another justification in any other subcommittee I have served on that I have seen like this. You want us to give you $25 million for contingencies, as you define them, when, as, and if they arrive. That is normally not the way we do things.

COMMITTEE APPROVAL OF PROJECT FUNDING

Mr. LAY. That is not quite so, Mr. McDade. We have previously discussed and agreed to come to this committee when we have decided specific projects we would like to fund. We have agreed to come to this committee and ask for your approval.

Mr. MCDADE. How many have you decided upon right now?

Mr. LAY. We have decided on none as of this moment. We have been developing the appropriate procedures.

Mr. MCDADE. The problem is that customarily the bureaus and agencies and departments come up to the Appropriations Committee with a request for money, whether it's NASA, whether it's HUD, or the Department of the Interior, any one I am familiar with, and

they have some specific ideas of what they are going to do. In response to Mr. Veysey, you said the figure could be $15 million.

Mr. LAY. The objective is clear, Congressman, I said that there was no sacredness in that particular dollar figure. The objective is to accelerate some of our fossil fuel research, working toward solutions of our short-term energy problem. Again, the areas that have the greatest promise are such things as coal liquefaction, and low Btu gasification.

Mr. MCDADE. Why not lump the whole department amount in and send it down? That is what he is asking us to do with this $25 million.

Mr. HITE. It would be for unforeseen opportunities in research.

Mr. MCDADE. Unforeseen opportunities?

Mr. HITE. Presently unforeseen, that the budget cycle can't accommodate because it's inflexible once the money has been appropriated.

Mrs. HANSEN. Your budget cycle can accommodate situations through the reprograming procedure.

Mr. HITE. It's somewhat analagous to the inholding contingency we have in the Park Service. We have $10 million in the contingency for Park Service acquisition. When these opportunities to acquire arise, we come to you and ask your permission to expand funds for a specific acquisition. This would be somewhat similar to that.

Mr. LAY. All we are saying is we are moving, we have, very fast in several research and development areas, particularly coal research, and we are beginning to get into geothermal a little more actively now and other areas. In many cases we cannot foresee some of the problems and bottlenecks. So it gives us an opportunity to get projects in during the budget cycle. We think this procedure, working with the committee, would allow us to move ahead a little faster on some of these programs.

Mrs. HANSEN. The biggest bottleneck to increased research has been in OMB. You wouldn't be near so far behind if the money had been spent when the committee had suggested that it be spent.

Mr. HITE. I agree, Mrs. Hansen.

Mrs. HANSEN. Over the years you have requested frugal budgets in this regard. Now all of a sudden you decide you need $25 million.

Mr. HITE. We didn't decide this unilaterally. It's an attempt, I believe, on the part of the administration, to establish some flexibility in the research area.

Mr. LAY. This amount and this fund was developed with OMB. They are in full support of the fund and the idea.

NONNUCLEAR R. & D. PROJECTS

Mrs. HANSEN. I will believe that when I see it.

You say this will be used for nonnuclear energy R. & D. Do you anticipate that AEC might receive some of the funds in this program?

Mr. LAY. There is a possibility, yes, Ma'am. A second purpose of the fund is, hopefully, to get a little better coordination among the nonnuclear R. & D. projects. There is a possibility that we would decide that some of the geothermal research, or maybe coal research done by AEC, is more promising during this fiscal year than what we are doing. If that is so, certainly they would be a candidate for it.

SELECTION OF PRIORITY PROJECTS

Mrs. HANSEN. Do you intend to establish research priorities and solicit proposals, or to wait for proposals to come to you and review them on a first-come, first-served basis?

Mr. LAY. We will establish priorities. That is what we are doing now. We will identify in many cases specific problems which have arisen which we would like to see solved. Then we will go out and solicit proposals directed to the priorities and to the problem areas. From those proposals we will select the projects that we think are most promising.

Some of these proposals can come, quite obviously, from within our own department. Others can come from academic institutions, private firms, or as you mentioned AEC, or elsewhere.

Mrs. HANSEN. What will be the review procedure for proposals?

Mr. LAY. There will be about a three-level review procedure. We hope to have a person within our department, such as the Director of Energy R. & D., who would have the first level review of these proposals. In other words, the Energy R. & D. staff people would review the proposals from the standpoint of technical feasibility, economic feasibility and as far as the promising nature of their approach to solving the problem.

We mentioned the Energy Board earlier today, which would be used for a departmentwide review of the recommendations from the Director of the Energy R. & D. staff. Then there will be a small group which will include other agencies, such as EPA, AEC, NSF, and probably the President's own Counselor on Energy, Charlie DiBona, which will be the review procedure of our recommendations. But the control of the fund and the final decision on each project will be made by the Secretary.

Mrs. HANSEN. You state that proposed projects will be forwarded to Congress. Will Congress have a veto power?

Mr. LAY. Our understanding with both the Senate committee and with you, I thought prior to now, but certainly now, is, yes, Ma'am. If we come up here with a project that you don't like, we will either try to sell you on the project or we will scrub it and get a new one.

Mr. WILES. We propose this would work the same way as inholdings. When the Park Service proposes to buy inholdings, we send a letter to both committees and, when they say no, we don't buy them.

It's the same procedure we have had for several years with the Park Service.

UNALLOCATED FUNDING REQUEST

Mr. VEYSEY. Madam Chairman, I become increasingly less clear about how this works as the discussion develops. If I understand it, this proposal is made so that you can have a fast-moving situation to take advantage of a target of opportunity that suddenly emerges, a great research breakthrough or something like that that comes along.

Later I hear you saying you are going to bring all these projects down here and we are going to approve them in advance anyway. So why don't you do it in the regular way? Instead of having a $25 million slush fund for Ph. D.'s to play with, why don't you bring the projects in and do them in the regular fashion?

Mrs. HANSEN. I have several questions like yourself, Mr. Veysey. For several years the committee has reminded the Interior Department, the Office of Coal Research, and the Bureau of Mines of the energy situation. In fact, the committee has added funds in this regard. Congress has had to nudge the Department. I am wondering what magic it took to convince OMB to let the Department have an additional $25 million. Forests funds are impounded as are moneys for many other projects.

Mr. LAY. I think quite simply it's just the matter of the importance of the energy situation right now.

Mrs. HANSEN. But the enery situation, which was pointed out to you 6 years ago, has been getting worse.

Mr. LAY. I agree, the energy problem has been getting worse for the last 6 years or 2 years or 4 years or whatever time frame you want to use. But it has not been widely known and acknowledged by a lot of people that it has been getting worse.

Mrs. HANSEN. No, but the Office of Management and Budget is supposed to be charged with long-range planning.

Mr. LAY. I can understand your reluctance, Madam Chairman. I think their attitude toward energy R. & D. has changed significantly. I don't think we have that problem with this fund.

Mrs. HANSEN. I will believe that when I see it.

Mr. VEYSEY. Would this money mostly go for basic research? Or would it go for hardware to accomplish some of these things? It's just terribly broad, it seems to me. I don't understand it.

Mr. LAY. It would go for some of both, but probably more for the basic research than the hardware. Obviously, when a project has proven out and we are working toward a pilot project or demonstration plant, then certainly it should be within the normal budget process.

What we are looking at here are situations where we do, during the budget cycle, identify projects or processes or, even something as I mentioned earlier, some bottlenecks which we think could be solved if we had some money to direct to that purpose. But we do not envision taking this money and building big pilot projects, for instance, or big demonstration plants. Obviously, those are the types of things that can come through the normal budget process.

Mrs. HANSEN. You have already cut some promising work in the Bureau of Mines. Isn't this correct, Dr. Osborn?

Mr. OSBORN. Yes.

Mr. HITE. The $25 million figure wasn't in the Department initiative. This level wasn't initiated by the Department. It was agreed upon within the administration, Mrs. Hansen. I really think the fund can be increased.

SALINE WATER RESEARCH

Mrs. HANSEN. We will insert justification pages 1 through 17 in the record at this point.

[The pages follow:]

SUMMARY AND HIGHLIGHT STATEMENT

The fiscal year 1974 Budget for saline water conversion research and development is $9,202,094 (including $6,675,094 planned carryover into 1974). Currently, the FY 1973 programs total $22,399,937, representing a redirected R&D effort this year pointing to a narrower, concentrated scope in FY 1974.

Research and development on freezing processes are programmed at $400,000 and on sea water membrane processes at $2,250,000. The balance of the FY 1974 program ($6,552,094) covers closing field facilities, operating and supporting Water Factory 21 (VTE/MSF module) at Fountain Valley, California, and administering the programs. Field development work on sea water membranes will be carried out at the Wrightsville Beach, North Carolina, Test Facility.

The FY 1974 research effort will be directed toward advancing the technology in the best potential freezing processes, investigating any new processes that appear most promising and accelerating applied research on current technology in the area of sea water membranes.

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY

Saline Water Research

Appropriation, 1973		$26,871,000
Unobligated balance:		
Start of Year	2,204,031	
End of Year	-6,675,094	-4,471,063
Total Available, 1973		22,399,937

Summary of Increases and Decreases, 1974

Research and Development:		
Research expense (decrease)	-1,400,000	
Development expense (decrease)	-8,824,937	
Construction, operation and maintenance:		
Test beds and facilities (decrease)	-3,343,000	
Modules	+1,370,094	
Administration and Coordination (decrease)	-1,000,000	
Net decrease, 1974		-13,197,843
Total available for obligation		9,202,094
Less: Unobligated balance from FY 1973		-6,675,094
Budget Estimate, 1974		$ 2,527,000

DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY

Saline Water Research

Analysis by Activities

	Actual Obligations 1972	Amount Available 1973	Fiscal Year 1974			Total available 1974 compared to total available 1973	Page Reference
			Estimated total Available	Unobligated Balance from 1973	Budget Estimate		
I. Research & Development Expenses:							
(a) Research	$ 5,364,477	$ 3,800,000	$ 2,400,000	$ 2,400,000	$ 0	$-1,400,000	6
(b) Development	10,639,589	9,224,937	400,000	400,000	0	-8,824,937	8
II. Construction, Operation & Maintenance:							
(a) Testbeds & facilities	5,048,196	5,593,000	2,250,000	2,000,000	250,000	-3,343,000	12
(b) Modules	1,194,935	1,182,000	2,552,094	1,875,094	677,000	+1,370,094	16
III. Administration & Coordination	2,662,953	2,600,000	1,600,000	0	1,600,000	-1,000,000	17
Totals	$24,910,150	$22,399,937	$ 9,202,094	$ 6,675,094	$ 2,527,000	$-13,197,843	

DEPARTMENT OF THE INTERIOR

OFFICE OF THE SECRETARY

Saline Water Research

PERSONNEL SUMMARY

	1972 Actual	1973 Estimate	1974 Estimate
Total number of permanent positions	149	140	78
Full time equivalent of other positions	13	11	6
Average paid employment	149	147	78
Average GS grade	10.8	10.8	10.8
Average GS salary	$19,430	$19,699	$19,983
Average salary of ungraded positions	$ 9,903	$ 9,903	$ 9,903

ITEMIZATION OF ESTIMATE

Department of the Interior

Appropriation Title: Saline Water Research

	Actual 1972	Estimate 1973	Estimate 1974	Increase (+) Decrease (-)
Program and Financial:				
Total obligations	$ 24,910,150	$ 22,399,937	$ 9,202,094	$-13,197,843
Receipts & reimbursements from Federal funds	- 64,634			
Recovery of prior year obligations	- 61,166			
Unobligated balance available, start of year	- 47,487	- 2,204,031	- 6,675,094	- 4,471,063
Unobligated balance available, end of year	2,204,031	6,675,094	---	- 6,675,094
Unobligated balance lapsing (Bolsa Island Project)	47,906			
Budget Authority (appropriation adjusted)	$ 26,988,800	$ 26,871,000	$ 2,527,000	$-24,344,000
Obligations by Objects:				
11 Personnel compensation	$ 2,621,837	$ 2,802,000	$ 1,492,000	$- 1,310,000
12 Personnel benefits	219,319	257,000	117,000	- 140,000
21 Travel and transportation of persons	260,117	167,900	135,000	- 32,900
22 Transporation of things	61,275	123,000	90,000	- 33,000
23 Rent, communications and utilities	917,573	1,300,000	1,500,000	+ 200,000
24 Printing and reproduction	100,424	100,000	100,000	0
25 Other services	19,289,763	16,060,037	5,593,094	-10,466,943
26 Supplies and materials	149,645	250,000	175,000	- 75,000
31 Equipment	988,214	1,000,000	---	- 1,000,000
32 Land and structures	301,983	340,000	---	- 340,000
Total Obligations	$ 24,910,150	$ 22,399,937	$ 9,202,094	$-13,197,843

I. (a) RESEARCH EXPENSE

This activity includes basic and applied research on: structural features in membranes and metallic surfaces, designs, unit operations, and effects on the environment. The following table provides a comparison by program package for the Fiscal Years 1972, 1973, and 1974.

Organization and Program Package	(In thousands) Actual FY 1972	Available FY 1973	Requested FY 1974	Increase (+) or Decrease (-)
Assistant Directorate Research	$5,364	$3,800	$2,400*	$-1,400
Fundamental	1,934	675	0	- 675
Environmental related	172	0	0	---
Thermal processes	729	800	400	- 400
Membrane processes	2,529	2,325	2,000	- 325

*Carryover funds only

An explanation of the decreases from FY 1973 to FY 1974 follows.

Fundamental Research: Fiscal Year 1973, $675,000; Fiscal Year 1974, $0; decrease, $675,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1) $-225,000	--	$ 0	--	Due to termination of fundamental research.
(2) -450,000	--	0	--	Due to termination of research on process fundamentals.
$-675,000				

(1) The decrease of $225,000 is due to termination of research on new promising processes, membrane structure, and marine ecology in order to provide funds for research on sea water membranes.

(2) The decrease of $450,000 is due to termination of research on corrosion, improved materials, process variables, and new promising concepts.

No funds are provided in FY 1973 or FY 1974 for studies on analytical techniques, relevant marine and other ecological problems, nucleation, scale formers, or pretreatment.

Some previously funded basic research will be allowed to continue, but due to the priority of sea water membranes, no further funding can be programmed in these areas.

Thermal Processes: Fiscal Year 1973, $800,000; Fiscal Year 1974, $400,000; decrease, $400,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1)$-100,000	---	$ 0	---	Due to termination of research on geothermal sources.
(2) -300,000	---	400,000	---	Due to reduction in crystallization research.
$-400,000				

(1) The decrease of $100,000 is due to elimination of further effort in geothermal studies involving the determination of thermodynamic properties of such brines, their phase rule diagrams, solubilities, and land subsidence.

(2) The decrease of $300,000 results from elimination of work on the hydrate process, an indirect thin channel process, and of general supporting and new research in crystallization due to funding constraints.

The major effort in FY 1974 will be directed toward improvement of secondary refrigerant and eutectic freezing processes. Other new and promising processes will be investigated.

Membrane Processes: Fiscal Year 1973, $2,325,000; Fiscal Year 1974, $2,000,000; decrease, $325,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-325,000	---	$2,000,000	---	Due to reduction in scope of sea water membrane program.

The decrease of $325,000 is due to telescoping the sea water membrane program in accordance with saline water research redirection and fiscal constraints.

The program plans for FY 1974 include limited synthesis and development of sea water membranes (e.g., composite and asymmetric) and their application to spiral, tubular and hollow fine fiber systems. The program is aimed at accelerating applied research effort on current technology, not on new or improved systems.

I. (b) DEVELOPMENT EXPENSE

This activity comprises the program packages involved in the development of desalting processes.

The following table shows the OSW organizational budgets and their makeup by program package for the Fiscal Years 1972, 1973, and 1974. (Changes in responsibility for programs resulting from reorganization in July 1972 are indicated in parenthesis)

Organization and Program Package	(In thousands) Actual FY 1972	Available FY 1973	Requested FY 1974	Increase (+) or Decrease (-)
Assistant Directorate Program Development				
Environmental related (Formerly under E&D Directorate)	$ 74	$ 450	$ 0	$- 450
Preliminary investigations, project development and program analysis (Formerly separate staff offices)	908	525	0	- 525
Assistant Directorate Research				
Materials	1,148	200	0	- 200
Assistant Directorate Engineering & Development				
Thermal Processes	4,009	3,500		-3,500
Membrane Processes	4,062	4,300	400*	-3,900
Field support and engineering projects (Formerly under PM&PE Directorate	439	250		- 250
Totals, Development Expense	$10,640	$9,225	$ 400*	$-8,825

*Carryover funds only

An explanation of the decreases from FY 1973 to FY 1974 follows.

Environmental Related: Fiscal Year 1973, $450,000; Fiscal Year 1974, $0; decrease, $450,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-450,000	---	$ 0	---	Due to discontinuing the brine disposal program.

The decrease of $450,000 is due to discontinuing further effort in any development of the ion exchange process for pretreatment and desalting of feed waters and in determining specific solutions to the brine disposal problems, as well as in using various processes and general methods to permit higher concentration of the effluent brine before disposal. This reduction results from redirection of the saline water conversion program.

Preliminary Investigations, Project Development, and Program Analysis: Fiscal Year 1973, $524,937; Fiscal Year 1974, $0; decrease, $524,937. The decrease consists of:

Increase (+) or Decrease(-) Amount	Positions	Total Program	Total Positions	Explanation
$-524,937	---	$ 0	---	Due to elimination of cooperative studies with states, studies on practical applications of desalting, and program analysis function.

Further expenditure of resources in cooperative studies with states, assessment of the role of desalting for salinity control, examinations of the technical and economic potential for reuse of water in industrial and municipal systems, economic studies, and program analysis is not included in the redirected saline water conversion program.

Materials: Fiscal Year 1973, $200,000; Fiscal Year 1974, $0; decrease, $200,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-200,000	---	$ 0	---	Due to elimination of the materials program.

The decrease of $200,000 represents completion of the phase out of this program due to the redirection of the saline water conversion program. In particular, the following projects, only partially funded in FY 1973, will be eliminated in FY 1974:

a. Operation of the Materials Test Center at Freeport, Texas, as a facility in which utilities, laboratory services, and treated feed water were made available for investigation of materials behavior under simulated desalting plant

conditions. Projects operating at the Center included research and testing sponsored by OSW and component evaluation studies jointly sponsored by OSW and private industry.

b. Evaluation of materials performance in operating plants. This activity included periodic inspections of the plants, analyses of failures, metallurgical examination, and studies of process monitoring and control.

c. Further development of promising new metallic materials.

d. Development of organic and inorganic coatings to prevent erosion and corrosion of carbon steel.

e. Development of nonmetallic materials for structural applications. This project emphasized the use of suitable reinforced plastics as substitutes for metallic components.

f. Demonstration of feasibility of promising new materials through installation of components in operating plants belonging to OSW or other cooperating organizations.

Thermal Processes: Fiscal Year 1973, $3,500,000; Fiscal Year 1974, $0; decrease, $3,500,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-3,500,000	--	$ 0	--	Due to termination of thermal processes development.

The decrease of $3,500,000 is due to the termination of the thermal processes program. This includes all effort in the field of distillation, crystallization, and geothermal desalting processes development. In particular, the following programs have been terminated as a result of redirection of the saline water conversion program:

a. Horizontal tube multiple effect distillation, including tests employing the new test vehicle at San Diego.

b. All vertical tube evaporation development, including the pilot plants and Freeport Test Bed. Also included is all work on heat transfer, scale control, upflow operation, and plant design.

c. All materials work, including the aluminum pilot plant operations, vessel lining tests, and development of new materials for distillation application.

d. All multistage flash work, including the 3-stage and 16-stage pilot plants at Wrightsville Beach and the Clair Engle Test Bed.

e. All crystallization effort, including any work on the very promising vacuum freezing ejector absorption program, the development effort on improved heat exchangers, and operation of the new secondary refrigeration pilot plant at Wrightsville Beach. This plant, now under construction, can only be run in the manufacturer's facility on a short check-out basis.

f. All geothermal work, including testing of both the MSF and VTE concepts on geothermal brines (test units have been constructed and are ready to move on site), the site preparation itself, brine injection studies, and pilot plant design. The program of desalting geothermal brines to supply new sources of water cannot proceed.

g. All work on improved deaeration, seeding and slurry scale control, instrumentation and plant control.

Membrane Processes: Fiscal Year 1973, $4,300,000; Fiscal Year 1974, $400,000; decrease, $3,900,000. This decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Program	Positions	Explanation
$-3,900,000	--	$400,000	--	Due to drastic reduction in scope of the membrane development program.

The decrease of $3,900,000 is due to the termination of all membrane development programs except reverse osmosis process operations and pilot plant modifications at the Wrightsville Beach Test Facility. All new sea water membrane development will be foregone and no effort will be conducted in the areas of improved membrane assembly development, process instrumentation and control, high pressure pump development, or feed water pretreatment.

All work on brackish water membrane development will have been terminated. This includes both ground and surface waters such as acid mine drainage and irrigation return flows. The Brackish Water Test Facility at Roswell, New Mexico, will be phased out.

Private industry will be relied upon to finance the continuation of development in promising low pressure, high flux membranes for greatly reducing water costs and for use in water softening. Investigations of the applicability of desalting technology to waste water reuse have been terminated.

Field Support & Engineering Projects: Fiscal Year 1973, $250,000; Fiscal Year 1974, $0; decrease, $250,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-250,000	--	$ 0	--	Due to phase out of San Diego, Roswell, Freeport, and Webster Test Facilities.

The decrease of $250,000 is due to the elimination of support requirements for four major OSW Test Facilities: San Diego, Roswell, Freeport, and Webster. Efforts in the area of data correlation, water chemistry, reliability, maintainability, and general support of field test operations will be terminated.

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1)$-960,000	-1	$ 0	0	Due to discontinuing all development activity.
(2) +400,000	---	700,000	---	Dismantling of all test equipment and restoration of the facility to its original condition.
$-560,000	-1			

(1) The decrease of $960,000 results from the termination of all development operations at this facility.

(2) The increase of $400,000 is due to second year phase-out costs and dismantling of all test equipment. The site must be restored to its original condition per lease requirements. Equipment to be torn down includes the lime magnesium carbonate pretreatment plant, the Clair Engle Test Bed, the VTE-X, and the HTE-X. All foundations, test pads, trailers, etc., will also have to be removed.

Roswell, New Mexico, Test Facility: Fiscal Year 1973, $1,050,000; Fiscal Year 1974, $400,000; decrease, $650,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1)$-750,000	-1	$ 0	0	Due to discontinuing all development activity.
(2) +100,000	---	400,000	---	Completion of facility deactivation.
$-650,000	-1			

(1) The decrease of $750,000 is due to termination of all development operations at this Facility.

(2) The increase of $100,000 is due to second-year phase-out costs and facility deactivation. Funding in FY 1974 is required to properly package, store, and protect Government equipment. Equipment which can be used at the Wrightsville Beach Test Facility will be cataloged, packed and shipped.

Freeport, Texas, Test Bed and Facility: Fiscal Year 1973, $1,050,000; Fiscal Year 1974, $500,000; decrease, $550,000. The decrease consists of:

II. (a) DESIGN, CONSTRUCTION, ACQUISITION, MODIFICATION, OPERATION AND MAINTENANCE OF SALINE WATER CONVERSION TEST BEDS AND TEST FACILITIES

OSW development plant activities have been conducted at seven locations across the country. The change in program goals has resulted in retention of only two facilities by the end of FY 1974. Previously authorized and appropriated funds for two reverse osmosis membrane test beds (sea water and high recovery) carried over from FY 1972 in this area are now programmed for other uses in FY 1973 and FY 1974, primarily in the reverse osmosis membranes area.

The following table provides an analysis of funds for this activity for the Fiscal Years 1972, 1973, and 1974.

	(In thousands)			
	Actual FY 1972	Available FY 1973	Requested FY 1974	Increase (+) or Decrease (-)
San Diego, California	$1,467	$1,260	$ 700	$- 560
Roswell, New Mexico	1,337	1,050	400	- 650
Freeport, Texas	1,092	1,050	500	- 550
Webster, South Dakota	194	165	0	- 165
Wrightsville Beach, North Carolina	958	1,378	250	-1,128
Fountain Valley, California	0	655	400	- 255
Geothermal Test Facility	0	35	0	- 35
	$5,048	$5,593	$2,250*	$-3,343

*Includes $2 Million carryover funds

The decrease of $3,343,000 is due to closing of San Diego, Roswell, Freeport, Webster, and Geothermal Test Facilities and reduction in the program at Wrightsville Beach. FY 1974 funds for San Diego, Roswell, and Freeport Test Facilities are to finance the close-down, mothballing, and/or disposal of the equipment and restoration of the sites as required. Wrightsville Beach and Fountain Valley are the only facilities planned for continuation in an operational status.

San Diego, California, Test Bed and Facility: Fiscal Year 1973, $1,260,000; Fiscal Year 1974, $700,000; decrease, $560,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
(1)$-850,000	-1	$ 0	0	Due to discontinuing all development activity.
(2) +200,000		400,000		Dismantling of VTE/MSF Test Bed and restoring of Test Bed site to original condition.
(3) +100,000		100,000		Packing, shipping or storage of all equipment at Materials Test Center. Test Loops will also be dismantled.
$-550,000	-1			

(1) The decrease of $850,000 is due to termination of all development operations at this Facility.

(2) VTE/MSF Test Bed--Increase of $200,000 is due to termination costs of shut-down and dismantling of this 1 mgd plant. Since the plant is located on non-Government property, the Test Bed area will be restored to its original condition if the owner desires. This also calls for possible tear-down of the control building.

(3) Materials Test Center--Increase of $100,000 is due to abandonment of the Test Center with the necessity for proper protective packing of all equipment, storage of equipment prior to disposal, and shipping of necessary equipment for use at Wrightsville Beach. Valuable laboratory equipment and OSW test loops will have to be dismantled, shipped to Wrightsville Beach, or otherwise disposed of.

Webster, South Dakota, Test Bed and Facility: Fiscal Year 1973, $165,000; Fiscal Year 1974, $0; decrease, $165,000. This decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-165,000	---	$ 0	0	Due to closing of Test Facility in FY 1973.

The decrease of $165,000 is due to complete shutdown and disposal of the Facility. All research and development will be completed at Webster.

Wrightsville Beach, North Carolina, Test Facility: Fiscal Year 1973, $1,378,000; Fiscal Year 1974, $250,000; decrease, $1,128,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-1,128,000	-5	$250,000	4	Due to decrease in pilot plant operations.

The decrease of $1,128,000 is due to the elimination of all thermal process pilot plant operations and the operation only of sea water reverse osmosis pilot plants and assemblies. The FY 1974 funding covers the facility support requirements for these units, including utilities, facility maintenance, chemicals, and laboratory services.

Fountain Valley, California, Test Facility: Fiscal Year 1973, $655,000; Fiscal Year 1974, $400,000; decrease, $255,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-255,000	---	$400,000	1	Due to nonrecurring costs associated with facility completion.

The net decrease of $255,000 is due to nonrecurring costs of facility completion and the requirement in FY 1974 for facility operations only. Operations will be in support of the operational development evaluation of the Vertical Tube Evaporation/Multistage Flash (VTE/MSF) Module scheduled to go on stream in FY 1973.

Geothermal Test Facility: Fiscal Year 1973, $35,000; Fiscal Year 1974, $0; decrease, $35,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-35,000	---	$ 0	0	Due to termination of OSW geothermal program.

The decrease of $35,000 is due to the termination of any geothermal work by the Office of Saline Water.

Field Personnel Summary: The elimination of 8 positions in the Test beds and facilities activity during FY 1974 results in a reduction-in-force of 19 field employees during FY 1973 and FY 1974.

II. (b) DESIGN, CONSTRUCTION, ACQUISITION, MODIFICATION, OPERATION AND MAINTENANCE OF SALINE WATER CONVERSION MODULES.

Saline Water Conversion Modules are sections of prototype plants which simulate the operation of a complete plant and confirm essential design features. This program is carried on at the San Diego and Fountain Valley, California, Test Facilities. Following is an analysis of funds for this activity for the Fiscal Years 1972, 1973, and 1974.

	(In thousands)			
	Actual FY 1972	Available FY 1973	Requested FY 1974	Increase (+) or Decrease (-)
Multistage Flash (MSF) San Diego, California	$ 735	$ 500	$ 500	$ ---
Vertical Tube Evaporator/MSF Fountain Valley, Calif.	460	682	2,052	+1,370
	$1,195	$1,182	$2,552*	$+1,370

*Includes $1,875,094 carryover funds

Modules: Fiscal Year 1973, $1,182,000; Fiscal Year 1974, $2,552,094; increase, $1,370,094. The increase consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$+1,370,094	---	$2,552,094	0	Due to full year operation of the VTE/MSF Module.

The increase of $1,370,094 is due to the first full year operational development program for the Vertical Tube Evaporator/Multistage Flash (VTE/MSF) Module.

There is no net change in funding for the Multistage Flash (MSF) Module at San Diego. Operational evaluation will be completed in FY 1973, whereas an equal amount of funds ($500,000) is estimated for tear down and restoration of the site in FY 1974.

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III. ADMINISTRATION AND COORDINATION

This activity includes all administration and coordination activities authorized under the Saline Water Conversion Act of 1971. Included are planning, supervisory, technical and administrative functions within the Office of Saline Water related to its research and development contracts and grants, preliminary desalting investigations, program analysis and administrative support.

Administration and Coordination: Fiscal Year 1973, $2,600,000; Fiscal Year 1974, $1,600,000; decrease, $1,000,000. The decrease consists of:

Increase (+) or Decrease (-)		Total	Total	
Amount	Positions	Program	Positions	Explanation
$-1,000,000	-43	$1,600,000	22	Due to further reduction in force.

The decrease of $1,000,000 results from the reduction in force represented by elimination of 43 positions in FY 1974, for a total reduction of 91 positions in the Washington headquarters during FY 1973 and FY 1974.

GENERAL STATEMENT

Mrs. HANSEN. Mr. O'Meara, you have a general statement. Please insert it in the record at this point and summarize it for us.

Mr. O'MEARA. Thank you, Madam Chairman.

[The statement follows:]

Madam Chairman, it is again my pleasure to appear before this committee to present the budget request of the Department of the Interior for the annual appropriation for the Saline Water Conversion program. The budget before you requests an appropriation for fiscal year 1974 of $2.5 million. We are also proposing a change in the legislation to consolidate budgetary categories. We have combined the budget categories of research, development, test beds and facilities, and modules, into one research and development category. The other category previously used, administration, is retained. The consolidation of categories is desirable in the light of a redirection of the program and due to the reduced fiscal year 1974 level of effort. We are also proposing that the authorizing legislation be changed to authorize necessary annual appropriations after fiscal year 1974. This obviates the need for annual authorizing legislation and seems desirable in the light of the program redirection.

PROGRAM REDIRECTION

The program redirection will result in a reduction of both funds and personnel. Last year I reported that we were then in the process of phasing out the Webster, S. Dak., test bed facility. That procedure has been satisfactorily completed and the actual transfer of title from OSW will be accomplished by the last day of April, right on schedule.

As I reported 1 year ago, we also intended to phase out the San Diego Test Facility which has done such important work in the field of seawater distillation development. It is a pleasure to be able to report to you that the increase in the numbers of larger scale distillation plants now in operation in many parts of the world has made it possible for us to speed up that phase out. Our purpose in OSW has always been to advance a process through the research and development stage until it reaches the point where private industry can take it over. During the past year we have seen substantial strides made in the distillation processes installed capacity. It appears that distillation needs no further effort from OSW at this time. For example, plants totaling 48 million gallons of water per day are under construction in Hong Kong. An American company was the successful bidder on desalting plants in the Virgin Islands totaling 4.5 million gallons per day of installed capacity. We have participated in the construction of the 3 million gallon per day module, part of a potential 15 million gallon per day distillation plant in Orange County, Calif. It is due to start production this coming August. Our budget for next year incudes funds to carry out our module development program which will extend into fiscal year 1975. Because of these advancements, we no longer need to continue research into distillation technologies. The test facility at San Diego, Calif., as I reported to the Congress last year, will also be closed during fiscal year 1974 as the distillation work there served its purpose and the seawater RO work can be moved to Wrightsville Beach and carried on at a significant reduction in cost. We will also discontinue research and testing of corrosion materials and methods for improved distillation carried on at the Freeport, Tex., test facility. This will allow us to close that facility sooner than we had anticipated in our internal schedule. As you know, Freeport has two responsibilities—distillation research and materials testing.

In our own internal planning, we had only two facilities to consider at this point. Research into brackish water desalting at the Roswell, N. Mex., facility and research into seawater desalting at Wrightsville Beach, N.C.

Last October, the four cities of Clinton, Bessie, Hobart, and Cordell, Okla., got together and advertised for bids to desalt 3 million gallons per day of the brackish water provided by the Foss Reservoir. Five large American companies submitted bids, proving the commercial availability of the membrane processes for brackish water desalting. One American company, Ionics, Inc., was the successful bidder and is constructing the plant. The same company has provided the membrane process plant at Gillette, Wyo., and Siesta Key, Fla. A smaller membrane process plant at Buckeye, Ariz., has been in operation for more than 10 years. Reverse osmosis plants have been sold in Ocean Reef, Fla.; Greenfield,

Iowa; and other commercial applications. This caused us to seriously question whether or not we needed the additional research into membrane process desalting of brackish waters, which was the main thrust of our operations at Roswell. Our decision has been to terminate the operation in Roswell and we are now shutting down.

The facility at Wrightsville Beach, N.C., is still needed to continue work on seawater membrane development. I will discuss this program later on.

The budget before you asks for an appropriation for fiscal year 1974 of only $2.5 million. The total program for fiscal year 1974 will amount to $9.2 million. The remainder of our operating expenses will be funded from the planned carryover of approximately $6.75 million for fiscal year 1973. The reduction in our overall program needs has been made possible by the excellent progress made by private industry in completing the development of processes which OSW research has sponsored and advanced. We are very proud of our accomplishments in that respect.

With the expectation that private industry will now be able to continue the work we have begun in the fields of distillation and brackish water desalting, we are free to exploit a very significant breakthrough which has materialized in the past year in seawater membrane process development. A considerable amount of brackish water membrane technology is directly transferable to seawater membrane process development and we will use the developments in this area to the best advantage in the seawater area.

For over a decade we have worked with semi-permeable membranes as a means of desalting brackish waters with their loan of dissolved solids in the neighborhood of 1,500 to 5,000 parts per million. Our laboratory work has developed new membranes for seawater application. We are now at the point where with one pass through the system we can desalt seawater with membranes. I think the members of this committee will agree that this breakthrough should be exploited to the fullest. The membrane process allows us to desalt seawater with a much lower expenditure of energy than is currently possible with distillation processes and conservation of energy is of top concern to us and the Nation. We also know that there will be no thermal pollution arising from membrane process desalting plants, which has become an environmental problem in recent years.

We are putting the emphasis on the laboratory and on engineering and development of one and two pass membrane process desalting technology. Our field development work will be conducted at the Wrightsville Beach test facility during fiscal year 1974.

A continuing research effort will be directed to the investigation of freezing processes and other new processes.

FACILITY OPERATIONS

The operation of the distillation equipment at San Diego was discontinued on March 2. We will continue to operate several small reverse osmosis sea water units there until approximately May 15, at which time they will be transferred to Wrightsville Beach.

The test bed part of our Freeport, Tex., operation will cease operation on March 26, and the metrials test center at Freeport, will cease operation on June 30.

Most of our test operations at Roswell are scheduled to be terminated prior to June 30. Some minor test units will continue to operate into early fiscal ytar 1974.

The Webster, S. Dak., plant has been closed as mentioned earlier and physical transfer of title is being accomplished right now.

Work on the Orange County water district plant, a part of the water factory 21 project, is 88 percent completed and the plant is scheduled to be in operation later this year. We will initiate operation of this 3 million gallon per day module in fiscal year 1974 and continue operations into fiscal year 1975.

We will continue to operate the Wrightsville Beach, N.C., facility for sea water membrane development during fiscal year 1974.

STAFFING

This redirection of our program will reduce our permanent employee numbers from the 149 presently authorized, to 78 before June 30 of this fiscal year. As of today our staff totals 123. Additional reductions will be required in fiscal year 1974 to fully comply with this redirection effort.

Here, let me pause in this testimony to state that the staff of OSW represents the Nation's top technical and scientific experts in the field of desalting. This expert staff was assembled slowly and carefully over many years, and with considerable difficulty. Their contribution to the Nation's desalting effort is a matter of clear and indisputable record. With their wealth of knowledge and expertise they will contribute significantly to other fields of endeavor.

SUMMARY

The program of the Office of Saline Water for fiscal year 1974 consists of the operation and maintenance of the Orange County module and its supporting facility ($2.45 million); operation and maintenance of the Wrightsville Beach, N.C., test facility and pilot plant development work in reverse osmosis sea water membranes ($.65 million); dismantling and disposal of test facilities which are being closed down ($2.1 million); highly concentrated effort in sea water membrane research ($2 million); freezing and other new processes ($.4 million) and salaries and related support expenses ($1.6 million).

We are proud of the accomplishments achieved by the program which the Office of Saline Water has sponsored with industry. We are pleased that so many desalting technologies are now available and ready for use in the world marketplace.

As new markets develop and industry gains additional experience, we hope they will make further improvements so that America's needs for new sources of water may be met. Desalting technology is the only developed method available to achieve an improved drinking water supply as it relates to total dissolved solids. When standards are adopted it could provide a large new market for industry and possibly encourage additional private research and development.

All in all, Madam Chairman and members of the committee, we have tried to design a program which will bring the greatest return for each research and development dollar invested.

I will now answer any questions which the committee might have.

Mr. O'MEARA. I have with me Mr. Chandler Townsend, our administrative officer, and Mr. Guy Chapin, our budget officer. We are pleased to have this opportunity to appear before this committee to present the budget request of the Department of the Interior for the annual appropriation for the saline water conversion program.

The budget before you requests an appropriation for fiscal year 1974 of $2.5 million. We are also proposing a change in the legislation to consolidate budgetary categories.

We have combined the budget categories of "Research and Development," "Test Beds and Facilities," and "Modules," into one "Research and Development" category. The other category previously used, "Administration," is retained. The consolidation of categories is desirable in the light of redirection of the program and due to the reduced fiscal year 1974 level of effort.

PROGRAM REDIRECTION

The program redirection will result in a reduction of both funds and personnel. Last year I reported that we were in the process of phasing out the Webster, S. Dak., test-bed facility. That procedure has been satisfactorily completed and the actual transfer of title from OSW will be accomplished by the last day of April, right on schedule.

BRACKISH WATER

Mrs. HANSEN. How successful is the process?

Mr. O'MEARA. It was the electrodialysis membrane process. It is finding wide application as a commercial process. During the past year

bids were opened at a 3 million gallon per day plant in Clinton, Okla. The low bid for the plant was the electrodialysis process. This is a 1.5 million gallons-per-day plant at Siesta Key, and one at Santa Bell, in Florida, and one of similar size in Gillette, Wyo. all using the process that was developed at Webster, S. Dak.

It is brackish water that is too salty for utilization for human consumption, but it is not near as difficult a problem as seawater. Nonetheless it is a water that cannot be utilized unless the desalting process is applied to improve its quality.

Mrs. HANSEN. What is the cost at the delivery point between this and natural water?

Mr. O'MEARA. In the Foss Reservoir plants, the estimate based on the bids without any operating data yet is 38 cents a thousand gallons for the cleanup of that water.

They did not study an alternative source of supply at that location.

The alternatives without a study appeared to be far more expensive than desalting because there was not any water available in the area except from this large brackish reservoir.

DISTILLATION

As we reported last year, to this committee, we intended to phase out the San Diego test facility which has served as a location for important work in the field of seawater distillation.

We believe that the increasing numbers of large scaler distillation plants now in operation in many parts of the world makes it possible for us to speed up that phaseout. It has been our purpose to advance the process through research and development until it reaches the point where private industry can take over. During the past several years we have seen substantial strides made in the distillation process.

Mrs. HANSEN. Are there any municipalities using the distillation process?

Mr. O'MEARA. The only municipality in the United States that is using the distillation process to get freshwater from seawater is Key West, Fla.

In that regard we have to consider as a part of the United States the Virgin Islands. They are utilizing distillation plants to provide their incremental source of supply. During the past year they have awarded contracts for two more desalting plants each of 2.5 million gallons-per-day capacity. During the past year, as another example, a bid was awarded for a 48 million gallons-per-day plant for the Crown Colony of Hong Kong.

Mrs. HANSEN. What is the cost of this process at the point of supply as against the natural water supply?

Mr. O'MEARA. From what we can learn, the architect-engineering work was conducted by a British firm and the winning contract went to a Japanese contractor. It appears the water will be in the range of 70 cents a thousand gallons and that will be cheaper for Hong Kong than any other alternative. That is still expensive water by most standards in the United States.

Mrs. HANSEN. Is it by the standards of yesterday or today?

DIFFERENTIAL COSTS

Mr. O'MEARA. Madam Chairman, having read the testimony when Under Secretary Whitaker appeared before this committee, we prepared and I would like to submit a differential cost between conventional supply of water and desalted water, and we have attached some tables that give some specific examples of comparing desalted water with conventional water.

Mrs. HANSEN. They will be placed in the record. We appreciate your preparing this material.

[The information follows:]

DIFFERENTIAL COST BETWEEN CONVENTIONAL SUPPLY OF WATER AND DESALTED WATER

Because of the many differing situations, it is not possible to state one definite differential cost between desalting water and conventional water. The alternatives for water supply at a specific location can only be evaluated on the basis of detailed economic and engineering studies. Obviously, for desalting to be considered, seawater or an adequate supply of brackish water must be available. The costs of desalted water are especially site sensitive. The type of process to be used, design of the plan, brine disposal, water storage, energy costs, et cetera, all greatly influence desalted water costs.

However, some indications can be seen from the desalting plants operating today for municipal water supply. Costs of desalted water at the plant are in the range of 35 cents to $1.50 per 1,000 gallons. At the lower end would be a membrane plant operating on mildly brackish water at several million gallons per day capacity. At the upper end would be a seawater distillation plant at about a million gallons per day. Likewise, ranges of water costs for conventional water supply vary upward from a few cents per 1,000 gallons where little storage or treatment is needed and the source of the supply is close to the user. Where larger reservoirs are involved, cost ranges, including acquisition, transport and treatment, may be 20 cents to 60 cents per 1,000 gallons.

In comparing desalted water versus conventional water supply, desalting is becoming a more viable alternative because of several factors, the most important being:

1. Lowering of desalting costs through improvement of processes through research and development,
2. Increase of costs of incremental water from natural supplies where the water has to be transported greater distances and more treatment is involved,
3. Where environmental and legal considerations stand in the way of making use of the apparently most economical source of water.

Desalting is being used today where it is most economically viable and in some cases the only alternative. There are many situations where the natural water supply is not readily available as in Kuwait for example, which is now distilling some 73 millions of gallons per day of seawater. Another example is in the Virgin Islands where the alternative is barging in fresh water at a very high cost of $3 to $5 per 1,000 gallons. At Key West, Fla., it was less costly to put in a seawater conversion plant than to obtain water from another pipeline to the mainland to bring in fresh water. In the case of Foss Reservoir in Oklahoma, the water in the reservoir was too salty for municipal use. Desalting it was the only way that the towns of Clinton, Cordell, Hobart, and Bessie could make use of the readily available supply; therefore, they are now building a 3 million gallon per day electrodialysis plant.

Another example is Siesta Key, Fla., where brackish water is being desalted primarily because of legal complications in obtaining fresh water from other government entities having first priority on the water supply. Roswell, N. Mex., is studying the advisability of building a 4 million gallons per day brackish water desalting plant versus obtaining additional conventional supply from two potential sources of underground water. In its preliminary considerations of the problem, the estimated cost of 40 cents per 1,000 gallons of desalted water appears to be the most economical approach, in addition to providing a higher quality product.

The Government of Hong Kong is now building a 48 million gallons per day seawater conversion plant because it was the best way for it to obtain the additional necessary supply of fresh water even though the cost of that water may well be between 60 cents and $1 per 1,000 gallons.

An emerging factor of great consequence which is beginning to have significant impact in regard to natural water supplies is the environmental constraint. For example, New York City's plan to build reservoirs in the Adirondacks is being challenged because of potential adverse environmental effects.

Thus, desalting, especially the desalting of seawater in large volumes, increasingly will become a viable alternative and, in some instances, the only alternative.

There are two other considerations to be considered in comparing the use of desalting with natural water supply:

1. In regard to large conventional water supply projects requiring dams or reservoirs and transport of the water long distances, the initial project must be built large enough to be adequate for increasing projections of water demands for the next 20 to 30 years. Therefore, they must be considerably oversized in relation to the immediate water demand. On the other hand, the desalting installation can be built in incremental steps so as to meet the demands as, and if, they increase.

2. The second is the use of desalting, particularly sea water desalting, as a relatively small increment of a total metropolitan area conventional water supply. In this "conjunctive use" system, a desalting plant may operate intermittently to serve the function of increasing safe yield from the system reservoirs and providing for adequate water supply during the drought periods. Even though the actual cost per 1,000 gallons from the desalting plant may be high in relation to the existing natural water cost, it may be economically viable when comparing it to the alternative of a major conventional project for an intermittent supply. Furthermore, it would add only a small amount to the overall water charge to the customers.

The large-scale conventional water supply project in operation today, in most cases, does not include environmental costs. In regard to new projects, it is difficult to estimate their costs, but they are expected to be significantly higher because of environmental considerations if they are permitted to be built at all.

One final point—we can see desalting technology being adapted to the treatment of waste water so that water may be reused, thereby reducing the requirement for additional sources of water supply.

Data From OSW—State Studies—Desalting and Conventional Costs

In conducting various studies with some of the State agencies to determine the feasibility of using desalting in municipal water supplies, a comparison was made between desalting saline feedwater and providing additional supplies by conventional means to determine the viability of a desalting plant for augmenting the supplies. In these studies, after examining the water resources and future demand of various areas and communities in the State in conjunction with water planning authorities, certain candidate communities were selected to examine the feasibility of desalting. Hence, in these instances, the same location for utilization of the product water was chosen with a specific set of circumstances and the same level of effort and accuracy was given to the engineering and economic evaluation of both desalting and conventional methods at the same point in time.

A study that was completed with the State of South Dakota in 1972 shows this comparison for some of the locations where desalting is an alternative to other conventional methods of supplying water. It should be borne in mind that the costs shown are estimates based on a feasibility type study and each one is subject to the specific conditions prevailing for that location and that these plants are small in capacity. An understanding of these conditions as described in the report is necessary to draw a proper conclusion as to which method should be chosen.

Town	Plant size, million gallons per day	Unit cost, cents per 1,000 gallons	
		Desalting	Conventional
Gettysburg	0.50	80–97	107
Miller	.65	63–82	109
Platte	.45	67–87	83
Redfield	1.25	67–85	47

Again the reader is cautioned that the costs are highly dependent on the prevailing conditions at each location and other assumptions and are meaningless unless these conditions are understood.

A previous study was made in 1966 and 1968 of several locations in Texas with the following results. It should be borne in mind that the data used for the process would require extensive updating to reflect changes in interest rates and process improvements. For instance, reverse osmosis was not developed to the point when the 1966 study was undertaken that it was considered as a method for desalting. The processes examined for feasibility were distillation and electrodialysis. The following conclusions were reached in the 1966 study:

City	Plant size, million gallons per day	Unit cost, cents per 1,000 gallons	
		Desalting	Conventional
Beeville	3.3	30.0	29.3
Dell City	.2	144.2	212.0
Fort Stockton	2.2	37.1	33.7
Freer	.4	55.6	90.5
Hebbronville	.7	44.1	44.8
Italy	.2	83.6	83.0
Kingsville	2.0	38.1	35.6
Rankin	.5	50.5	47.9
Refugio	.5	36.9	59.5

The west Texas desalting study in 1968 with the Office of Saline Water showed the following comparison in cost between desalting and conventional supplies for several regions:

Region	Plant size, million gallons per day	Unit cost, cents per 1,000 gallons	
		Desalting	Conventional
El Paso	10	35.6–43	35–50
Reeves-Ward-Winkler	5	65 4	40–45
Ector-Midland	5	39.4	30–35
Crane-Reagan-Upton	4	66.7	50
Taylor	10	37.9	30–35
Childress-Hardeman-Vernon	2	105.6	26

Mr. O'MEARA. It is a difficult situation to compare. Is natural water available or is it not?

If natural water is not available, there is no comparison.

Mrs. HANSEN. I am sure you are aware of the problems of that part of the Southwest of the United States where there is a limited supply. Most of us in the Northwest have a very fine river, but if this were diverted in any way, it would create problems in the Northwest which would destroy shipping, the current farm program, et cetera. So when they say no source available, they sometimes forget to specify no source available in the Southwest.

Mr. O'MEARA. I am aware of that. We recognize that is one of the major impacts that desalting can have on the water economy of the United States, that is, to provide a new source of water as an incremental source of supply rather than transbasin diversion.

Mrs. HANSEN. I think you have to measure the cost of the right-of-way, the construction costs, the costs of environmental impact statements, et cetera. Those costs ought to be the costs considered when you compare natural cost to saline water costs.

Mr. O'MEARA. That is correct. I think the National Water Commission in their report has called attention to how costs of alternative sources of supply be compared. As a nation, I think more and more we are coming to grips with the question you have been raising time after time.

Mrs. HANSEN. This committee has been raising this question for 10 years.

OTHER FACILITY CLOSEOUTS

Mr. O'MEARA. Madam Chairman, we have been conducting some seawater reverse osmosis work at our test facility in San Diego, Calif., and because we propose to close that facility we will transfer the work on reverse osmosis currently underway there to our facility at Wrightsville Beach, N.C. Our facility at Freeport, Tex., has been used for two responsibilities. We have a distillation research plant and a materials test center. The distillation plant ended operations last week, and the materials test station will shut down on June 30.

Mrs. HANSEN. What plants will remain?

Mr. O'MEARA. At that point in our program planning we had two other facilities to consider. One was the Roswell, N. Mex., for the brackish water research and the Wrightsville, N.C., facility where we were conducting seawater research.

Mrs. HANSEN. These are the only facilities that will remain?

CONTINUED FACILITY OPERATIONS

Mr. O'MEARA. No. As I answered in the earlier question, brackish water desalting plants are finding rather widespread application both for municipal water and for a number of commercial industrial applications.

We have planned to conclude the work we have been doing on brackish water and we will close the Roswell, N. Mex., facility. That will mean we will continue to operate our facility at Wrightsville, N.C., and we will complete the distillation experimental module we are building in Fountain Valley, in Orange County, Calif.

That unit is currently 88 percent complete and we will complete the construction in August. We plan to operate the module in fiscal 1974 and into fiscal 1975. Shortly after the beginning of the fiscal year we will be operating only the two field facilities, Wrightsville Beach, N.C., and Fountain Valley, Calif.

PERSONNEL

Mrs. HANSEN. Under the redirection of your program, what will happen to your employees?

Mr. O'MEARA. When we announced the redirection of the program, and we would operate with 78 people beginning in July 1, we had 137 people on board. We have reduced that number down to 122. Working with my administrative officer we have picked up vacancy lists from other agencies in Government who require additional technical personnel. We have a very active campaign to try to locate additional jobs for them. The Department of Interior, through its personnel office, is working very diligently to find employment in other agencies for these people.

Mrs. HANSEN. Won't some of the commercial enterprises hire some of these people?

Mr. O'MEARA. Madam Chairman, it was not until last Friday that we issued the reduction-in-force notice. Until that was issued the employees did not know whether they would be part of the reduction in force or carry on.

Mrs. HANSEN. It appeared in the President's budget.

Mr. O'MEARA. Yes, but the individual did not know who would be reduced in force.

We have encouraged industry, and we have had our people prepare job applications.

I am confident that such firms as Envirogenics and Catalytic Construction Co., are interested in some of the technical people we have on our staff. I am reasonably confident that most of them will transfer into other areas of activity, and by that I mean with other agencies and private industry and continue to work in the desalting field.

I don't feel we will lose their expertise.

Mrs. HANSEN. It would be tragic to lose that expertise out of the total knowledge.

Mr. O'MEARA. We spent a long time building a staff and I would like to state for the record that I think our staff has the finest expertise in the separation of dissolved solids from liquids that exists in the world.

I hope that expertise will be utilized in other areas as we approach the problems we will face with salinity of water.

ENERGY VERSUS FRESH WATER

Mrs. HANSEN. We have an energy crisis. The committee has tried to remind the Office of Management and Budget of this for several years with great futility. I hope the United States is not going off on a tangent where it is only energy that receives some thought. We still have a tremendous water problem in the United States. We also have the necessity for increased coal research.

If we are going to use the coal, we will have to have enormous amounts of water. Water cannot be a sort of sacrificial lamb, or we are going to wake up about 5 years from now with everybody talking about the water crisis.

Mr. O'MEARA. I can share those remarks with you. Water has long been a problem and the problem has not been solved, but will get worse as our population increases.

FOUNTAIN VALLEY PROJECT

Mrs. HANSEN. In fact, water is a basic necessity of life itself.

Mr. O'MEARA. In the instance of where we stand in our program today, Madam Chairman, I can cite specifically that the experimental module we are building to test the combination of distillation processes was approved by this committee 2 years ago and it cost $4.5 million to build that facility and 2 years' time to construct it. We are at the point in the distillation technology that from this facility we would obtain the knowledge that would give us the basis for large-scale distillation plants for making fresh water from seawater. This is not to imply that we have reached the ultimate distillation process, but the amount of investment it would take the Federal Government to make marginal improvements is so great that we believe that industry will learn from the plants that need to be built the improvements that will accrue from construction experience. This will be more sensible than investing enormous amounts of money in experimental hardware.

Mrs. HANSEN. Will industry take the initiative that is going to be required in these fields to move beyond what you have developed?

Mr. O'MEARA. They won't take the initiative as a research and development project. But desalting plants are being built, and from field experience they learn, and from operating they learn.

MEMBRANES VERSUS DISTILLATION

There are now over 700 desalting plants in operation, and from this fund of experience and from the plants that will be built, the engineering refinements will come from industry. The investment that we need to make in order to improve distillation processes, compared to the amount of money needed to obtain marginal improvements, we do not feel it merits further Federal support. We are concentrating our effort on the breakthrough we have made with membranes. It is very exciting that we now have a reverse osmosis membrane where with one pass we can take 35,000 parts per million seawater and pass it through the membrane and have 200 parts per million water which is water of exceptionally high quality. To operate this process all we require is pressure, so it takes much less energy than the distillation process in which we have to boil the water and condense the vapor. It also requires much less equipment. Since it takes less energy, it is very important to us.

Energy is of concern, if we have a higher energy consumptive process, we know the cost of water is going up. Additionally with the membrane process, we would not operate at elevated temperatures and thus we eliminate any thermal pollution. There is also one other drawback with the distillation process and that is in order to offset the corrosive effect of the hot seawater we have to use copper-nickel tubes. We get some leaching of the copper into the water and the copper can have an adverse effect on the fish life in the immediate area of the brine discharge. This is again an environmental concern.

So with reverse osmosis we have all of these potential advantages. It is not yet a commercial process. We have only operated a few small experimental devices on seawater, but it has been done. Now we intend to exploit that breakthrough.

Mrs. HANSEN. You will concentrate on this process.

Mr. O'MEARA. For reverse osmosis we only use small units. We can build many small experimental units with fewer dollars than we could build one large experimental distillation unit. We can effect a reduction in dollars without causing a reduction in our effort to achieve our goal.

Mrs. HANSEN. This will be the major part of your effort?

Mr. O'MEARA. Yes, ma'am. In our program redirection we also plan to continue the Fountain Valley project and obtain the data from that.

Other than that, our principal effort will be the continued development of membranes for seawater desalting.

AUTHORIZING LEGISLATION

Mrs. HANSEN. What is the status of your authorizing legislation?

Mr. O'MEARA. We have had our hearing before the Subcommittee on Water and Power Resources of the House.

The subcommittee is scheduled to mark up the bill tomorrow morning. The Senate committee staff people told me they did not plan to call a Senate hearing until the House had marked up the bill.

Since the markup is tomorrow, I would expect very soon the Senate committee will set the hearing.

OPERATING DESALTING PLANTS

Mrs. HANSEN. In his testimony before this committee in February Under Secretary Whitaker said that private industry should take over construction of desalting plants. He also said that there are about 300 plants operating in this country and about 800 in the world.

Please supply for the record a list of those plants in this country and who built and operates them?

[The information follows:]

WORLDWIDE DESALTING PLANT CAPACITY,[1] AS OF JAN. 1, 1972

Region	Number of plants	Capacity (million gallons per day)
North America (United States)	321	51
U.S. territories	17	13
North America (except United States)	14	9
Caribbean	39	26
South America	27	6
Europe (Continental)	117	51
England and Ireland	64	16
Australia	6	1
Asia (including Indonesia)	33	6
Middle East	96	109
Africa	65	30
U.S.S.R.	13	30
Total	812	348

[1] For land-based plants 25,000 gal per day or greater.

Desalting Plants Inventory Report No. 3

(By Frank O'Shaughnessy)

Worldwide inventory of land based desalting plants in operation or under construction capable of producing 25,000 gallons or more of fresh water daily.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian territorial affairs are other major concerns of America's Department of Natural Resources.

The Department works to assure the widest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

PREFACE

This is the third in a series of annual inventory reports issued by the Office of Saline Water for land-based desalting plants with capabilities of at least 25,000 (U.S.) gallons per day. It is based on data supplied by the world's desalting plant manufacturers. The report provides detail on plant location, size, type of process, year construction began or of plant commissioning, and name of process contractor. Also included, when and as provided by the manufacturer, are data on type of water feed, product water use, type of fuel used, and whether or not a desalting plant operates in conjunction with an electric power generating plant (single or dual purpose). Information on new plant starts during 1969–70 is provided, with the caution that data for 1970 are not complete. The report concludes with a short-term projection of world desalting sales.

SUMMARY

According to manufacturers' information, there were 712 land-based desalting plants of 25,000 gallons-per-day capacity or larger in operation or under construction throughout the world as of January 1, 1970. These plants are capable of producing about 245 million gallons of fresh water daily for cities and industries. Distillation is the most widely used, accounting for 95 percent of total capacity. The balance is almost entirely in membrane processes, with freezing accounting for less than 1 percent.

During the year 1969 there were 42 construction starts on plants with a total processing capability of 29.1 million gallons per day. These are detailed in table 6. Also shown in table 6 are new starts in 1970. These data are not to be considered complete, but show 35 starts with a total capability of 68.3 million gallons per day.

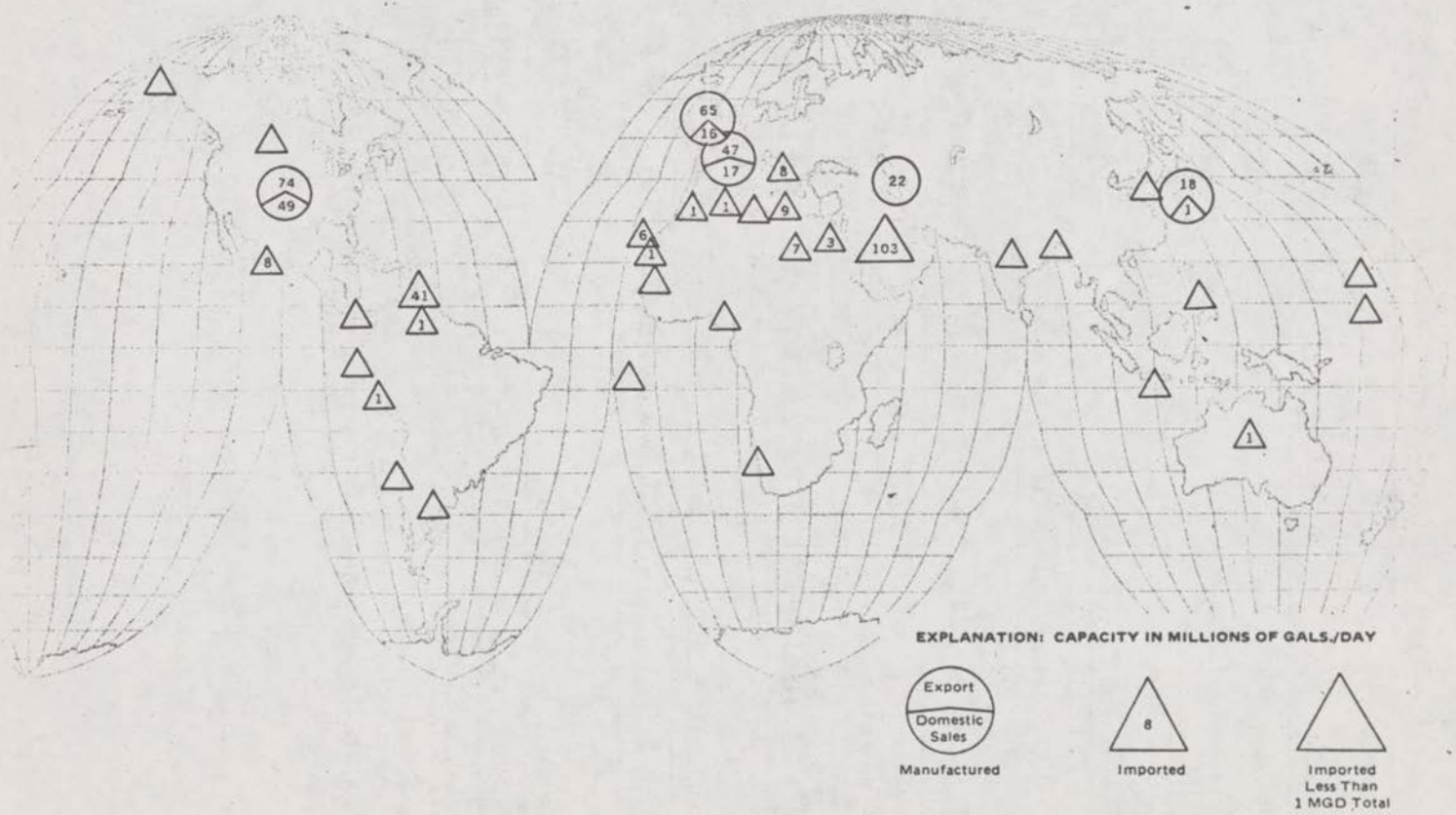


Figure 1. World Desalting Market as of January 1, 1971

TABLE 1.—DESALTING PLANTS, BY TYPE OF PROCESS

Process	Number of plants	Plant capacity (million gallons per day)	Percent capacity
Total, all processes	712	244.6	100.0
Distillation:			
Single-stage flash (F)	49	6.6	2.7
Multistage flash (MSF)	196	158.4	64.9
Vertical tube evaporator (VTE)	102	30.5	12.3
Submerged tube (ST)	293	33.5	13.7
Vapor compression (VC)	22	2.9	1.2
Membrane:			
Electrodialysis (ED)	44	12.2	5.0
Reverse osmosis (RO)	3	.2	.1
Freezing: Vacuum freezing-vapor compression (VFVC)	3	.3	.1

TABLE 2.—DESALTING PLANTS BY GEOGRAPHIC LOCATION

Area	Number of plants	Plant capacity, million gallons per day
United States (U.S.A.)	301	43.1
U.S. territories	14	10.3
North America except United States and its territories	12	8.5
Caribbean	31	24.1
South America	23	4.1
England and Ireland	63	15.9
Europe (Continental)	97	31.7
Union of Soviet Socialist Republics (U.S.S.R.)	9	12.6
Middle East	78	69.1
Africa	50	19.7
Asia	27	4.2
Australia	7	1.3
Total	712	244.6

TABLE 3.—DESALTING PLANTS BY SIZE

Size range	Number of plants	Plant capacity, million gallons per day
25 to 99	359	18.4
100 to 499	263	50.7
500 to 999	32	21.6
1,000 to 4,999	51	108.7
5,000 and greater	7	45.2
Total	712	244.6

TABLE 4.—*Land-based desalting plants operating or under construction as of January 1, 1970*

REGICA

ACRTH APERICA (U.S.)

CCLATRY/STATE	IC	LCCATICA	CAPACITY	UN	ST	TYPE	YEAR	PFG	WF	LSE	SC	FUEL
ALPEARA	1020	PCRTLE	23C.0	02	C	ST	1953	22				
ALASKA	1030	PCINT BARRCW (AF)	30.0	02	C	VC	1963	11	15%	PIL	W	CIL
ALASKA	1040	FAIRBANKS	100.0	01	C	ST	1954	22				
ALASKA	1050	MCTZEBUE	30.0	04	C	VC		71				
ARIZCNA	1060	FLCRENCE	450.0	3	C	ED	1962	55		PPAL	W	ELEC
ARIZCNA	1070	HELENA	35.0	1	C	ST	1973	22				
ARIZCNA	1080	TUSCCN	45.0	2	C	ST	1953	22				
CALIFCRNIA	1100	ETCCKTCN	65.0	1	C	ST	1936	22				
CALIFCRNIA	1110	FITTSBURGH	180.0	2	C	ST	1960	22				
CALIFCRNIA	1120	FRECCACO	1CC.0	1	C	ST	1956	22				
CALIFCRNIA	1130	EL CERRITC	40.0	1	C	ST	1956	22				
CALIFCRNIA	1135	SAN CLEMENTE (ALCLEAR)	172.5	2	C	F	1966	55	5%	F	WP	URAN
CALIFCRNIA	1140	HUMBCLDT BAY	60.0	1	C	ST	1955	22				
CALIFCRNIA	1150	ETKAMDA	165.3	2	C	ST	1952	22				
CALIFCRNIA	1160	VENTURA	1CC.0	1	C	ST	1932	22				
CALIFCRNIA	1170	MCNRC RAY A-NC. 1	72.0	1	C	ST	1955	63	5%	P	WP	
CALIFCRNIA	1180	MCNRC RAY B-NC. 2	72.0	1	C	ST	1955	63	5%	P	WP	
CALIFCRNIA	1270	MCNRC RAY C-NO. 3	127.0	1	C	F	1962	55	5%	F	WP	GAS
CALIFCRNIA	1210	MCNRC RAY C-NC.4	123.0	1	C	F	1963	55	5%	P	WP	GAS
CALIFCRNIA	1220	SANTEE	45.0	01	C	ED	1968	55	15%	CEMO	W	ELEC
CALIFCRNIA	1230	MCSS LANDING - A-NC.6	190.0	1	C	F	1965	55	5%	F	WP	GAS
CALIFCRNIA	1240	MCSS LANDING B-NC.7	199.0	1	C	F	1966	55	5%	P	WP	GAS
CALIFCRNIA	1250	CCALINGA	24.0	1	C	ED	1955	55	15%	PPAL	W	ELEC
CALIFCRNIA	1270	LCS ANGELES (FRNCHERCE)	100.0	2	C	VC	1947	11	15%	IND	W	ELEC
CALIFCRNIA	1275	LCS ANGELES	36.0	1	C	VC	1967	11	15%	IND	W	ELEC
CALIFCRNIA	1290	PASACENA	58.0	2	C	ST	1965	46	15%	IND	W	
CALIFCRNIA	1250	SAN CIEGC,CLAIR EAGLE MEMS	1,700.0	1	C	PSF	1967	11	5%	DEMO	WP	STM
CALIFCRNIA	1251	SAN CIEGC EFFECT 1A	65.0	01	C	PSF	1965	11	5%	CEMO	WP	
CALIFCRNIA	13C0	SAN CIEGC SCLTH BAY NC. 2	53.6	1	C	F	1962	55	15%	F	WP	GAS
CALIFCRNIA	1310	SAN CIEGC SCLTH BAY NC. 3	57.6	1	C	F	1964	55	15%	F	WP	GAS
CALIFCRNIA	1320	SAN CIEGO TEST MCDULE	2,6CC.0	1	C	PSF	1967	46	5%	CEMC	WP	STM
CALIFCRNIA	1321	SAN CIEGC STE-K	30C.0	01	C	VTE	1965	11	5%	CEMO	W	
CALIFCRNIA	1325	SCLTH LAGUNA	53.0	01	C	RD	1967	02	15%	CEMO	W	ELEC
CALIFCRNIA	1340	CCNTRA CCSTA A-NC. E	104.5	1	C	F	1964	55	15%	P	WP	GAS
CALIFCRNIA	1350	CCNTRA CCSTA E-NC. 7	104.5	1	C	F	1964	55	15%	P	WP	GAS
CALIFCRNIA	1360	MCFRANC	27.2	1	C	PSF	1943	79	15%	IND	W	STM
COLERACO	1380	CFAVER A	97.0	2	C	ST	1954	22				
CCLCRACC	1390	CENVER B	60.0	1	C	ST	1951	22				
CCLCRACC	1400	CENVER C	70.0	1	C	ST	1944	22				
CCLCRACC	1410	LECCMRE	140.0	1	C	ST	1952	22				
CCLCRACC	1420	CHERCKEE	75.0	1	C	ST	1960	22				
CCLCRACC	1430	WALMCNT	90.0	1	C	ST	1961	22				
COLCRACO	144C	CAMEC STATICA	29.0	1	C	ST	1955	22				
CCNNECTICLT	1450	MCNTVILLE A	35.0	1	C	ST	1953	22				
CCNNECTICLT	1460	MCNTVILLE B	41.0	1	C	ST	1936	22				
CCNNECTICLT	148C	DEVCN A	40.0	1	C	ST	1957	22				
CCNNECTICLT	1490	DEVCN B	35.0	1	C	ST	1952	22				
CCNNECTICLT	1500	DEVCN C	29.0	1	C	ST	1944	22				
CCNNECTICLT	151C	DEVCN D	29.0	1	C	ST	1941	22				
CCNNECTICLT	1520	NEW HAVEN	50.0	1	C	ST	1952	22				
CCNNECTICLT	1530	STAMFCRD	42.0	1	C	ST	1940	22				
CCNNECTICLT	1540	HARTFCRD	43.0	1	C	ST	1938	22				
CCNNECTICLT	1547	WATERFCRD	116.C	2	C	ST	1968	46	5%	IND	W	
FLCRIDA	1560	KEY WEST	2,620.0	1	C	PSF	1967	55	5%	PPAL	W	CIL
FLCRIDA	1565	SIESTA KEY	1,2C0.0	7	C	EC	1969	55	15%	PPAL	W	ELEC
FLCRIDA	1570	TAMPA	44.0	2	C	ST	1954	22				
FLCRIDA	1580	JACKSCNVILLE	45.0	1	C	ST	1956	22				
FLCRIDA	1590	CRLANDO	50.0	1	C	ST	1954	22				
FLCRIDA	1610	FLCRIDA PCWER & LIGHT A	4C.0	1	C	ST	1958	22				
FLCRIDA	1620	FLCRIDA PCWER & LIGHT B	90.0	1	C	ST	1954	22				
FLCRIDA	1630	AVCN PARK	31.0	1	C	ST	1952	22				
FLCRIDA	1640	CLDSMAR	50.0	2	C	ST	1953	22				
FLCRIDA	1650	ELLAVILLE	30.0	1	C	ST	1953	22				
FLCRIDA	1660	RIVIERA STATICN	41.0	1	C	ST	1944	22				
FLCRIDA	1661	LCNGBCAT KEY	80.0	09	C	PO	1969	45	15%	PPAL	W	ELEC
GECRGIA	167C	YATES	115.0	1	C	ST	1957	22				
GECRGIA	1680	GECRGIA PCWER	115.0	1	C	ST	1956	22				
GECRGIA	1690	KRANNERT	200.0	2	C	ST	1953	22				
HAWAII	1695	KAHE NO. 1	52.6	01	C	F	1962	55	15%	F	WP	OIL
HAWAII	1696	KAHE NC.2	52.6	01	C	F	1964	55	15%	F	WP	CIL
HAWAII	1697	KAHE NO.3	48.0	1	C	F	1968	55	5%	IND	WP	OIL
HAWAII	1698	KAHE NO.4	48.0	1	C	F	1968	55	15%	F	WP	OIL
ILLINCIS	171C	SPRINGFIELC	31.6	1	C	PSF	1961	22	15%	IND	W	STM
ILLINCIS	1720	STICKNEY	120.0	2	C	ST	1952	22				
ILLINCIS	1730	CICERO	60.0	1	C	ST	1952	22				
ILLINCIS	175C	HLTSCNVILLE	52.0	1	C	ST	1953	22				
ILLINCIS	1770	CHICAGO A	2C0.0	2	C	ST	1944	22				
ILLINCIS	178C	CHICAGC B	145.0	2	C	ST	1938	22				
ILLINCIS	1790	CHICAGO C	144.0	2	C	ST	1940	22				
ILLINCIS	1800	CHICAGO D	145.0	2	C	ST	1940	22				
ILLINCIS	1810	CHICAGC E	8C.0	1	C	ST	1936	22				
ILLINCIS	1820	PERECCSIA	44.0	2	C	ST	1944	22				
ILLINCIS	1830	JCLIET	72.0	2	C	ST	1940	22				
ILLINCIS	1850	PECRIA A	41.0	1	C	ST	1935	22				
ILLINCIS	1860	PECRIA B	29.0	1	C	ST	1937	22				
INCIANA	1870	TANNERS CREEK	145.0	1	C	ST	1961	22				
INCIANA	1890	MISHAWAKA A	54.0	1	C	ST	1943	22				
INCIANA	1900	MISHAWAKA B	52.0	1	C	ST	1944	22				
INCIANA	1920	SCUTH BEND A	150.3	1	C	ST	1956	22				
INCIANA	1930	SCUTH BEND B	150.3	2	C	ST	1958	22				
INCIANA	1940	CAMPBELLS	5C.0	1	C	ST	1953	22				
INCIANA	1950	LAWRENCEBLRG	8C.0	1	C	ST	1953	22				
INCIANA	1970	INDIANAPCLIS A	59.0	1	C	ST	1951	22				
INCIANA	1980	INDIANAPCLIS B	50.0	1	C	ST	1953	22				
INCIANA	1990	FAYETTE	100.0	2	C	ST	1952	22				
INCIANA	2000	TERRE HAUTE	35.0	2	C	ST	1939	22				
ICWA	2005	BURLINGTCN	166.0	1	C	F	1968	55	15%	F	WP	CCAL
KANSAS	2010	WICHITA NC. 4	57.6		C	F	1965	55	15%	P	WP	GAS
KANSAS	2015	LAWRENCE NC.5	132.5	1	C	F	1968	55	15%	F	WP	CCAL
KENTUCKY	2029	BIG SANDY NC. 1	116.5	01	C	F	1962	55	15%	P	WP	CCAL
KENTUCKY	2030	CWENSBORC NO. 2	57.6	01	C	F	1964	55	15%	P	WP	COAL
KENTUCKY	2050	LCUISVILLE A	95.0	1	C	ST	1953	22				
KENTUCKY	2060	LCUISVILLE B	70.0	1	C	ST	1954	22				
KENTUCKY	2070	LCUISVILLE C	98.0	1	C	ST	1964	22				

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFG	WF	LSE	SC	FUEL
[illegible]	2040	YRA PARADISE NO.1	205.0	1	C	F	1963	95	15k	F	WP	CCAL
[illegible]	2047	YRA PARADISE NO.2	209.0	1	C	F	1963	55	15k	F	WP	CCAL
[illegible]	2047	YRA PARADISE NO.3	173.0	1	C	F	1968	95	15k	IND	WP	CCAL
[illegible]	2100	NEW ORLEANS A	100.0	1	O	ST	1961	22				
[illegible]	2110	NEW ORLEANS B	35.0	1	C	ST	1953	22				
[illegible]	2120	NEW ORLEANS C	80.0	1	C	ST	1955	22				
[illegible]	2130	NEW ORLEANS C	31.0	1	O	ST	1941	22				
[illegible]	2140	NEW ORLEANS E	26.0	1	C	ST	1937	22				
[illegible]	2150	NEW ORLEANS F	67.0	1	O	ST	1944	22				
[illegible]	2160	KAISER CHEMICAL	120.0	8	C	ST	1953	22				
[illegible]	2170	HARVEY	35.0	1	C	ST	1952	22				
[illegible]	2180	LAKE CHARLES	58.0	2	C	ST	1943	22				
[illegible]	2183	WILLOW GLEN NO.4	144.0	1	O	F	1968	55	15k	F	WP	GAS
[illegible]	2184	WILLOW GLEN NO.3	144.0	1	C	F	1968	95	15k	F	WP	GAS
[illegible]	2190	MCY S. NELSON	144.0	1	O	F	1968	55	15k	F	WP	GAS
[illegible]	2195	VENICE	216.0	1	C	PSF	1966	46	15k	IND	W	
MASSACHUSETTS	2220	BRAYTON POINT A-NO. 1	111.0		C	F	1963	55	5k	F	WP	CCAL
MASSACHUSETTS	2230	BRAYTON POINT B-NO. 2	111.0		C	F	1964	55	5k	F	WP	CCAL
MASSACHUSETTS	2240	SPRINGFIELD	70.0	1	C	ST	1956	22				
MASSACHUSETTS	2250	NEW BEDFORD	25.0	1	C	ST	1944	22				
MASSACHUSETTS	2270	EVERETT A	44.0	1	C	ST	1944	22				
MASSACHUSETTS	2280	EVERETT B	87.0	2	C	ST	1941	22				
MASSACHUSETTS	2290	LYNN	26.0	1	C	ST	1942	22				
MASSACHUSETTS	2300	FALL RIVER	35.0	1	C	ST	1944	22				
MICHIGAN	2320	DETROIT A	29.0	1	C	ST	1935	22				
MICHIGAN	2340	DETROIT B	30.0	1	C	ST	1944	22				
MICHIGAN	2350	DETROIT C	30.0	1	C	ST	1940	22				
MICHIGAN	2360	DETROIT C	30.0	1	O	ST	1938	22				
MICHIGAN	2370	DETROIT E	30.0	1	C	ST	1937	22				
MICHIGAN	2380	DETROIT F	27.0	1	C	ST	1936	22				
MICHIGAN	2390	BELLE RIVER	146.0	2	C	ST	1952	22				
MICHIGAN	2400	PORT HURON	30.0	1	C	ST	1940	22				
MICHIGAN	2410	TRENTON	137.0	1	C	ST	1940	22				
MICHIGAN	2430	COMSTOCK A	41.0	1	C	ST	1940	22				
MICHIGAN	2440	COMSTOCK B	41.0	1	C	ST	1937	22				
MICHIGAN	2460	BAY CITY A	41.0	1	C	ST	1938	22				
MICHIGAN	2470	BAY CITY B	82.0	1	C	ST	1937	22				
MICHIGAN	2480	MANCOTTE	35.0	1	C	ST	1931	22				
MINNESOTA	2490	ST. PAUL	43.0	1	C	ST	1959	22				
MINNESOTA	2500	MINNEAPOLIS	40.0	1	C	ST	1957	22				
MINNESOTA	2510	TACONITE HARBOR	87.0	2	C	ST	1955	22				
MINNESOTA	2520	CLOQUET	250.0	1	C	ST	1930	22				
MISSISSIPPI	2530	GULF COAST STATION	100.0	1	C	ST	1961	22				
MISSISSIPPI	2540	MISSISSIPPI POWER	85.0	1	C	ST	1956	22				
MISSOURI	2550	SIBLEY	43.0	1	C	ST	1960	22				
MISSOURI	2555	ASBURY NO.1	86.5	1	C	F	1968	95	15k	IND	WP	CCAL
MISSOURI	2560	KANSAS CITY	119.0	1	O	ST	1956	22				
MISSOURI	2570	RAYTOWN	43.0	1	C	ST	1956	22				
MISSOURI	2580	ST. LOUIS	119.0	1	C	ST	1936	22				
MONTANA	2590	HAVRE (AF)	56.0	1	O	FD	1956	55	15k	PPAL	W	ELEC
MONTANA	2600	SIDNEY	40.0	1	C	ST	1957	22				
NEBRASKA	2620	OMAHA A	85.0	1	C	ST	1961	22				
NEBRASKA	2630	OMAHA B	42.5	1	C	ST	1930	22				
NEW JERSEY	2660	VINELAND	28.8	1	C	PSF	1955	79	15k	IND	W	STP
NEW JERSEY	2670	ATLANTIC CITY	45.0	1	O	ST	1944	22				
NEW JERSEY	2680	CAMDEN	100.0	1	C	ST	1930	22				
NEW MEXICO	2690	ROSWELL	1,000.0	1	C	VC	1963	32				
NEW MEXICO	2700	JAL	84.0	1	C	ST	1959	22				
NEW MEXICO	2710	REEVES	25.0	1	C	ST	1959	22				
NEW MEXICO	2720	NICHOLS	43.0	1	C	ST	1960	22				
NEW MEXICO	2740	ALBUQUERQUE A	50.0	1	O	ST	1956	22				
NEW MEXICO	2750	ALBUQUERQUE B	40.0	1	C	ST	1959	22				
NEW MEXICO	2760	ALBUQUERQUE C	150.0	3	C	ST	1951	22				
NEW MEXICO	2770	FARMINGTON	75.0	1	C	ST	1953	22				
NEW MEXICO	2771	SOCORRO WHITE SANDS	100.0		C	EG	1969	55	15k	PTL	W	
NEW YORK	2780	HEMPSTEAD	450.0	4	O	ST	1964	07	5k	IND	W	RUE
NEW YORK	2810	ROCHESTER A	136.0	1	C	MSF	1947	79	15k	IND	W	STP
NEW YORK	2820	ROCHESTER B	29.0	1	C	ST	1935	22				
NEW YORK	2830	ROCHESTER C	27.0	1	O	ST	1932	22				
NEW YORK	2840	JAMESTOWN	36.0	1	C	MSF	1956	79	15k	IND	W	STP
NEW YORK	2860	PORT JEFFERSON A	115.0	1	C	ST	1961	22				
NEW YORK	2870	PORT JEFFERSON B	58.0	1	O	ST	1956	22				
NEW YORK	2880	PORT JEFFERSON C	115.0	1	C	ST	1959	22				
NEW YORK	2890	ARRET	115.0	1	C	ST	1961	22				
NEW YORK	2900	NIAGARA FALLS	500.0	3	O	ST	1956	22				
NEW YORK	2910	INDIAN POINT	500.0	2	C	ST	1959	22				
NEW YORK	2912	INDIAN POINT NO.2	144.0	1	O	F	1968	55	15k	IND	WP	URAN
NEW YORK	2914	INDIAN POINT NO.3	144.0	1	C	F	1968	95	15k	IND	WP	URAN
NEW YORK	2920	TOMKINS COVE	64.0	1	C	ST	1953	22				
NEW YORK	2930	ASTORIA	442.0	2	C	ST	1957	22				
NEW YORK	2940	STATEN ISLAND	229.0	1	C	ST	1957	22				
NEW YORK	2960	FAR ROCKAWAY A	80.0	1	C	ST	1952	22				
NEW YORK	2970	FAR ROCKAWAY B	90.0	1	O	ST	1951	22				
NEW YORK	2990	GLENWOOD LANDING	58.5	1	C	ST	1952	22				
NEW YORK	3000	GLENWOOD	90.0	1	C	ST	1954	22				
NEW YORK	3020	KOSKO A	82.0	1	C	ST	1952	22				
NEW YORK	3030	KOSKO B	84.0	1	C	ST	1952	22				
NEW YORK	3035	JAMES POINT	80.0	1	C	FD	1958	55	15k	TCUH	W	ELEC
NORTH CAROLINA	3040	WRIGHTSVILLE BEACH A	50.0	1	C	MSF	1967	11	5k	CEMC	W	STP
NORTH CAROLINA	3041	WRIGHTSVILLE BEACH B	50.0	01	C	MSF	1968	72	5k	CEMC	W	OIL
NORTH CAROLINA	3070	WRIGHTSVILLE BEACH C	87.0	1	C	WFSC	1964	35	5k	CEMC	WP	ELEC
NORTH CAROLINA	3080	CHARLOTTE	80.0	2	C	ST	1942	22				
NORTH CAROLINA	3090	ASHEVILLE	60.0	1	C	ST	1951	22				
NORTH CAROLINA	3110	CRAMERTON	100.0	1	C	ST	1931	22				
OHIO	3120	ASHTABULA	57.5	1	C	PSF	1964	76	15k	IND	W	STP
OHIO	3130	CINCINNATI	26.0	1	C	ST	1916	22				
OHIO	3140	MUSKINGUM (OHIO POWER)	140.0	1	C	ST	1953	22				
OHIO	3150	A.E.P.	135.0	1	C	ST	1956	22				
OHIO	3170	KAMMER A	270.0	2	C	ST	1956	22				
OHIO	3180	KAMMER B	140.0	1	C	ST	1956	22				
OHIO	3190	CANTON A	80.0	1	C	ST	1957	22				
OHIO	3210	CANTON B	80.0	1	C	ST	1956	22				
OHIO	3220	CANTON C	115.0	1	C	ST	1954	22				
OHIO	3230	PHILLIP SPORN STATION	75.0	1	O	ST	1958	22				
OHIO	3240	WILLCUGHBY	87.0	1	O	ST	1952	22				
OHIO	3250	RELIEF	186.0	2	C	ST	1952	22				
OHIO	3260	TOLEDO	60.0	2	O	ST	1952	22				
OHIO	3270	CLEVELAND A	90.0	2	C	ST	1953	22				
OHIO	3290	CLEVELAND B	44.0	2	C	ST	1940	22				

CCLATRY/STATE	IE	LCCATION	CAPACITY	UN	ST	TYPE	YEAR	REC	WF	USE	SC	FUEL
CHIC	3307	PHILC	54.0	2	0	ST	1941	22				
CHIC	3310	ARTILIANT	87.0	1	C	ST	1943	22				
PENNSYLVANIA	3330	PHILADELPHIA A	144.0	1	C	PSF	1961	55	15%	F	WP	CCAL
PENNSYLVANIA	3340	PHILADELPHIA B	100.8	1	C	PSF	1962	55	15%	F	WP	CCAL
PENNSYLVANIA	3350	PHILADELPHIA C	115.0	1	C	PSF	1950	79	15%	IND	W	STM
PENNSYLVANIA	3360	PHILADELPHIA E	72.0	1	C	ST	1933	22				
PENNSYLVANIA	3370	MARCUS HOOK	300.0	1	C	ST	1938	55	15%	F	WP	OIL
PENNSYLVANIA	3380	ELRAMA	35.0	1	C	ST	1953	22				
PENNSYLVANIA	3390	PITTSBURGH ALECA	122.0	1	C	ST	1958	22				
PENNSYLVANIA	3400	PITTSBURGH SPHILLIP SHERMAN	30.0	1	C	ST	1955	22				
PENNSYLVANIA	3410	PITTSBURGH	446.0	1	C	PSF	1968	11	15%	IND	W	STM
PENNSYLVANIA	3420	PITTSBURGH A	26.0	1	0	ST	1940	22				
PENNSYLVANIA	3430	PITTSBURGH B	24.0	1	C	ST	1937	22				
PENNSYLVANIA	3440	CLAIRTON	1,440.0	1	C	PSF	1969	55	15%	IND	WP	CCAL
PENNSYLVANIA	3450	SCRANTON	36.0	1	C	ST	1944	22				
PENNSYLVANIA	3455	WILLIAMSPORT	87.0	2	C	ST	1944	22				
PENNSYLVANIA	3460	NEW CASTLE A	41.0	1	0	ST	1937	22				
PENNSYLVANIA	3470	ERIE PA	100.0	1	C	ST	1930	22				
PENNSYLVANIA	3480	SPRINGDALE	52.0	1	C	ST	1944	22				
RHODE ISLAND	3500	PROVIDENCE A	41.0	1	C	ST	1940	22				
RHODE ISLAND	3510	PROVIDENCE B	44.0	1	C	ST	1944	22				
RHODE ISLAND	3520	NEWPORT	115.0	1	C	PSF	1963	79	5%	IND	W	STM
SOUTH CAROLINA	3530	GREENWOOD	50.0	1	F	ST	1959	22				
SOUTH CAROLINA	3540	COLUMBIA	41.0	1	C	ST	1940	22				
SOUTH DAKOTA	3570	WEBSTER	325.0	1	P	FC	1969	15	15%	CEMC	W	ELEC
TENNESSEE	3610	TVP MLLL PLA AC. 1	169.6		C	F	1965	99	15%	F	WP	CCAL
TENNESSEE	3620	WITTS CREEK	210.0	1	C	ST	1962	22				
TENNESSEE	3630	CALLETTA	200.0	2	C	ST	1958	22				
TENNESSEE	3640	CALLETTA STATION	140.0	2	C	ST	1954	22				
TENNESSEE	3650	KINGSTON	300.0	4	C	ST	1952	22				
TENNESSEE	3660	NASHVILLE	87.0	1	0	ST	1944	22				
TENNESSEE	3690	BLAIR A	60.0	1	C	ST	1944	22				
TENNESSEE	3695	BLAIR B	145.0	2	C	ST	1961	22				
TEXAS	3700	FREEPORT	1,000.0	1	C	VTF	1961	33	5%	CEM)	W	
TEXAS	3710	FORT MANSFIELD	250.0	1	C	FC	1965	55	15%	PFAL	W	
TEXAS	3720	CHOCOLATE BAYOU	762.0	1	0	PSF	1952	99	15%	IND	WP	GAS
TEXAS	3730	HANDLEY NO. 3	144.0	91	C	F	1963	99	15%	F	WP	GAS
TEXAS	3740	SWEENY	150.5	2	C	PSF	1949	79	15%	IND	W	STM
TEXAS	3750	OAK CREEK	45.0	1	C	ST	1960	22				
TEXAS	3760	GRAND PRAIRIE	160.0	1	C	ST	1955	22				
TEXAS	3770	SEALY SMITH	25.0	1	C	ST	1959	22				
TEXAS	3790	EL PASO A	30.0	1	C	ST	1956	22				
TEXAS	3800	EL PASO B	45.0	1	C	ST	1956	22				
TEXAS	3810	EL PASO C	75.0	1	0	ST	1952	22				
TEXAS	3820	SHERRIN	35.0	1	C	ST	1953	22				
TEXAS	3840	DALLAS A	74.3	1	C	ST	1957	22				
TEXAS	3850	DALLAS B	55.0	1	C	ST	1954	22				
TEXAS	3860	DALLAS C	50.0	1	C	ST	1952	22				
TEXAS	3870	HOUSTON	95.0	1	C	ST	1955	22				
TEXAS	3875	BRYANTSVILLE	288.0	1	C	PSF	1968	22	5%	IND	W	CTL
TEXAS	3880	PORT STOCKTON	40.0	1	C	ST	1953	22				
TEXAS	3890	PECOS COUNTY	45.0	1	C	ST	1954	22				
TEXAS	3900	ALSTIN	45.0	1	C	ST	1954	22				
TEXAS	3910	SANDEE	216.0	3	C	ST	1952	22				
TEXAS	3920	EASTEX	45.0	1	C	ST	1952	22				
TEXAS	3930	AMARILLO	31.2	1	C	ST	1948	22				
TEXAS	3940	CARLSON	28.0	1	C	ST	1937	22				
TEXAS	3945	CELL CITY	50.0	2	C	FD	1963	55	15%	PFAL	W	ELEC
TEXAS	3950	TEXAS CITY	140.0	1	C	ST	1944	22				
TEXAS	3955	TEXAS CITY UNION CARBIDE	2,160.0	2	C	PSF	1967	55	15%	IND	WP	GAS
UTAH	3960	HILL AFB	49.0	1	C	WC	1964	11	15%	PTL	W	CTL
UTAH	3965	MAGNA	66.3	1	C	EC	1967	55	15%	IND	W	
VIRGINIA	3980	POSSUM POINT A	100.0	1	C	ST	1960	22	5%	IND	W	CCAL
VIRGINIA	3990	POSSUM POINT B	70.3	1	C	ST	1954	22	5%	IND	W	CCAL
VIRGINIA	4000	POSSUM POINT C-AC. 4	187.0		C	F	1962	99	15%	F	WP	CCAL
VIRGINIA	4010	PORTSMOUTH	100.0	1	C	ST	1960	22				
VIRGINIA	4020	CHESTERFIELD	81.0	1	C	ST	1954	22				
VIRGINIA	4025	CHESTERFIELD NO.1	260.3	1	C	F	1968	99	15%	F	WP	COAL
VIRGINIA	4030	PREPC	44.0	1	C	ST	1953	22				
VIRGINIA	4040	WHEELWRIGHT	130.0	2	C	ST	1941	22				
VIRGINIA	4050	NORFOLK	53.5	1	C	ST	1940	22				
VIRGINIA	4055	SURRY NO.1	173.0	1	C	F	1968	55	15%	F	WP	URAN
VIRGINIA	4055	SURRY NO.2	173.0	1	C	F	1968	55	15%	F	WP	URAN
VIRGINIA	4060	PICKMOND	58.0	2	C	ST	1938	22				
VIRGINIA	4070	GLENALYN	52.0	1	C	ST	1944	22				
WEST VIRGINIA	4080	LOGAN	29.3	1	C	ST	1936	22				
WEST VIRGINIA	4100	PT STORM A-AC. 1	324.3	91	C	F	1965	55	15%	F	WP	CCAL
WEST VIRGINIA	4110	PT STORM B-AC. 2	324.3	91	C	F	1966	55	15%	P	WP	COAL
WEST VIRGINIA	4130	A.E.P. A	144.0	1	C	ST	1950	22				
WEST VIRGINIA	4140	A.E.P. B	720.0	3	C	ST	1954	22				
WEST VIRGINIA	4150	A.E.P. C	470.3	6	C	ST	1952	22				
WEST VIRGINIA	4160	OHIO VALLEY ELECTRIC	50.0	1	C	ST	1954	22				
WEST VIRGINIA	4170	GLASGOW	100.0	1	0	ST	1952	22				
WEST VIRGINIA	4190	CABIN CREEK	65.0	1	C	ST	1944	22				
WEST VIRGINIA	4199	RIVESVILLE	70.0	1	0	ST	1938	22				
WEST VIRGINIA	4200	POLCAR	30.0	1	C	ST	1930	22				
WISCONSIN	4210	PORT WASHINGTON	20.0	1	C	ST	1940	22				
WISCONSIN	4220	MILWAUKEE	29.0	1	C	ST	1932	22				

REGION TOTAL: 301

REGION CAPACITY: 43,051.2

REGION

U.S. TERRITORIES

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFG	WF	LSE	SO	FUEL
JOHNSTON ISLAND	4432	JOHNSTON ISLAND	150.0	1	C	MSF	1964	11	5%	PIL	W	STM
MARSHALL ISLANDS-MISSILE TESTS	4435	U.S. CORPS ENGINEERS	295.0	1	C	MSF	1967	22	5%	PIL	W	OIL
PUERTO RICO	4445	PENUELAS	2,500.0	2	C	MSF	1969	11	5%	IND	W	STM
PUERTO RICO	4446	PONCE	250.0	01	C	F	1965	05	5%	EXMG	W	
VIRGIN ISLANDS	4455	ST. THOMAS CHARLOTTE AMALIE A	1,000.0	1	C	MSF	1965	05	5%	MFAL	WP	OIL
VIRGIN ISLANDS	4456	ST. THOMAS CHARLOTTE AMALIE B	275.0	1	C	MSF	1962	11	5%	MFAL	WP	STM
VIRGIN ISLANDS	4475	V.I. WATER & POWER AUTHORITY	2,400.0	1	C	MSF	1967	22	5%	MFAL	WP	OIL
VIRGIN ISLANDS	4478	V.I. WATER & POWER AUTHORITY	1,000.0	1	C	VTE	1968	77	5%	MFAL	WP	OIL
VIRGIN ISLANDS	4480	ST. CROIX HARVEY ALUMINUM	1,500.0	1	C	MSF	1965	55	5%	IND	WP	OIL
VIRGIN ISLANDS	4483	ST. CROIX ROSECT #COAL	100.0	1	C	WFWC	1968	35	5%	TCUR	W	ELEC
VIRGIN ISLANDS	4485	ST CROIX HESS OIL #1	172.0	1	C	MSF	1966	55	5%	IND	WP	OIL
VIRGIN ISLANDS	4496	ST CROIX HESS OIL #2	350.0	1	C	MSF	1968	11	5%	IND	W	STM
VIRGIN ISLANDS	4499	ST. CROIX ICHAPSTREE BAY #C.1	100.0	1	C	MSF	1967	22	5%	TCUR	W	OIL
WAKE ISLAND	4500	FAA	100.0	2	C	MSF	1959	11	5%	PIL	W	STM

REGION TOTAL: 14 REGION CAPACITY: 10,247.0

REGION

NORTH AMERICA EXCEPT USA

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFG	WF	LSE	SO	FUEL
CANADA	4710	ALBERTA	35.0	2	C	ST	1959	22				
CANADA	4730	SASKATCHEWAN 2	100.0	1	C	VTE	1958	03	15%	IND	W	COAL
CANADA	4732	SASKATCHEWAN	201.6	2	C	VTE	1967	03	15%	IND	W	COAL
CANADA	4743	SASKATCHEWAN M	90.0	1	C	ST	1956	22				
MEXICO	4750	TIJUANA	184.0	3	C	MSF	1962	55	5%	IND	WP	OIL
MEXICO	4755	CUAYMAS	99.0	1	C	MSF	1965	37	5%	IND	WP	STM
MEXICO	4760	TOPOLOBAMPO	63.0	1	C	MSF	1967	15	15%	MFAL	WP	STM
MEXICO	4770	VERA CRUZ	35.0	1	C	ST	1957	22				
MEXICO	4780	ACAPULCO	25.0	1	C	ST	1958	22				
MEXICO	4790	SAN LUIS POTOSI	120.0	1	C	ST	1961	22				
MEXICO	4800	ROSARITA	7,500.0	2	C	MSF	1967	11	5%	MFAL	W	STM
PANAMA	4910	CIA PANAMENA DE FUERZA Y LUZ	44.0	2	C	ST	1957	22				

REGION TOTAL: 12 REGION CAPACITY: 8,497.2

REGION

CARIBBEAN

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFG	WF	LSE	SO	FUEL
ANTIGUA (BRITISH)	5210	WEST INDIES OIL CO	180.0	1	C	MSF	1966	27	5%	IND	W	STM
ANTIGUA	5230	ST JOHNS	1,200.0	01	C	MSF	1969	11	5%	MFAL	WP	
ARUBA (NETH. ANT.)	5945	BALASHI GCVT WATER WORKS	2,688.0	5	C	ST	1955	87	5%	MFAL	WP	OIL
ARUBA	5946	BALASHI GCVT WATERWORKS #3	1,594.0	01	C	MSF	1965	11	5%	MFAL	WP	OIL
BAHAMAS	5050	CRPT PUBLIC WORKS	2,400.0	01	C	MSF	1969	27	5%	MFAL	W	OIL
ARUBA (NETH. ANT.)	5060	BALASHI GCVT. WATER WORKS	900.0	1	C	MSF	1965	11	5%	MFAL	W	STM
BAHAMAS	5061	ARAWAK, CLIFTON PIER	86.4	01	C	VTE	1965	03	15%	IND	W	OIL
BAHAMAS (BRITISH)	5062	ARAWAK,CLIFTON PIER	1,440.0	2	C	MSF	1962	87	5%	MFAL	WP	OIL
BAHAMAS (BRITISH)	5363	FREEPORT	1,267.0	1	C	MSF	1968	11	5%	IND	W	STM
BAHAMAS	5064	FREEPORT	75.0	01	C	MSF	1969	11	5%	TCUR	W	STM
BERMUDA	5065	KINDLEY AFB A	100.0	1	C	MSF	1965	11	5%	PIL	W	STM
BERMUDA	5066	KINDLEY AFB B	100.0	2	C	VC	1954	11	5%	PIL	W	OIL
BERMUDA	5067	KING EDWARD VII HOSPITAL	156.0	1	C	MSF	1964	11	5%	MFAL	W	STM
BERMUDA	5369	CARLTON BEACH HOTEL	32.0	1	C	MSF	1961	11	5%	TCUR	W	STM
BERMUDA	5071	ERPLYNIARA HOTEL C	48.0	1	C	EC	1966	55	15%	TCUR	W	ELEC
BERMUDA	5072	MCKINLEY FIELD	35.7	3	C	MSF	1943	79	5%	TCUR	W	STM
BERMUDA	5073	PRINCESS HOTEL	70.0	1	C	MSF	1966	11	5%	TCUR	W	STM
BERMUDA	5074	PRINCESS HOTEL	100.0	1	C	MSF	1967	22	5%	TCUR	W	OIL
BAHAMAS	5080	NORTH RIDING	58.0	04	C	VC	1966	11	5%	MFAL	W	
BAHAMAS	5081	GRAND TURK AIRFIELD	36.0	05	C	VC	1955	71	5%	PIL	W	OIL
PENNERY (NETH. ANT.)	5085	GCVT. WATER WORKS	134.4	1	C	MSF	1963	87	5%	MFAL	WP	OIL
CLOR	5090	CURANTANAMO	2,250.0	3	C	MSF	1964	55	5%	MFAL	WP	OIL
CURACAO	5100	PLADE NORE 7 E M	1,004.0	2	C	ST	1955	87	5%	MFAL	WP	OIL
CURACAO (NETH. ANT.)	5120	PLADE NOBE C S E IC	3,440.0	2	C	MSF	1963	87	5%	MFAL	WP	OIL
CURACAO	5121	EMMASTAD	1,590.0	01	C	MSF	1969	51	5%	IND	W	STM
CURACAO (NETH. ANT.)	5130	SHELL PETROLEUM MAT.	1,584.0	1	C	MSF	1963	87	5%	IND	WP	OIL
CURACAO	5131	PUNTO NORD	1,060.0	01	C	MSF	1969	87	5%	MFAL	W	OIL
ST MARTIN (FR. ANT.)	5145	ST MARTIN	132.0	1	C	MSF	1967	37	5%	TCUR	W	OIL
ST. MARTIN(NETH)	5146	PHILLIPS PEAC RESORT	107.0	01	C	35GT1	1969	11	5%	TCUR	W	
ST MARTEN(NETH. ANT.)	5150	ST MARTIN	264.0	2	C	MSF	1968	19	15%	MFAL	W	OIL
TURKS ISLAND (BRITISH)	5160	WEST INDIES	30.0	4	C	VC		71				

REGION TOTAL: 31 REGION CAPACITY: 24,043.5

REGION

SOUTH AMERICA

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFC	WF	LSE	SO	FUEL
ARGENTINA	5510	ALTO VALLE	40.3	2	C	ST	1966	03	15%	IND	W	OIL
ARGENTINA	5511	MAR DEL PLATA	86.4	02	C	VTE	1969	03	15%	IND	W	OIL
ARGENTINA	5515	PIPC TRUNCACC	46.0	1	C	MSF	1962	33	15%	IND	WP	STM
ARGENTINA	5520	SAN NICHOLAS	149.0	2	C	VTE	1953	35	15%	IND	W	STM
CHILE	5550	CHAMARAL	264.0	1	C	MSF	1965	87	5%	MFAL	W	OIL
CHILE	5560	CLINTARO	70.0	1	C	MSF	1964	11	5%	IND	W	STM
CHILE	5570	PIC BIC	31.7	1	C	ST	1963	87	5%	IND	W	OIL
CHILE	5580	TOCOPILLA	35.0	1	C	MSF	1958	11	5%	IND	WP	STM
CHILE	5590	PARCSA	40.0	1	C	MSF	1962	11	5%	MFAL	W	STM
MEXICO#5	5610	PUERTO CORTES	172.0	1	C	MSF	1967	55	5%	IND	WP	OIL
ECUADOR	5620	ANCON	120.0	1	C	MSF	1966	03	5%	MFAL	WP	OIL

SOUTH AMERICA

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFC	WF	USE	SO	FUEL
ECUADOR	5640	SALINA A	100.0	2	C	VC	1958	11	5k	PPAL	W	OIL
ECUADOR	5650	SALINA B	50.0	1	C	MSF	1959	11	5k	PPAL	W	STM
ECUADOR	5660	LA LIBERTAD	60.0	1	C	MSF	1955	07	5k	IND	WP	OIL
ECUADOR	5665	GUAYAQUIL	35.0	2	C	ST	1961	22				
PERU	5670	SAN JUAN	41.0	2	C	VC	1954	11	5k	IND	W	OIL
PERU	5680	LAMITOS A	73.0	1	D	ST	1957	07	5k	PPAL	W	OIL
CHILE	5695	ANACONDA COPPER	250.0		C	FG	1965	15	15k	IND	W	ELEC
PERU	5696	LOMITOS E	134.0	1	C	ST	1958	07	5k	PPAL	W	OIL
PERU	5710	ILO	720.0	1	D	MSF	1966	11	5k	IND	W	STM
VENEZUELA	5720	(PORT) CARACA	1,440.0	1	C	MSF	1961	29	5k	IND	W	OIL
VENEZUELA	5740	MARACAIBO	26.0	1	C	ST	1937	22				
VENEZUELA	5760	CARDON	25.0	1	C	ST	1920	22				

REGION TOTAL: 23 REGION CAPACITY: 4,043.4

REGION

EUROPE - CONTINENTAL

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFC	WF	USE	SO	FUEL
AUSTRIA	6010	LINZ	119.0	1	C	MSF	1952	03	15k	IND	WP	ELEC
BELGIUM	6020	WATERSCHEI	35.0	1	C	VTE	1947	47				
BELGIUM	6021	ESTEAU	100.0	01	C	MSF	1965	02	5k	IND	WP	GAS
CAPE VERDI (PORTUGAL)	5930	PORTUGAL	582.0	2	C	MSF	1968	20	5k	PPAL	W	OIL
CYPRUS	6040	CHRYSELIA	400.0	2	D	MSF	1964	25	5k	PPAL	WP	OIL
CYPRUS	6041	ELECTRICITY BOARD	104.0	02	D	MSF	1966	27	5k	P	W	OIL
CYPRUS	6050	CHRYSELIA	28.8	1	C	ST	1962	07	5k	IND	WP	OIL
DENMARK	6060	AARHUS	64.0	1	C	VTE	1952	15	15k	IND	W	STM
FINLAND	6070	HELSINKI	32.0	1	C	VTE	1951	15	15k	IND	W	STM
FRANCE	6080	E HARMES	62.0	3	C	ST	1944	22				
FRANCE	6081	LE HAVRE	153.0	4	D	MSF	1955	33	5k	IND	WP	STM
FRANCE	6082	MARCONDOLAT	444.0	1	C	ST	1968	37	15k	IND	WP	STM
FRANCE	6083	VINCENNES	35.0	1	C	ST	1967	37	15k	IND	W	STM
FRANCE	6084	CARCANE	51.0	2	C	MSF	1952	37	15k	IND	WP	STM
FRANCE	6085	PULHOUSE	356.0	2	C	MSF	1954	67	15k	IND	WP	COAL
FRANCE	6086	GROSSELIEGERSTROFF(P.S.)	153.0	4	D	MSF	1951	37	15k	IND	WP	STM
FRANCE	6087	HORNING (P.S.)	127.0	1	D	ST	1957	37	15k	IND	WP	STM
FRANCE	6088	KANTES-CHEVIRE (P.S.)	53.0	1	C	MSF	1957	37	5k	IND	WP	STM
FRANCE	6089	VIELAINES (P.S.)	127.0	1	D	ST	1955	37	15k	IND	WP	STM
GERMANY, WEST	6090	BREMEN	132.0	1	C	MSF	1966	15	15k	IND	W	STM
GERMANY, WEST	6100	STUTTGART	331.0	1	C	VTE	1950	15	15k	IND	W	STM
GERMANY, WEST	6110	FARGE	127.0	1	C	VTE	1950	15	15k	IND	W	STM
GERMANY, WEST	6130	FLINSBERG	56.0	1	C	VTE	1952	15	15k	IND	W	STM
GERMANY, WEST	6140	CELLE-WARBERG	146.0	1	C	VTE	1957	15	15k	IND	W	STM
GERMANY, WEST	6150	ELWERINGSEN	65.0	1	C	VTE	1952	15	15k	IND	W	STM
GERMANY, WEST	6160	ASCHAFFENBERG	64.9	1	C	VTE	1952	15	15k	IND	W	STM
GERMANY, WEST	6170	HACEN	152.0	2	C	VTE	1954	15	15k	IND	W	STM
GERMANY, WEST	6180	BERLIN	48.0	1	C	VTE	1953	15	15k	IND	W	STM
GERMANY, WEST	6190	CEVENHAUSEN	82.0	2	C	VTE	1953	15	15k	IND	W	STM
GERMANY, WEST	6200	REFL	32.0	1	C	VTE	1953	15	15k	IND	W	STM
GERMANY, WEST	6210	DUSSELDORF	60.0	1	C	VTE	1954	15	15k	IND	W	STM
GERMANY, WEST	6220	WEISWEILER	101.0	1	C	VTE	1954	15	15k	IND	W	STM
GERMANY, WEST	6230	HAMBERN	39.0	1	C	VTE	1955	15	15k	IND	W	STM
GERMANY, WEST	6240	REISHOLZ	90.0	1	C	VTE	1955	15	15k	IND	W	STM
GERMANY, WEST	6250	HACEN	39.0	1	D	VTE	1955	15	15k	IND	W	STM
GERMANY, WEST	6260	ANNSBERG	76.0	1	C	VTE	1955	15	15k	IND	W	STM
GERMANY, WEST	6270	HELMSTEDT	262.0	2	C	VTE	1955	19	15k	IND	W	STM
GERMANY, WEST	6280	HATTINGEN	32.0	1	C	VTE	1957	15	15k	IND	W	STM
GERMANY, WEST	6290	OFFBERN	152.0	2	C	VTE	1957	15	15k	IND	W	STM
GERMANY	6291	HATTORF	515.0	3	C	MSF	1964	07	15k	IND	WP	OIL
GERMANY	6292	LEHRTE	110.3	1	C	MSF	1953	07	15k	IND	WP	OIL
GERMANY	6293	HERINGEN	350.0	1	C	MSF	1953	07	15k	IND	WP	OIL
GERMANY	6294	HERINGEN	140.0	1	C	MSF	1964	07	15k	IND	WP	OIL
GERMANY, WEST	6300	NEUMUNSTER	120.0	1	C	VTE	1960	19	15k	IND	W	STM
GERMANY, WEST	6310	HULS	76.9	2	C	VTE	1963	19	15M	IND	W	STM
GIBRALTAR	6315	GIBRALTAR	270.0	1	C	MSF	1968	27	5k	PPAL	W	OIL
GIBRALTAR (BRITISH)	6330	THE ADMIRALTY A	161.0	2	C	ST	1947	07	5k	PPAL	W	OIL
GIBRALTAR (BRITISH)	6340	THE MINISTRY OF DEFENCE	60.0	1	D	MSF	1965	03	5k	PPAL	WP	OIL
GIBRALTAR (BRITISH)	6380	NATO	145.0	2	C	MSF	1960	07	5k	RIL	S	OIL
GIBRALTAR (BRITISH)	6390	CITY COUNCIL	84.0	1	C	MSF	1964	07	5k	PPAL	WP	OIL
GIBRALTAR (BRITISH)	6400	ARMY BASE	25.0	1	D	VC	1957	07	5k	PPAL	W	OIL
GREECE	6405	HERAKLION/KRETA	32.0	2	C	MSF	1966	15	15k	IND	W	STM
ITALY	6410	GENOA	81.0	1	C	ST	1938	07	5k	IND	WP	OIL
ITALY	6412	CARLO	380.0	01	C	FD	1969	26	15k	IND	W	ELEC
ITALY	6413	MANFREDONIA	32.3	01	C	FD	1969	26	15k	IND	W	ELEC
ITALY	6430	ITALSIDER	1,200.0	2	C	MSF	1964	11	5k	IND	WP	STM
ITALY	6435	ITALSIDER # 3	725.0	1	C	MSF	1967	40	5k	IND	W	STM
ITALY	6449	SHELL OIL	600.0	3	C	MSF	1966	40				
ITALY	6451	PORTO VESME	162.2	02	C	MSF	1966	27	5k	IND	W	OIL
ITALY	6455	VESTE	288.0	2	C	EC	1969	26	15k	PPAL	W	ELEC
ITALY	6456	VIESTA	275.9	01	C	ED	1969	51	15k	PPAL	W	ELEC
ITALY	6470	BRINDISI	70.0	1	D	MSF	1965	11	5k	IND	W	STM
ITALY	6475	BRINDISI	2,556.0	2	C	MSF	1968	48	5k	IND	W	OIL
ITALY	6490	NAPLES	80.0	1	C	ST	1936	22				
ITALY	6492	BARI	100.0	1	C	VFVC	1969	44	5k	DEMO	W	ELEC
MALTA	6530	VALETTA	1,260.0	1	C	MSF	1966	27	5k	PPAL	W	STM
MALTA	6531	ELECTRICITY BOARD	58.8	01	D	MSF	1967	27	5k	IND	W	OIL
MALTA	6535	VALETTA	4,385.0	3	C	MSF	1967	07	5k	PPAL	WP	OIL
NETHERLANDS	6550	FLISSING	45.6	1	C	VTE	1954	03	15M	IND	W	COAL
NETHERLANDS	6551	BOTLEK	100.0	01	C	MSF	1965	51	15k	DEMO	W	STM
NETHERLANDS	6552	ROTTERDAM	250.0	01	C	FD	1965	51	15k	IND	W	ELEC
NETHERLANDS	6553	ROTTERDAM	100.0	01	C	ED	1965	51	15k	PPAL	W	ELEC
NETHERLANDS	6554	AMSTERDAM	50.0	01	C	ED	1965	51	15k	DEMO	W	ELEC
NETHERLANDS	6555	EEMSCOORT	1,140.0	2	C	VTE	1968	03	5k	IND	W	OIL
NETHERLANDS	6560	STAATSMIJN EMMA	56.0	1	C	VTE	1952	03	15k	IND	W	COAL
NETHERLANDS	6570	FENNIS	762.0	1	C	MSF	1963	07	15k	IND	WP	OIL
NETHERLANDS	6580	AMSTERDAM	43.0	2	C	VTE	1947	47				
NETHERLANDS	6590	ROTTERDAM	43.0	2	C	VTE	1950	47				
NETHERLANDS	6600	ROTTERDAM	174.0	1	C	EC	1965	26	15k	IND	W	ELEC
NETHERLANDS	6610	FENNIS	700.0	1	C	VTE	1966	47				
NETHERLANDS	6620	THE HAGUE	43.0	2	C	VTE	1955	47				
NETHERLANDS	6630	UTRECHT	67.0	1	C	VTE	1955	47				
NETHERLANDS	6640	UTRECHT A	53.5	1	C	VTE	1956	47				

EUROPE - CONTINENTAL

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFG	WF	LSE	SC	FUEL
NETHERLANDS	6650	UTRECHT A	53.5	1	C	VTE	1967	43				
NETHERLANDS	6660	LEIDEN	177.0	1	C	VTE	1956	47				
NETHERLANDS	6670	HAARLEM	27.0	2	C	VTE	1938	47				
NETHERLANDS	6680	ARNHEM	52.5	1	C	VTE	1941	47				
NETHERLANDS	6690	LEEUWARDEN	27.0	2	C	VTE	1945	47				
NETHERLANDS	6700	HENGLO	32.0	1	C	VTE	1945	47				
NETHERLANDS	6720	TERNEUZEN	7,662.0	2	C	MSF	1967	51	5%	IND	WP	GAS
PUERTO RICO	6725	BCA VISTA	25.3	01	C	VTE	1965	67	5%	TCUP	W	OIL
SPAIN	6730	SEVILLE	29.0	1	C	ST	1960	22				
SPAIN	6735	ALGECIRAS (P.S.)	39.0	1	C	F	1966	55	5%	IND	WP	OIL
SPAIN	6740	PACHECHA	90.0	2	C	VTE	1966	19	15%	IAC	W	STM
SWITZERLAND	6750		85.0	1	C	VTE	1953	15	15%	IND	W	STM
SWEDEN	6760	GOTEBORG	64.0	1	C	VTE	1952	19	15%	IND	W	STM
TURKEY	6770	ISTANBUL	129.0	2	C	ST	1952	63	5%	IAC	WP	OIL
REGION TOTALS	57		REGION CAPACITY:				31,669.1					

REGION

ENGLAND & IRELAND

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFG	WF	LSE	SC	FUEL
CHANNEL ISLANDS (BRITISH)	6790	GUERNSEY	600.0	1	C	MSF	1960	87	5%	PPAL	W	OIL
CHANNEL ISLANDS (BRITISH)	6791	JERSEY	1,800.0	4	C	MSF	1968	87	5%	PPAL	W	OIL
ENGLAND	6800	SOUTH DENES, GREAT YARMOUTH A	174.0	3	C	ST	1955	03	5%	IND	W	COAL
ENGLAND	6810	SOUTH DENES, GREAT YARMOUTH B	24.0	1	C	MSF	1960	03	5%	IND	W	COAL
ENGLAND	6840	KILROY, P	634.0	4	O	VTE	1966	03	5%	IAC	W	COAL
ENGLAND	6850	CANVEY ISLAND ESSEX	119.0	2	C	MSF	1965	03	5%	IND	W	OIL
ENGLAND	6890	FLIXBOROUGH SCUNTHORPE	26.0	1	C	VTE	1940	03	15%	IND	W	COAL
ENGLAND	6900	SHOTTON, CHESHIRE	173.0	2	C	VTE	1952	03	15%	IND	W	COAL
ENGLAND	7060	A, BURTON-UPON-TRENT	216.0	3	C	VTE	1954	03	15%	IND	W	COAL
ENGLAND	7070	B, BURTON-UPON-TRENT	468.8	8	O	VTE	1958	03	15%	IND	W	COAL
ENGLAND	7080	C, BURTON-UPON-TRENT	295.2	4	C	VTE	1966	03	15%	IND	W	COAL
ENGLAND	7082	CROX	389.0	3	C	VTE	1967	03	15%	IND	W	COAL
ENGLAND	7084	CLAGENESS -B-	652.0	3	C	VTE	1967	03	5%	IND	W	LRAS
ENGLAND	7100	EGGBOROUGH, YORKS	403.2	4	C	VTE	1965	03	15%	IND	W	COAL
ENGLAND	7130	FERRYBRIDGE C	748.8	1	C	VTE	1965	03	15%	IAC	W	COAL
ENGLAND	7225	IMMINGHAM B	202.0	2	O	VTE	1966	03	15%	IND	W	COAL
ENGLAND	7235	KEADBY, SCUNTHORPE	259.2	3	C	VTE	1952	03	15%	IND	W	COAL
ENGLAND	7244	KENT OIL REFINERY	1,245.0	18	C	ST	1953	87	15%	IND	W	OIL
ENGLAND	7332	MARKINGTREE, ESSEX	57.0	1	C	ED	1967	26	15%	DEMO	W	ELEC
ENGLAND	7430	RATCLIFF-ON-SOAR	748.8	1	C	VTE	1967	03	15%	IAC	W	COAL
ENGLAND	7500	A, NEWARK-UPON-TRENT	432.0	6	O	VTE	1949	03	15%	IND	W	COAL
ENGLAND	7510	B, NEWARK-UPON-TRENT	79.2	3	C	VTE	1960	03	15%	IND	W	COAL
ENGLAND	7560	THORNHILL, DEWSBURY	115.0	2	C	VTE	1950	03	15%	IND	W	OIL
ENGLAND	7590	TILBURY A	242.0	4	C	ST	1957	03	5%	IND	W	COAL
ENGLAND	7640	WEST THURROCK	562.5	5	C	VTE	1962	03	5%	IND	W	COAL
ENGLAND	7700	WORCESTER	43.2	1	C	VTE	1943	03	15%	IAC	W	COAL
ENGLAND	7710	ROWERS MAIN, WEXFORDSHIRE	385.2	5	C	VTE	1956	03	15%	IND	W	COAL
ENGLAND	7720	GRIMETHORPE, BARNSLEY	216.0	3	C	VTE	1956	03	15%	IND	W	COAL
ENGLAND	7730	KINTON, SHROPSHIRE	144.0	2	C	VTE	1958	03	15%	IND	W	COAL
ENGLAND	7740	STOKEPRIDGE PARK, LINCOLN	53.0	2	C	VTE	1941	03	15%	IND	W	OIL
ENGLAND	7770	ILKESTON, DERBY	230.4	4	C	VTE	1954	03	15%	IND	W	COAL
ENGLAND	7790	CARNFA, LANCASHIRE	172.8	2	C	VTE	1964	03	15%	IND	W	COAL
ENGLAND	7820	CLAYTON	265.0	5	C	ST	1947	87	15%	IND	W	OIL
ENGLAND	7830	HAYLE	46.9	3	C	ST	1939	87	15%	IND	W	OIL
ENGLAND	7835	DEPTFORD EAST	139.0	1.0	C	ST	1952	87	15%	IND	W	OIL
ENGLAND	7840	DEPTFORD WEST	106.0	2	C	ST	1945	87	15%	IND	W	OIL
ENGLAND	7850	EDMONDHEAD	30.0	1	C	ST	1948	87	15%	IND	W	OIL
ENGLAND	7860	BATTERSEA B	213.0	2	C	ST	1947	87	15%	IND	W	OIL
ENGLAND	7870	PERCIVAL LANE	45.0	1	C	ST	1940	87	15%	IND	W	OIL
ENGLAND	7880	LEICESTER	60.0	2	O	ST	1950	87	15%	IND	W	OIL
ENGLAND	7890	BRADFORD	45.0	1	O	ST	1946	87	15%	IND	W	OIL
ENGLAND	7920	BANKSIDE	112.0	3	C	ST	1928	87	15%	IND	W	OIL
ENGLAND	7930	SPINEY BECK	58.0	1	O	VTE	1945	87	15%	IND	W	OIL
ENGLAND	7940	ACTON LANE	173.0	2	C	VTE	1952	87	15%	IND	W	OIL
ENGLAND	7950	SKELTON GRANGE	173.0	2	C	VTE	1952	87	15%	IND	W	OIL
ENGLAND	7960	THAMES MILL	173.0	2	C	VTE	1955	87	15%	IND	W	OIL
ENGLAND	7970	MERSEY MILL	173.0	2	C	VTE	1956	87	15%	IND	W	OIL
ENGLAND	7980	IPSWICH	29.0	1	O	VTE	1945	87	15%	IND	W	OIL
ENGLAND	8000	CORNINGTON	29.0	1	C	VTE	1947	87	15%	IND	W	OIL
ENGLAND	8010	FULHAM	108.4	2	C	ST	1949	87	15%	IND	W	OIL
ENGLAND	8020	WILLINGTON	144.0	2	C	ST	1953	87	15%	IND	W	OIL
ENGLAND	8030	BLACKBURN	35.0	1	C	ST	1941	87	15%	IND	W	OIL
ENGLAND	8040	WEST HAM	63.0	2	C	ST	1947	87	15%	IND	W	OIL
ENGLAND	8050	UPPER BOAT	39.0	1	C	ST	1941	87	15%	IND	W	OIL
ENGLAND	8060	PRESTON	86.0	2	C	ST	1945	87	15%	IND	W	OIL
ENGLAND	8070	RIPPLE	43.0	1	C	ST	1941	87	15%	IND	W	OIL
ENGLAND	8080	BARKING	202.0	1	C	ST	1957	87	15%	IND	W	OIL
ENGLAND	8090	CLARENCE DOCK	144.0	1	C	ST	1952	87	15%	IND	W	OIL
ENGLAND	8100	SCUNTHORPE (LYSAGHTS)	432.0	3	C	F	1960	87	15%	IND	WP	OIL
ENGLAND	8110	SCUNTHORPE (RTB)	288.0	2	C	F	1960	87	15%	IND	WP	OIL
IRELAND (NORTH)	8140	BELFAST CORP	144.0	2	C	VTE	1955	87	15%	IND	W	OIL
IRELAND	8144	TARBERT	144.0	1	C	VTE	1967	02	5%	IND	W	OIL
SCOTLAND	8160	CLYDESMILL	81.0	4	C	ST	1950	87	15%	IND	W	OIL
REGION TOTALS	63		REGION CAPACITY:				15,841.2					

REGION

AUSTRALIA

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFG	WF	LSE	SC	FUEL
AUSTRALIA	9410	BARALINGA	92.0	3	O	ST	1956	03	15%	PPAL	WP	OIL
AUSTRALIA	9420	PERWELL	230.4	4	C	VTE	1958	03	15%	IND	W	COAL
AUSTRALIA	9460	TALLAWARR	144.0	2	C	VTE	1954	03	15%	IAD	W	COAL
AUSTRALIA	9475	BRISBANE	216.0	1	C	MSF	1967	55	5%	IAD	WP	GAS
AUSTRALIA	9480	EMPOLTH GULF	60.0	1	C	EC	1965	55	15%	PPAL	W	ELEC
AUSTRALIA	9485	CITY-PALMA	46.0	01	C	MSF	1965	11	5%	IAD	W	
AUSTRALIA	9490	HAMMERSLEY	480.0	2	C	MSF	1966	87	5%	PFAL	WP	OIL
REGION TOTALS	7		REGION CAPACITY:				1,282.4					

REGION

ASIA (INCLUDING INDONESIA)

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFG	WF	USE	SC	FUEL
ANDAMAN IS.	8609	P.W. COCKYARE	89.4	1	C	ST	1947	87	5%	PPAL	W	OIL
INDIA	8610	CHAKAPORE	49.2	1	C	VTE	1945	63	15%	IND	W	COAL
INDIA	8611	DINGARPENI	25.9	1	C	VTE	1955	63	15%	IND	W	OIL
INDIA	8617	ELAGEPUR	95.0	2	C	VTE	1957	15	15%	IND	W	STM
INDIA	8614	PHULSEWAL	98.3	1	C	VTE	1954	15	15%	IND	W	STM
INDIA	8615	SINDRI	110.0	1	C	PSF	1959	67	15%	IND	W	
INDIA	8618	TUTICORIN	105.0	4	C	ST	1945	87	15%	IND	W	OIL
INDONESIA	8622	DJAPARDJA NO. 1	24.4	1	C	F	1963	55	5%	F	WP	OIL
INDONESIA	8623	DJAPARDJA NO. 2	28.8		C	F	1963	55	5%	F	WP	OIL
INDONESIA	8624	TANDJUNG PRICK	76.0	1	C	PSF	1966	15	5%	F	W	STM
JAPAN	8630	KASUGU	700.0	1	C	PSF	1965	55	5%	IND	WP	COAL
JAPAN	8631	SAKITO	660.0	01	C	VC	1956			IND	W	
JAPAN	8632	TOKYO	48.0	01	C	PSF	1965	55		CEMS	W	
JAPAN	8633	TAKETOYO CITY	115.2	1	C	PSF	1965	73	5%	IND	W	OIL
JAPAN	8635	TAKETOYO CITY	165.9	1	C	PSF	1965	73	5%	IND	W	COL
JAPAN	8637	YIPEJI CITY	317.0	1	C	PSF	1965	73	5%	IND	W	COL
KOREA (SOUTH)	8640	YUKO WOL	127.0	2	C	VTE	1962	19	15%	IND	W	STM
PAKISTAN	8661	EAST PAKISTAN	80.0	2	C	F	1966	55	15%	F	WP	GAS
PAKISTAN	8662		85.0	2	C	PSF	1964	19	15%	IND	W	STM
PHILIPPINE ISLANDS	8671	MANILA	80.0	2	C	F	1965	11	15%	PPAL	W	STM
PHILIPPINE ISLANDS	8672	CEBU CITY	67.0	1	C	ST	1964	22				
PHILIPPINE ISLANDS	8673	CEBU CITY	70.7	1	C	PSF	1966	11	15%	PPAL	W	STM
POLYNESIA (FR.)	8681		317.0	2	C	PSF	1966	37	5%	IND	WP	COL
POLYNESIA (FR.)	8682		264.0	1	C	PSF	1968	37	5%	MISC	WP	COL
POLYNESIA (FR.)	8683		32.0	2	C	ST	1968	37	5%	IND	W	OIL
POLYNESIA (FR.)	8684		63.0	2	C	PSF	1965	37	5%	IND	W	COL
THAILAND	8690	SRIRACHA	275.0	01	C	PSF	1965	11		IND	W	

REGION TOTAL: 27 REGION CAPACITY: 4,186.9

REGION

MIDDLE EAST

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFG	WF	USE	SC	FUEL
ADEN (PROTECTS)	8701	B.P. REFINERY LITTLE ADEN	485.0	3	C	ST	1955	87	5%	IND	WP	OIL
ADEN (PROTECTS)	8702	MEDJLIF	34.5	2	C	ST	1962	87	5%	IND	WP	OIL
ARABIA (SAUDI)	8712	RAFAHUZA	50.0	1	C	PSF	1967	11	5%	IND	W	STM
ARABIA (SAUDI)	8714	CUBA	61.0	1	C	PSF	1967	11	5%	PPAL	W	OIL
ARABIA (SAUDI)	8716	CUBA-AL-WAJH	24.0		C	EC	1967	55	15%	PPAL	W	ELEC
ARABIA (SAUDI)	8719	AL-WAJH	61.0	1	C	MSF	1967	11	5%	PPAL	W	STM
ARABIA (SAUDI)	8720	DHAHRAN ARIANCO	115.2	2	C	EC	1961	55	15%	PPAL	W	
SAUDI ARABIA	8725	AL KHOBAR-PEPSI COLA	28.0		C	ED	1967	55	15%	IND	W	ELEC
ARABIA (SAUDI)	8730	AL KHOBAR	7,400.0	03	C	MSF	1969	11	5%	PPAL	W	GAS
ARABIA (SAUDI)	8770	RAS TANURA E	140.0	4	C	ST	1956	22	5%	IND	W	GAS
ARABIA (SAUDI)	8780	RAS TANURA C	130.0	1	C	ST	1956	22	5%	IND	W	GAS
ARABIA (SAUDI)	8790	RAS TANURA E	260.0	2	C	ST	1960	22	5%	IND	W	GAS
ARABIA (SAUDI)	8803	ARAMCO	288.0	1	C	PSF	1968	22	5%	IND	W	COL
ARABIA (SAUDI)	8805	DAMMAM	346.0	1	C	PSF	1967	11	5%	IND	W	STM
SAUDI ARABIA	8806	DAMMAM	130.0		C	ED	1967	55	15%	IND	W	ELEC
ARABIA (SAUDI)	8810	JIDDA	5,600.0	2	C	PSF	1968	11	5%	IND	W	STM
BAHREIN	8830	AWALI (BAHRAIN)	100.0	1	C	EC	1963	55	15%	PPAL	W	
BAHREIN	8832	ARABIAN GULF	100.0	1	C	EC	1964	63				
BAHREIN	8833	HASSIN & BAPCO	60.0		C	ED	1968	55	15%	IND	W	ELEC
BAHREIN	8834	RAF BASE	50.0		C	EC	1963	55	15%	PPAL	W	ELEC
IRAN	8864	ABADAN	57.0	1	C	ST	1967	19	15%	IND	W	STM
IRAN	8880	KHARG, ISLAND A	300.0	2	C	MSF	1960	87	5%	PPAL	W	COL
IRAN	8890	KHARG, ISLAND B	300.0	1	C	MSF	1967	87	5%	PPAL	W	OIL
IRAN	8910	AGHA JARI	28.8	1	C	VTE	1950	03	5%	PPAL	WP	COL
IRAN	8912	PERSIAN GULF	240.0	3	C	VC	1968	44	5%	MIL	W	ELEC
IRAN	8913	BIG BOLANG	202.0	1	C	EC	1968	26	15%	PPAL	W	ELEC
IRAN	8915	BIG BOLANG	156.0	1	C	ST	1968	03	15%	IND	W	GAS
IRAN	8920	KASHAN	130.0	3	C	ST	1959	03	15%	IND	W	COL
IRAN	8930	IMAM HASSAN	159.0	1	C	PSF	1963	87	5%	PPAL	W	COL
IRAN	8931	IMEC	200.0	01	C	ED	1969	91	15%	PPAL	W	ELEC
IRAN	8935	KHARG ISLAND	66.0	2	C	PSF	1965	73	5%	IND	W	COL
IRAN	8936	KHARG ISLAND	239.0	1	C	PSF	1969	73	5%	IND	W	COL
IRAN	8937	KHARG ISLAND	100.0	01	C	MSF	1965	11		IND	W	
IRAN	8940	TEHERAN	67.0	2	C	F	1967	11	5%	PPAL	W	STM
IRAN	8950	ABADAN	86.0	1	C	ST	1951	87	5%	IND	WP	COL
IRAN	8955	ABADAN	100.0	1	C	MSF	1967	11	5%	IND	W	STM
IRAQ	8960	BAGHDAD	95.0	1	C	VTE	1958	03	15%	IND	W	COL
IRAQ	8961	BASRAH	57.6	1	C	VTE	1961	03	15%	IND	W	COL
ISRAEL	8970	EILAT A	1,000.0	1	C	MSF	1965	22	5%	PPAL	WP	COL
ISRAEL	8971	ISRAEL	46.0	02	C	VC	1969	44	5%	MIL	W	ELEC
ISRAEL	8973	ZAALIM	130.0		C	ED	1968	72	15%	CEMC	W	ELEC
ISRAEL	8975	YOTVATA	53.0	1	C	RC	1968	44	15%	CEMS	W	ELEC
ISRAEL	8980	HASHARPI SACER	630.0	01	C	ED	1969		15%	PPAL	W	ELEC
ISRAEL	8CCC	CCAC SEA	260.0	2	C	ST	1961	22	5%	IND	W	COL
KUWAIT	9050	SHUWAIKH C	1,260.0	2	C	MSF	1957	95	5%	PPAL	WP	GAS
KUWAIT	9060	SHUWAIKH C	1,260.0	2	C	MSF	1957	95	5%	PPAL	WP	GAS
KUWAIT	9C7C	SHUWAIKH E	2,400.0	2	C	MSF	1960	87	5%	PPAL	WP	GAS
KUWAIT	9080	SHUWAIKH F	2,400.0	2	C	MSF	1965	87	5%	PPAL	WP	GAS
KUWAIT	9090	SHUWAIKH G	4,800.0	2	C	MSF	1968	95	5%	PPAL	WP	GAS
KUWAIT	9100	CONT	240.0	3	C	EC	1963	55	15%	PPAL	W	
KUWAIT	9110	SHUAIBA	4,800.0	2	C	MSF	1967	95	5%	PPAL	WP	GAS
KUWAIT	9112	SHUWAIKH	4,800.0	2	C	MSF	1967	95	5%	PPAL	WP	GAS
KUWAIT	9113	SHUWAIKH	30.0	1	C	MSF	1968	73	5%	IND	W	GAS
KUWAIT	9114	SHUAIKH	4,8C8.C	1	C	MSF	1968	73	5%	PPAL	WP	GAS
KUWAIT	9120	SHUAIBA A	3,600.0	3	C	MSF	1966	87	5%	PPAL	WP	GAS
KUWAIT	9130	SHUAIBA B	2,400.0	1	C	MSF	1967	95	5%	PPAL	WP	GAS
KUWAIT	9140	WATER RESOURCES CENTER	49.2		C	MSF	1968		5%	CEMC	W	
KUWAIT	9150	MINA-AL-AHMADI A	960.0	8	C	ST	1954	95	5%	PPAL	WP	GAS
KUWAIT	9170	MINA-AL-AHMADI 1C	720.0	1	C	MSF	1962	87	5%	PPAL	WP	GAS
KUWAIT	9180	MINA-AL-AHMADI 11	720.0	1	C	MSF	1968	87	5%	PPAL	WP	GAS
KUWAIT	9190	GETTY OIL CO	100.0	1	C	MSF	1964	11	5%	IND	W	STM
KUWAIT	9210	AMERICAN INDEPENDENT OIL CO. A	50.9	2	C	ST	1959	75	15%	PPAL	W	GAS
KUWAIT	9220	AMERICAN INDEPENDENT OIL CO. B	96.0	1	C	MSF	1962	95	5%	IND	WP	GAS
KUWAIT	9240	RAS MARFAJI, NEUTRAL ZONE	500.0	1	C	MSF	1966	56	5%	PPAL	W	GAS
KUWAIT	9250	P. RAS AL MARFAJI	500.0	1	C	MSF	1962	95	5%	IND	WP	GAS

MIDDLE EAST

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFC	WF	LSE	SD	FUEL
KUWAIT	9260	BAFRA INDUSTRIAL ZONE	48.0	1	C	ED	1965	55	15%	PPAL	W	
KUWAIT	9265	MINA ABDULLA	450.0	1	C	MSF	1967	11	5%	IND	W	STM
LEBANON	9266	CENTRAL ELECTRICITY	137.4	1	C	MSF	1965	33	5%	IND	WP	OIL
OMAN	9270	MASIRAH AIR FORCE BASE	29.0	2	C	MSF	1963	87	5%	PPAL	W	OIL
OMAN (TRUCIAL)	9280	GAS ISLAND	90.0	3	C	MSF	1962	03	5%	PPAL	W	GAS
OMAN (TRUCIAL)	9290	ABU DHABI	30.0	1	C	MSF	1963	27	5%	PPAL	W	OIL
OMAN (TRUCIAL)	9291	ABU DHABI	7,200.0	2	C	MSF	1968	87	5%	PPAL	WP	GAS
OMAN (TRUCIAL)	9300	ABU DHABI	24.0	2	C	MSF	1963	26	15%	PCIR	W	OIL
OMAN (TRUCIAL)	9310	SHARJAH AIR FORCE BASE	58.0	4	C	MSF	1963	87	5%	PPAL	W	OIL
QATAR	9330	CCPA A & B	1,900.0	2	C	MSF	1963	87	5%	PPAL	WP	GAS
QATAR	9331	CCPA	238.3	4	C	ST	1963	87	5%	IND	W	OIL
QATAR	9332	CCPA CSD	2,516.7	2	C	MSF	1967	87	5%	PPAL	WP	GAS
QATAR	9333	CCPA	360.0	02	C	MSF	1955	87	5%	PPAL	W	OIL

REGION TOTAL: 78 REGION CAPACITY: 65,081.5

REGION

AFRICA

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFC	WF	LSE	SD	FUEL
ALGERIA	9340	ARZEW	154.0	3	C	ST	1964	37	5%	IAC	WP	STM
ALGERIA	9341	ARZEW	396.3	1	C	MSF	1968	37	5%	IND	WP	GAS
ALGERIA	9342	BONE (P.S.)	76.0	4	C	MSF	1953	37	5%	IND	WP	STM
ALGERIA	9343	CRAM (P.S.)	76.0	4	C	MSF	1953	37	5%	IND	WP	STM
ALGERIA	9344	SKIKDA	381.0	01	C	MSF	1965	37	5%	IND	WP	STM
ALGERIA	9345	SKIKDA	141.0	01	C	MSF	1965	37	5%	IND	WP	STM
QATAR	9350	CCPA	46.0	01	C	MSF	1968	11	5%	PIL		
ASCENSION ISLAND	9351	MILITARY AIRFIELD	103.6	01	C	VC	1957	71	5%		W	OIL
ASCENSION ISLAND (BRITISH)	9352	AMURA STANDARD OIL C	360.0	2	C	MSF	1959	87	5%	PPAL	W	OIL
ASCENSION ISLAND (BRITISH)	9353	BRITISH MINISTRY OF WORKS	30.0	1	C	F	1965	51	5%	PPAL	W	OIL
ASCENSION ISLAND (BRITISH)	9355	BRITISH MINISTRY OF WORKS	25.0	1	C	MSF	1966	51		PPAL	W	OIL
ASCENSION ISLAND (BRITISH)	9356	BRITISH MINISTRY OF WORKS	30.0	1	C	MSF	1967	51		PPAL	W	OIL
CANARY ISLANDS (SPAIN)	9357	LAS PALMAS	5,284.0	1	C	MSF	1967	51	5%	PPAL	WP	OIL
CANARY ISLANDS (SPAIN)	9359	FUERTEVENTURA	33.0	1	C	VC	1965	44	5%	TCUR	W	ELEC
EGYPT (U.A.R.)	9360	AEL ZEIMA (SINAI)	600.0	1	D	MSF	1966	87	5%	PPAL	WP	GAS
EGYPT (U.A.R.)	9370	CAIRO SOUTH	201.6	2	C	VTE	1964	03	15%	IND	W	OIL
EGYPT (U.A.R.)	9384	MERSA MATRUH	264.0	2	C	MSF	1967	19	5%	PPAL	WP	OIL
EGYPT	9385	PORTEL PLANT	27.0	01	D	MSF	1965	15	5%	IND	W	OIL
EGYPT (U.A.R.)	9390	SIDI	51.0	1	C	VTE	1955	15	15%	PPAL	W	STM
EGYPT (U.A.R.)	9404	CHAFAGA	264.0	2	C	MSF	1967	19	5%	PPAL	WP	OIL
EGYPT (U.A.R.)	9410	SAFAGA BAY	40.3	2	C	ST	1930	87	5%	PPAL	W	OIL
EGYPT	9415	SAFAGA	76.5	03	C	MSF	1969	73	5%	IND		
LYBIA	9420	BENGHAZI	5,673.0	16	C	ED	1969	26	15%	PPAL	W	ELEC
LIBYA	9435	PORT BREGA A (ESSO)	200.0	1	C	MSF	1965	11	5%	IND	W	STM
LIBYA	9440	PORT BREGA B (ESSO)	50.0	1	C	MSF	1963	11	5%	IND	W	STM
LIBYA	9445	PORT BREGA	200.0	1	C	MSF	1965	11	5%	IND	W	STM
LYBIA	9446	PORT BREGA	200.0	01	C	MSF	1969	11	5%	IND	W	STM
LIBYA	9450	MARSA BREGA	60.0		C	F		71				
LIBYA	9460	ES SIDER	100.0	2	D	MSF	1962	55	5%	IND	WP	GAS
LIBYA	9462	ZLITAN	115.0	1	C	ED	1964	26	15%	PPAL	WP	OIL
LIBYA	9472	EL-ACEM	25.0	1	C	ED	1961	26	15%	PIL	W	ELEC
LIBYA	9473	ZUETINA	720.0	1	C	MSF	1968	11	5%	PPAL	W	OIL
LYBIA	9476	AIR BASE	70.0		C	EC	1960	55	15%	IND	W	ELEC
LIBYA	9490	TRIPOLI	30.0	3	D	VC		71				
LIBYA	9490	MISRATA	45.0	3	D	VC		71				
MAURITANIA	9495	PORT ETIENNE	57.0	2	C	VC	1954	11	5%	IND	W	OIL
MAURITANIA	9498	NOUAKCHOTT	793.0	1	C	MSF	1968	37	5%	PPAL	WP	OIL
MOROCCO (SPANISH)	9500	CEUTA	1,055.3	2	C	MSF	1965	15	5%	PPAL	W	OIL
NIGERIA	9510	IJORA	115.0	2	C	VTE	1962	87	15%	IND	W	OIL
SPANISH SAHARA	9520	EL AIUN	26.0	2	C	MSF	1966	15	5%	IND	W	
SPANISH SAHARA	9530	EL AIUN EMPRESA MINERA	925.1	01	C	MSF	1969	20	5%	IND	WP	
SPANISH SAHARA	9540	VILLA CISNEROS	30.0	3	C	VC		71				
SPANISH SAHARA	9545	EA MINSA	26.5	1	C	EC	1966	55	15%	PPAL	W	
SUDAN	9550	KHARTOUM	60.0	02	C	MSF	1968	27	15%	IND	W	OIL
TUNISIA	9581	KHEMKOUCH	77.9	02	C	ST	1969	37	15%	IND	WP	STM
TUNISIA	9585	A.G.I.P.	28.0	1	C	EC	1967	55	15%	PPAL	W	ELEC
SOUTH AFRICA	9592	APCOS	24.0	1	C	ST	1960	03	15%	IND	W	OIL
SOUTH AFRICA	9594	LUDERITZ	144.0	1	D	MSF	1961	87	5%	PPAL	W	OIL
SOUTHWEST AFRICA	9595	LUDERITZ	61.0		C	ST	1954	15	15%	PPAL	W	STM
CANARY ISLAND	9997	LANZAROTE	650.0	01	C	MSF	1965	55	5%	PPAL	WP	OIL

REGION TOTAL: 56 REGION CAPACITY: 19,652.6

REGION

USSR

COUNTRY/STATE	ID	LOCATION	CAPACITY	UN	ST	TYPE	YEAR	PFC	WF	LSE	SD	FUEL
U.S.S.R.	9730		25.0		C	ST		22				
U.S.S.R.	9732	CASPIAN SEA	26.0	1	C	FD	1961	22	15%	PPAL	W	ELEC
U.S.S.R.	9740		233.0		C	ST		22				
U.S.S.R.	9750		290.5		C	ST		22				
U.S.S.R.	9760	SHEVCHENKO #1	1,200.2		C	VTE	1963	81	5%	DEPC	W	OIL
U.S.S.R.	9761	SHEVCHENKO #2	3,500.5		C	VTE	1967	81	5%	PCIR	WP	OIL
U.S.S.R.	9762	SHEVCHENKO #3	3,500.0		C	VTE	1968	81	5%	PCIR	WP	OIL
U.S.S.R.	9763	SHEVCHENKO #4	3,500.0		C	VTE	1969	81	5%	PCIR	WP	OIL
U.S.S.R.	9800	KHASAVYOCSK	317.9		C	VTE	1969	81				

REGION TOTAL: 9 REGION CAPACITY: 12,591.7

GRAND TOTAL: 712 GRAND TOTAL: 244,604.8

EXPLANATION OF CODES AND SYMBOLS

Key

CAPACITY

Total plant capacity in 1,000 U.S. gallons per day

UN

Unit-one complete unit and no stack or module thereof.

STATUS

C - Plant under Construction
O - Plant in Operation

TYPE OF PROCESS

Distillation

F - Single-stage Flash-Distillation
MSF- Multi-stage Flash-Distillation
VTE- Long T be Vertical
ST - Submerged Tube
VC - Vapor Compression

Membrane

ED - Electrodialysis
RO - Reverse Osmosis

Freezing

VF - Vacuum Freezing-Compression

YEAR

Year of beginning operation and/or year when construction was initiated.

WATER FEED

SW - Sea Water
ISW - Inland or Brackish Water

USE

MPA - Municipal
IND - Industrial
P - Power
TOUR - Tourism
DEMO - Demonstration
MIL - Military
M&IN - Municipal and Industrial

SD - SINGLE OR DUAL PURPOSE

W - Water plant only
WP - Water and Power

FUEL

GAS
OIL
COAL
URAN - Uranium
STM - Steam
ELEC - Rubbish
RUB - Cooling water and
CW exhaust gases from diesel-engine

Manufacturers Code

Aerojet General (Envirogenics)	02
Alton Co., Ltd., England	03
Alsthom, France	06
Aluminum Co. of American	05
American Machine & Foundry Co., USA	07
Aqua-Chem, Inc., USA	11
Asahi Chemical Ind. Co., Ltd., Japan	15
Atlas-Mak Maschinenbeau GmbH, West Germany	19
Babcock & Wilcox, Spain	20
Baldwin-Lima-Hamilton Corp., USA	22
Boby, England	26
British Aqua Chem, Ltd., England	27
Buckley & Taylor, Ltd., England	29
Chicago Bridge & Iron, USA	32
Colt Industries, USA	35
Compagnie Electro-Mechanique-SCAM, France	37
Condenseurs Delas, France	38
Continental Engineering	47
DEMAG, West Germany	39
De Pretto-Escher Wyss, Italy	40
Desalination Engineering, Ltd., Israel	44
du Pont Company, USA	45
Foster-Wheeler Corp., USA	46
Franco Tosi, Italy	48
George Clark & Sons, England	51
Gulf General Atomic, USA	53
Ionics, Inc., USA	55
Ishikawajima-Harima Heavy Industries Co., Ltd. Japan	59
The Lummus Co., USA	63
Lurgi, West Germany	67
Mechanical Equipment Co., USA	71
Negev Inst., Israel	72
Sasakura Engineering Co., Japan	73
Selas Corporation of America, USA	75
Sidem, France	76
Stearns-Roger Corp., USA	77
Struthers SC. International Co., USA	79
Union of Soviet Socialist Republics (USSR)	81
Universal Desalting, USA	82
Weir Westgarth, England	87
Werkspoor-Amsterdam V., Holland	91
Westinghouse, USA	95

Table 5

DESALTING PLANTS WITH CAPABILITIES
OF 1 MILLION GPD OR GREATER

Country	Location	Process	Status	Plant Capacity 1000 gpd	Mfr.
United States (USA)					
California	San Diego	MSF	O	1,000	11
New Mexico	Roswell	VC	O	1,000	22
Texas	Freeport	VTE	O	1,000	32
Florida	Siesta Key	ED	O	1,200	55
Pennsylvania	Clairton	MSF	O	1,440	95
Texas	Texas City	MSF	O	2,160	95
California	San Diego	MSF	O	2,600	46
Florida	Key West	MSF	O	2,620	95
United States Territories					
Virgin Islands	Virgin Island Water & Power Auth.	VTE	O	1,000	77
Virgin Islands	St. Thomas	MSF	O	1,000	95
Virgin Islands	St. Croix	MSF	O	1,500	95
Virgin Islands	Virgin Islands Water & Power Auth.	MSF	O	2,500	22
Puerto Rico	Penualas	MSF	O	2,500	11
Virgin Islands	V.I. Water & Power Authority-St Croix	VTE	O	1,000	77
North America except USA and its territories					
Mexico	Rosarita	MSF	O	7,500	11

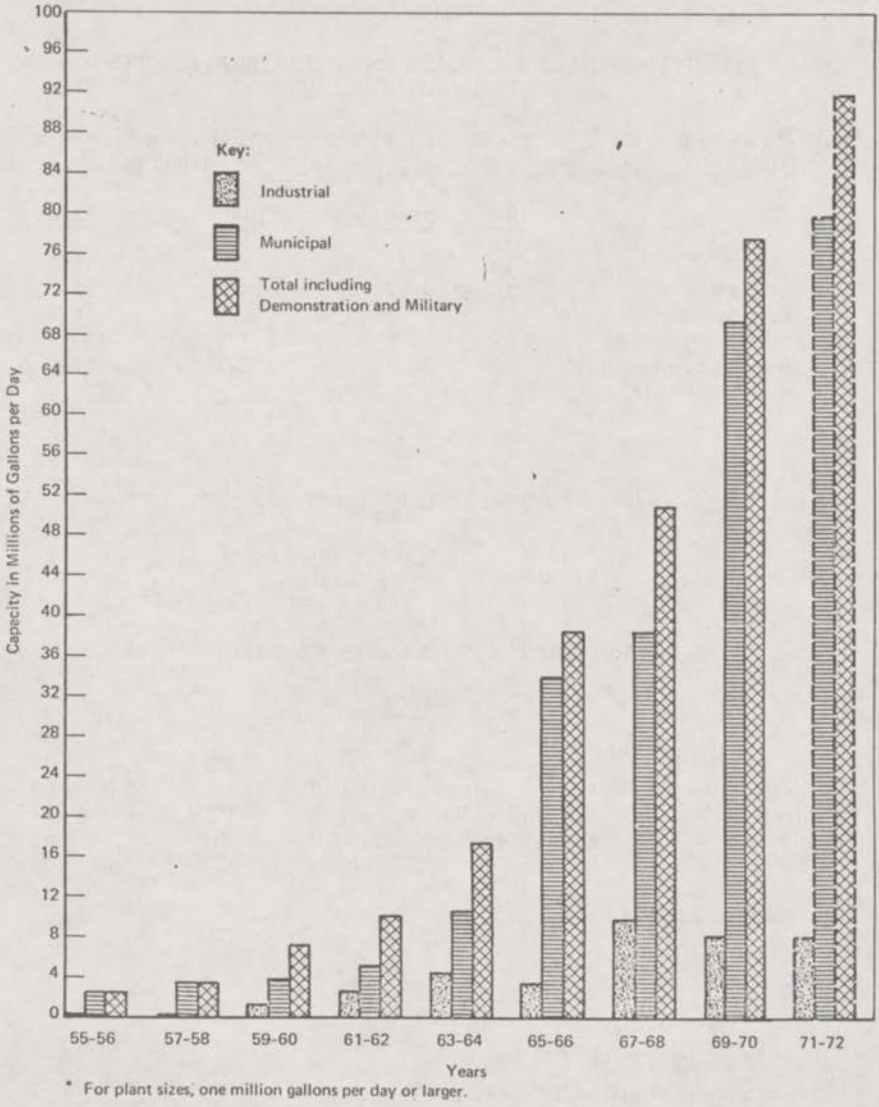
Table 5 (Cont'd)

Country	Location	Process	Status	Plant Capacity 1000 gpd	Mgr.
Caribbean					
Curacao	Mundo Nobo ,	ST	O	1, 074	87
Bahamas/Br.	Freeport	MSF	O	1, 267	11
Bahamas/Br	Nassau, New Providence Island	MSF	O	1, 440	81
Bahamas/Br		MSF	C	2, 400	27
Curacao	Shell Petroleum	MSF	O	1, 584	
Cuba	Guantanamo	MSF	O	2, 250	
Aruba/Neth Ant.	Balashi Govt.	ST	O	2, 688	
Aruba/Neth Ant.	Balashi Govt.	MSF	C	1, 584	
Curacao	Mundo Nobo	MSF	O	3, 440	
Curacao	Mundo Nobo	MSF	C	1, 060	
Curacao	Emmastad	MSF	C	1, 590	
Antigua	St. Johns	MSF	C	1, 200	
South America					
Venezuela	(Port) Cardon	MSF	O	1, 440	
Europe (Continental)					
Netherlands	Europoort	VTE	C	1, 140	
Italy	Italsider	MSF	O	1, 200	
Italy	Brindisi	MSF	C	2, 550	
Malta	Valetta	MSF	O	1, 200	
Italy	Brindisi	MSF	O	1, 320	
Netherlands	Terneuzen	MSF	O	7, 650	
Malta	Valetta	MSF	O	4, 400	
England and Ireland					
England	Kent Oil Refinery	ST	O	1, 295	
Channel Islands	Jersey	MSF	O	1, 800	

Table 5 (Cont'd)

Country	Location	Process	Status	Plant Capacity 1000 gpd	Mgr.
Australia					
Asia					
Middle East					
Israel	Eilat A	MSF	O	1,000	
Kuwait	Shuwaikh C	MSF	O	1,260	
Kuwait	Shuwaikh D	MSF	O	1,260	
Qatar	Doha	MSF	O	1,800	
Qatar	Doha Ced	MSF	O	2,300	
Kuwait	Shuwaikh E	MSF	O	2,400	
Kuwait	Shuwaikh F	MSF	O	2,400	
Kuwait	Shuaiba B	MSF	O	2,400	
Kuwait	Shuaiba A	MSF	O	3,600	87
Kuwait	Shuaiba	MSF	O	4,800	59
Kuwait	Shuwaikh	MSF	O	4,800	59
Kuwait	Shuwaikh	MSF	O	4,800	73
Kuwait	Shuwaikh G	MSF	C	4,800	95
Saudi Arabia	Jidda	MSF	C	5,000	11
Oman/TR.	Abu Dhabi	MSF	C	7,200	87
Africa					
Libya	Benghazi	ED	C	5,100	26
Morocco/Sp	Ceuta	MSF	O	1,055	19
Canary Islands	Las Palmas	MSF	C	5,284	91
Union of Soviet Socialist Republic					
U.S.S.R	Shevchenko	VTE	O	1,200	85
U.S.S.R	Shevchenko	VTE	O	3,500	85
U.S.S.R.	Shevchenko	VTE	O	3,500	85
U.S.S.R.	Shevchenko	VTE	O	3,500	85
TOTAL	(59 Plants)			148,551	

See footnotes at end of Table 2 for coding.



* For plant sizes, one million gallons per day or larger.

Figure 2. Worldwide Desalting Plant Sales*

Table 6

1969-1970 DESALTING PLANT CONSTRUCTION STARTS
STATISTICAL SUMMARY

Plant Capacity Range (1000 gpd)	No. of Plants		Total Plant Capacity (1000 gpd)	
	1969	1970	1969	1970
25-99	13	12	808	669
100-499	17	12	3482	2218
500-999	3	3	2083	1995
1000-4999	7	5	10175	14944
5000 & Greater	2	3	12573	48500
	42	35	29, 121	68, 326

1969-1970 DESALTING CONSTRUCTION STARTS[1/]

Country or State	Location	Plant Capacity 1000 gpd	Type of Process[2/]	Mfr.[2/]
UNITED STATES AND ITS TERRITORIES				
		1969		
Florida	Longboat Key	80.0	RO	45
Puerto Rico	Ponce	250.0	F	05
California	San Diego VTE-X	300.0	VTE	11
Florida	Siesta Key	1200.0	ED	55
New Mexico	Socorro	100.0	ED	55
Subtotal (5 Plants)		1930.0		

1/ Data for 1970 are incomplete.

2/ See footnotes at end of Table 2.

Table 6 (Cont'd)

Country or State	Location	Plant Capacity 1000 gpd	Type of Process	Mfr.
		1970		
Puerto Rico	Culebra	288.0	VC	35
North Dakota	Fortuna	85.0	ED	55
Pennsylvania	Wilkes Barre	5000.0	MSF	95
Iowa	Greenfield	150.0	RO	45
Subtotal (4 Plants)		5523.0		
		CARIBBEAN		
		1969		
Bahamas	North Bimini	58.0	VC	11
Antigua	Crabs Peninsula	1200.0	MSF	11
Bahamas	Public Works	2400.0	MSF	27
Bahamas	Freeport	70.0	MSF	11
Bahamas	Nassau	86.4	VTE	03
Brit. West Indies	Antigua	90.0	VC	71
Curacao	Mundo Nobo	1060.0	MSF	87
Curacao	Emmastad	1590.0	MSF	91
Aruba	Balashi	1585.0	MSF	11
St. Martin (Neth. Ant.)	Millett's Pond	100.0	MSF	11
Subtotal (10 Plants)		8239.4		
		1970		
Bermuda	Castle Harbor	30.0	MSF	07
Aruba	Balashi	1584.0	MSF	11
Virgin Islands	St. Croix	1000.0	MSF	95
Virgin Islands	Culebra	30.0	VC	71
Lesser Antilles	St. Maarten	264.0	MSF	19
Virgin Islands	St. Croix, Grape Tree Hotel	100.0	MSF	11
Subtotal (6 Plants)		3003.0		

Table 6 (Cont'd)

Country or State	Location	Plant Capacity 1000 gpd	Type of Process	Mfr.
		SOUTH AMERICA		
		1969		
Argentina	Mar-Del-Plata	86.4	VTE	03
Ecuador	La Libertad	180.0	MSF	03
Subtotal (2 Plants)		266.4		
		1970		
Chile	Anaconda Copper Co.	250.0	ED	55
		250.0		
		CONTINENTAL EUROPE		
		1969		
Portugal	Boavista	25.0	VTE	57
Belgium	Ostend	100.0	MSF	82
Italy	Gaeta	380.0	ED	26
Italy	Manfredonia	32.0	ED	26
Italy	Viesta	275.0	ED	91
Netherlands	Botlek	100.0	MSF	91
Netherlands	Rotterdam	250.0	ED	91
Netherlands	Rotterdam	100.0	ED	91
Netherlands	Amsterdam	50.0	ED	91
Netherlands	Europort	1140.0	VTE	03
Subtotal (10 Plants)		2452.0		
		1970		
Spain	Palomares	100.0	VC	11
Gibraltar	Ministry of Works	120.0	F	51
Cyprus	Shell Oil	132.0	MSF	27
Cyprus	Power Plant	52.0	MSF	51

Table 6 (Cont'd)

Country or State	Location	Plant Capacity 1000 gpd	Type of Process	Mfr.
		1970		
Italy	Bari	530.0	ED	55
Italy	Taranto	793.0	MSF	95
Crete	Heraklion	64.0	MSF	19
Malta	Valette	3600.0	MSF	95
Greece	Is. of Syros	264.0	MSF	22
Italy	Brindisi	150.0	MSF	11
Subtotal (10 Plants)		5805.0		
		ASIA		
		1969		
Thailand	Sriracha	275.0	MSF	11
		ASIA		
		1970		
Hong Kong		60.0	MSF	73
		MIDDLE EAST		
		1969		
Arabia (Saudi)	Al Khobar	7500.0	MSF	11
Iran	Kharg Island	100.0	VC	11
Oman/Tr.	Abu Dhabi	60.0	VC	71
Iran	Imeg	200.0	ED	91
Israel	Israel	66.0	VC	44
Israel	Mashabei Sadeh	630.0	ED	
Subtotal (6 Plants)		8556.0		

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Table 6 (Cont'd)

Country or State	Location	Plant Capacity 1000 gpd	Type of Process	Mfr.
		1970		
Bahrain	Alba	300.0	VTE	03
Bahrain	Delmon Hotel	29.0	ED	55
Qatar	UMM Said	672.3	VTE	03
Qatar	Doha	4800.0	MSF	87
Oman	Abu Dhabi	70.0	VC	11
Arabia (Saudi)	Abu Dhabi	70.0	MSF	11
Kuwait	Getty Oil Co.	100.0	MSF	11
Kuwait	Shuaiba	30,000.0	MSF	06
Kuwait		25.0	ED	55
Subtotal (9 Plants)		36,066.3		
	AFRICA			
		1969		
Egypt	Mobile Plant	27.0	MSF	19
Canary Islands	Fuerteventura	528.0	MSF	20
Libya	Benghazi	5073.0	ED	26
Libya	Port Brega	200.0	MSF	11
Algeria	Skikda	381.0	MSF	37
Algeria	Arzew	191.0	MSF	37
Tunisia	Rhennouch	77.0	ST	37
Spanish Sahara	El Aaiun	925.0	MSF	20
Subtotal (8 Plants)		7402.0		
		1970		
Tunisia	Gabes	88.8	MSF	38
Egypt	Mershah Matrouth	65.0	ED	55
Subtotal (2 Plants)		153.8		

Table 6 (Cont'd)

Country or State	Location	Plant Capacity 1000 gpd	Type of Process	Mfr.
		U.S.S.R.		
		1970		
Russia	Shevchenko B	13,500.0	VTE	81
Russia	Shevchenko C	3,960.0	MSF	81
Subtotal (2 Plants)		17,460.0		
GRAND TOTALS:	1969 (42 Plants)	29,120.8		
	1970 (35 Plants)	68,326.1		

ACKNOWLEDGMENT

Assistance in review of inventory data and statistical analysis was provided by Dr. Nabil El-Ramly, University of Hawaii. The author found Water Desalination Report (R.A. Smith, editor), a valuable source of data on new plants.

The continued cooperation of the following manufacturers in supplying data for use in this report is gratefully acknowledged:

Aiton Co., England.
Alsthom, France.*
Aluminum Co. of America, United States.*
AMF, Inc., United States.
Aqua-Chem, Inc., United States.
Asahi Chemical Ind. Co., Ltd., Japan.
Atlas-Mak Maschinenbeau GmbH, West Germany.
Baldwin-Lima-Hamilton Corp., United States.
William Boby and Co., Ltd., England.
British Aqua Chem Ltd., England.[1]*
Buckley & Taylor, Ltd., England.
Chicago Bridge and Iron, United States.
Colt Industries, United States.
Condenseurs Delas, France.*
Continental Engineering N.V., Netherlands.
Demag Electrometallurgie GmbH, West Germany.[2]*
De Pretto-Escher Wyss, Italy.[1]
Desalination Engineering, Ltd., Israel.
du Pont Company, United States.
Envirogenics Co., United States.*
Foster Wheeler Corp., United States.
Franco Tosi, Italy.*
George Clark & Sons, AMF, England.
Gulf General Atomic, United States.
Ionics, Inc., United States.
Ishikawajima-Harima Heavy Industries Co., Japan.
The Lummus Co., United States.
Lurgi, West Germany.
Mechanical Equipment Co., United States.
Negev Institute for Arid Zone Research, Israel.*
Sasakura Engineering Co., Ltd., Japan.
S. E. C. Babcock & Wilcox, C.A., Spain.[2]*
Selas Corporation of America, United States.
SIDEM, France.
Stearns Roger Corp., United States.
Struthers Scientific and International Co., United States.
Union of Soviet Socialist Republics.
Universal Desalting Corp., United States.*
Weir Westgarth, England.
Werkspoor Water N.V., Netherlands.
Westinghouse, United States.

Mrs. HANSEN. Will you also give us a list of the countries in the world who have plants operating?

Mr. O'MEARA. Madam Chairman, we have a publication that does just that.

COST OF DESALTED WATER

Mr. MCDADE. Is it possible when you furnish us that information to give us some range of costs?

Mrs. HANSEN. He has given us the cost at the site for natural water and the cost for the saline water.

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[1] Licensee of Aqua-Chem, Inc., United States.
[2] Licensee of Baldwin-Lima-Hamilton Corp., United States.
[3] New this report.

Mr. O'MEARA. One specific thing I mentioned was that based on the bids for the 3-million-gallons-per-day plant in Oklahoma, we expect that water to be desalted for 38 cents per 1,000 gallons. That is brackish water, not seawater. That is a pretty firm number because the capital investment is known. The operating costs have not been proved out but based on other plants that have been built it is fairly accurate.

Mr. MCDADE. Is that a significant decrease?

Mr. O'MEARA. Yes.

Mr. MCDADE. What is the next?

Mr. O'MEARA. There is one in Florida that has a similar operating cost.

The cost of desalting brackish water is coming down to a very reasonable price.

It is very clear that these plants are being built because they are the best and cheapest source of supply in that given locality; otherwise, they would not have been constructed.

Mrs. HANSEN. Are those what you wanted, Mr. McDade?

Mr. MCDADE. Yes, these are helpful.

COLORADO RIVER SALINITY

Mrs. HANSEN. What will be the impact of the proposed program reduction on the agreement between the United States and Mexico to reduce the salinity of U.S. waters flowing to Mexico?

Mr. O'MEARA. Madam Chairman, we don't believe our redirected effort will affect any proposed agreement. The Department assisted Mr. Brownell in his evaluation of the salinity problem with Mexico. Many alternatives were examined, some of which involved desalting. The resulting report is presently classified and is now before President Nixon for his consideration.

Mr. EVANS. What has happened to the plan for constructing a desalination plant on the Colorado River at the border with Mexico?

Mr. O'MEARA. There is no plan at this time to construct a desalination plant on the Colorado River near the Mexican border.

Following the visit of President Echeverria to the United States last summer, President Nixon appointed the Honorable Herbert Brownell as his Special Representative for Resolution of Salinity Problems with Mexico. Mr. Brownell was directed by the President to submit a report providing recommendations for a permanent, definitive, and just solution to the problem.

Mr. Brownell formed a task force of water experts to study this very complex problem and to develop a possible course of action or combination of activities that would provide an acceptable answer to the salinity issue.

After due consideration of all the alternatives, Mr. Brownell prepared a confidential report and submitted it to President Nixon in December 1972. The recommendations, which are presently classified, are still under consideration by the President.

DISCONTINUED PROJECTS

Mrs. HANSEN. Please provide for the record a listing of the specific projects and locations and personnel to be affected by the proposed cutback. Also indicate the disposition of each facility.

Mr. O'MEARA. Yes, ma'am.

[The information follows:]

The funding reduction will result in the closing of the following test facilities, equipment, and test programs:

Present capital investment

Item	*Million*
Closing of San Diego, Calif., test facility [1]	$14.0
Closing of Roswell, N. Mex., test facility	3.7
Closing of Freeport, Tex., test facility (including the materials test center)	4.0
No field operation of recently completed freezing process pilot plant	6.5
No operation of recently completed horizontal tube distillation pilot plant	.5
Cancellation of plans to build high recovery brackish water test bed (experimental plant)	.5

[1] Facility was previously scheduled for closing down but not on the present accelerated timetable.

Other research and development activities which will be terminated include the following: (1) Development of distillation processes, (2) any research and development on brackish waters, (3) work on ion exchange processes, (4) work on pretreatment and brine disposal methods, (5) research on new or improved materials, (6) cooperative studies with States on potential application of desalting at a time when water supply planning groups are beginning to recognize value of desalting, (7) most of the fundamental research, including that on process fundamentals, and (8) research on desalting geothermal brines.

Major specific projects and operations which are being ended or are not to be initiated and number of personnel in permanent positions to be reduced in force, follow:

RESEARCH

Specific projects eliminated for fiscal years 1973 and 1974:

THE MATERIALS TEST CENTER (FREEPORT, TEX.)—$1,600,000

This is judged to be the best work being done in the United States on corrosion studies, testing of alloys, polymer coatings, instrumentation required, et cetera. The cooperative studies with three industrial associations must also be terminated. All work on the development of new alloys, polymer concrete, evaluation of materials performance in operating plants, basic research on alloys, and related projects.

ENVIRONMENTAL RESEARCH—$420,000

Geothermal brines, brine chemistry. SiO_2 Scale, Corrosion, Solubilities, et cetera. Effect of pH, salinity, temperature, specific metal ions, et cetera, on the ecology.

PRETREATMENT OF FEED STREAM—$250,000

Chemical treatment; sludge blanket and coagulation. Essential for membrane processes and elimination of many fouling problems.

BASIC RESEARCH—$245,000

Basic research on properties of water, composition of aqueous solutions, ultrapure water; additives for scale prevention and related studies.

ION EXCHANGE—$225,000

Separation with regeneration by electric current or hot water. New ion exchange hollow fibers for RO and Donnan dialysis.

SELECTIVE REMOVAL—$300,000

Selective removal of deterious metal ions and/or toxic compounds by: Dynamic membrane process, ultrafiltration, chemical, and RO processes.

DEVELOPMENT OF A PVC TUBULE SYSTEM—$195,000

Development of a PVC tubule system with new noncellulosic membranes having a moderate packing density.

MEMBRANE RESEARCH—$350,000

Membrane research on new materials (polysulfones, polyimines, composite membranes, polypropylenes, et cetera) which have shown promise for brackish waters, rejection of organic compounds, et cetera.

CROSS FLOW FILTRATION—$225,000

Cross-flow filtration and ultrafiltration membrane systems. Principle applications should be brackish water and waste water desalting.

RESEARCH ON NOVEL PROCESSES—$175,000

Research on novel processes such as polymer solvation, electric grill and others, since they are applicable to brackish waters and not sea water.

JOINT PROGRAMS—$325,000

Joint programs with NASA and Corps of Engineers which involve washwater recovery and recycle, utilization of new dry membrane (RO) by the Army.

FREEZING PROGRAM—$850,000

The freezing program is being emasculated just as it was coming to fruition. This process has low-energy requirement, no scaling problems, minimal corrosion problems, can be adapted to yield a dry salt (no brine discharge problems), and works for all classes of saline and polluted waters, but requires further R. & D. and pilot plant activities.

HYDRATE PROCESS—$200,000

An even more favorable crystallization process from the above considerations is a hydrate process. An extremely favorable hydrating agent, F–31 (CH_2FCl) has been found and characterized. Most of the new technology being developed for freezing should have direct applicability to an F–31 hydrate process, but this has to be demonstrated.

DU PONT'S DP–1—$275,000

DuPont's DP–1 membrane and Celanese's PBI membranes have demonstrated truly outstanding physical properties for permselective membranes. Further development of both of these materials will be seriously jeopardized.

NEW DRY PROCESS—$150,000

A new dry process for making RO membranes has been developed. This has intrinsic advantages in processing simplicity (and thereby cost and reproducibility), storage, shipping, handling, and biodegradibility characteristics. In a very short period of time, these have become fully competitive with conventional "wet-process" membranes. The general approach looks very promising for other polymer systems and for sea water membranes, but adequate funding is not available.

PIEZODIALYSIS—$250,000

A very promising new desalting process is piezodialysis. Funding to date has properly been at a low level because, although very significant theoretical advantages can be cited, the fabrication of the requisite charge-mosaic membranes

appeared to be a dubious proposition. Three separate contractors have recently made dramatic progress in this area (using three fundamentally different approaches), and the theoretical promise now appears obtainable, and clearly justifies an accelerated effort.

BASIC AND EXPLORATORY—$1,100,000

Basic and exploratory research aimed at the development of new phenomena, new ideas, new data, et cetera leading to the development of new processes, and information required for the solution of many water problems. This activity has been carried on principally by universities and research organizations.

ENGINEERING AND DEVELOPMENT

The impact of program redirection

Item	*Estimated cost to complete*
1. Shutdown of the horizontal tube test vehicle at San Diego results in no essential data from a $500,000 investment. Checkout of the unit was only performed.	$500,000 for a required year's operation.
2. Long-term test operation of the aluminum pilot plant will not be possible, thus never achieving the answers to "will aluminum work in desalting plants and what are the limitations."	$200,000 for a required additional year's operations.
3. The performance of new materials (protective coatings and polymers) in an actual desalting environment will not be established since the Freeport test bed will be shut down. Thus, recommendations for materials application to commercial plants so as to reduce cost and extend life cannot be made.	$200,000.
4. The long-term performance and associated economic potential of brackish water membranes as applied to surface and other waters cannot be established.	$300,000.
5. Newly designed RO modules having capacities of over 30,000 gpd. cannot be tested, although experimental membrane segments which could be employed in these modules are available.	$300,000.
6. Long-term pump tests will have to be terminated in midstride so that required improvements applicable to both seawater and brackish water reverse osmosis desalting cannot be firmly defined. Additionally, new high efficiency pumps designed for RO service will not be constructed or tested, even though designs have been completed. Thus, the opportunity of reducing costs by reduction in energy requirements cannot be fulfilled.	$500,000 over 2 years.
7. A 70,000 gpd freezing pilot plant which is in the final stages of construction can only go through in-plant checkout. No actual field tests can be conducted on seawater. The result is that $500,000 is expended with essentially no technology return to the Government	$300,000 to $400,000.
8. The high recovery RO systems potential cannot be realized since the high recovery test bed will not be built. The design has been completed. Thus, the technical and economic potential of a system for obtaining up to 90 percent of the feed water as fresh water (with the resultant conservation of water	

resources and decrease in waste brine) will not be established. Additionally, a building costing about $400,000 to house a high recovery reverse osmosis test bed has been completed but will not be used	$1,000,000 for test bed; $400,000 for operations.
9. The work on brine concentration by both distillation and electrodialysis will be terminated. The data necessary to substantially reduce the brine disposal problem from inland desalting plants will not be obtained	$250,000 distillation; $100,000 electrodialysis.
10. In order to reduce reverse osmosis brackish water process costs, major developments have taken place resulting in membranes having very high fluxes at about one-third to one-fifth of present-day unit operating pressures. Under the program redirection, it is not now possible to evolve and test assemblies employing these membranes. Thus, the full potential of these membranes cannot be established	$500,000.
11. Planned operation of the Freeport test bed using the seeding method of scale control cannot be conducted. To reach the point of providing this system in a large plant, a major amount of research and development has been conducted. That work will be lost in terms of its potential for pretreatment of feed water for commercial plants	$1,000,000 for seed equipment installation and operation.
12. Deletion of the SWRO test bed (ops)	$250,000.
13. Deletion of distillation effort at WB (over and above aluminum pp.):	
PM & PE	$150,000.
ED–TP	$400,000.
14. Deletion of geothermal effort	$800,000.
15. Deletion of heat transfer investigations, new materials application design studies, operation and reliability studies	$600,000.
16. Deletion of effort in brackish water membranes component development, including instrumentation and controls	$350,000.
17. Reduction of advanced SW membranes development including components, membranes modules, pretreatment investigations and improved pilot plants	$1,700,000.
18. Deletion of all membrane development investigations directed towards possible use of RO and ED for water reuse	$500,000.
19. Termination of high temperature electrodialysis investigations	$200,000.
20. Deletion of all field support and engineering projects, such as handbook data, water chemistry, reliability and maintainability studies, and data correlation	$400,000.
21. Deletion of all development work in eutectic freezing and system design studies	$400,000.
22. Deletion of all work in direct contact condensation	$200,000.
23. Deletion of development of advanced pretreatment systems for distillation	$300,000.
24. Deletion of all parametric studies, consultants, technical digests, etc	$300,000.

PROGRAM DEVELOPMENT

Impact of program redirection

Item	Estimated cost to complete
A. Transfer technology to enable State and municipal agencies to utilize desalting in development of water resources.	
1. Cooperative studies:	
(a) Florida	46,000
(b) Virgin Islands	35,000
(c) Nebraska	50,000
(d) Nevada (Las Vegas Wash)	25,000
(e) OCWD	50,000
Subtotal	206,000
2. Update data and supplement "Desalting Handbook for Planners"	25,000
B. Evaluate AVCO continuous bed ion-exchange pretreatment system. Continue development of the process for desalination and quality improvement of brackis waters	200,000
C. Complete study and experimental work on Colorado River water quality improvement program:	
1. Ion-exchange process pilot plant evaluation in cooperation with MWD on Colorado River Water (MWD has given an informal indication that it might assume responsibility for operation. In this case, the $225,000 could be reduced by $100,000	225,000
2. Studies to assess value of desalting on highly saline point sources to river	25,000
Subtotal	250,000
D. Brine disposal:	
1. Determine effect of brine discharged from Foss plant into Washita River	92,000
2. Determine effect of brine discharged from test facility on coastal ecology	200,000
3. Evaluate combination of ED and solar evaporation with RO discharge by pilot plants	300,000
Subtotal	592,000
E. Studies to respond to Congress on sections (4a) and (4b) of Saline Water Conversion Act on prototypes:	
1. Santa Barbara (Seawater RO)	50,000
2. San Luis Obispo (Seawater RO)	50,000
3. Arizona nuclear powerplant	10,000
4. United States-Mexico	25,000
5. Westwide water study support	50,000
Subtotal	185,000
F. Computer services for process analysis and program evaluation	100,000
Total	1,558,000

REDUCTION-IN-FORCE

The reductions in personnel in permanent positions that are to be effected by the proposed cutback will total 110 by the end of fiscal year 1974. The activities and number of positions involved follow:

Washington, D .C. (administration and coordination activity)	91
San Diego, Calif	2
Freeport, Tex	1
Roswell, N. Mex	3
Wrightsville Beach, N. Car	13

Mr. O'MEARA. We are leasing property from the San Diego Gas & Electric Co. Our lease will expire by 1975 and we intend to be off the property within the time frame of our lease. At Freeport we are on property that we are leasing from Dow Chemical.

Roswell, N. Mex., is a different situation. When we located there, the city donated the land to the Federal Government for our use. We have not made a decision on what we would do with that property at this time.

Mr. EVANS. The President's budget redirects the carryover funds for several reclamation projects on the western slope in Colorado to salinity control studies. How can you reconcile this apparent concern with the salinity problems in Colorado with the drastic cutback in the Office of Saline Water?

Mr. HITE. The program on the Upper Colorado River relates more to evaluation of the effect of proposed construction than to development of new sources of water supplies.

The salinity of the Colorado River is increasing and adding to a water quality problem that already is of grave concern to both this country and the Republic of Mexico. Continued development of the water resources is expected to generate additional salinity increases if it is not controlled. Natural sources contribute most of the salts to the river and increases in consumptive use of water in turn decreases the amount of water available to dilute the salt load in the river. Return flows from irrigation also add significant quantities of salt. The Upper Colorado evaluation will provide for a review of the potential effects of the authorized but not yet constructed projects and will include an estimate of the costs for facilities which may be required to control these increases in salinity. It is intended that such costs will be reflected in the justifications for development of these projects. The results of the studies will be available in fiscal year 1975.

Mrs. HANSEN. Mr. McDade?

Mr. MCDADE. I have no questions.

CONCLUSION

I do want to compliment Mr. O'Meara on a statement that is delivered with a great deal of excellence and commend him for the way he has devoted his energies toward running this program. I think it has been a great credit to the Department and the Federal Government.

Mr. O'MEARA. Thank you very kindly, Mr. McDade.

Mrs. HANSEN. Mr. O'Meara, I would like to express my appreciation and the appreciation of the committee for the work you have done and the very excellent presentations you have made before the committee.

Mr. O'MEARA. We look forward to the opportunity to come before this committee.

WEDNESDAY, APRIL 4, 1973.

OFFICE OF WATER RESOURCES RESEARCH

WITNESSES

WARREN A. HALL, ACTING DIRECTOR
F. WILLIAM KOOP, EXECUTIVE OFFICER
RAYMOND A. JENSEN, MANAGER, WATER RESOURCES SCIENTIFIC INFORMATION CENTER
FRANCIS M. WILES, DIRECTOR OF BUDGET, OFFICE OF THE SECRETARY
JACK O. HORTON, ASSISTANT SECRETARY, LAND AND WATER RESOURCES

Mrs. HANSEN. We now have the Office of Water Resources Research and our principal witness is Dr. Warren A. Hall, the Acting Director.

We will insert Mr. Hall's biography in the record at this point.

[The biography follows:]

AUTOBIOGRAPHICAL STATEMENT—WARREN A. HALL

Born in Hot Springs, S. Dak.

Attended high school in Crawford, Nebr. Obtained degrees in engineering from the California Institute of Technology (B.S. 1942) and the University of California (Ph. D. 1952).

Began career as lecturer to professor at the University of California, in Los Angeles, 1947–72. Subsequently, held positions as assistant dean for undergraduate studies, engineering (curriculum development, administration of undergraduate degrees); director of the water resources center, University of California 1960–66; and director, Dry Lands Research Institute, University of California 1966–70.

Some special assignments and positions from September 1969 through December 1970 include: Technical assistant for Water Resources, Office of Science and Technology, Executive Office of the President, Washington, D.C.; Chairman, Committee on Water Resources Research of the Federal Council on Science and Technology; member, President's Task Group on the Great Lakes and member, Joint United States–Canadian Working Group on the Great Lakes.

From July 1967–July 1969 he was Chairman, Executive Board, Universities Council on Water Resources (UCOWR); July 1964–July 1969, member of the Executive Board of UCOWR; July 1964–July 1966, served as Executive Secretary, UCOWRk; July 1965–July 1970, member, U.S. National Committee, International Hydrologic Decade (IHD), member, of the Steering Committee, and Chairman of the Education Subcommittee. In 1965 and 1966, member, U.S. Delegation to Coordinating Council (IHD), Paris, France. From 1964 to 1967, Chairman, Western Interstate Water Conference.

Various committee assignments as member of American Society of Agricultural Engineers, American Society of Civil Engineers, American Geophysical Union, American Society for Engineering Education, International Association for Scientific Hydrology. Lecturer in numerous short courses (California, Colorado, Nebraska, Maryland, District of Columbia, Utah, Ohio).

He is the author of over 65 technical papers on irrigation, ground water recharge, and the application of systems analysis to problems of irrigated agriculture and water resources management. Textbook (with John Dracup) "Water Resources Systems Engineering" McGraw-Hill, 1970.

GENERAL STATEMENT

Mrs. HANSEN. I am sure you have a general statement, Mr. Hall.

Mr. HALL. That is correct.

Mrs. HANSEN. We will insert your statement in the record. Please summarize it for the committee.

Mr. HALL. Yes, Madam Chairman.

[The statement follows:]

Madam Chairman:

It is an honor and a privilege to appear before this Committee for the first time to present the appropriation request for the Office of Water Resources Research (OWRR) for fiscal year 1974.

The purpose of this statement is to summarize and in some instances supplement the narrative statements included in the budget justifications document. It also provides information as to the current status of the program being conducted under provisions of the Water Resources Research Act of 1964, as amended, together with information regarding the 1974 program.

Budget Request

OWRR's request for 1974 is $13,149,000, a decrease of $3,195.000 from the 1973 appropriation for the program. The request includes:

(a) $8.1 million for support of research, training, and related activities by 51 water resources research institutes that have been established in each State and Puerto Rico as originally authorized by Title I of the Act. Of this amount, $5.1 million is for the Section 100 "Assistance to States for Institutes" annual allotment program, and $3.0 million is for the Section 101 "Matching Grants to Institutes" program. This $8.1 million is $2,040,000 below the amount appropriated for 1973. The decrease is equivalent to the 1973 Congressional add-on for the "Assistance to States for Institutes" program.

(b) $3.17 million for additional water research by qualified individuals or organizations under the Title II provisions of the Act. This $3.17 million is $1.13 million below the current year's appropriation.

(c) $934,000 for operation of a center for the collection, retrieval and dissemination of scientific and technical water resources information, the same amount as is currently available for 1973 center operations.

(d) $945,000 for program development, management, and related administrative costs, a decrease of $25,000 for the 1973 appropriation.

Annual Report

Copies of our 1972 Annual Report recently were furnished the Committee. That report provides more detailed descriptions of the various aspects of OWRR program operations than are contained in this statement or in the budget justification document. In addition to covering research results and their application, the report discusses manpower training and public involvement

aspects of the program. It also devotes separate sections to highlight reports from each of the State institutes and to activities of OWRR's Water Resources Scientific Information Center.

Distribution of Appropriation

Significant elements of the five "activities" which are included within the 1974 budget request are as follows:

(1) Annual Allotments of $100,000 will be provided to a water resource research institute located at a State university in each of the 50 States and Puerto Rico, pursuant to Section 100 of the Act.

* This allotment provides basic and essential financial support to each of the 51 institutes to assist them in conducting their water research programs as approved by OWRR, in the training of potential water resource personnel through the participation of selected student research assistants, and in the dissemination of research results.

* The States are contributing approximately $4 million to the annual allotment program each year.

* Based largely on the annual allotment program, institutes have assumed State leadership roles in providing advisory, consultant and research services directed toward developing solutions to urgent water-related problems. The State institute directors have also taken positive action to consult and collaborate with leading water officials within the states in the development of their annual programs, as required by the December 1971 amendments to the Act.

* Over 450 research projects are in progress during 1973 and approximately the same number will be supported in 1974.

* Over 1,000 students receive training annually by participation as research assistants on these projects.

(2) Matching Grants totaling $3 million in Federal funds will be awarded to the State water resources research institutes pursuant to Section 101 of the Act.

* This program provides the State institutes with up to 50% of the funding necessary to conduct water resources research projects which could not otherwise be undertaken.

* No set amount is granted each State. Rather, State institutes compete for Federal matching funds by submitting research proposals to OWRR. Competition between institutes is keen with 350 proposals requesting over $12 million having been submitted for 1974 consideration of which approximately

100 have been tentatively selected. This selection has permitted us to assure that funded projects will be of high quality.

* Research proposals are reviewed and selection is made based on their overall merit as reflected by the contribution the research can be expected to make toward the solution of important water problems. Review assistance to OWRR is regularly obtained from water resources scientists and specialists in other Department of the Interior bureaus and in other Federal agencies to supplement evaluations made by the OWRR staff.

* Training is also an integral part of this program. More than 800 student engineers and scientists currently are receiving training in water resources research disciplines while serving as research assistants to experienced project leaders.

(3) Contracts and Grants totaling $3.17 million in Federal funds, will be awarded to competent public and private academic and non-academic organizations and individuals pursuant to Title II of the Act.

* Under this program the services of outstanding research organizations and individuals, in addition to those eligible to participate under the Title I university institute research program, are available to carry out research to fill voids in the overall research program and to carry out research directed toward the solution of water problems of urgent national concern related to the mission of the Department of the Interior as prescribed by law.

* Projects are reviewed and selected by OWRR based on their overall merit and relevance to research voids in major water resources problem areas. As in the matching grant program, OWRR obtains outside review and evaluation assistance from Department of the Interior bureaus, other Federal agencies, and others having special competence and interest in the water resources areas proposed for research attention.

* For the 1974 program a total of 344 research proposals requesting over $32 million have been submitted for funding consideration. It is expected that approximately 50 of these proposals will be approved.

* Title II funds have been about equally divided between academic and non-academic entities. During the 1968-1973 period, 89 were conducted by private industry, 21 by non-profit research groups, and 19 by State or local public agencies. The remaining 150 were awarded to academic institutions.

(4) Water Resources Scientific Information Center (WRSIC) operations provide an effective means for collecting, retrieving, and disseminating scientific and technical information concerning water resources research and developments to meet the needs of organizations and individuals working in

the water resources field. The Center's services speed the application of research results and reduce undesirable duplicative research efforts.

* The Center will acquire more than 15,000 abstracts in 1974 reflecting the results of completed research and will process and publish these abstracts in its "Selected Water Resources Abstracts" journal. Over 3,000 copies of each semi-monthly issue are made available to serve some 15,000 persons throughout the Nation's water resources community.

* Ten "literature centers of competence" will be supported in 1974 to provide scientific information base materials. Expanded cooperation of Federal, State and other water resource organizations, to provide additional information, will be encouraged.

* The Center will publish an annual "Water Resources Research Catalog" containing summary descriptions of approximately 7,000 ongoing water resources research projects, as well as state-of-the-art reports and several topical bibliographies in special subject areas.

* In 1974 a computer-supported search and retrieval system, which uses the Center's machine-readable information base to respond to specific information requests and for the economical production of topical bibliographies, will be further refined and improved.

* WRSIC is a relatively new unit, established about 5 years ago. Its machine-readable information base now contains over 60,000 items including abstracts and appropriate keywords and indexing terms, all or any part of which can be readily retrieved as needed. Hence, the Center continues to increase its capacity to respond effectively and comprehensively to the technical information needs of the Nation's water resources community. The information base, kept up to date by prompt acquisition by WRSIC, now makes it possible to permit anyone who can describe his high priority water resources problem area information needs, with appropriate and specific keywords, to obtain bibliographical references and abstracts of virtually all research results and related information pertinent to that problem.

(5) Program Administration and Management activities will continue to be carried out by a small staff.

* Staff responsibilities include the development of plans, programs, and budgets; identification of water research priorities; review, analysis, and selection of projects for support; monitoring progress of research projects; coordination of research activities including the conduct of meetings, field visits, and providing liaison between officials of Federal agencies, State institutes, and others; and providing normal housekeeping activities required for program conduct.

* The administration and management workload handled by the OWRR staff has increased by an estimated 5% during the past year, and a larger

increase is expected to occur in 1974. In part, this increasing workload is due to the fact that an ever-increasing number of agencies, organizations, and individuals are gaining knowledge of and developing an interest in the research and related activities of this relatively new program. A major increase is anticipated as a consequence of the introduction of new program management practices for improved identification and definition of the most critical research needs and the development of cost-effective research programs to meet those needs. It is expected that these workload increases will be absorbed through administrative efficiencies.

* For 1974 46 positions are proposed of which eight are assigned to the Water Resources Scientific Information Center. This is identical to the 1973 staffing plan.

Effect of 1974 Budget Request

The requested appropriation will permit the Office of Water Resources Research to carry out an effective program at a funding level somewhat below the current-year level. It will enable OWRR to continue to:

(a) Encourage an experienced and diversified group of water resource scientists to perform research directed toward the solution of urgent water resource problems existing at local, State, regional, and national levels. While particular emphasis will continue to be given to pressing current problems calling for immediate research attention, it is expected that a reasonable amount of the effort will be directed toward improving water planning, conservation and related methodologies and practices which will permit anticipation and hopefully avoidance of future problems before they occur.

(b) Attract and contribute to the effective on-the-job training of student scientists, in a variety of water resource related specialties, thus providing an increasing number of qualified personnel to meet the future demands of the Nation's water resource community.

(c) Promote improved communication and coordination of efforts among those engaged in Federally sponsored water-related programs; avoid undesirable replication of research effort; and provide improved means for collecting, storing and disseminating information about water resource developments and results to persons and organizations who will apply such information to existing or potential water resources planning, management, research, and related problems.

As discussed below, certain new program development and operating policies and procedures have been initiated which we believe will improve significantly the relevancy and cost-effectiveness of research conducted under the OWRR program, thus increasing the pay-off from funds appropriated for the program.

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Increasing Program Effectiveness in the Future

A primary past task of OWRR has been to provide leadership and assist in the creation of broadly competent centers of excellence for water resources research at each of the fifty-one State water research institutes established by the Water Resources Research Act. Building on the originally small nucleus of scientists concerned with research on the Nation's water problems in 1964, the State institute universities together with other universities that have been brought into the program now have at their disposal an impressive array of outstanding research talent in all of the essential disciplines. This talent can be called upon when and as needed to conduct the research required in treating the multi-faceted problems of preserving, enhancing, developing and utilizing the Nation's water resources. Although differences exist between institutes in the specific fields in which they excel, there have been created fifty-one star performers in water resources research.

The next task for OWRR is to put these fifty-one "star performers" together in multi-institute, hard-hitting, championship teams working cooperatively and in unison to achieve major State, multi-State, regional and national water resources research objectives. With effective consultation and collaboration with leading water officials at the local, State, regional and national levels, these teams can proceed efficiently and effectively to identify the dimensions of the serious problems which cry out for urgent attention at all these levels. They can proceed with an integrated systematic analysis of research requirements, identifying the potential courses of action which might be followed to mitigate those problems in the most effective and least costly way, determining the deficiencies in knowledge and understanding which would appear to block their implementation or to raise serious questions of feasibility, consequences, cost or effectiveness. The research studies required to eliminate the deficiencies of knowledge and understanding thus identified as essential to national actions can then be allocated to the team members through a planned and coordinated delegation of research responsibilities.

Finally, but as a continuous simultaneous and correlative process through the consultation and collaboration mechanisms now being emphasized, it is expected that a coordinated cost-effective means will be developed and utilized for interpreting and transferring the results of the research to those responsible for implementing solutions to problems.

Implementation Plans

OWRR currently is proceeding as rapidly as possible to adjust its program so as to achieve the potential represented by the opportunities for improvement mentioned above.

OWRR realizes that it can accomplish its mission only with the wholehearted participation or cooperation of the Nation's universities, the

state, local and regional water agencies and associations, and the many agencies of the Federal government involved to a greater or lesser extent in the management of the Nation's water resources. Thus, the program actions described below will be effected largely through encouragement and leadership provided by OWRR, carefully backed and supplemented by judicious decisions concerning the allocation of OWRR funds.

1. Plans for the development of a multi-institute regional approach to identify and accomplish water resources research, and for disseminating results thereof, have been initiated with various regional groups of State institute directors. The response to date has been most enthusiastic. These study plans are now being implemented and applied to regional groupings of all of the OWRR institutes and their affiliated universities as rapidly as is consistent with good management. They involve the development and use of teams of inter-university research staff and state, regional and other involved water officials that will, on a regional or sub-regional (e.g., river basin) basis, specifically and systematically identify the major water-related problems of the area involved, make in-depth analyses and determinations of the potentially most practicable and viable alternatives for the solution of such problems, and identify and describe the gaps in knowledge that are required to be filled through research before a selected alternative can be implemented. Also to be built into these study plans will be arrangements to facilitate ultimate dissemination and application of research results. All study provisions will require effective, continuing consultation and collaboration with the appropriate water resource officials.

2. Working closely with the State Institutes, special priority attention will be given by the OWRR staff to the development of efficient and effective mechanisms for accomplishing this problem and research analysis on a systematic basis as well as avoiding undesirable or unnecessary duplicative efforts by the several regional study teams involved. This will assure that the research program designed as a result of the studies is timely, relevant, necessary, and cost-effective and at the same time sufficient to allow prompt mitigation of the corresponding water problems.

3. A program already has been instituted to improve significantly the processes of consultation and collaboration between the State institutes and the leading water officials within the State and region. This will continue to be developed to the maximum extent practical.

4. Mechanisms have been established and are being extended for improved coordination of the OWRR research program with other bureaus having water and water-related land resources functions in Interior. As these prove effective, it is planned to extend them to other Federal agencies having significant water-related responsibilities.

Summary

The major purpose and objective of the program administered by the Office of Water Resources Research is to assist in meeting the Nation's present and future quantitative and qualitative water requirements by: conducting a meaningful water resources research program; attracting and training scientists and engineers in water resources oriented disciplines; and assembling and disseminating information concerning ongoing research and the results of completed projects. To date, excellent progress has been made to achieve this purpose and objective. Looking to 1974 and beyond, it is expected that progress will be significantly enhanced: (1) by working jointly and cooperatively with, and benefiting from, the excellent research organization and competence developed by the State institute universities, by their affiliates, and by the private research community, during the past eight years; and (2) by adopting new research program development procedures that will more adequately assure that the research conducted has high cost-effective potential and is clearly relevant to the most critical water problems of the Nation.

BUDGET REQUEST

Mr. HALL. Madam Chairman, I will highlight only the budget part per se and then suggest, with your permission, that it would be best if we moved directly to questions.

The request for 1974 is $13.149 million, which represents a decrease of $3,195,000 from the appropriations for 1973, and is $1.155 million below the obligations we expect to make for 1973.

Of this amount $5.1 million will be used for the support of State institutes, one in each State. However, as you will notice this will cover the 51 institutes already in being and will not provide funds for the three new institutes authorized in 1971.

Mrs. HANSEN. Where are the three new institutes located?

Mr. HALL. At Guam, Virgin Islands, and the District of Columbia.

In addition to the $5.1 million, $3 million, which is the same as last year, will be used for matching grants to State institutes. The amount for additional water research, our title II program, will be $3.17 million which is $1.13 million lower than 1973.

REDUCTION IN BUDGET REQUEST

Mrs. HANSEN. Why was this program reduced by $1.13 million?

Mr. HALL. It stems from the budgetary constraints imposed by the President and the Department of the Interior. I don't believe it represents a feeling that water resources research is not important. It rather represents a need to trade off something, and this is what had to go.

The Water Resources Scientific Information Center will be funded at the same rate as for 1973, which is $934,000. The amount for administration will be $945,000, which is a decrease of $25,000 below the 1973 appropriation.

I think that that indicates the essential parts that we need to cover. In the rest of my statement I have indicated some of the important things that we expect to do with the program.

I would like to particularly call attention to one section in the statement which concerns increasing program effectiveness. I don't believe that it's necessary to go into the details at this time, unless you would like to see what some of this involves.

Mrs. HANSEN. The committee will decide what questions are going to be asked.

SALARIES AND EXPENSE

Please insert justification pages 1 through 19 in the record at this point.

[The pages follow:]

HIGHLIGHT STATEMENT

The total budget request for the Office of Water Resources Research (OWRR) is $13,149,000, a decrease of $3,195,000 from the FY-1973 appropriation for the program and $1,155,000 from the amount requested for the FY-1973 program. The request includes: (1) $5.1 million for annual grants to State Water Research Institutes under Sec. 100, Title I, of the Water Resources Research Act, a decrease of $2,040,000 from the FY-1973 appropriation but identical to the FY-1973 request; (2) $3.0 million for matching grants to the State institutes for specific research projects under Sec. 101, Title I, of the Act, which amount is identical to the amount requested and appropriated for FY-1973; (3) $3,170,000 for additional water research by qualified organizations pursuant to Title II of the Act, a decrease of $1,130,000 from the amount requested and appropriated for FY-1973; (4) $934,000 for operating a center for acquisition, dissemination and retrieval of scientific water resources information, which amount is identical to the amount requested and appropriated for FY-1973; and (5) $945,000 for program management and administration, a decrease of $25,000 from the amount requested and appropriated for FY-1973.

Title I and II Research Programs

As set forth in some detail in the statements that follow and in OWRR's 1972 Annual Report, significant and demonstrable progress has been made in achieving program purposes and objectives. These are, to assist in meeting the Nation's present and future quantitative and qualitative water requirements by conducting a meaningful water resources research program, training water scientists and engineers, and disseminating information about research results.

Under the Title I program authorized by the Water Resources Research Act, university water research centers are firmly established in each State and Puerto Rico. Over 800 research projects, in progress at these centers, are concerned with problems such as water management and protection, planning methodology, and conservation of water. Many projects supported under this program have already produced results used by State, Federal, and other officials. Prompted by the 1971 Act amendment, the State centers are now giving increasing attention to various consultation and collaboration actions directed toward assuring increased relevance of their programs.

The Title II research program enables the Department to obtain the services of outstanding research competence wherever it may be available, at universities, foundations, and private firms. Assisted by advice of Interior's bureaus and offices, this competence is being used to solve urgent water problems relating to the Department's mission. Currently, 150 Title II projects are in progress, concerned with priority research areas such as urban-metropolitan water supplies and conservation of estuarial and other fragile ecological complexes.

Training

Training provisions of the Act have been successfully implemented. Some 2,000 talented and imaginative students are employed each year as research assistants on approved projects, thus benefiting the program and providing training. In the past, following graduation, many of these students have accepted water-related positions in Federal and State agencies, universities and private enterprise.

Non-Federal Contributions

To accomplish the Sec. 101 matching grant portion of the Title I research program, the State institutes, during the 1965-1973 period, made commitments to provide $24 million in non-Federal funds and are prepared to provide substantial amounts of additional funds to match future Federal investments. In addition, and although not required to do so, the State institutes are making significant annual

contributions to the Sec. 100 annual allotment portion of the Title I program; such contributions are expected to be over $4,000,000 for the fiscal year 1973 alone.

Coordination Within States

State Institute Directors and their associates take an active part in public affairs activities relative to water problems within their States. They serve on statewide or basin committees, councils, commissions, and advisory groups, and on several occasions have been asked to provide expert advisory assistance to State legislative committees. Through such activities the State institutes are providing coordination and leadership for State water resource activities, thus helping to fill organizational gaps that have been a handicap to coordinated and more cost-effective water resource problem solving in several of the States.

Scientific Information Dissemination

OWRR's Water Resources Scientific Information Center (WRSIC) is successfully meeting scientific information needs of the Nation's water resources community. Its operations aid in avoiding duplication of research, provide more prompt application of research results, and improve research coordination at Federal and State levels. WRSIC's machine-readable information base now contains nearly 50,000 items (citations and abstracts) and is increasing at an annual rate of 16,000. Principal products are a twice-monthly research results abstracts journal, an annual catalog describing ongoing research, and topical bibliographies. The feasibility of establishing a remote retrieval station network to facilitate prompt responses to specific inquiries concerning research results is being studied.

DEPARTMENT OF THE INTERIOR

OFFICE OF WATER RESOURCES RESEARCH

Salaries and Expenses

Appropriation, 1972 (Total available, 1972)	$14,290,000
Appropriation, 1973	16,344,000

Summary of Increases and Decreases, 1974

	Base for 1974	Decrease 1974	
Assistance to States for Institutes:			
Retains annual grants to State institutes at level requested in 1973 budget request	$7,140,000	$ -2,040,000	
Additional Water Research:			
Reduces dollar value of research grants and contracts with universities, private firms and others	4,300,000	-1,130,000	
Administration:			
Reduction in costs incurred for critical review and similar management support studies	970,000	-25,000	-3,195,000
Net Decrease, 1974			3,195,000
Budget estimate, 1974			13,149,000

SALARIES AND EXPENSES

Analysis by Activities

Activity	Fiscal Year 1972 Amount Available	Fiscal Year 1973 Total Appropriation	Fiscal Year 1973 Transfers	Fiscal Year 1973 Amount Available
1. Assistance to States for Institutes	$ 5,100,000	$ 7,140,000	--	$ 7,140,000
2. Matching grants to institutes	3,000,000	3,000,000	--	3,000,000
3. Additional water research	4,300,000	4,300,000	--	4,300,000
4. Scientific information center	906,857	934,000	--	934,000
5. Administration	952,348	970,000	--	970,000
Unobligated balance lapsing	30,795	--	--	--
Total	14,290,000	16,344,000	--	16,344,000

SALARIES AND EXPENSES

Analysis by Activities

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Amount Available	F.Y. 1974 Estimate	Increase(+) or Decrease(-) 1974 compared with 1973	Page Reference
1. Assistance to States for institutes	$ 5,100,000	$ 7,140,000	$ 5,100,000	$-2,040,000	7
2. Matching grants to institutes	3,000,000	3,000,000	3,000,000	--	10
3. Additional water research	4,300,000	4,300,000	3,170,000	-1,130,000	13
4. Scientific information center	906,857	934,000	934,000	--	16
5. Administration	952,348	970,000	945,000	-25,000	17
Unobligated balance lapsing	30,795	--	--	--	
Total	14,290,000	16,344,000	13,149,000	-3,195,000	

JUSTIFICATION

The knowledge and understanding needed to develop solutions to problems, or to make effective and improved planning and decision-making possible, are the major purposes of water resources research. In every region of the Nation rising water quality and quantity requirements for the growing population and economy necessitate substantial investments in facilities. Existing water-related problems vary greatly in nature, often involve conflicting needs, and encompass local, State, regional or national economic, environmental, and social impacts of increasing significance and severity. Hence, water decision-makers face large and complex issues in adoption of plans and programs to best meet current and future needs.

The cooperative Federal/State program authorized by the Water Resources Research Act is uniquely designed and, among Federal programs, singularly well suited to fill urgent and significant water research gaps wherever they exist or develop. The 1974 program will emphasize the development of research solutions to "real-life" water-related problems of concern to the Department of the Interior as well as State and local water agencies. These gaps and real-life problems involve such matters as: urban/metropolitan water problems; developing improved planning, development and management methodologies; protecting the valuable and ecologically fragile complexes of estuaries, bays and wetlands; water saving and augmentation techniques; conjunctive use of surface and ground waters; and State, local and river basin water quality problems. The program will also provide increased attention to the matter of improving technology transfer as well as to improving consultation and collaboration actions between the State institutes and leading water resources officials within the several States.

This is a relatively new research program which began eight years ago. However, substantive and useful results have already emanated from research projects supported in prior years, and there are a number of instances where such results have been put to immediate use in water resources planning and management activities. Annual reports of the Office of Water Resources Research cite many examples of such results. A few examples also are summarized in the following justification statements for the annual allotment, matching grants, and additional water research (Title II) programs. Building upon this established research competence, and complementing it in fiscal year 1974 with increasingly effective scientific communication services provided by the Water Resources Scientific Information Center, continued demonstrable progress is anticipated in developing solutions to water resources problems existing throughout the United States.

1. Assistance to States for Institutes

Analysis by Activity

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Amount Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 compared with 1973
Assistance to States for institutes.....	$5,100,000	$7,140,000	$5,100,000	$ -2,040,000

Assistance to States for institutes. Fiscal year 1973, $7,140,000; fiscal year 1974, $5,100,000; decrease $2,040,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-2,040,000	--	$5,100,000	--	Provides for $100,000 for each State and Puerto Rico.

Pursuant to the authorization in Section 100 of the Water Resources Research Act of 1964, as amended, this portion of OWRR's appropriation request will provide $100,000 to each State and to Puerto Rico to support the work of a competent and qualified State university water resources research institute.

This annual allotment program is perhaps the most vital part of the total program authorized by the Act because it provides minimum support needed for continued operation of effective State water research institutes. The States, through these Institutes, are already assuming leadership roles in meeting urgent needs for water research, the training of competent water resource personnel, intra-state coordination of water research activities, and dissemination of research results to water officials who need and will apply those results. In addition to carrying forward an estimated 450 new and continuing research projects concerned with water problems within the States, it is expected that in 1974 the State institutes will:

(a) contribute approximately 40% of the cost of research and related activities carried out under their annual allotment programs;

(b) provide for training approximately 2,000 water resources scientists and engineers through student participation in approved research project work;

(c) expand upon the extent of their present knowledge and understanding of State water problems through increased consultation and collaboration with leading water officials within the States, thus assuring increased relevance of research to the most significant State water problems;

(d) continue to give attention to the need for disseminating research results to persons who need and can apply such results;

(e) collaborate with each other in developing procedures for researching water problems of concern to two or more states; and

(f) involve professional personnel employed by more than 50 universities other than the ones where the State institutes are located, thereby increasing the research competence available to the institutes.

Experience has shown that the State university institutes and other participating universities can take an objective approach to water resources problems, marshal creative talents from many sciences and academic disciplines, and develop innovative

approaches that can bring applicable new knowledge and breakthroughs. OWRR's Annual Reports contain summary information on a large number of useful research results stemming from the Section 100 annual allotment program. A few recent examples are cited below:

(1) An Indiana research project titled "Fluctuation of Reservoir Levels and the Related Cause of Landslides" examined the potential instability of earthen reservoir slopes at two levels, a general or regional level and a specific slope level. The Dam Inspection Section, Division of Water, Indiana Department of Natural Resources has adapted a portion of the results to their operations. This research had particular relevance in view of dam failures that have occurred recently. Another application of the research results, not originally anticipated, was in highway construction. The Office of Highway Operations of the U. S. Department of Transportation indicated that it is interested in using the results of this study.

(2) Modeling studies carried out by the Alaska institute in collaboration with Water Resources Engineers, Inc., of Walnut Creek, California, under the research project title "Preliminary Water Resources Study of Arctic Alaska" have improved knowledge of the hydrologic regime for the Arctic coastal plain. The Alaska institute has received several inquiries about this study and its tentative results from British Petroleum Alaska, the U. S. Geological Survey, the Tundra Biome Program, the U. S. Army Cold Regions Research and Engineering Laboratory, the U. S. Forest Service, and Environment Canada of the Canadian Federal Government.

(3) At the present time in Arizona large quantities of treated sewage effluent, which represent a valuable water resource in this semiarid region, are being discharged into the otherwise dry beds of rivers. A research project by the Arizona institute examined the technical, economic, and legal aspects of the exchange of nutrient-rich treated municipal waste water for high-quality ground water now used for irrigation of field and forage crops in the Avra-Marana Valley near Tucson. The computed cost of delivery of treated sewage effluent to the irrigated area compares favorably with the cost of ground-water pumping in the area. Under an exchange system, the farmers would, in effect, cycle some of their ground water through the city before using it for irrigation. Assuming 50 percent return flow from the city system and minimal conveyance losses in a lined system, the municipal waste-water now available, under continuous recycling, would nearly double the city of Tucson's total water supply. The legal arrangement necessary for such a plan appears to be compatible with the existing framework of Arizona statutory and case law.

(4) Research by the Kentucky institute titled "Hydraulic and Sediment Transport Studies in Relation to River Sediment Control," demonstrated that dredge holes in a river can act as sediment traps, and that through proper design these holes can be used to recover coal, sand, or other potentially valuable materials comprising the sediment. By proper location, these may also help to control the accumulation of sediment around locks and in navigation channels. Because of the very large saving in dredging costs which could result, the U. S. Army Corps of Engineers has approved a research proposal to see if the results of this project can be adapted to this use. The American Sand and Gravel Association also has shown interest in using the method for controlling pollution.

(5) Relating to the mounting pressures for recreational lands and homes in Montana, the results of a research project titled "Planning for Multiple Purpose Water Resources Development: A Case Study of the Bitterroot Valley as it Relates to a State Plan" have stressed that it might be wise for residents to take steps to protect their areas from the ravages of rapid and unguided growth and to improve the effectiveness of the recreation-residential real estate market. The study indicated that substantial land values stem from free-flowing streams, wildlife resources, habitat maintenance, and aesthetics. Further, all of these should be regarded as beneficial uses of water and related land resources.

Results of this project are being used by the State Resource, Conservation, and Development Committees in their planning and development activities and also by the Water Resources Division of the State Department of Natural Resources and Conservation.

(6) The Louisiana Water Resources Research Institute has completed a very important study of the potential effects of diverting water from the Mississippi River to Texas. Diversions during periods of low flow would be very harmful to downstream users. However, it was found that diverting Mississippi River water during periods of high flow would probably have minimal adverse effects on downstream users. To accomplish this would require a large capacity of storage to provide a continuous flow to users in Texas and New Mexico. Diversion, storage, pumping, and distribution were studied from an economic point of view--and questions are raised as to whether costs might be prohibitive.

(7) The population and industrial growth in the coastal plain has created a corresponding increase in the demand for fresh water. Adequate planning for this area has been severely hampered since the agency responsible for water planning has only limited knowledge of the ground water resource. Drilling costs have restricted the number of observation wells necessary for conventional explorations. It became readily apparent that a faster and more economical method must be devised for assessing the status of the ground water resource in this area if good water planning were to become a reality. The result of a Virginia institute research project has been the development of a seismic mapping procedure for use by the Virginia Bureau of Water Resources in their planning activities for the coastal plains. The economies present in this new system for conducting ground water investigations are readily apparent when it is realized that the cost is approximately $400 per site with the seismic technique, compared to an instrumented test well costing $5,000. The seismic technique does not give the same amount of detail as a test well but it does give sufficient information for comprehensive ground water planning.

2. Matching Grants to Institutes

Analysis by Activity

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Amount Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 compared with 1973
Matching grants to institutes.....	$3,000,000	$3,000,000	$3,000,000	--

Matching grants to institutes. Fiscal year 1973, $3,000,000; fiscal year 1974, $3,000,000; no change.

Under this "Matching grants to institutes" program (Section 101 of the Water Resources Research Act of 1964, as amended), the State institutes will compete for the requested $3 million in Federal matching funds by submitting research proposals to the Office of Water Resources Research. Because the program requires equal amounts of non-Federal funds for approved research projects, it provides an ideal provision for furthering the Federal-State partnership concept of the Act. With the requested $3 million budget it is expected that approximately 90 to 100 research projects can be supported.

For the 1973 program, the State institutes submitted 323 matching grant research proposals requesting over $11,000,000 in Federal matching funds. Of these 323 proposals, 98 are being supported from the $3 million Federal appropriation, with the States providing an additional $3.2 million in matching funds. Due to this keen competition, projects selected for support relate to the most urgent problems as determined by the State institutes and the Office of Water Resources Research. The number of proposals submitted also provides a clear indication of the capacity and willingness of the State institutes to participate in this matching fund or cost-sharing portion of the Title I program.

The State institute universities, and other universities participating with them in this program, will give priority attention in 1974 to those water-related problem areas of Nationwide concern identified in the subsequent justification statement relating to the Title II "Additional Water Research" program. Because this is a dollar-for-dollar Federal-State matching program, however, other water-related problems of particularly urgent State, regional, or river basin concern will receive full and careful consideration by State institute directors, State institute research program review committees, and by the Office of Water Resources Research. Further, recognition will be given to the fact that many universities participating in the matching grant program are well suited to organizing the multi-disciplinary approaches required for developing practical and effective solutions to the complex problems involved in natural resource development and management.

Some examples of proven or potentially useful matching grant program research results that have evolved during the past year in ongoing or completed projects are as follows:

(1) Municipal water and sewer rates do not, as presently constituted, provide an economic incentive for the control of industrial wastes. Present attention is focused largely on treatment of the aggregate municipal waste flows with little or no attention to means for reducing industrial waste flows within the municipal system prior to waste treatment. A North Carolina study of the industrial response to sewer surcharges has led to the development of informational packets and guidelines for city governments which have been widely distributed by the North Carolina League of Municipalities. These, together with talks by researchers before city managers and other local officials, have sparked a major response by cities toward more equitable and effective water- and sewer-pricing systems.

(2) The New Jersey institute has been investigating possibilities of aeration in polluted rivers. Findings have shown the value of such aeration when used to supplement secondary waste treatment of polluted rivers, and have determined the design characteristics of suitable installations and methods of analyzing the effects. These findings have been used by the Miami Conservancy District (Ohio) in planning a small prototype installation of river aerators, and are currently being used by the Tennessee Valley Authority in planning a much larger river-oxygenation installation. Also, the Metropolitan Sanitary District of Chicago is using the results in planning and designing a large prototype installation of aerators, which has been officially recommended to the Illinois Pollution Control Board.

(3) During the long hot and dry summers characteristics of much of southern California, wildfires may denude large land areas, leading to erosion problems, loss of income from grazing, reduced use of recreational resources, and other related water problems. Increased attention is being given to management of these lands so as to minimize the extent of fire damage. A research project at the California institute titled "Ecological and Physiological Implications of Greenbelt Irrigation" currently is examining the use of irrigated greenbelts as fire breaks in the brushland areas. Results thus far indicate that such greenbelts may be an effective means of wildfire control.

(4) Research findings by the Massachusetts institute on public management of fresh-water wetlands were utilized effectively in revision of the State's inland wetlands legislation. Basic elements of the following legislation had their origin in or were significantly influenced by this research: "An Act Further Protecting the Inland Wetlands and Floodplains of the Commonwealth" (Chapter 782, Acts of 1972); and "An Act Relative to the Protection of Wetlands" (Chapter 784, Acts of 1972). The first strengthened the State's power to classify and restrict wetland modification in advance of threatened land development. The second provided for regulation of dredging and filling operations affecting wetlands. In addition to clarifying and reinforcing State policy as reflected in the above legislation, research findings were utilized by the State Division of Fisheries and Game in its successful effort to obtain a $5 million bond issue for State acquisition of privately-owned wetlands.

(5) A report by the Wyoming institute estimates the consumptive use by various crops grown in Wyoming for localities around the State. The findings presented in this report are used by the Wyoming Water Planning Office to estimate the present and potential demand for agricultural water in their planning reports. The document is also used by Federal agencies planning water resource developments in Wyoming. Because of its method of presentation, the report also is being used for reference in college classes in hydrology, conservation engineering, and water resources planning.

(6) Development of methods for evaluating wild and scenic rivers is the subject of an Idaho study. Results from this project are being used by the U. S. Forest Service in its official study under the Wild and Scenic Rivers Act and project personnel have been called upon frequently for advice. The Idaho Water Resource Board has relied heavily on the Idaho Institute to provide practical input to the Board's river evaluation efforts.

(7) A keystone step in Statewide water planning was taken by the Colorado Water Conservation Board two years ago when it requested that a research project be initiated and agreed to support the project with State matching funds. This year the fruits of that project are beginning to be seen. Survey teams have collected interview data from several sectors preparatory to constructing an input-output model. When the model is completed next year, Colorado will have an invaluable tool for analyzing the role of water in the State economy. Alternatives in water resource development and allocation can be examined and used as a rational basis for State water plans.

(8) Much of the water allocated to Utah from the Colorado River system is already utilized or under development and the importance of securing proper allocation of remaining supplies cannot be overstressed. In a Utah research project, a successful attempt was carried out to develop a mathematical programming model that would be helpful to decisionmakers in handling the difficult task of allocating remaining Colorado River waters. The model is comprehensive, flexible, easy to use, and should be of great help to those directly responsible for planning and development of Utah's remaining Colorado River water entitlements. The model is already in use by the Utah Division of Water Resources, and the Corps of Engineers senses in the model an opportunity to build upon work already accomplished and has funded a follow-on study.

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3. Additional Water Research

Analysis by Activity

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Amount Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 compared with 1973
Additional water research	$4,300,000	$4,300,000	$3,170,000	$ -1,130,000

Additional water research. Fiscal year 1973, $4,300,000; fiscal year 1974, $3,170,000; decrease $1,130,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-1,130,000	--	$3,170,000	--	Reduction in research contract/ grant support to public and private research organizations.

The "Additional water research" (Title II) program is an integral and valuable part of the total program authorized by the Water Resources Research Act. It provides balance to the program by giving the Department direct access to the excellent research talent available in private firms, foundations, State and local agencies, as well as universities not participating in the Title I program. With the proposed $3,170,000 million requested for this program activity, contracts and grants will be executed to fund approximately 50 research projects.

It is planned that in 1974 priority consideration will be given to studies to improve methodology for management and development of complex water-related human-use systems, such as: (a) Improving the quantity and quality of water in the metropolitan environment for municipal and industrial uses; (b) Water supply augmentation by reuse and other water salvage and water saving methods; (c) Analysis and improvement of planning, managerial, financial, operating and regulatory policies of water resources institutions; (d) Improved procedures for determining water quality and quantity relationships with the eco-systems of marshes, wetlands, estuaries, bays, and other ecologically fragile complexes; and (e) Problems concerning ground-water supply, management and protection, and conjunctive use of available ground and surface water. A more comprehensive description of these and other priority research subjects is set forth on pages 74 through 79 of OWRR's 1972 Annual Report.

For the 1973 "Additional water research" program, over 350 research proposals were submitted by private firms, universities, and others for OWRR consideration. Total funding requested by these proposals is over $33,000,000. About 65 of the proposals have been or will be approved for support. For the 1974 program, OWRR anticipates receiving approximately the same number of proposals as were submitted for 1973 consideration. Because of the large number received, the Department can be very selective in supporting only those proposals which have the highest technical merit and greatest relevance to water resource problems of concern to the Nation.

Although the Title II program was started only six years ago, many useful research results are summarized in OWRR's Annual Reports. A few examples of research results developed during the past year are set forth below:

(1) The Conservation Foundation, Washington, D. C., and the University of Miami are conducting a joint study of Rookery Bay and environs, southwest Florida, involving analysis of socio-economic, political, and institutional factors affecting water-management decisions, and an evaluation of the impact of alternative land uses on Water Management District 6, Collier County. The study is already contributing information of value to the District's planning process and is helping

keep the community informed on problems of maintaining a high quality estuarine environment in the face of land and water development. The Rookery Bay Study Program is the most significant project of its kind in the State and it continues to be watched by both public and private interests at local, regional and state levels, with queries being received, also, from other parts of the country.

(2) The benefit-cost analysis applied to Federal water resource project planning and evaluation has been an area of considerable contention and controversy. A research study by INTASA, Inc., of California developed a conceptual framework for multi-objective water resource plan formulation and evaluation. This framework was an outgrowth of the study and analysis of a completed Corps of Engineers reservoir and two completed Bureau of Reclamation reservoirs. The analysis was keyed to identifying and measuring the impacts stemming from the construction and management of these reservoirs. It will provide planners with insights into broader examination of benefits, costs and alternatives.

(3) Auburn University in Alabama reports highly significant interim findings from a research project entitled, "The Impact of Water Pollution Abatement in Alabama on Consumer Prices and the Balance of Competition." The researchers have thus far completed their investigation of the textile industry and are currently analyzing the steel and paper industries. Their in-depth study of the textile industry reveals that pollution abatement under current standards would cause an increase of 0.01 to 2.40 percent in the unit cost of textile products. Indications are that this added expense could be borne entirely by textile manufacturers, there would be no shifts in competition, no jobs would be lost, and consumers would not have to pay higher prices. Fundamental economic analysis such as this is vital in providing the basis for policies and decisions related to the Nation's quest for clean water.

(4) An Illinois-based project by a consulting engineering firm and entitled, "Investigation of On-Site Stormwater Storage Concepts and Techniques for Pollution and Flood Control" is an in-depth investigation of onsite detention storage of urban stormwater runoff as opposed to directed flows to conventional stormwater drainage systems. Such storage systems appear to offer practical and economical means for reducing the adverse effects of stormwater flow at reasonable costs. Because of this, a great deal of interest has been evidenced in this study, and excellent cooperation has developed with the American Public Works Association (APWA). This has included supplying information on existing applications of on-site storage techniques. Furthermore, the APWA Research Foundation has agreed to print the first report as an APWA Special Report to insure wide distribution to many of its 12,000 members who are, in fact, the ones who will use the results.

(5) A report, "An Economic Analysis of Erosion and Sediment Control Methods for Watersheds Undergoing Urbanization," by Dow Chemical Company is receiving wide interest. Multiple copies have been requested by a sediment legislative task force in North Carolina, by the Federal Highway Administration, and by the Geological Survey. Additionally, numerous requests for individual copies have been received from planning commissions, soil conservation districts and other groups concerned with the sediment problems. Methods were devised in the Dow study to calculate effectiveness of control systems and to determine the resulting economic impact on larger streams. Present practice employs sediment basins, diversion berms, level spreaders, grade stabilization structures, sodded ditches, and seeding and straw mulch tacked with asphalt or disked. The practice was estimated to control 91 percent of the potential erosion and to cost $1,125 per acre, on the average. Large sediment basins can boost system performance to 96 percent at slightly lower cost. Sediment forebays preceding multipurpose impoundments provide the highest achievable control, but are more expensive per ton of sediment trapped. However, improved land values and recreational values help justify their costs.

(6) Research being conducted at the Massachusetts Institute of Technology (MIT) dealing with the forecasting and control of urban runoff has produced results that are being applied in coping with increased flooding and sediment

transport problems in Fairfax County, Virginia. The engineering consultants retained by the County to develop and implement a multi-million dollar flood control program are putting to use techniques developed by MIT that will forecast the future hydrologic effects of continued urbanization in Fairfax County. More specifically, the computer models provided by the subject research will enable the County to assess fairly the upstream developers for downstream hydrologic impacts.

(7) The International Joint Commission (IJC), since its formation in 1909, has been the primary institutional vehicle used by Canada and the United States to resolve boundary water problems. Critical conditions of water pollution in several of the Great Lakes, the growth of industry and population and the urbanization of lands bordering the lakes, the loss of fishery resources, and similar problems prompted a review of the authority of the IJC and the manner in which both countries were using it to cope with Great Lakes problems. A report by a Cornell University Graduate Seminar, followed by conclusions drawn by an inter-university seminar of 20 Canadian and United States universities have led to proposals (1) to substantially strengthen the IJC; (2) to replace the IJC by a new treaty organization; or (3) to moderately strengthen the central management of IJC and combine this effort with stronger local, regional, State, provincial, and Federal cooperative activities. The Great Lakes Basin Commission is currently using these proposals as a set of alternatives to consider in determining future Great Lakes organization.

(8) The National Association of Counties (NACO), Washington, D. C., studied the data and methodological needs of local officials for optimum water-resources planning and management. The end product was a relatively simple, readable, and effective manual intended for the use of local officials. This manual was widely disseminated; 21,000 copies to members of NACO, 3,000 distributed at NACO's Annual County Convention, and 5,000 to other interested individuals and organizations. It should be of substantial assistance in attuning local officials to viable approaches for solving water resources problems.

(9) Hofstra University in the State of New York evaluated recreational and cultural benefits of estuarine use in an urban setting, the Town of Hempstead, and developed methodology that can serve as a guide to public policymakers who wish to assess the economic values of other sites. Based on this methodology, Hempstead Estuary was estimated to support 605,000 recreation-days of boat fishing per year and an annual catch of 3.5 million fish worth $2.8 million, or $4.60 per recreation-day. These, with other data on water-oriented recreation, show a demand for boating and fishing, and expand to a 1970 value flow of $51,937,583. Annual values were also derived for services provided through estuary use, as well as a capitalized value of $12,249,962 of differential land value due to on-water location. The estuary thus yields annual recreational services of about $3.8 million, capitalized at six percent to give a value of $64.2 million for services of the estuary.

4. Scientific Information Center

Analysis by Activity

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Amount Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 compared with 1973
Scientific information center.....	$930,000	$934,000	$934,000	--

Scientific information center. Fiscal year 1973, $934,000; fiscal year 1974, $934,000; no change.

Funds requested will provide for operation of the Water Resources Scientific Information Center (WRSIC) in 1974 at the same level as in 1973.

In 1974 WRSIC will:

(a) Acquire approximately 15,000 to 16,000 abstracts reflecting the results of completed water resources research as described in technical journals, monographs, books and serials, process these abstracts into machine-readable form for WRSIC's information base, and publish the abstracts together with appropriate identifiers and indexing terms in WRSIC's twice-monthly "Selected Water Resources Abstracts" bulletin that is made available to the water resources community;

(b) Support approximately 8 "literature centers of competence" to provide abstracts for the WRSIC information base, and encourage and obtain the cooperation of Federal, State and other organizations in providing information base abstracts;

(c) Publish in collaboration with the Smithsonian Science Information Exchange, a comprehensive annual volume (catalog) of abstracts describing ongoing research projects;

(d) Prepare a limited number of state-of-the-art reports.

(e) Respond to the technical information needs of water program officials by using an automated retrieval program and a growing information base, which now includes over 50,000 citations and abstracts, to: (1) generate topical bibliographies rapidly and economically in significant problem areas of water resources; and (2) produce responses to special requests for literature references relating to specific and current interests of individuals and organizations; and

(f) Continue on a limited scale the experimental program of operating a small number of geographically dispersed remote terminals to determine their feasibility in providing improved technical information services to the water resources community.

In its first five years of operation, WRSIC has made excellent progress and, with the now significantly large and expanding information base, is in a position to substantially increase its contributions. The Center is: (a) being increasingly responsive to the water resources scientific information needs of the Nation's water resources community; (b) assisting in the avoidance of undesirable research replication and thereby facilitating increased cost-effectiveness of ongoing research; and (c) improving communications and coordination of efforts among organizations and individuals engaged in water-related research. Persons and organizations that are participants in the Center's program, or are familiar with the services it provides, have been highly complimentary regarding the program and have urged that the Center expand its program whenever fund resources will allow.

5. Administration

Analysis by Activity

Activity	F.Y. 1972 Amount Available	F.Y. 1973 Amount Available	F.Y. 1974 Estimate	Increase (+) or Decrease (-) 1974 compared with 1973
Administration.....	$960,000	$970,000	$945,000	$-25,000

Administration. Fiscal year 1973, $970,000; fiscal year 1974, $945,000; decrease $25,000. The decrease consists of:

Increase (+) or Decrease (-) Amount	Positions	Total Program	Total Positions	Explanation
$-25,000	--	$945,000	38	Reduction in supporting program activities, such as consultive critical reviews.

The requested "administration" funds will provide support for salaries and related program planning, development, management, operating, and housekeeping activities of the Office of Water Resources Research.

In 1974 OWRR's program administration staff will:

(a) Provide over-all direction to the OWRR program including developing and implementing, wherever possible, new policies and procedures to increase the cost-effectiveness of the OWRR research programs, while at the same time minimizing the program management workload so that it can be handled by a very small staff;

(b) Provide programming, budgeting, and related administrative-management program support including analysis of essential research needed to resolve critical problems;

(c) Provide technical and business-management monitoring of over 500 ongoing grants and contracts;

(d) Evaluate approximately 900 to 1,000 new research proposals and execute some 200 new contract and grant documents;

(e) Review and process an estimated 1,400 reports and documents stemming from OWRR-supported research;

(f) Provide program and research project guidance to several hundred existing and potential program participants in the form of personal contacts and by means of many hundreds of letters;

(g) Coordinate the nationwide OWRR research program activities with related activities of other agencies;

(h) Take appropriate actions to evaluate and identify new and increasingly urgent national, regional and state water problems that need priority research attention, and develop appropriate research priority listings for consideration by research proponents;

(i) Conduct conferences and meetings as appropriate for effective program operations; and

(j) Obtain, through the support of symposiums as well as the use of recognized authorities on a consultant or contractual basis, a limited number of advisory critical-review reports in selected subject areas of water resources

research, and utilizing such reports to: (a) keep the State Centers and others informed about the status of and need for research in specific technical areas as well as water research program goals, objectives, and priorities; and (b) assist the Office of Water Resources Research staff in its continuing efforts to assure that research supported under the Act is meritorious, does not duplicate other completed or ongoing research, and remains focused on the most urgent water problems.

Personnel Summary

	1972 Actual	1973 Estimate	1974 Estimate
Total number of permanent positions.....	46	46	46
Full-time equivalent of other positions....	1	1	1
Average paid employees.....	41	43	43
Average GS grade.....	11.1	11.1	11.1
Average GS salary.....	$19,111	$19,192	$19,260

ITEMIZATION OF ESTIMATE

Appropriation Title: Salaries and Expenses — Office of Water Resources Research

	Actual 1972	Estimate 1973	Estimate 1974	Increase (+) Decrease (-)
Program and Financing:				
Total obligations	$14,259,205	$14,304,000	$13,149,000	$-1,155,000
Unobligated balance lapsing	30,795	2,040,000	--	-2,040,000
Budget authority (Appropriation)	14,290,000	16,344,000	13,149,000	-3,195,000
Object Classification:				
11 Personnel compensation	747,218	787,000	790,000	+3,000
12 Personnel benefits	64,515	70,000	71,000	+1,000
21 Travel and transportation of persons	20,893	27,000	27,000	-
22 Transportation of things	74	-	-	-
23 Rent, communications, and utilities	15,884	20,000	20,000	-
24 Printing and reproduction	54,643	58,000	58,000	-
25 Other services	2,160,119	2,144,000	1,855,000	-289,000
26 Supplies and materials	12,704	13,000	13,000	-
31 Equipment	13,553	15,000	15,000	-
41 Grants, subsidies, and contributions	11,169,622	11,170,000	10,300,000	-870,000
TOTAL	14,259,205	14,304,000	13,149,000	-1,155,000

IMPOUNDED FUNDS

Mrs. HANSEN. Last year Congress added $2.04 million to your budget for additional grants to State institutions pursuant to Public Law 92–175, which was passed by Congress and signed by the President. Now we find that the money is impounded. Congress increased the amount of money due to the critical conditions in the States. Why was the money impounded?

Mr. HALL. The money was actually apportioned for use in the fourth quarter of this year. We had every expectation that it would be available to us. However, when the budget crunch came on, we were asked to allow this particular sum to lapse.

Mrs. HANSEN. What was the date on which you learned you would not be able to spend the funds?

Mr. HALL. I believe that we received word on it, my recollection is, December or January of this year.

Mr. KOOP. In December.

REQUEST VERSUS AUTHORIZATION

Mrs. HANSEN. How does your budget request for the various parts of your program compare with your authorization ceiling?

Mr. HALL. The authorization for the institutes is $250,000 per institute and that is for the 51 institutes. Then for each of the three new institutes the figure auhorized for the coming year is $200,000.

Mrs. HANSEN. Which would total what amount if the program was fully funded?

Mr. HALL. The total amount would be $13,350,000.

Mrs. HANSEN. Which is about the total amount of your entire budget.

Mr. HALL. Just a little bit more.

EFFECT OF IMPOUNDMENT OF FUNDS

Mrs. HANSEN. What effect will this action have on water research in the States? Will revenue sharing be able to meet these needs?

Mr. HALL. I am afraid the research wouldn't get done. I will add to that, though, that there has been a general increase in the amount of funds being made available to the State institutes through their State sources.

Mrs. HANSEN. But weren't the States anticipating an equal amount being appropriated by the Federal Government?

Mr. HALL. For the section 101 matching grants, this was to be a 50–50 proposition. This is where the $3 million stands at the present time which, by the way, is authorized at $5 million. This has been overmatched by the institutes.

With respect to the section 100 allotments, we have not quite an equal matching from the States at the present time. It appears to be

about $4 million of nonfederal funds, although these are not required by the act and are not considered matching funds. The State institutes are contributing about $4 million in State funds and we provide $5.1 million in Federal grants.

Mrs. HANSEN. Do the States appropriate funds according to your grant?

Mr. HALL. Not on the section 100 allotments. They are supposed to appropriate according to our grants on the section 101.

Mrs. HANSEN. But you had hoped that they would provide moneys in the same categories as the Federal grants?

Mr. HALL. I don't believe that the original act required that.

Mrs. HANSEN. No; but that was the hope?

Mr. HALL. Yes.

NON-FEDERAL FUNDS

Mrs. HANSEN. In your justifications you mention that non-Federal funds are provided by the States to supplement not only your section 101 matching grant program but also the section 100 annual allotment program. Please place in the record a listing of what funds each of the States has provided for fiscal year 1971 and fiscal year 1972.

Mr. HALL. We shall do that.

[The information follows:]

NON-FEDERAL CONTRIBUTIONS - TITLE I PROGRAM
(In Thousands of Dollars)

	FY-1971			FY-1972		
	SEC. 100	SEC. 101	Total	SEC. 100	SEC. 101	Total
Alabama	95	90	185	136	68	204
Alaska	69	62	131	76	25	101
Arizona	42	82	124	35	101	136
Arkansas	99	25	124	86	51	137
California	420	116	536	374	179	553
Colorado	71	153	224	71	110	181
Connecticut	142	50	192	189	-	189
Delaware	54	-	54	42	-	42
Dist. of Col.	-	-	-	-	-	-
Florida	113	187	300	115	-	115
Georgia	47	68	115	46	86	132
Guam	-	-	-	-	-	-
Hawaii	93	23	116	133	68	201
Idaho	42	-	42	51	77	128
Illinois	73	181	254	74	123	197
Indiana	51	98	149	50	103	153
Iowa	124	65	189	137	113	250
Kansas	77	74	151	57	53	110
Kentucky	103	94	197	93	18	111
Louisiana	38	14	52	47	-	47
Maine	61	-	61	64	-	64
Maryland	109	66	175	67	65	132
Massachusetts	88	122	210	122	99	221
Michigan	161	-	161	181	69	250
Minnesota	40	99	139	39	110	149
Mississippi	35	-	35	45	22	67
Missouri	118	117	235	88	83	171
Montana	79	-	79	66	50	116
Nebraska	49	102	151	48	75	123
Nevada	40	51	91	20	90	110
New Hampshire	100	-	100	102	-	102
New Jersey	83	122	205	88	76	164
New Mexico	77	87	164	110	88	198
New York	90	33	123	84	78	162
North Carolina	115	101	216	196	130	326
North Dakota	40	45	85	56	52	108
Ohio	42	50	92	47	86	133
Oklahoma	79	90	169	112	23	135
Oregon	139	91	230	119	93	212
Pennsylvania	48	93	141	52	147	199
Puerto Rico	74	-	74	-	-	-
Rhode Island	120	32	152	142	54	196
South Carolina	56	99	155	58	74	132
South Dakota	64	80	144	67	46	113
Tennessee	83	76	159	97	28	125
Texas	92	78	170	102	112	214
Utah	73	114	187	83	75	158
Vermont	61	2	63	57	-	57
Virginia	82	94	176	88	83	171
Virgin Islands	-	-	-	-	-	-
Washington	80	146	226	112	124	236
West Virginia	21	35	56	52	-	52
Wisconsin	43	105	148	30	85	115
Wyoming	56	-	56	108	7	115
Total	4,251	3,512	7,763	4,514	3,299	7,813

Mrs. HANSEN. As I mentioned, you are requesting a decrease of $2.04 million for grants to State institutes. Do you have anything to add to your previous remarks? Is this reduction because the States don't need additional funding?

Mr. HALL. No. I think it's strictly budget constraints.

Mrs. HANSEN. It is too bad we are constrained on the matter of water, which is a basic commodity of humanity. Hasn't your research proved fruitful?

Mr. HALL. I believe our research has proved very fruitful.

RESEARCH ACCOMPLISHMENTS

Mrs. HANSEN. Do you want to place in the record a list of successful accomplishments in every State?

Mr. HALL. It would be a fairly large list.

Mrs. HANSEN. Provide for the record one outstanding project in each State.

Mr. HALL. We could do this.

[The information follows:]

Successful Research Accomplishments

As requested, we briefly describe one successful practical application of research results from each of the State Institutes. These applications are drawn from a larger number called to the attention of the individual State Institute directors. Such attention commonly stems from letters or oral statements from information seekers who wish to acknowledge appreciation of assistance received. These applications are not necessarily the best examples as tracking down research applications is a formidable study in itself and one where supporting data are not always readily available. Most research findings reach the user through the media of the technical, scientific, and professional journals or through the training process, including short courses and seminars for professional workers in water resources. In such instances the application of research results is unrecorded more often than not.

ALABAMA

A study of the future water requirements of the Mobile metropolitan urban area will be of use to local and regional planning groups in making long-range plans for water resources development and management. The research produced estimates indicating that the presently planned municipal water system will become incapable of supplying the city's residential water needs by about 1990.

ALASKA

Project B-015-ALAS dealt with the discharge of domestic wastes into a silt-laden estuary--Cook Inlet, Alaska. Findings from the project have been reviewed and used by planning and regulatory authorities in conjunction with the modernization and upgrading of the Greater Anchorage Area's waste collection, treatment and disposal systems. Results of the study have suggested that primary treatment--including removal of floatable solids--of wastes discharged from a well designed outfall will be sufficient treatment for the area until an excess of one million people reside there. The findings have a possibility of saving the Borough of Anchorage several million dollars in the cost of outfall construction.

ARIZONA

Since the Central Arizona Project will account for only about one million of the approximately three acre feet of present yearly overdraft of the State's ground water reserves, an urgent need remains for parallel development of water conservation and efficient use measures. Along these lines, previously initiated research and field demonstrations have continued at the Arizona Water Resources Research Center in the field of water harvesting, evaporation and seepage suppression, and artificial ground-water recharge. In A-027-ARIZ, the results from investigations determining the effects of surface crusting on infiltration rates are being used to refine water-harvesting methods. Water harvesting methods developed at the University are finding application on private, State and Federal lands for water for stock and game. Project A-029-ARIZ provides information relative to the development of operational forest-management guidelines for increasing snowpack water yield. An through B-020-ARIZ the means are being reached for avoiding contamination of ground water from fertilizers and pesticides applied in agricultural practices.

ARKANSAS

Several related projects studied the distribution of harmful trace elements in Arkansas impoundments. This work has been of practical value to the Greer's Ferry National Fish Hatchery in conjunction with water quality problems in the hatchery water supply, to the Soil Conservation Service concerning the effects of impoundments of small watersheds, to the U.S. Corps of Engineers in determining the level at which releases should be made on the DeGray Reservoir. It has also been of particular value to an engineering firm in their proposal study of the City of Hot Springs' sewer treatment plant that empties into Lake Hamilton.

CALIFORNIA

An economic study of irrigation water in the Imperial Valley shows that decreased farm and regional incomes are to be expected if water-quality degradation continues in the area. A side effect of this may be an unfavorable impact on the Salton Sea if the drainage outflow from the Imperial Valley continues to increase salt content and large scale evaporation of the Salton Sea continues unhindered (B-136-CAL). The adoption of the design and operation of a multipurpose reservoir system developed under project A-043-CAL could provide a basis for improved water-system management and basin-wide salt balance.

COLORADO

Waste water treatment has become a major production expense in the beet, sugar and canning crop industry, a seventy five million dollar business in Colorado. In 1971, technology was available for all wastes but condenser water, which requires both cooling and bio-treatment. Recognizing this fact, in 1969, the Colorado Center initiated an innovative study (A-008-COLO) to find out if a cooling tower could be combined with bio-treatment. It was successful. First, with a technical design which was verified by laboratory bench experiments. A prototype plant design was formulated to complete the project. The project completion report was submitted in June 1971 on the very day a cease and desist order was ordered to Great Western Sugar Company for discharging inadequately treated waste water (mainly condenser effluent) into the South Platte River. An investment of less than $30 thousand in research produced a solution to an urgent problem which otherwise would have demanded an expensive crash program costing many times that amount. The research cost was only 0.1 per cent of one-year's income in the Colorado sugar beet industry.

CONNECTICUT

As a result of research at the Water Resources Institute, the Connecticut Department of Transportation has drawn up specifications for use of "rock sausages" in highway construction. Rock sausages are essentially loose rock enclosed in open-mesh tubes or cylinders of galvanized wire or plastic. Such sausages have been shown to be a highly efficient and economical means for reducing erosion, preventing soil leaching, and decreasing stream pollution. In May 1972 the usefulness of rock sausages was described in a film shown at one of the American Society of Civil Engineers Hydraulic Seminar Series (A-035-CONN).

DELAWARE

The Christina Basin project (C-2185) is developing technical know-how concerning stormwater runoff in urban areas including aspects of groundwater recharge, runoff pollution, erosion and sedimentation and flooding. The study has developed techniques to reduce these problems through protection measures that can be incorporated into urban development anaywhere in Delaware and has identified legal techniques of requiring such measures from developers. Through the efforts of the study some of these techniques now have been incorporated into planning and legislation. Examples are: a flood plain ordinance in the city of Newark; the New Castle County surface and groundwater drainage code; and the Wilmington Metropolitan Area Planning Coordinating Council (WILMAPCO) open space and land use plan which identifies natural resources protection areas along bodies of water.

FLORIDA

Research into water law and administration in relation to State and private water use, resulted in two hardback books entitled, "Water Law and Administration - The Florida Experience" and "Model Water Code and Commentary". The first was selected as a reference work for the U.S. House of Representatives, Public Works Committee. The second was used extensively in drafting the Florida Water Resources Act of 1972, which was passed by the Legislature and is now incorporated in the Florida Statutes as Chapter 72-299.

GEORGIA

The largest manufacturing industry in Georgia is textiles and it has a significant environmental impact related to its excessive requirements for water and waste disposal. Through research supported by OWRR, the State, the Textile Education Foundation, and the Georgia Textile Manufacturers Association, improvements have been made in dyeing processes and in waste treatment which have improved the aesthetic value of Georgia's streams. As an extra benefit, nine students were trained in techniques for controlling pollution from textile manufacturing and most of them have become research and management leaders in the industry.

HAWAII

Improved management, development, and regulation of Hawaii's ground water resources have resulted from the application of methodology, developed under OWRR supported projects, for determining ground-water age and tracing ground-water replenishment based on the analysis of isotopes (tritium and radiocarbon) in water; A-033-HI, a testing of an improved method for estimating safe yield of basal ground water; A-020-HI, an analog simulation study of the flux-storage relations of basal ground water in coastal areas; and A-032-HI, a study of porosity and permeability in basaltic terrane with a down-hole radiation-logging technique.

IDAHO

A project, B-018-IDA, still underway in eastern Idaho, is concerned with systems analysis of irrigation water management. The investigation has included surface water inputs and outputs and evapotranspiration estimates for a 100,000 acre study area, canal seepage tests, a crop distribution survey, development of a water quality sampling program, and evaluation of the irrigation efficiency of various farm practices. Water table data collected in 1970 have been used by Jefferson County commissioners in locating sites for new sanitary landfills not subject to excessive rise in the water table. The same information has assisted the highway department in locating areas for excavation of gravel without water table complications, and for planning for water-oriented recreation areas. Crop distribution information has been requested by the local county agent and Soil Conservation Service for use in planning and analysis of county development. The Idaho Water Resources Board and the State Department of Water Administration have been considering the potential impact of this water use data from the standpoint of developing new legislation and administrative regulations.

ILLINOIS

B-005-ILL: "Hydraulic Geometry of Illinois Streams." This project was concerned with developing relationships between the fundamental hydraulic characteristic of streams (depth, width, cross-sectional area, velocity, discharge, and drainage area) which can be applied to locations where no direct measurements are available. Successful relationships were developed for 18 river basins in Illinois, and later research showed that the general approach could be applied to basins in other states. The results have found significant application in Illinois, having been used to predict time of travel of pollutants for 41 river reaches. This information has been incorporated in the Emergency Planning Handbook of the Illinois Environmental Protection Agency and is used extensively by their technical staff. The results have also been used in the successful development of a water quality model for Illinois rivers by Argonne Laboratory under the sponsorship of the Illinois Institute for Environmental Quality and will be used for planning purposes in Illinois.

INDIANA

B-042-IND: "Multiple Objectives for Evaluating Small Watershed Projects." Stimulated by the U.S. Water Resources Council proposed standards for planning water and land resources, and with an interest in the way these might be applied to the very active program of small watershed development in Indiana under P.L. 566, the principal investigator has worked very closely in the development of this project with Soil Conservation Service personnel at the state, regional and national levels. The results of the study are a graphical technique whereby 14 parameters of environmental quality can be analyzed as trade-off functions with the economic efficiency objective. The goal of the study was to permit the decisionmakers to attain a set of socially acceptable values for the combination of objectives.

The results of this study have been developed in close consultation with SCS personnel at the state and regional level. The principal investigator has also discussed these results with the Watershed Planning Division of the SCS in Washington, D.C. It is understood that the findings of the research will contribute to the revision of the SCS manual, "Economic Guides for the SCS."

IOWA

The results from project A-021-IA, "Using soil filtration to reduce pollution potential of lagoon effluent entering ground water systems" have been immediately useful and applied. A solid set irrigation system designed from the research results have been installed to dispose of the lagoon waste from a hog confinement unit. The results have also been used by the Agricultural Advisory Committee to the Iowa Water Pollution Control Commission in setting guidelines for animal waste disposal on agricultural land. The demand for research results of this nature is evident by the demand for copies of the completion report. Approximately 200 copies have been distributed.

KANSAS

Under the project "A New Type of Disinfectant for Water Supplies," a new and unusual type of disinfectant for water supplies has been developed and tested. The resin halide disinfectant is a highly efficient germicide, killing both virus and bacteria. The disinfectant is extremely insoluble and supplies only the amount needed on demand without adding harmful amounts of deleterious substances to the water. Test results were so encouraging that a patent has been applied for. The new material can be used for large as well as small water supplies, for a wide range of purposes including drinking, confined reuse systems, and in swimming pools where no irritating free halogen such as chlorine need be added to the water. It can also be used in industrial cooling water, by hospitals, and in the canning industry.

KENTUCKY

At the Kentucky Institute, a study was made of the economic impact of flood control reservoirs from the standpoint of effects on local employment patterns, changes in land use, losses from the inundation of valuable land, and income redistribution resulting from reservoirs. The conclusions on the economic benefits from reservoir recreation, values to be placed on the hardships imposed on people who lose their property, how reservoirs can be operated to produce more benefits, and the effectiveness of water projects in helping low-income families to improve their position have attracted considerable attention among planners in the water community. The Corps of Engineers, TVA, and other Federal agencies have adopted some of the principles deriving from the study, and have used them in their planning for new impoundments. The publications resulting from this research have been in heavy demand.

LOUISIANA

One research project was keyed to the encroachment of salt waters threatening the industrial and domestic groundwater supply in the Baton Rouge area. Results indicated that this encroachment could be stopped by a series of wells for trapping or injecting the salty ground water intrusion. The work of the Institute in solving the groundwater problems in the Baton Rouge area has led to the drafting of legislation for State-wide management of groundwater. The legislation has not as yet been adopted but is under legislative consideration at this time.

MAINE

Maine's Land and Water Resources Center studied the correlation between the rate of application of animal wastes under varying environmental conditions and the escape of nutrients laterally and vertically to receiving waters. These data were then used as criteria in the design of disposal practice standards. These standards are being adopted, voluntarily, by major poultrymen and dairymen throughout Maine. Efficient attainment of water quality standards in rural areas is the end result (A-020-ME).

MARYLAND

Research under the project "The Thermal Requirements and Tolerances of Key Estuarine Organisms" analyzed the effects of thermal loading in estuarine waters. These studies were complementary to other research in Maryland estuaries and specifically permitted detailed laboratory work to fill gaps not covered elsewhere. The findings have been very useful to the Maryland Water Resources Department and its Commission in establishment of water quality standards in compliance with the Federal Water Quality Act of 1965. As a result, the regulations which has been adopted have been based upon sound scientific knowledge. Even greater, long-range importance is the proof that mortality of aquatic organisms, and thus the effects of thermal loading, depend upon how long these organisms are exposed to above-normal temperatures. As a result, these research findings have provided knowledge which has changed engineering design concepts of cooling water discharge systems.

MASSACHUSETTS

More than 1,300 Massachusetts ponds, lakes, and reservoirs, greater than 5 acres in area, were profiled according to physical, chemical, and biological character, geographic location and distribution, and use factors. Published computer runouts are in demand by real estate agencies, recreational groups, and individuals in the market for second homes. Additionally, this inventory is finding wide usage by State agencies. For example, the State Division of Fisheries and Game uses it in locating waters suitable for trout stocking; the State Board of Public Access uses it in defining problems relating to access to Great Ponds and in determining appropriate courses of action; the Department of Public Works is using it in planning locations of new State highways. Through this project, the Water Resources Research Center has established a data bank for ponded waters that is already proving its value in water resources planning (A-034-MASS).

MICHIGAN

A-035-MICH: "The Uptake of Insecticides by Freshwater Mussels and the Effects of Sublethal Concentrations of Insecticides on these Mussels." This research resulted in the discovery of a technique for continuously monitoring water for pesticide contamination by analyzing the tissue of freshwater mussels. The procedure by which the enforcement agencies had previously tried to monitor pesticides frequently overlooked short-term, yet ecologically damaging, spills that occurred between sampling periods. This technique provides a continuous monitoring service and can be used to locate the sources of the discharges in a economical and official manner not previously available. The technique is now a standard procedure for the pollution monitoring program of the Michigan Water Commission.

MINNESOTA

Many recommendations resulting from OWRR projects A-015-MINN, "Aspects of Water Laws in Minnesota" and A-021-MINN, "Water Resources Administration in Minnesota," conducted during the period July 1967 to June 1972 have been accepted by legislators and incorporated in bills introduced and passed during the last three sessions of the Minnesota Legislature. The principal investigator on the projects has served as an adviser to committees of the Minnesota Senate and House. Recommendations stemming from the above research concerned needed changes in water laws and state policies and reorganization of State agencies.

MISSISSIPPI

Research into the probability of occurrence of precipitation in Mississippi resulted in a report which has gone into a second printing for a total distribution of more than 1,000. It has been used mostly by the State Cooperative Extension Service in advising farmers as to the best probable time for planting, cultivating, and harvesting crops.

MISSOURI

An OWRR grant of less than $4,000 is changing supplemental irrigation practices on the acid, humid soils of the midwest. In a single county in Missouri last year the findings of project A-003-MO increased the value of the corn crop by more than $200,000 while reducing stream flooding. The research findings developed recommendations for reducing the toxic effects of soluable manganese and aluminum when water is improperly applied to these soils. Pursuant to those findings, supplemental irrigation systems are developing to store runoff from a single field on a farm. Where the recommended practices are properly used on the field producing the water runoff, the amount of water is adequate to provide optimum yield even in driest years.

MONTANA

Croplands are being lost due to saline seeps in the Highwood Bench area of Northcentral Montana. This is an area of glacial till underlain by a thick shale formation impervious to water and is representative of a much larger region. Water moves through the soil profile developed in the glacial till and builds up on top of the underlying impermeable shale, gradually moves downslope, accumulates in the lower swales, and eventually breaks out at the surface where it evaporates, leaving the dissolved salts behind. This process has converted once fresh springs and reservoirs to saline waters and threatens further deterioration of water resources, wildlife habitat and recreation potential of a larger area. Although the situation stems from the geology of the region, it is aggravated by the crop-fallow-dryland farming system now in use. Results from this study have led to revised farming practices in order to prevent further crop acreage losses. Findings have been so promising that follow-up studies will continue in cooperation with ARS and Montana Agricultural Experiment Station personnel.

NEBRASKA

The project entitled "Engineering Phases of Land Treatment Related to Increasing Water Use Efficiency and Storage Efficiency of Rainfall" was designed to find ways to reduce water and soil losses on cropped farmland. The problem is especially important in Nebraska and other Corn Belt states. A system was developed which reduces soil losses by 90% and water losses by 50%. Flood hazard reduction and pollution control are additional benefits. Findings of this research and a companion project are being implemented and actively promoted by State and Federal conservationists and local county advisers. Significant economic and environmental benefits have already accrued.

NEVADA

Nevada's aridity has necessitated a vigorous water research program to provide physical and statistical information about the restricted supplies and methods of managing them to maximize efficiency and minimize conflict. The project "Research and Analysis of Hydrology of Truckee Meadows" (A-034-NEV) was concerned with the development of a model of the Truckee meadows watershed system to dynamically quantify the interaction of both the quantity and quality of water moving through the system. Topographic maps, aerial photos, and infra-red imagery were used to determine the type and extent of major land uses in the area. Existing well logs, pump tests, and water level measurements were used to evaluate ground-water characteristics. Meteorological records and infra-red imagery were utilized to estimate ungaged runoff and consumptive use by plants. Flow and water-level records were used in conjunction with water chemistry to define movement of water within and through the system. The resulting model of the system can be used to predict the physical and economic consequences resulting from changes in model parameters. The report of the project entitled, "Hydrology of Truckee Meadows, Nevada" was adopted as an element of the General Plan of Development for Washoe County by the Washoe, Reno, Sparks Regional Development Commission.

NEW HAMPSHIRE

Research in New Hampshire has shown that the impact of toxic microorganisms in water may not always be signaled by a measure of fish kill, but that other important forms of aquatic life are affected as well. As a result of this study, the New Hampshire Water Supply and Pollution Control Commission takes the precaution of submitting samples for bioassay to the Water Resources Research Center prior to any algae killing operation, if toxin-producing algae are suspected (A-021-NH).

NEW JERSEY

The project "Urbanization and its effect on Water Resources" (B-002-NJ) developed a methodology of mass balance analysis of biochemical oxygen demand, and in applying it, discovered that unrecorded sources of pollution greatly exceeded pollution from recorded effluents, in three river basins studied. The project "Dynamics of Biochemical Oxygen Demand" (A-025-NJ) extended further research into unrecorded pollution sources and perfected the analytical study of dynamics of biochemical oxygen demand in streams. Observations over a three year period have shown how to correlate observations made at different seasons and with different hydrological conditions, and have derived estimates of amounts of annual organic pollution to be expected respectively from undeveloped land, row crops, or single family suburban housing. Other similar studies have been extended to urban runoff, and it has been shown that even in clean, nonindustrial towns, the organic pollution from urban runoff may be expected to exceed that from secondary effluent from the same population. Nutrients also are largely contributed by urban runoff.

Since most water quality planning has proceeded on the assumption that controlling the recorded effluents constituted the entire problem, this research finding calls for a major revision in approach. Application of these methods nationwide could prevent the misapplication and inefficient use of literally billions of dollars.

NEW MEXICO

The Institute undertook a very comprehensive study of the Rio Grande Basin - bringing together representatives from local, State and Federal agencies. On the academic side, the study involved a research team drawn from many disciplines and several campuses. Results of this investigation have been used in the formulation of the New Mexico State Water Plan. It also provided valuable information for: A U.S. Dept. of Agriculture assessment of the upper Rio Grande water and related land resources, for the work of Middle Rio Grande Council of Governments in their inventory of water resources, for the U.S. Geological Survey in the groundwater investigations of the Mesilla Valley, and the U.S. Bureau of Reclamation in the management of the upper Rio Grande Basin - San Juan-Chama Diversion.

NEW YORK

C-2145: "Government Institutional Arrangements and Allied Law to Facilitate Water and Related Land Resources Planning, Development and Operational Management." As a case study the investigators on this project chose to look at the institutional structure related to the management of the land and water resources of the Great Lakes Basin. Coordination of the activities of an international group of experts resulted in a series of documents outlining the issues and problems of the Great Lakes. Finally, specifications for alternative management organizations were formulated and recommendations for the establishment of a legally constituted international study commission were made. Although the study has only recently been completed, informal presentations before congressional representatives has developed a great deal of interest in the results. In fact, it has been indicated that the Subcommittee on Inter-American Affairs of the House Committee on Foreign Affairs may call a special meeting to allow the principal investigator to present the results of the study in detail.

NORTH CAROLINA

Studies entitled, "Water Quality Management of Impoundments," have had strong influences in North Carolina. Research on New Hope Reservoir has settled questions of nutrient levels and their possible interference with recreation use and public water supply by showing that existing water quality is sufficiently poor to indicate that usefulness for recreation is questionable and is undesirable for water supply. The State of North Carolina based its position regarding this controversial reservoir on this research, and the Corps of Engineers, which constructed the reservoir, has been so impressed with the work that it has funded additional studies by the research team.

NORTH DAKOTA

A study was made to determine the impact of man and his facilities upon the recreational water resources in North Dakota (A-034-NDAK). It was found that a direct relationship exists between the numbers of people utilizing a lake and the levels of bacterial and chemical contaminants. Salmonella bacteria increased by a factor of 10 following heavy-use weekends. The study also revealed that water based recreation during the summer generated a 3.4 million dollar impact on a community of approximately 2,000. Results of the study are being used to: 1) develop guidelines for the optimum density of lake shore developments including public and private use; 2) establish adequate solid and sanitary waste disposal systems; and 3) establish a long term program of lake restoration and management in North Dakota. In addition, a local citizen group is using the results and recommendations of this study to develop and implement a modern sanitary waste disposal system.

OHIO

B-019-OHIO: "Hydrologic Investigations of Small Watersheds." Prior to this research no practical model was available for the prediction of runoff from small and intermediate size watersheds and the lack of such a model restricted the use of computer techniques in basic planning and analysis. Now such a model has been developed and thoroughly tested, and is capable of accurately predicting flows through the entire hydrologic year including difficult phenomena such as snowmelt and flow from stratified geology. The model has been adopted by the Ohio Department of Natural Resources for flood plain land management planning. Other known current applications include use at hydrologic stations to reduce expensive streamflow measurement requirements and acid mine drainage abatement planning. The model has been requested by numerous universities and governmental agencies, both domestic and foreign.

OKLAHOMA

Oklahoma has a number of large and small multi-purpose reservoirs which, among other uses, are important for outdoor recreation and providing water supplies for municipal and industrial water uses. A major problem is the stratification of the water layers which is most critical in the summer months. This results in algae blooms, unpleasant odor and taste of drinking water, and harmful effects on fish populations. A prototype mechanical agitator was designed and tested on a 100-acre lake, using a motive force of only 1/2 horsepower. It proved highly successful in improving the water quality through aeration. A subsequent 5 horsepower model capable of pumping 1,000 acre/feet of water per day will soon be installed on the 2,400 acre Lake of the Arbuckles. This holds considerable promise.

OREGON

A study (A-002-ORE) of water management institutions has dealt with the "submerged lands" issue in Oregon. The research suggested that clarifying legislation was sorely needed because of continuing clashes involving public interests and private rights in an area of legal morass. Legislators and other officials have used the results of this research in the development of policies, laws, and regulations relating to the use and management of submerged lands and estuaries in Oregon. Testimony based on findings from this project is being given in the current session of the Oregon Legislature and the project investigator is assisting in drafting additional legislation.

PENNSYLVANIA

A comprehensive study of spray irrigation disposal of sewage effluent has produced some valuable and practical results. Controlled investigations were conducted regarding the effectiveness of disposing of sewage wastewater by spraying it on forest lands, crop and grass lands, and even on acid mine spoil banks. The application to the latter achieved spectacular results in using sewage effluent for the rehabilitating and vegetating acid mine spoils - offering these positive prospects for about 3 million acres of land in the United States that has been disturbed by strip and surface mining. The Pennsylvania Institutes work in developing the living filter concept has been utilized in several water quality problem areas studied by the U.S. Army Corps of Engineers, by a Michigan county, Disney World and many others.

PUERTO RICO

One of the most important crops in Puerto Rico is sugarcane. A study of irrigation water requirements indicated experimental evidence that 20 inches of water per acre can be saved without affecting sugarcane yields if water is applied frequently during the first part of the growing season and irrigation is stopped five months prior to harvest.

RHODE ISLAND

Objectionable concentrations of iron and manganese in ground water supplies is an important problem in many sections of Rhode Island. The Water Resources Center has cooperated with the State Water Resources Board and the U. S. Geological Survey in studies to alleviate this problem. Part of the research by the Center has been the development of cartridges for the filtration of iron and manganese from small ground water supplies (A-029-RI).

SOUTH CAROLINA

In studies aimed at improved design of municipal water treatment plants, the South Carolina Institute has demonstrated the effectiveness of the vortex chamber as a device for removing heavy, inert particles from water undergoing treatment. The research showed that particles settle faster in a curved path flow than in a rectilinear flow. These results have been well received in the industry, and prompted the construction of a related design in Pennsylvania for combined sewer outfalls. Moreover, the American Public Water Works Association has now proposed the construction of a vortex chamber, using the project's principal investigator as a consultant.

SOUTH DAKOTA

Since about 90% of community and nearly all rural homes in South Dakota depend on ground water for a potable water source, it must be protected. At the same time many communities and rural homes dispose of waste by use of stabilization ponds or septic tanks. To protect our groundwater supplies from contamination from waste disposal practices both state and local planning and regulatory bodies exercise control over the location, design, operation, and maintenance of both liquid and solid waste facilities. The results of research project A-016-SDAK, "Groundwater Contamination Resulting from Waste Disposal," are being extensively used by these state and local bodies as a guide in arriving at their regulatory decisions.

TENNESSEE

The Tennessee Institute has had success with research on urban water policy as an input in urban growth policy. The planning of water and sewer extension policies as shapers of urban development patterns was studied from the standpoint of financing policies, practices, and alternatives in Knoxville, Tennessee, Washington, D.C., Philadelphia, Pennsylvania, and Greensboro, North Carolina. The Metropolitan Planning Commission of Knoxville is using results from this research in its management of water in the Knoxville area, recognizing that water and sewer extension is an important shaper of the urban pattern.

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TEXAS

A recently-completed project, entitled, "Cultural Benefits from Metropolitan River Recreation - San Antonio Prototype" has made a most significant contribution to urban river development. The study demonstrates how a small segment of an urban river can be used to improve the environmental quality of the urban core. Several cities of the nation are considering similar improvements and have requested additional information about this research. Some of the cities are: Salt Lake City, Utah; Milwaukee, Wisconsin; Ithaca, New York; Minneapolis, Minn.; Niles, Mich.; Fountain, Colo.; Fredericksburg, Texas; Lansing, Mich.; and Wichita, Kansas. Several thousand copies of the completion report have been distributed to interested groups of the State and Nation.

UTAH

This study "Evaluation of Flood Risk Factors in the Design of Storm Drainage Systems for Urban Areas," developed a mathematical model which is helping municipal engineers to design drainage work for handling storm water in urban areas. The basis of the technique is a joint simulation model of the hydrologic and economic components within an urban area. For a given level of urbanization, the model provides damage estimates for floods corresponding to specified frequencies. In addition, costs associated with various flood control measures are taken into account by the model so that an optimum design in terms of economics can be selected for flood control works. The model is being applied by Salt Lake County planners with decision-making in various urbanizing areas along the Wasatch Front in the eastern parts of Salt Lake City. The research findings are also being used by engineers to provide estimates of peak water flows under various conditions of urban development for the design of storm drainage structures.

VERMONT

The results of studies of the hydrologic and related soil characteristics of the Lake Champlain basin have been used by the Vermont Water Resources Department in the design of a water treatment plant intake, by the State Highway Department in the design of highways, and by local authorities as the basis for establishing new sanitary landfills or f-- d---------- existing sites.

VIRGINIA

The animals on the bottom of the North Anna River in Virginia were the subject of a study by the Virginia Institute which foresaw the importance of characterizing the fauna before the construction of a power plant that will add heated river to the water. The impact of the heated water can now be measured by later studies after the plant is placed in operation. The results of the studies were important to Theodore J. Wythe & Associates, who prepared an environmental report for the Virginia Outdoor Recreation Commission and to the Virginia Electric Power Company (VEPCO), who will operate the power plant. VEPCO, on the basis of the good beginning with OWRR research, has now contracted for $176,000 of research by the investigators, and the research is expected to be extended even further -- perhaps for 6 to 10 additional years.

WASHINGTON

Project B-037-WASH is a multidisciplinary study dealing with establishment of low flow criteria of Washington's river systems, or elsewhere, for conservation, recreation and aesthetic purposes. Criteria for evaluating economic values associated with aesthetic, recreational, fisheries, and wildlife uses in determining low flow levels have been developed along with water quality guidelines. A method for determining low flows has been developed through systematic analysis of isolated basin characteristics. This method has shown a fairly consistent relationship between low flows, total length of first order streams in a basin, and vertical fall in basin elevation. The principal investigators have been working closely with staff members of the Washington State Department of Ecology in concluding the project with results that can be applied in setting statewide minimum flow requirements. A handbook will be prepared which agency planners can use in setting minimum flow standards. Training sessions and testing of the criteria on several streams and rivers are planned and the Department of Ecology has indicated that implementation of the program has high priority.

WEST VIRGINIA

West Virginia Institute research on runoff on small watersheds has had wide acceptance in the water community. The researchers' use of a model has resulted in procedures that have simplified analysis and improved the accuracy of predicting stream characteristics, droughts, and snow loads. The method has now been extended to large watersheds, and has been used as a basis for further research in West Virginia. The State Water Resources Division has adopted the method in its management operations, and the method is also being used in Nevada.

WISCONSIN

B-002-WIS: "Physical Techniques and Institutional Mechanisms for Integrated Adjustment Within Flood Plain Hazard Zones." An investigation of the physical techniques and institutional mechanisms influencing integrated adjustment within the flood plain hazard zone has directly benefited the people of the State of Wisconsin and the Nation. Detailed field soil survey and air photo interpretation techniques were adapted for delineating hazard zones in mature landscapes. Based on this information and related engineering, economic, and legal studies, a unique floodplain ordinance was developed and subsequently adopted for use in at least 65 of Wisconsin's 72 counties, thus allowing for the development of practical mandatory state legislation. Ten counties with suitable topography realized the advantages of using the rapid, low-cost soil survey procedure and adopted it as the predominent method for delineating floodplain hazard zones in rural areas.

WYOMING

The research results of project "Consumptive Use by Irrigated High Mountain Meadows in Wyoming" are already in use by the State Water Planning Program. They have been especially valuable for defining estimates of water use. This information has served as the foundation for basic analysis of present and future water needs. Because of the definite relationship to the other work of the Water Resources Research Institute, the impact of this study has been far-reaching in its significance.

1974 BUDGET

Mrs. HANSEN. If you don't consider this program important, why request any funds at all?

Mr. WILES. Madam Chairman, we have had a program with these State universities for a number of years at $100,000 a university, I believe. This was an additional $40,000. It's $2.040 million. An additional $40,000 was for each university. We are maintaining the $100,000 level this year, again in 1974 and in 1973.

Mrs. HANSEN. You are maintaining a $100,000 level? The committee has discussed in each one of the budgetary hearings the fact that escalation of costs continue to reduce your total effort. So you are not maintaining the same program level. You are maintaining about an $80,000 figure as compared to a year ago. Is that correct?

Mr. WILES. I would have to say this is correct.

Mrs. HANSEN. So when you say you are maintaining the same level of funding, that is not the complete picture.

Mr. WILES. Excuse me. I mean a level of dollars.

MATCHING GRANT PRIORITIES

Mrs. HANSEN. You are requesting $3 million for matching grants to State institutes. What changes do you expect this year in the priority research areas to which these funds will be directed?

Mr. HALL. The primary changes will be an increased emphasis on the efficient use of water and recycling of water. This would be the primary shift.

Mrs. HANSEN. Do you work with other bureaus or agencies in the Federal Government?

Mr. HALL. Yes, Ma'am. We coordinate very closely with virtually all agencies that are involved in the water business. Obviously, we work with Interior agencies and also with those in the Department of Defense, the Atomic Energy Commission, and others.

DISSEMINATING RESEARCH RESULTS

Mrs. HANSEN. The committee has had some questions through the years about the coordination of your research information so that the information doesn't sit on a shelf someplace and gather dust. What are you doing to improve that situation?

Mr. HALL. One of the reasons that I thought I might like to come back to Washington on this job was to do something about that particular question and also the question of making sure that our work is directed towards the most important problems and to the most important aspects of these problems.

We are working hard on the question of how can we improve the dissemination of research results, to see to it that they get to the right places. We feel that one of the most important ways of doing this is to be sure that we consult and collaborate with the right people in developing the research program in the first place so that we know, almost to the individual, who it is who is going to need and can use these results and see to it that it gets in their hands.

We also have developed the water resources scientific information center to a point now where we can get our hands on practically all of the research that has been done on almost any problem that we wish to name, provided only that we can state the key words that describe what we want to know about that problem.

Mrs. HANSEN. How many States and municipalities are using your data?

Mr. HALL. That would be a hard one to guess.

Mrs. HANSEN. If you are going to justify your appropriations, I would think you would be aware of this information.

Mr. HALL. The reason I say it would be hard to state is that much of our research is of a sequential nature. We develop knowledge, that in turn develops. When the whole thing falls together, then it appears in a use. Some of our use is negative in the sense we show that you shouldn't do something. So to identify that the City Council of Crawford, Nebr., has used this bit of research and that bit of research is a little nebulous for us to document. On the other hand, we do have some documentation and we regularly ask the State institutes to assist us in this effort.

Mrs. HANSEN. You must have the technical knowledge that would be applicable to some critical situations in an area of the United States.

Mr. HALL. That is right.

Mrs. HANSEN. How many requests do you receive per year for information?

Mr. JENSEN. The requests come to us and they also come to the National Technical Information Service, which is the agency that handles our documents. We would have to have their statistics and our statistics.

Mr. HALL. There is another factor that comes into this, in that much of the research is reported in the regular technical journals. Of course, it is hard to determine just which subscribers reacted to what. Some of them read it directly and use it. Others hear it second hand.

Mrs. HANSEN. As long as we have budget constraints, I want to know if the material that you develop in your research is important enough to be of lasting consequence to make an impact. If you are just performing research for the sake of research the committee wants to know.

Mr. HALL. No.

Mrs. HANSEN. I have directed that question to the Office of Water Resources Research before, because there was a time when we did not see much dissemination of some of the knowledge that was being gained, hopefully, from your efforts in working with the States, the research agencies, and the individuals who are participating.

Mr. HALL. We recognize your question, and we will provide an answer for the record.

[The information follows:]

DISSEMINATION AND USE OF RESEARCH RESULTS

Information on the results of water resources research is disseminated in many ways. The evidence of dissemination and use which can be documented, such as that described below, reflects only a fraction of the total dissemination process.

Most research results are disseminated through the scientific and technical journals of many professional societies such as the American Society of Civil Engineers, the American Geophysical Union, and the American Water Resources Association. Virtually all professional and semiprofessional persons involved in the planning, design, and operation of water resources systems subscribe to one or more of these journals, corresponding to their own fields of interest and expertise. It would be almost impossible to maintain a factual record of the amount of information transferred by this procedure. There is no practical way of assuring that a person or organization that learns of OWRR research results, by reading a journal article, attending a seminar, or by some other means of communication, will notify OWRR or a State Institute whenever that person or organization uses the results of an OWRR-supported research project. Even with this limitation, however, OWRR's annual reports over the past several years contain many illustrations of the application and use of research results.

A second and much more effective transfer mechanism occurs through the several thousand graduate students and even greater number of undergraduate students who participated as research assistants on OWRR projects and are subsequently employed by water agencies and organizations at all levels of government and private industry. As a part of the educational process these students are required to review and interpret a large part of the technical literature in their disciplines. Unfortunately, there commonly is a significant time lag associated with this process.

While OWRR has not had sufficient administration resources to enable it to make a concerted effort at documentation of the extent to which various people have turned to our research, we have received several reports which do indicate considerable interest and use.

A recent survey disclosed sales of OWRR-sponsored research project reports and related documents by the National Technical Information Service (NTIS), Department of Commerce. This survey showed that of 322 titled submitted to NTIS in 1970 (the first full year in which they handled retail sales of OWRR-sponsored project reports), 9,328 documents, or an average of 29 copies per title, were sold. These purchases are, of course, in addition to the wide, often free, dissemination of information made at various levels.

In addition to the sale of research reports by NTIS, some 700 technical reports and 200 scientific articles on research findings were published in fiscal year 1972 alone.

OWRR-sponsored projects and their results also provided subject matter for the majority of the 1,500 technical lectures and talks given to audiences estimated at 120,000 in fiscal year 1972. State water resources research institutes sponsored over 250 seminars attracting audiences totaling 14,000 during the same period.

In addition to formal publications and presentations, an estimated 50,000 responses to day-to-day written requests for information on water resource matters were handled by the 51 State institutes during the year. The increased emphasis that has been given to information dissemination is expected to result in even greater dissemination effectiveness in the future.

For some time now, the State institutes have recognized the need for improvement of the dissemination process and this has been the subject of several resolutions for a number of years by the Universities Council on Water Resources. Unfortunately, most of the techniques for improving dissemination, such as that used by the Agricultural Extension Service, are much too expensive for the budgeted resources available. Several of the institutes are studying new ways of accomplishing this at substantially lower cost.

ADDITIONAL WATER RESEARCH

Mrs. HANSEN. You are requesting a decrease of $1,130,000 for additional water research. What will be the impact of this reduction? Why couldn't it have been $3.13 million or $4.13 million?

Mr. HALL. It could have been $3.13 million or $4.13 million. In terms of our ability to utilize the money effectively, we at present fund about 1 out of 10 of the proposals that come in under title II.

Mrs. HANSEN. How many proposals overlap?

Mr. HALL. Actually, it's very interesting, but not too many of them overlap. Many of them are on the same subject, but it may be a different facet of the problem. We just finished reviewing our 1974 Title I matching grant proposals. I think in this group of 350 proposals we found probably about 4 which were even close enough to the same subject that we felt that we had to provide some very, very close coordination in the event we decided to fund them.

RESEARCH IN THE STATE OF WASHINGTON

Mrs. HANSEN. What constructive research has the State of Washington performed?

Mr. HALL. The State of Washington, like most of the States, looks at the problems that are important to the State. There is research on water resources planning and work on irrigation.

Mrs. HANSEN. I want to know what actually was accomplished.

Mr. HALL. I wish I could recite all of the accomplishments of all of the institutes.

Mrs. HANSEN. Give us one concrete example of an outstanding research project. What has South Dakota accomplished?

Mr. HALL. That is where I was born. I lived there for 2 weeks.

RESEARCH IN CALIFORNIA

Mrs. HANSEN. What have California institutes accomplished?

Mr. HALL. Here I can speak a little easier. There have been a large number of studies. One was a study on the west side of the San Joaquin, attempting to get an idea of what could be grown on the water that is brought down on the west side of the San Joaquin to see what crops might be suitable.

Mrs. HANSEN. Don't they know that by this time?

Mr. HALL. This is what some people thought was so. But here you are very tightly dependent upon the climatic factors as to whether you can grow citrus or not or whether you can grow deciduous fruits or you can't. You might be in that band in between where all you can grow is alfalfa. This makes a big difference in the ability to pay the price involved.

SOUTHWEST WATER PROBLEMS

Mrs. HANSEN. One of the most critical areas in the United States is the Southwest. There are many Indian tribes located in this area. The lower Colorado Indians come to mind. They want to improve their economy which is largely agricultural.

Have you or has any State made efforts to work on some research that would be beneficial to the Colorado Indians?

Mr. HALL. My answer to that is I do not believe that our institutes have done so in the past. However, I will say that our institutes will do so in the coming years.

Mrs. HANSEN. I listened to one tribal group testify last year on the crops they propose. These are crops that are substantially dependent not only on water but on the climate. Is any research being performed that would look at both of these particular problems?

Mr. WILES. You know Secretary Horton, don't you, Mrs. Hansen?

Secretary HORTON. I am very sorry for being late. I honestly didn't get the word until 8 minutes ago.

ARID LAND PRODUCTIVITY

Mr. HALL. Madam Chairman, in connection with your question regarding enhancement of some of the agricultural productivity on some of the arid lands, in a different institute, not one of our State institutes but an institute which I was in charge of which is involved in international development, we were working in Mexico. There we developed, at least part way, a system of agriculture where with a rainfall of 8 to 12 inches and no orthodox irrigation system we were growing corn, beans, and peach trees. We think that agricultural practices developed in those studies might help resolve some of the problems that the Indians have in their area. However, you cannot just say let's do it and see what happens, because there are critical factors of whether a crop is adaptable, whether it can stand a drought, when the rains will come, or when the dry period will be.

RESEARCH IN WASHINGTON STATE

Mrs. HANSEN. What did you find on research accomplishments in the State of Washington?

Mr. KOOP. I wanted to mention this year, Mrs. Hansen, there is a research project being carried out on the Quinault Reservation.

Mrs. HANSEN. Good. What is the title of that project?

Mr. KOOP. A project titled "Impacts of Forest Management Practices on Aquatic Environment." They are very concerned about what forest production and management will do to the water environment. We have a grant to the Quinault group at this time. They are studying a problem. I am not the project leader in our office on that project but I have been informed it's going well.

Mrs. HANSEN. What did you accomplish in the State of Washington?

Mr. KOOP. The Washington institute did some good research, Madam Chairman, in an area which led to some improvements in State water laws sometime ago. I don't recall the specific details, but the results of the research done by the State institute were utilized by the State legislature in enacting corrective legislation. They are also doing a lot of work now in close coordination with the State department of ecology.

Mrs. HANSEN. Yes. The reason I asked is because we, as you know, have probably the most complicated water problem of any State because of the pulp mills. Forest products are a major part of the economy in the Northwest. There are also further problems, because of nuclear power and the fishing programs.

I wondered how deeply you are researching these practical problems to provide answers to some of the environmental questions that have to be solved before industry can survive.

Mr. HALL. There is a problem there.

Mrs. HANSEN. All the problems of environment are not concerned with smoke emission, but they are concerned with what spills into the water, and particularly in the lower river.

Mr. HALL. In that institute we do have a study on the problem of the heated water discharge, what happens to it, how the temperature is distributed in the hot plume, where it goes, so we can make a much better assessment of just exactly what the damage might be and what might be done to mitigate it.

Mrs. HANSEN. On the Columbia River you have not only the problem of heat but you have the pulp mill liquid going into the river that creates an entirely different situation. The State of Oregon is just as interested in these problems.

Mr. HALL. Yes. Much of the work on treatment processes for these wastes is being done in the EPA sector rather than in ours. We have sort of an invisible dividing line.

Mrs. HANSEN. But there is a basic knowledge that can be developed, I would think, so that the next step can be taken by those who are commercially involved.

Mr. HALL. Yes.

SCIENTIFIC INFORMATION CENTER

Mrs. HANSEN. You are requesting $934,000 for the Scientific Information Center. This is the same level of funding as last year. I hope you know more about the accomplishments of the rest of the States than you know about the State of Washington. Whoever prepared your justifications for the Department was skimpy with information this year for every bureau except the Office of the Secretary.

Mr. HALL. I feel we have one of the most outstanding information centers.

Mrs. HANSEN. Is your center located in Washington, D.C.?

Mr. HALL. Yes. Mr. Jensen is the man who is in charge of this. I believe we can stack this particular information center against any elsewhere in the world. It really is an outstanding center.

Mrs. HANSEN. Do you also use the Smithsonian Scientific Information Exchange?

Mr. HALL. Yes, we do. We provide them with information and they provide us with information. The Smithsonian and the National Technical Information Service, NTIS, are all essentially one unit, except that they have other things in addition to water. We work with them hand in glove.

ADMINISTRATION

Mrs. HANSEN. You are requesting a decrease of $25,000 for administration. Why are you requesting a decrease when there is no change in your authorized positions? Where will the savings be absorbed?

Mr. HALL. Actually, we feel that we have probably between a 5% and a 10% increase in workload, particularly with these new ideas that we are attempting to develop on making the program more effective.

We are simply going to have to pick that up by getting some more efficient methods in our office for getting the work done. This is what we intend to do.

Mrs. HANSEN. What is your authorized personnel ceiling?

Mr. KOOP. We have an authorized personnel number of 46.

Mrs. HANSEN. That is for 1973?

Mr. KOOP. In 1973 and 1974. They are the same. But we have a ceiling within that authorization of 43.

Mrs. HANSEN. How many people are aboard?

Mr. KOOP. There are 38 on board right now. We are in the process of recruiting two at the very moment, a grants and contracts assistant and a secretary. Two additional ones are the Director of our office or,

if Dr. Hall is designated the Director, it will be the Associate Director and his secretary. That accounts for four. We are also trying to fill a scientist vacancy on our staff.

ACTING DIRECTOR

Mrs. HANSEN. You are the Acting Director, Mr. Hall. I have never seen such a large list of acting officials.

Secretary HORTON. I would much prefer to have Dr. Hall acting than not acting.

Mrs. HANSEN. Is Mr. Hall going to be the Director?

Secretary HORTON. We hope so.

Mrs. HANSEN. What are you waiting for?

Secretary HORTON. Higher authority. I think, as a matter of fact, there should be no inordinate delay in this. It's simply a matter that we have other important assignments, as you will appreciate. The Commissioner of Reclamation is one. There are other bureau level assignments which are getting priority attention. I think there should be no very long delay involved with this.

Mrs. HANSEN. I hope not.

BUDGET CONSTRAINTS

Mr. EVANS. Public Law 92–175 authorizes annual allotments to each of the State institutes in the amount of $250,000. In view of the strong nationwide interest in this program why are you requesting only $100,000 for each of the 50 States and Puerto Rico?

Mr. HALL. It is a matter of the application of overall budgetary constraints, Mr. Evans. It does not reflect any reduction in priority for water resources research, but simply continues the section 100 part of the program at the same dollar level of obligation as before.

Mr. EVANS. Public Law 92–175 also authorized support of three new "State" institutes in the District of Columbia, Guam, and the Virgin Islands. Does your proposed fiscal year 1974 budget include allotment funds for these new institutes, and if not why not?

Mr. HALL. No; it does not. The same budgetary constraints has precluded initiating allotments for these new institutes.

Mr. EVANS. Your request for fiscal year 1974 title II funds under the category of "Additional Water Research" in the amount of $3,170,000 is significantly lower than was appropriated in fiscal year 1973 ($4,300,000). Please explain why this is so.

Mr. HALL. Again it is a matter of applying budgetary constraints. In order to try to maintain the momentum of our excellent title I university programs, virtually all of the required reduction in obligation of funds for 1974 was absorbed in the title II program.

NATIONAL WATER COMMISSION RECOMMENDATIONS

Mr. EVANS. What research are you sponsoring that will be helpful in assessing the recommendations, still in draft form, of the National Water Commission?

Mr. HALL. Almost all of our work has pertinence to an analysis of the conclusions and recommendations of the National Water Commission.

However, most of the research projects sponsored by OWRR were either completed or underway considerably before the announcement of the tentative conclusions of the Commission; hence, none of those projects were tailored specifically to analyze any of these recommendations and conclusions.

The following ongoing research projects are examples of the type of work which we believe will develop results with specific relevance to some of the conclusions and recommendations of the National Water Commissions:

[The projects follow:]

C–2089: "A Study of the Effectiveness of Water Resource Planning Groups"—Utah State University (completion date 10/73)
C–4030: "Socio-Economic Feasibility of Reclaiming Waste Water"—Ralph Stone & Co. (completion date 4/74)
C–4080: "The Effectiveness of the National Environmental Policy Act of 1969 in Water Resources Planning"—Stanford University (completion date, 6/74)
C–4264: "Plan Formulation and Evaluation in Multiple Purpose Water Resource Projects: A Framework for Regional Planning Through Water Resource Systems"—INTASA (completion date 8/73)
C–4330: "Development of Techniques for Estimating the Potentials of Water Resources Development in Achieving National and Regional Social-Goals"—Western Water Research Centers (completion date 2/74)
C–4361: "Some Neglected Benefits of Resource Flexibility Conferred by Bureau of Reclamation Projects"—Utah State University (completion date 8/74)
C–2192: "Social Impact of Water Resource Development Projects and their Implications for Urban and Rural Development: A Post Audit Analysis"—Utah State University (completion date 5/74)
C–2195: "Evaluation of the Benefit of the Regional Multipurpose Economic Benefits Resulting from a Water and Related Land Resource Development"—University of Idaho (completion date 6/73)
C–2199: "Evaluation of Water Resource Investments, Including Water Resource Projects in an Urban Setting"—Cornell University (completion date 6/74)
C–3353: "Market and Nonmarket Benefits and Costs of Water Resource Systems"—Texas Water Development Board (completion date 8/73)
C–3292: "Impact of Industrial Water Pollution Abatement in Alabama on Consumer Prices and Balance of Competition"—Auburn University (completion date 11/73)

ECONOMIC BENEFITS EVALUATION

Mr. EVANS. What usable research results have you been able to obtain in the area of evaluation of economic benefits derived from water resource projects?

Mr. HALL. Perhaps the most important research result for evaluating economic benefits is the vastly improved ability to predict what is going to happen with the physical and biological system. This permits us to estimate the value of these effects a lot more accurately.

In terms of economic research, one very significant result of one of our studies is that the recreational benefits of our large western reservoirs are much larger than anticipated. Our research also documented a consistent increase in the value of land near water areas in both urban and rural areas.

Our studies of costs of industrial pollution abatement indicate these will not be as high as was once expected.

Our studies on recycling sewage effluent on land indicate a big potential savings in cost over present advanced waste treatment systems. Additional research is still needed but we think it will be a very useful method.

We have also analyzed the potential of in-stream aeration. This would be particularly important for oxidizing the large amount of waste products which wash into our streams without going through a sewage treatment plant.

Incidentally, one of our studies showed that there is as much or more pollution producing organic matter that washes off the surface of an urban area as goes through the sewer-treatment system. This will be a major problem in attaining water pollution control.

Another research project has produced more precise methods of estimating the demand for water for various uses such as domestic, industrial and agricultural uses.

There are a great many more, including some post-audit studies of projects to determine what actually happened, but this will give you some idea of some of the results.

EFFECTIVENESS OF COLORADO CENTER

Mr. EVANS. How would you assess the effectiveness of the Colorado Environmental Resources Center, supported by your agency, in meeting the pressing water resources research needs of the State of Colorado?

Mr. HALL. We believe it is one of our outstanding institutes in this regard. Dr. Norman Evans, the director, is held in high esteem professionally on his own and other campuses throughout the State. He serves as a member of the Colorado Water Pollution Control Commission in order to keep abreast of the latest research findings. Furthermore, he has made outstanding progress in developing close consultation and collaborative relationships with State and Federal agencies for the purpose of analyzing research needs and initiating research activities directed toward the solution of pressing water problems. The outstanding research staff of CSU and the University of Colorado are internationally known.

RESEARCH RESULTS DISSEMINATION

Mr. EVANS. Public Law 92–175 authorized and encouraged the State institutes to effectively disseminate research findings. What progress have you made in this regard?

Mr. HALL. The State institutes have recognized the essentiality of effective dissemination of research findings for a long time and have made good progress in developing procedures to do this even though severely constrained by budgetary considerations. They have initiated programs to increase their consultation and collaboration with leading Federal, State, and local water officials in each State. This consultation and collaboration will continue as the research is accomplished. We believe this will make research results dissemination much more effective than at present. The State institute directors have also joined forces, on a regional basis, to make in-depth analyses to determine the major water-related problems in their regions, the best alternatives for solving those problems, the research that is needed, and what agencies will apply the research results; that is, to whom should the research results be made known. Other studies are also in progress to determine how best to disseminate results and at lowest cost. Additionally, in co-

ordination with our water resources scientific information center, three State institutes are operating remote retrieval stations wherein they have access to the center's entire computerized information base which now exceeds 60,000 items. Any one of the stations can retrieve research results information from that base.

UNSOLICITED PROPOSALS

Mr. EVANS. My understanding is that you have been funding "unsolicited" research proposals in title II of your program. Please explain the rationale for not "soliciting" specific research proposals in areas of major national concern and interest.

Mr. HALL. There are several reasons why we have used the unsolicited proposal. The principal reason is that we are seeking good innovative ideas for resolving the basic problems more effectively or at lower cost. Solicited proposals would require more precise specifications from us and minimize opportunities for innovation by highly knowledgeable and competent research proponents. However, our unsolicited proposals are not unguided. We do prepare and issue guidelines in the form of researchable priority problem areas. We try to make these as explicit as possible without discouraging sound innovation. As a result, we feel that our funded title II proposals do relate to water-related problem areas of major concern throughout the Nation.

CHESAPEAKE BAY

Mr. LONG. What title II projects are being conducted relative to the Chesapeake Bay? Is the Baltimore metropolitan areas water supply being studied as part of the title II urban-metropolitan water supplies priority research? If so, what have been the results? When do you expect to complete the study?

Mr. HALL. Although only one title II project is now in progress in the Chesapeake Bay area, OWRR has funded quite a few title I and title II projects in the past relating to bays and estuaries. We also have one title I project that is still underway at the Virginia Institute of Marine Sciences through the VPI Water Resources Research Center.

We have had several title II studies of the Baltimore metropolitan area water supply since 1968. The research was done by Hittman Associates and dealt with planning and modeling for forecasting municipal and industrial water requirements, water conservation, price-demand and demand-cost functions, and stormwater management, using Baltimore data. The result has been the development of predictive and management methods for water operations in Baltimore and elsewhere. The studies are scheduled for completion in December 1973.

MATCHING GRANT DISTRIBUTION

Mr. LONG. Do you have any requirements that your matching grants to institutes under section 101 of the Water Resources Research Act

not be concentrated in a small number of States? Please provide a breakdown by State of the matching grants awarded during fiscal year 1973.

Mr. HALL. No. Matching grant proposals are selected for support on the basis of the merit of the proposal with respect to the potential contribution of the proposed work for solution of an important water problem, adequacy of plan for conduct of the research, relationship to completed and ongoing research, competency of research investigators, the reasonableness of the proposal cost, and duration of the research. We will be pleased to provide for the record a breakdown of our fiscal year 1973 matching grants, by State.

[The information follows:]

SEC. 101 MATCHING GRANTS AWARDED, FISCAL YEAR 1973

	Number of approved projects	Amount of Federal funds
Alabama	2	$80,774
Alaska	1	26,649
Arizona	1	73,000
Arkansas	2	51,022
California	5	79,734
Colorado	2	95,270
Connecticut		
Delaware		
District of Columbia		
Florida	2	63,607
Georgia	2	66,174
Guam		
Hawaii	4	88,168
Idaho	3	75,000
Illinois	3	97,397
Indiana	3	71,268
Iowa	4	79,542
Kansas	1	77,244
Kentucky	2	62,000
Louisiana		
Maine	1	18,300
Maryland	2	62,359
Massachusetts	3	113,700
Michigan	2	58,782
Minnesota	3	94,471
Mississippi		
Missouri	3	63,167
Montana	1	45,000
Nebraska	2	$78,644
Nevada	3	72,140
New Hampshire		
New Jersey	2	54,768
New Mexico	2	43,945
New York	2	89,075
North Carolina	6	131,573
North Dakota	2	35,700
Ohio	3	106,287
Oklahoma	2	94,500
Oregon	1	45,000
Pennsylvania	3	56,380
Puerto Rico		
Rhode Island	1	12,000
South Carolina	2	43,007
South Dakota	1	48,832
Tennessee		
Texas	4	86,003
Utah	3	92,690
Vermont		
Virginia		
Virgin Islands		
Washington	2	74,366
West Virginia		
Wisconsin	3	115,000
Wyoming	2	29,458
Total	98	2,851,996

Mrs. HANSEN. Thank you very much, Dr. Hall.

Mr. HALL. Thank you, Madam Chairman.

WATER PROBLEMS RECOGNIZED

Mrs. HANSEN. I have been very interested in the water resources research program because I think those of us who live in the West are usually conscious of problems of water. If you live in this area you are doubly conscious of the water problems.

Mr. HALL. You get the other face of the coin.

Mrs. HANSEN. Yes, I very much appreciate your statement. Thank you very much.

Mr. HALL. Thank you.

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