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FISCAL YEAR 1980 DEPARTMENT OF ENERGY AUTHORITY  
TION FOR ATOMIC ENERGY DEFENSE ACTIVITIES

HEARING  
BEFORE THE  
COMMITTEE ON ARMED SERVICES  
UNITED STATES SENATE  
NINETY-SIXTH CONGRESS

FIRST SESSION

ON

S. 673

A BILL TO AUTHORIZE APPROPRIATIONS FOR THE DEPARTMENT OF ENERGY FOR NATIONAL SECURITY PROGRAMS FOR FISCAL YEAR 1980 AND FISCAL YEAR 1981, AND FOR OTHER PURPOSES

MARCH 26, 1979

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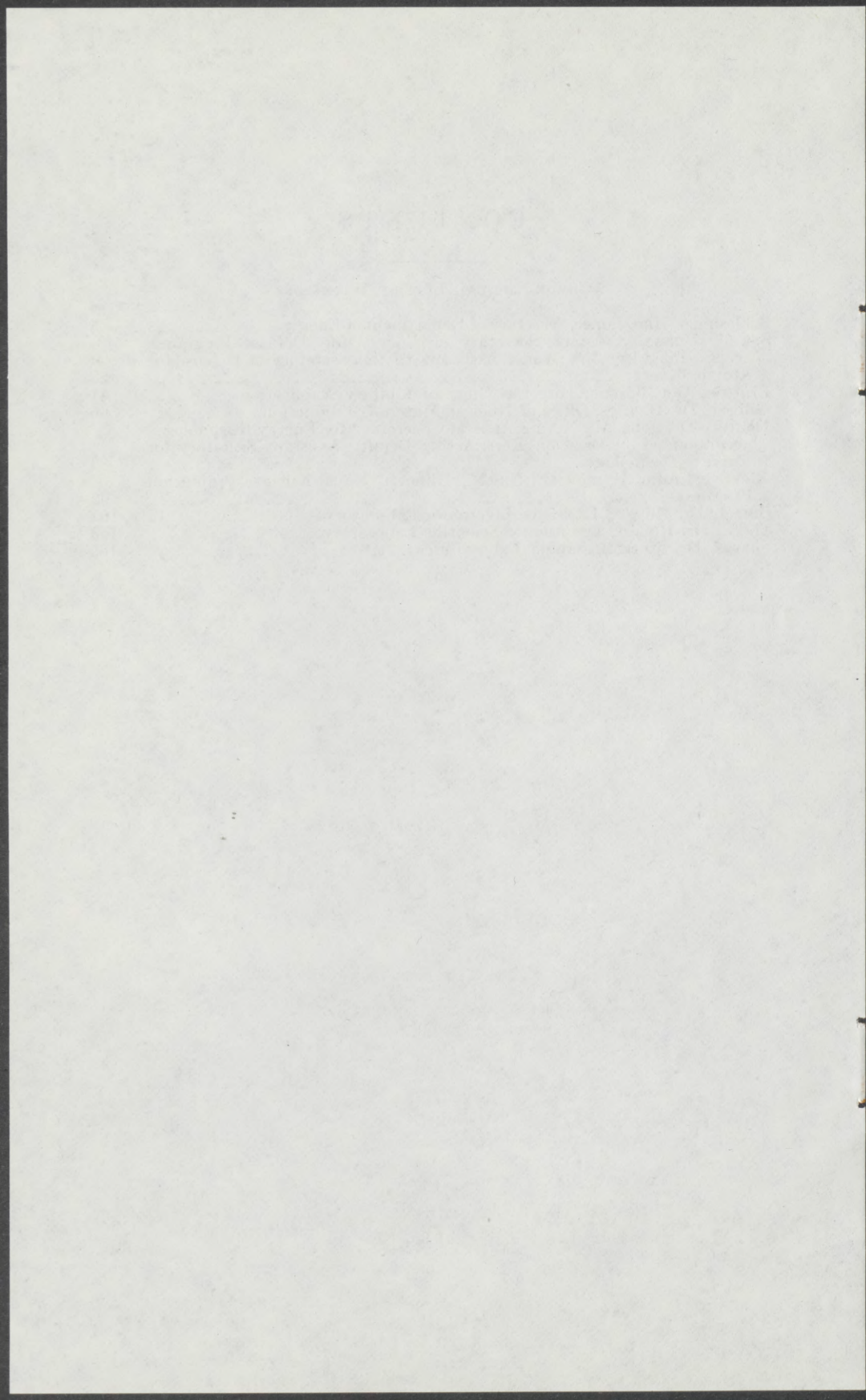
# CONTENTS

## CHRONOLOGICAL LIST OF WITNESSES

|                                                                                                                                                                        | Page |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Schlesinger, Hon. James, Secretary of Department of Energy-----                                                                                                        | 5    |
| Sewell, Duane, Assistant Secretary of Energy for Defense Programs;<br>accompanied by: Jim Wade, Assistant to the Secretary of Defense for<br>Atomic Energy-----        | 28   |
| Bratton, Gen. Joseph, Director, Office of Military Application-----                                                                                                    | 41   |
| Gilbert, Dr. Charles, Office of Nuclear Materials Production-----                                                                                                      | 66   |
| Deutch, Dr. John M., Acting Assistant Secretary for Energy Technology;<br>accompanied by Dr. Don Kerr, Acting Deputy Assistant Secretary for<br>Energy Technology----- | 83   |
| Rickover, Adm. Hyman G., U.S.N., Director, Naval Nuclear Propulsion<br>Program-----                                                                                    | 92   |
| Batzel, Dr. Robert, Lawrence Livermore Laboratory-----                                                                                                                 | 162  |
| Thorn, Dr. Robert, Los Alamos Scientific Laboratory-----                                                                                                               | 163  |
| Sparks, Dr. Morgan, Sandia Laboratories-----                                                                                                                           | 165  |

(III)





# FISCAL YEAR 1980 DEPARTMENT OF ENERGY AUTHORIZATION FOR ATOMIC ENERGY DEFENSE ACTIVITIES

MONDAY, MARCH 26, 1979

U.S. SENATE,  
SUBCOMMITTEE ON ARMS CONTROL,  
COMMITTEE ON ARMED SERVICES,  
Washington, D.C.

## DEPARTMENT OF ENERGY

The subcommittee met, pursuant to notice, at 10:10 a.m., in room 212, Russell Senate Office Building, Senator Henry M. Jackson (chairman of the subcommittee) presiding.

Present: Senators Stennis, Jackson, Byrd (Virginia), Nunn, Hart, Exon, Levin, Thurmond, and Warner.

Also present: Francis J. Sullivan, staff director; John T. Ticer, chief clerk; Rhett B. Dawson, minority staff director; Edward B. Kenney, Ronald L. Lehman, James C. Smith, professional staff members; Marie Fabrizio Dickinson, clerical assistant; Frank Gaffney, assistant to Senator Jackson; John Stirk, assistant to Senator Morgan; Greg Pallas, assistant to Senator Exon; and Peter Lennon, assistant to Senator Levin.

### DEFENSE PROGRAMS

[The bill S. 673 follows:]

[S. 673, 96th Cong., 1st sess.]

A BILL To authorize appropriations to the Department of Energy for national security programs for fiscal year 1980 and fiscal year 1981, and for other purposes

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That in accordance with section 660 of the Department of Energy Organization Act, there are hereby authorized to be appropriated to the Department of Energy the following amounts under titles I and II:

### TITLE I—NATIONAL SECURITY PROGRAMS

#### OPERATING EXPENSES

SEC. 101. Funds are hereby authorized to be appropriated for fiscal year 1980 for operating expenses incurred in carrying out national security programs, including scientific research and development in support of the armed services, strategic and critical materials necessary for the common defense, and military applications of nuclear energy, and related management and support activities, as follows:

- (A) For Weapons Activities, \$1,388,241,000.
- (B) For Verification and Control Technology, \$36,800,000.
- (C) For Materials Production, \$326,048,000.
- (D) For Defense Waste Management, \$249,791,000.



## PLANT AND CAPITAL EQUIPMENT

SEC. 102. Funds are hereby authorized to be appropriated for fiscal year 1980 for plant and capital equipment, including planning, construction, acquisition, or modification of facilities (including land acquisition), and fabrication of capital equipment not related to construction, and related management and support activities, necessary for national security programs, as follows:

## (A) For weapons activities:

(1) Project 80-AE-4, Addition to computer facility, Sandia Laboratories, Livermore, California, \$2,800,000;

(2) Project 80-AE-5, Ground launched cruise missile (GLCM) warhead production facilities, various locations, \$7,000,000;

(3) Project 80-AE-6, Utilities and equipment restoration, replacement and upgrade, various locations, \$69,300,000;

(4) Project 80-AE-7, Relocate water towers, Mound Facility, Miamisburg, Ohio, \$1,400,000;

(5) Project 80-AE-8, Advanced size reduction facility, Rocky Plant, Golden, Colorado, \$10,000,000;

(6) Project 80-AE-9, New polymer production facility, Bendix Plant, Kansas City, Missouri, \$1,400,000;

(7) Project 80-AE-10, Additional loading facilities, Savannah River Plant, Aiken, South Carolina, \$3,500,000;

(8) Project 80-GPP-1, General plant projects, \$25,400,000;

(9) Project 80-PE&D-1, Plant engineering and design, \$3,600,000;

(10) Project 71-9, Fire, safety, and adequacy of operating conditions projects, various locations, an additional sum of \$7,000,000, for a total project authorization of \$287,000,000;

(11) Projects 77-11-c, 8" Artillery Fired Atomic Projectile (AFAP) production facilities, various locations, an additional sum of \$4,600,000, for a total project authorization of \$27,200,000;

(12) Project 78-16-d, Weapons safeguards, various locations, an additional sum of \$2,000,000, for a total project authorization of \$28,000,000;

(13) Project 78-16-g, Radioactive liquid waste improvement, Los Alamos Scientific Laboratory, New Mexico, an additional sum of \$6,200,000, for a total project authorization of \$12,500,000;

(14) Project 79-7-b, Fire protection improvements, Los Alamos Scientific Laboratory, New Mexico, an additional sum of \$2,500,000, for a total project authorization of \$4,500,000;

(15) Project 79-7-c, Proton storage ring, Los Alamos Scientific Laboratory, New Mexico, an additional sum of \$16,100,000, for a total project authorization of \$21,100,000;

(16) Project 79-7-l, System research and development laboratory, Sandia Laboratories, Albuquerque, New Mexico, an additional sum of \$12,000,000 for a total project authorization of \$13,000,000;

(17) Project 79-7-n, Utility system restoration, Y-12 plant, Oak Ridge, Tennessee, an additional sum of \$15,800,000, for a total project authorization of \$18,000,000;

(18) Project 79-7-o, Universal pilot plant, Pantex Plant, Amarillo, Texas, an additional sum of \$3,900,000, for a total project authorization of \$7,400,000; and

(19) Capital equipment not related to construction, \$104,164,000;

(B) For verification and control technology for capital equipment not related to construction, \$1,060,000;

## (C) For materials production:

(1) Project 80-AE-2, Replace obsolete processing facilities, HB Line, Savannah River, South Carolina, \$19,000,000;

(2) Project 80-AE-3, Steam generation facilities, Idaho Chemical Processing Plant, Idaho, \$23,500,000;

(3) Project 80-GPP-1, General plant projects, \$15,000,000;

(4) Project 80-PE&D-1, Plant engineering and design, \$3,400,000;

(5) Project 77-13-a, Fluorinel dissolution process and fuel receiving improvements, Idaho Chemical Processing Plant, Idaho National Engineering Laboratory, Idaho, an additional sum of \$84,400,000, for a total project authorization of \$149,400,000;

(6) Project 78-18-e, Environmental, safety and security improvements to waste management and materials processing facilities, Richland, Washing-



ton, an additional sum of \$11,500,000, for a total project authorization of \$40,000,000;

(7) Project 79-7-h, Utilities replacement and expansion, Idaho Chemical Processing Plant, Idaho Falls, Idaho, an additional sum of \$5,500,000, for a total project authorization of \$10,500,000;

(8) Project 79-7-i, Transmission and distribution systems upgrading, Richland, Washington, an additional sum of \$7,000,000, for a total project authorization of \$14,000,000; and

(9) Capital equipment not related to construction, \$35,000,000:

(D) For defense waste management:

(1) Project 80-GPP-1, General plant projects, \$8,880,000;

(2) Project 80-PE&D-1, Plant engineering and design, \$21,320,000;

(3) Project 77-13-f, Waste Isolation Pilot Plant, Delaware Basin, south-east New Mexico (A-E, land lease acquisition and long-lead procurement), an additional sum of \$55,000,000, for a total project authorization of \$93,000,000; and

(4) Capital equipment not related to construction, \$12,000,000:

## TITLE II—MISCELLANEOUS PROGRAMS

### OPERATING EXPENSES

SEC. 201. Funds are hereby authorized to be appropriated for fiscal year 1980 for operating expenses, including related management and support activities, incurred in carrying out the following programs:

(A) For Naval Petroleum Reserves, \$72,900,000.

(B) For Inertial Confinement Fusion, \$108,890,000.

(C) For Naval Reactors Development, \$241,367,000.

(D) For Nuclear Materials Security and Safeguards Development, \$43,227,000.

### PLANT AND CAPITAL EQUIPMENT

SEC. 202. Funds are hereby authorized to be appropriated for fiscal year 1980 for plant and capital equipment, including planning, construction, acquisition, or modification of facilities (including land acquisition), and fabrication of capital equipment not related to construction, and related management and support activities as follows:

(A) For inertial confinement fusion activities:

(1) Project 80-PE&D-1, Plant engineering and design, \$1,500,000;

(2) Project 75-3-b, High energy laser facility, Los Alamos Scientific Laboratory, New Mexico, an additional sum of \$8,000,000, for a total project authorization of \$62,500,000; and

(3) Capital equipment not related to construction, \$8,500,000:

(B) For naval reactors development:

(1) Project 80-AE-1, Fluids and corrosion test facilities upgrading, various locations, \$17,900,000;

(2) Project 80-GPP-1, General plant projects, \$3,300,000; and

(3) Capital equipment not related to construction, \$15,800,000:

(C) For nuclear materials security and safeguards for capital equipment not related to construction, \$3,400,000.

## TITLE III—GENERAL PROVISIONS

SEC. 301. Except as otherwise provided in this Act—

(A) no amount appropriated pursuant to this Act may be used for any program in excess of either (1) 105 percent of the amount authorized for that program by this Act, or (2) \$10,000,000 more than the amount authorized for that program by this Act, whichever is the lesser, and

(B) no amount appropriated pursuant to this Act may be used for any program which has not been presented to, or requested of, the Congress, unless (1) a period of 30 calendar days (not including any day in which either House of Congress is not in session because of adjournment of more than three calendar days to a day certain) has passed after the appropriate committees of Congress receive notice from the Secretary containing a full and complete statement of the action proposed to be taken and the facts and circumstances relied upon in support of such proposed action, or (2) unless each such committee



before the expiration of such period has transmitted to the Secretary written notice to the effect that such committee has no objection to the proposed action.

SEC. 302. The Secretary is authorized to start any project provided for under the general plant projects provisions set forth in this Act only if:

(A) the then maximum currently estimated cost of such project does not exceed \$750,000 and the then maximum currently estimated cost of any building included in such project does not exceed \$300,000, except that the building cost limitation may be exceeded if the Secretary determines that it is necessary to do so in the interest of efficiency and economy; and

(B) the total cost of all projects undertaken under all general plant projects provisions in this Act does not exceed the estimated cost of all such projects by more than 25 percent.

SEC. 303. (A) Whenever the currently estimated cost of a line item construction project for which appropriations are authorized in section 102 of this Act exceeds by more than 25 percent the estimated cost for such project at the time of enactment of this Act, such project may not be started or additional obligations incurred in excess of the amounts currently appropriated, as the case may be, unless (1) a period of 30 calendar days (not including any day in which either House of Congress is not in session because of adjournment of more than three days to a day certain) has passed after the appropriate committees of Congress receive a notice from the Secretary containing a full and complete statement of the action proposed to be taken and the facts and circumstances relied upon in support of such proposed action, or (2) unless each such committee before the expiration of such period has transmitted to the Secretary written notice to the effect that such committee has no objection to the proposed action.

(B) The provisions of this section shall not apply to any project which has a currently estimated cost of less than \$5,000,000.

SEC. 304. Subject to the provisions of appropriations Acts, amounts appropriated pursuant to this Act for management and support activities and for general plant projects are available for use, when necessary, in connection with all programs of the Department of Energy.

SEC. 305. When so specified in an appropriation Act, funds authorized to be appropriated by this Act may be transferred to other agencies of the Government for the performance of the work for which the appropriation is made, and in such cases the sums so transferred may be merged with the appropriations to which they are transferred.

SEC. 306. The Secretary is authorized to perform construction design services for any construction project of the Department of Energy in support of national security programs which have been presented to the Congress, in amounts not in excess of the amounts specified in sections 120(A)(1), 102(C)(9), 102(E)(4), and 102(F)(2). In any case in which the estimated design cost for any project is in excess of \$300,000, the Secretary shall notify the appropriate committees of Congress in writing of the estimated design cost for such project at least 30 days before any funds are obligated for design services for such project.

SEC. 307. In addition to construction design services performed with plant engineering and design funds, the Secretary is authorized to perform construction design services for any Department construction project whenever (A) such construction project has been included in a proposed authorization bill transmitted to the Congress by the Secretary, and (B) the Secretary determines that the project is of such urgency in order to meet the needs of national defense or protection of life and property or health and safety that construction of the project should be initiated promptly upon enactment of legislation appropriating funds for its construction.

SEC. 308. Appropriations authorized by this Act for salary, pay, retirement or other benefits for Federal employees may be increased by such amounts as may be necessary for increases in such benefits authorized by law.

SEC. 309. When so specified in an appropriation Act, amounts appropriated for "Operating expenses" or for "Plant and capital equipment" may remain available until expended.

#### TITLE IV—AUTHORIZATION OF APPROPRIATIONS FOR FISCAL YEAR 1981

SEC. 401. (A) There is hereby authorized to be appropriated to the Department of Energy to be available no earlier than October 1, 1980, such sums as may be necessary for fiscal year 1981 for programs set forth in this Act.



(B) All of the provisions which are applicable to amounts appropriated pursuant to other sections of this Act shall apply in the same manner to amounts appropriated pursuant to this section.

Senator JACKSON. The hearing will come to order.

This is the first meeting of the Senate Armed Services Subcommittee on Arms Control for the 96th Congress.

The purpose of our hearings today is to get a look at the Department of Energy's fiscal year 1980 budget request for national defense programs. Primarily, these programs involve the R. & D., production and maintenance of our nuclear deterrent. We will also get into ancillary programs involving inertial confinement fusion, naval nuclear reactors, and defense nuclear waste management.

This is the third year that the Armed Services Committee has had jurisdiction over these programs since the abolishment of the Joint Committee on Atomic Energy.

The Department of Energy is seeking new authority for fiscal year 1980 in the amount of \$3.048 billion, an increase of 4 percent over last year's authorization total of \$2.930 billion. However, considering inflation, the fiscal year 1980 request is down 4 or 5 percent over last year's act.

At this time, I have not scheduled additional hearings beyond what is planned for today. As we proceed, we will make a judgment as to the necessity for further hearings. Today's hearing record will be kept open for 10 days for the submission of material by any interested party for consideration to be included in the hearing record.

We start off this morning by hearing from Dr. James Schlesinger, Secretary of the Department of Energy.

Dr. Schlesinger, you have a prepared statement, both classified and unclassified?

#### **STATEMENT OF HON. JAMES SCHLESINGER, SECRETARY OF THE DEPARTMENT OF ENERGY**

Secretary SCHLESINGER. Yes sir, Mr. Chairman. I think I might as well just place that statement in the record, if you wish.

Senator JACKSON. Without objection, the prepared statement will go in the record at this point.

[The prepared statement follows:]

#### **PREPARED STATEMENT OF JAMES R. SCHLESINGER**

Mr. Chairman and Members of the Committee: I appreciate the opportunity to introduce the Department of Energy's National Defense Program to you today and to discuss the implications of the world energy situation for this program.

The Department's FY 1980 Authorization Request for Atomic Energy Defense Activities is about \$3 billion. These activities play a major role in supporting the Nation's national defense policy and objectives through accomplishment of the Nuclear Weapons Program, the production and processing of nuclear materials for weapon applications, and the development of improved naval nuclear propulsion reactors.

The Naval Reactor Program, as well as the Defense Waste Management Program, are under the Assistant Secretary for Energy Technology, while those activities related to the Nuclear Weapons Program are under the Assistant Secretary for Defense Programs. You will receive testimony on the first two activities from Dr. Deutch, Dr. Kerr and Admiral Rickover. Mr. Sewell will provide details on Defense Programs activities. Therefore, I would like to highlight only several of the important aspects of these programs as they relate to our FY 1980 Authorization Request.



First, it should be noted that, for planning purposes only, the budget has been developed assuming that the entry into force of a Comprehensive Test Ban (CTB) will not occur within FY 1980. In order to fully support U.S. policy, we are developing an aggressive safeguards program and are taking steps to maintain the best possible position to meet the Department's responsibilities with respect to the Nation's nuclear weapon stockpile under a treaty regime and adapt to a treaty's provisions in a timely manner. The FY 1980 request also includes modest funds to pursue regional seismic research and to produce five national seismic stations similar to those we would propose to emplace within the Soviet Union during a CTB to improve our verification capabilities. The final FY 1980 funding requirement and the FY 1981 funds for the activities related to the national seismic stations will, of course, depend upon the final terms and conditions of the Separate Verification Agreement and the rate of progress of CTB negotiations in Geneva. It is clear that under a CTB some changes in weapons program emphasis and some new or different activities will be necessary. The nature of these changes, as well as our specific activities within the safeguards program, will depend upon the final terms and conditions of the treaty itself. You can rest assured, however, that we will permit neither a deterioration of our nuclear weapons stockpile nor a deterioration of the technology base or production complex.

In order to begin to restore and modernize our nuclear weapons research and production complex, we are requesting in the FY 80 budget \$80 million and then we plan to update our assessment of future requirements and planning.

Finally, we will [deleted] increase our nuclear weapons production, primarily to provide the new strategic warheads for the Trident submarine-launched ballistic missile (SLBM), the Minuteman III ICBM and the latest modification of the B61 tactical bomb. [Deleted.]

Now, to the implications of the world energy situation for this program. We must recognize that this program, as all of our programs, will be undertaken in the face of a serious world energy situation, serious in part because it is uncertain. The uncertainties fall into three general categories. First, the future state of the world energy market—the availability and price of oil in particular. Second, the possibility of major supply interruptions because of politically inspired embargoes, wars or other events. The third major uncertainty involves the technical and commercial results of our research, development and demonstration programs. Our efforts and plans aim to reduce all of these uncertainties to the fewest possible and to the greatest practical extent.

In the near-term, the world energy situation should not have any major effect on the Department's national defense activities. But the Department's national defense complex is as energy dependent as are all of the Nation's important industrial and commercial activities. Consistent with our commitment to reduce reliance upon imported petroleum, we are implementing a broad program for restricting the demand for oil through conservation and use of alternative fuels.

Already the nuclear weapons complex has reduced its energy consumption in recent years. Furthermore, I have asked for an additional reduction of 5 percent Departmentwide. The already accomplished energy savings have been made without any sacrifice of production, a fact I believe carries a message for the Nation as a whole. Our weapons plants are using coal or gas where possible and have introduced wide-scale metering that gives us accurate knowledge of the energy consumed in each phase of activity. This has resulted in raised consciousness of energy consumption and costs. Consciousness of the problem, plus teamwork and cooperation throughout the weapons complex, has led to changes that saved energy without sacrificing output. We believe the additional reductions now requested also will be accomplished without damage to the program. But, in all frankness, should further cuts in energy consumption have to be imposed on the Department's national defense activities, some penalty might result.

To avoid possible harm to our national security and to ensure that vital defense activities are not curtailed, is a task for all of us. Switching to coal or gas where possible and accelerating our efforts at conservation will minimize the impact of the current world energy situation. However, in the long-term, it is crucially important that the Nation, all of it, implement the National Energy Act effectively and move forward on other measures that help address



the energy problem. Working together we must break the paralysis of inaction experienced in recent years if we are to avoid what could be serious long-term consequences of energy dependence.

Thank you, Mr. Chairman, for this opportunity to appear before you.

Senator JACKSON. Would you summarize your statement?

#### NATIONAL SECURITY

Secretary SCHLESINGER. Yes sir. I will have a number of subjects to take up, Mr. Chairman. I just might mention some of them.

#### FISCAL YEAR 1980 DOE BUDGET REQUEST—ATOMIC ENERGY DEFENSE ACTIVITIES

[In thousands of dollars]

|                                                       | Fiscal year<br>1979<br>authorization<br>enacted | Fiscal year<br>1980<br>authorization<br>request |
|-------------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Weapons activities.....                               | 1, 498, 944                                     | 1, 686, 905                                     |
| Nuclear materials production.....                     | 485, 655                                        | 524, 848                                        |
| Inertial confinement fusion.....                      | 300, 200                                        | 126, 890                                        |
| Nuclear materials security and safeguards.....        | 48, 089                                         | 46, 627                                         |
| Verification and control technology.....              | 32, 600                                         | 37, 860                                         |
| Total, Assistant Secretary for Defense Programs.....  | 2, 365, 488                                     | 2, 423, 130                                     |
| Defense waste management.....                         | 273, 945                                        | 346, 991                                        |
| Naval reactors development.....                       | 290, 600                                        | 278, 367                                        |
| Total, Assistant Secretary for Energy Technology..... | 564, 545                                        | 625, 358                                        |
| Personnel resources.....                              | 47, 451                                         | ( <sup>1</sup> )                                |
| Total, atomic energy defense activities.....          | 2, 977, 484                                     | 3, 048, 488                                     |

<sup>1</sup> Fiscal year 1980 personnel resources are spread above.

I have put up here the budget in the national security area for the Department of Energy. It represents a sizable chunk of the DOE's budget this year, something on the order of 40 percent of the total.

Senator JACKSON. Incidentally, the public does not seem to understand how the budget breaks down in terms of the total amount allocated to the Department of Energy. What is your total budget, roughly?

Secretary SCHLESINGER. It is about \$10 billion in outlays. Twenty thousand employees and \$10 billion.

Senator JACKSON. But 40 percent of the budget is not related directly to energy matters, is that correct?

Secretary SCHLESINGER. That is correct. Two-thirds of our spending is directly related to the national security if one includes the establishment of the strategic petroleum reserve. Another \$3 billion is related to energy R. & D. Much attention is concentrated on the \$200 or \$300 million that we spend on regulation. For obvious reasons, that is an area that provides a certain amount of controversy.

#### NUCLEAR WEAPONS

Mr. Chairman, generally speaking, as you have indicated, we have increased the size of the budget, though not in relation to the rate of inflation. There is a substantial growth of weapons activities; and the reason for that, Mr. Chairman, is a [deleted] increase in the workload associated with the production of nuclear weapons.



In fiscal year 1978 we delivered [deleted] weapons. In fiscal year 1980 we expect to deliver [deleted].

We have made every effort in addition, in the research and development area to maintain employment at the laboratories. Laboratory morale is generally good.

I think that there are two worrisome elements from the standpoint of laboratory people. One, of course, is the CTB and what the consequences might be of such an agreement. The other is the great amount of interest that has been taken in the selection of a new director for LASL and the changing attitude toward these laboratories at the University of California. I think those are potentially disturbing elements.

Aside from that, I think that the laboratory directors will testify that the laboratory morale is in good shape.

We have, this year in the testing program, declined in the number of projected tests. We are attempting to hedge against the possibility of a CTB and the way that we are doing that is to assure that the weapons that we will need in the event of a CTB have indeed been tested. The consequence of that is some sacrifice of advanced development testing.

Also, I might say that the maintenance of the strong R. & D. capabilities and the necessary increased funding for the laboratories has taken place to some extent at the sacrifice of testing.

Also, in connection with the CTB we are providing for advance examination of potential safeguards.

The other item in the weapons area is nuclear materials production. That also increases this year. Inertial confinement fusion, security and safeguards, verification and control technology, all of these add up to a small increase in the programs that are assigned to the Assistant Secretary for Defense Programs.

#### NATIONAL SECURITY

Outside of that area, the national security responsibilities also rest with the Assistant Secretary for Energy Technology, both in defense waste management and naval reactor development. I should say that the defense waste management is something that we are deeply concerned about and we have not resolved this problem in this country over the course of a quarter of a century or more. There is a substantial increase in this budget for waste management. We hope to make a start on that program and in the course of that provide the public with the confidence that we can indeed isolate nuclear waste which I think is critical to the development of nuclear power.

#### NAVAL REACTOR DEVELOPMENT

In naval reactor development, Mr. Chairman, there is a slight decrease in this budget; Admiral Rickover has received the funding that he has requested. Generally speaking, that is a well funded program and has been a well funded program over the years.

The decline in real authorization associated with the program reflects some adjustment in the aspirations with regard to nuclear propulsion of the Department of Defense.



Those are generally the areas, Mr. Chairman, that are included in the national security programs budget. I think that this is a good budget. It is, of course, an austere budget.

[Deleted.]

[Laughter.]

#### ADMINISTRATION OF LABORATORIES

Senator JACKSON. I would like to ask the general question as to how the new arrangement we have worked out with the Department of Energy, in connection with the civilian and military programs, is going at this time. Do you feel there has been a good transition, and is it working out well from the standpoint of the administration of the laboratories and the basic programs under your jurisdiction?

Secretary SCHLESINGER. I think that it is going very well, Mr. Chairman. As you know, there has been speculation over the years whether or not the nuclear weapons production complex should be shifted to the Department of Defense. Every review of that has come to the conclusion that the program is working very well within the Department of Energy or ERDA, or AEC before, and such a shift should not be made.

Generally speaking, the shift has been advocated by those who would reduce funding for nuclear weapons activity—the feeling being that if it were within the Department of Defense that there would be a move to trade off weapons, or nuclear weapons development, for other activities.

The existence of this program within the Department of Energy provides some degree of protection for the program. I think that the program is one of our jewels in the sense that it is well conducted, well administered. It has clearly specified objectives, and it has been successful over the years in achieving those objectives.

#### COMPREHENSIVE TEST BAN

Senator JACKSON. I would like to turn now to the comprehensive test ban, CTB.

How many tests did the Soviets conduct last year?

Secretary SCHLESINGER. The Soviet Union conducted [deleted] Mr. Chairman, and that is [deleted] high.

Senator JACKSON. That is way up, is it not?

Secretary SCHLESINGER. Yes, sir. We never know precisely how many tests they conduct because we are dependent on our monitoring capabilities, and it is possible that certain low level tests are undetected or unidentified by us. But we have detected [deleted].

Senator JACKSON. Do you know to what yield we have been able to detect roughly, depending on where it is, of course, in the Soviet Union?

Secretary SCHLESINGER. Generally speaking, we believe we can detect down to [deleted] if the test is conducted in hard rock. If it is conducted in some other medium, our ability to detect and to identify is less.

Senator JACKSON. Even with decoupling?

Secretary SCHLESINGER. With decoupling we know you can have a reduction of detection and identification capability of a factor of at



least 20 or 30 as a result of the tests that we have carried out in the past. Our assumption has been that there has been no such attempt at decoupling.

Senator JACKSON. And our numbers are based on that assumption when we talk [deleted].

Secretary SCHLESINGER. Yes, sir.

Senator JACKSON. How many tests did we conduct?

Secretary SCHLESINGER. Last calendar year we conducted, I believe [deleted] of which two were in behalf of the British. As you know, we carry on these tests for the British Government in Nevada. So it was [deleted] two for the British.

Senator JACKSON. Where would we be, in the event we enter into a comprehensive test ban agreement based on the tests we conducted last year and those which will be done for the next fiscal year? Where does that leave us, in the event of a comprehensive test ban agreement, considering various assumptions of the kinds of agreement?

Secretary SCHLESINGER. [Deleted.]

As I mentioned earlier, we have skewed the distribution of our testing to assure that, if a CTB were to come into force that we would have tested weapons for programed DOD systems, so that we would have the designs on hand. The problems of the CTB do not, I think, lie in the area of foregoing weapons designs that we would want to have for known systems.

Senator JACKSON. [Deleted] if we should enter into an immediate agreement, we would not be able to test adequately [deleted] would we?

Secretary SCHLESINGER. That is correct, sir. Therefore, we plan on the basis that such an agreement will be delayed in any event until after completion of the SALT agreement, consequently there would be time. We will have to reach a decision with regard to the [deleted].

Senator JACKSON. What is the schedule on the design and the potential testing date?

Secretary SCHLESINGER. We have designs the [deleted]. That decision could be made rapidly. We could have the appropriate option selected before a CTB came into force.

Senator JACKSON. We have yet, of course, to decide on the [deleted] that has not been resolved?

Secretary SCHLESINGER. That is correct, sir.

Senator JACKSON. That decision affects, of course, the yield we are talking about?

Secretary SCHLESINGER. It certainly would affect the optimization of the weapon for the delivery vehicle.

Senator JACKSON. What is the highest yield the Russians have tested this last year? There is the understanding that they were to stay, I think, at 150 kilotons?

Secretary SCHLESINGER. 150 KT, yes sir. They have pledged publicly that they would not go above 150 KT.

Senator JACKSON. Do we have any information that they have been above that yield?

Secretary SCHLESINGER. [Deleted.]

Senator JACKSON. [Deleted.]

Secretary SCHLESINGER. Yes, sir.

[The information follows:]

[Deleted.]



## ENHANCED RADIATION

Senator JACKSON. Could you review briefly where we are as a result of the action we took in the last budget with reference to the enhanced radiation device?

Secretary SCHLESINGER. [Deleted.]

With regard to the decision on the enhanced radiation weapon, as you know, for international policy reasons the President in April had announced that we would not go forward with the weapon because of the failure of our allies to indicate that they were prepared to accept deployment.

[Deleted.]

Senator JACKSON. [Deleted.]

Secretary SCHLESINGER. [Deleted.]

Senator JACKSON. I want to ask this last question and then we will follow the 10-minute rule.

Senator NUNN. Before we leave this subject, I am not sure what you mean [deleted].

Secretary SCHLESINGER. Yes, sir. [Deleted.] But we do not have approval from the President at this juncture [deleted].

Similarly, on the 8-inch shell, which is due for initial deployment [deleted].

What I am underscoring is, at this juncture, we have lost no options. Those options lie before the President. They lie before the United States.

## NUCLEAR MATERIALS

Senator JACKSON. Mr. Secretary, [deleted] as I understand it, the budget contemplates a one-third cutback of plutonium production at the Savannah River plant in South Carolina.

Secretary SCHLESINGER. Yes, sir. We are going to two-thirds capacity in the three reactors at Savannah River. I was concerned that if we shut down one of those reactors we would not be able to start it up again. Therefore, the cutback is being prorated over the three reactors. [Deleted.]

Senator JACKSON. That was my next question, [deleted].

Secretary SCHLESINGER. [Deleted.]

Senator JACKSON. [Deleted.]

Secretary SCHLESINGER. Yes, sir, at the present time.

Senator JACKSON. Based on the projected budget?

Secretary SCHLESINGER. Yes, sir.

Senator JACKSON. What is the half-life of tritium, 12 years?

Secretary SCHLESINGER. The half-life is 12.33 years to be precise.

Senator JACKSON. For the new members of the committee, I think it is important to keep in mind that this process of recycling goes on in effect, does it not, in the weapon systems? You start moving it out as you reach the end of that cycle. So, it is not a matter of deploying it as in the case of other weapons on a permanent basis.

With tritium you have to constantly monitor the time element. Is that not correct?

Secretary SCHLESINGER. Yes, sir.

Senator JACKSON. Senator Byrd?

Senator BYRD. I yield my time temporarily, Mr. Chairman.



Senator WARNER. Mr. Chairman, I will yield mine hoping to get into the energy aspects this morning.

Senator NUNN. As I understand it, Mr. Secretary, your testimony is that [deleted].

Secretary SCHLESINGER. [Deleted.]

Senator NUNN [Deleted.]

Secretary SCHLESINGER. [Deleted.]

Senator NUNN. [Deleted.]

Secretary SCHLESINGER. [Deleted.] Dr. Gilbert will discuss this in more detail this afternoon.

Senator NUNN. [Deleted.]

Secretary SCHLESINGER. [Deleted.]

As a consequence, we have been looking at the new plutonium reactor, the so-called N-plutonium reactor which is getting a little elderly at Hanford, with the thought that in that reactor we might produce additional material. We have the capacity to enhance our rate of nuclear material production so long as we know in advance when we would require it.

I will insert in the record certain comments with regard to cost and lead times.

[The information follows:]

[Deleted.] However planned and needed production of weapon grade plutonium will be reduced by [deleted] need to shut down each Savannah River reactor sequentially over a four year period for upgrading.

In order to compensate for the loss of weapon grade plutonium production at Savannah River, the N-reactor at Richland can be converted from fuel grade plutonium production to weapon grade plutonium production. The extra costs to convert and operate N-reactor in this mode, and to restart the Richland fuel processing plant (PUREX) to obtain the plutonium are tabulated below.

The following table summarizes the estimated costs associated with the change in N-reactor operations from producing fuel grade (12 percent Pu-240) plutonium to producing weapons grade (6 percent Pu-240) plutonium, and associated with the Richland PUREX Plant startup. These estimated costs are incremental to the ongoing program funding.

[Millions of dollars]

|                           | Fiscal year— |                   |                  |                  |
|---------------------------|--------------|-------------------|------------------|------------------|
|                           | 1981         | 1982              | 1983             | 1984             |
| Operating:                |              |                   |                  |                  |
| N-reactor conversion..... | 3.9          | <sup>1</sup> 13.5 | 0                | 0                |
| N-reactor operating.....  | 0            | 5.1               | 16.9             | 16.9             |
| Purex startup.....        | 12.5         | 11.3              | <sup>2</sup> 5.9 | 0                |
| Purex operating.....      | 0            | 0                 | 12.3             | 22.0             |
| B-plant operating.....    | 0            | 0                 | <sup>3</sup> 9.3 | <sup>3</sup> 9.8 |
| Subtotal.....             | 16.4         | 29.9              | 44.4             | 48.7             |
| Capital equipment:        |              |                   |                  |                  |
| Purex.....                | 3.5          | 3.9               | 2.5              | 2.2              |
| N-reactor.....            | 0            | 1.4               | 0                | 0                |
| Subtotal.....             | 3.5          | 5.3               | 2.5              | 2.2              |
| Construction:             |              |                   |                  |                  |
| Fuel storage.....         | 5.0          | 0                 | 0                | 0                |
| Purex.....                | 14.7         | 5.8               | 2.0              | 2.0              |
| Subtotal.....             | 19.7         | 5.8               | 2.0              | 2.0              |
| Total.....                | 39.6         | 41.0              | 48.9             | 52.9             |

<sup>1</sup> N-reactor conversion to 6 percent Pu-240 plutonium production completed in fiscal year 1982.

<sup>2</sup> Purex startup completed in fiscal year 1983.

<sup>3</sup> Funded by Defense Waste Management, ET.



Senator NUNN. Thank you.

Senator JACKSON. Senator Hart.

Senator HART. I apologize for being late, Mr. Chairman.

It is my understanding that we are separating weapons from energy related testimony?

Senator JACKSON. No, go right ahead.

Senator HART. What have you decided?

Senator JACKSON. The plan will be to hear the Secretary now and then have Dr. Wade and Mr. Sewell follow Dr. Schlesinger. Certainly the Secretary will be excused after we have completed with him.

#### ROCKY FLATS PLANT

Senator HART. First of all, let me ask one that is not energy related. That has to do with your department's jurisdiction over the plutonium operation. What is that?

Secretary SCHLESINGER. We run the Rocky Flats facility. The contractor operates that facility for us.

Senator HART. It is under your jurisdiction?

Secretary SCHLESINGER. It is a Department of Energy facility.

Senator HART. You are aware, I am sure, of the increasing public concern out there. There have obviously been demonstrations and I think there will continue to be. That is not what I am commenting on so much as a more moderate middle-of-the-road concern about the location of that facility and its long-term usefulness, given urban growth patterns. Has any long-range thought been given to relocation of that facility anywhere?

Secretary SCHLESINGER. Thought has been given to that. That question has come up before throughout this decade, indeed, I would suspect in the decade of the sixties. If we were to build that facility today we would not build it in that particular location. When the facility was built just after World War II, of course, that was open country to the northeast of Denver. There has been a buildup in the area.

We have tried to develop a sufficient buffer zone around the plant to give assurances to people in the area. But that facility would cost at least \$3 billion to relocate and, as a consequence, the decision over the years has been that it would be too costly to attempt to relocate the facility as a whole.

Senator HART. Therefore, it is safe to say that the position of this administration and probably the position of the whole Government is that there will be no relocation plan whatsoever?

Secretary SCHLESINGER. There is not a relocation plan. We continuously have under review the possibility of removing certain of the activities, if that should be appropriate. But this is a unique facility. It is critical for the production of [deleted] nuclear weapons. Since it is unique, since it would be costly to relocate, I think the probabilities are against it.

Senator HART. All I can say is that I have not joined the cry to move it, but I am telling you politically that that location of that facility is becoming more tenuous almost daily. I think what keeps any public support for it in the State now is not the criticality of its role but the jobs and the economic impact. It is going to be very difficult to



sell the people, particularly those who are building homes closer and closer to it, that that \$3 billion investment and the importance of the role justifies its being located there.

As one Member of the Congress and one particularly concerned, I would urge you and others who have some responsibilities here to begin to think long term because the day is going to come, I want to tell you, whether it costs \$5 or \$10 billion, where the people in the State are probably going to reach the point where they don't think it is wise to keep it there.

Secretary SCHLESINGER. I understand, Senator.

Senator HART. I don't know what to do about it.

Secretary SCHLESINGER. I don't either. In 1971 there was a great concern expressed which died down to some extent in subsequent years. As you have indicated, it has risen again in crescendo. Then Governor Love asked me to relocate the facility at that time. I was at the AEC. It is a very tricky problem, given limited budgets.

#### WASTE DISPOSAL

Senator HART. I have some questions of Mr. Deutch about the waste disposal program. Before you leave, do you have anything you want to say about it generally, the state of it, the degree to which it is going to involve others in weapons disposal, weapons material disposal?

Secretary SCHLESINGER. Yes sir. We would like to have the authorization to dispose on a retrievable basis of up to 1,000 civilian fuel assemblies in the waste isolation pilot plant project in New Mexico. I think we all recognize there is public concern about the precise mechanism of waste disposal, but we must have the assurance that when either assemblies or, if we should go for reprocessing, high-level waste, emerge from the process of producing power, they can be disposed of.

What we are contemplating here, since there is no decision to go ahead with reprocessing is to dispose of fuel assemblies on a retrievable basis. That would indicate to the public that waste can indeed be handled.

Senator HART. How would you characterize the present state of public and political opinion in regard to that facility?

Secretary SCHLESINGER. I am not in a position to judge firsthand, but according to the conversations that I have had, the public opinion is skeptical to some extent but reasonably receptive. New Mexico has been a State, of course, closely associated with the atomic energy program for 30-odd years.

Senator HART. A final question. Do you have any thoughts on the so-called State veto?

Secretary SCHLESINGER. Yes sir. We have indicated, as a matter of pragmatism, that we are not going to go ahead in a particular area without the concurrence of the people in the area. We have indicated that, as a matter of administration policy, we are going to seek such concurrence from the State authorities. That has gotten tangled up with the issue of whether the veto is a legal right of the State. Under the current law, it is not a legal right of the State because the Federal Government has preempted all issues in this area.



Congress, of course, can change the law, but at the present time, what we have done is to provide assurances to such States as Louisiana, I think Texas, New Mexico, others that have raised the question, that there will be no permanent waste disposal in the area without the concurrence, by whatever process, of State authorities.

Senator HART. Thank you, Mr. Chairman.

Senator JACKSON. Senator Levin?

Senator LEVIN. Would you have any objection to that concurrence being written into law?

Secretary SCHLESINGER. Yes, I think I would, Senator. I would hate to make a firm judgment at this time. The reason that I would is that I think that the principle of Federal preemption in atomic energy areas has served us well, that it has prevented the growth of nonuniform standards, for example, with regard to control of radioactivity at the perimeter of the plant and the like.

I would hate to see the principle of Federal preemption compromised, even though in this particular case there is perhaps more justification in the sense that a waste disposal facility is unique.

Senator LEVIN. You do acknowledge that the Federal preemption would not be compromised if the Federal Government willingly gave them the veto authority?

Secretary SCHLESINGER. Yes sir. That is the difference between law and the administration policy. There is a GAO report on this matter.

#### TESTING

Senator LEVIN. I have just a few questions on the relationship between our national defense and some world energy problems we have. Before I do that, you have indicated you thought the highest level of Soviet tests [deleted].

Secretary SCHLESINGER. I don't know what the test was. It was in the range of [deleted]. The best estimate of our specialists was that it was [deleted].

Senator LEVIN. You stated that you monitored [deleted] where you believe the yield was [deleted]. Is that accurate?

Secretary SCHLESINGER. Let us check the record on that. I think that [deleted] is very difficult in that there are two aspects of this, Senator. One is detecting that something has happened. The other is identification that indeed what has happened is a nuclear test. The threshold for identification is much higher than the threshold for detection.

Senator LEVIN. Could you make available the yield that you have estimated?

Secretary SCHLESINGER. On those tests, yes sir.

[The information follows:]

[Deleted.]

#### ENERGY

Senator LEVIN. The next question I have is relative to the relationship of the energy crisis to national defense. [Deleted.]

Is that still something that is being considered and if so, under what conditions, what are the contingency plans?

Secretary SCHLESINGER. I think Secretary Brown should speak to any contingency plans. [Deleted.]



Senator LEVIN. Are you privy to contingency plans that we have developed to supply energy needs in the event of a future energy crisis such as I have described?

Secretary SCHLESINGER. Yes, sir, I am privy to them [deleted].

Senator LEVIN. Can you tell us what those plans are that you are privy to in the area?

Secretary SCHLESINGER. Essentially it is a drawdown of the strategic petroleum reserve and very significant demand-constraints measures here.

Senator LEVIN. In terms [deleted].

Secretary SCHLESINGER. I am sorry, I am not at this juncture dealing with those kinds of matters.

Senator LEVIN. You are not privy to that?

Secretary SCHLESINGER. I could be. I have not been.

Senator LEVIN. I think my 10 minutes are up.

Senator JACKSON. Go ahead, Senator Levin, and finish your questions.

Senator LEVIN. Other countries I presume would be very much involved [deleted]. Do you know whether or not we have consulted with other countries [deleted].

Secretary SCHLESINGER. When last I reviewed these issues, it was the intention to have discussions with various of our allies with regard to long-term policy in the Persian Gulf region. I have not checked back in these last 6 or 8 weeks to see whether those discussions have gone forward.

Senator LEVIN. I will make this my last question.

Mr. Secretary, in your opinion, how likely is another Arab oil embargo in response to the Israel-Egypt peace settlement?

Secretary SCHLESINGER. I think it is very unlikely.

[Deleted.] The Saudis have been producing at 9½ million barrels a day this quarter. The last quarter of 1978 they produced approximately 10 million barrels a day. That is well over their ceiling level of production. To the extent that they have done so, they have been attempting to accommodate the West.

[Deleted.]

Senator JACKSON. Senator Warner?

Senator WARNER. I have some questions but you may wish to have the witness proceed to the energy portion and then I will have some questions.

Senator JACKSON. As I understand, the Secretary does not have a formal statement on the energy portion of his testimony.

Secretary SCHLESINGER. No sir.

Senator JACKSON. Do you wish to make any additional comment at this time?

Secretary SCHLESINGER. With regard to energy matters?

Senator JACKSON. Yes.

Secretary SCHLESINGER. Yes sir.

I think from the standpoint of the connection between energy and defense that the critical area of the world is, of course, the Persian Gulf. Over the last 6 or 7 years there have been gradual changes in our relations with nations of that area which reflect changes in the demand-supply balance with regard to crude oil. At the moment, Iran



is coming back onstream. We think we know that they have reached a level of production of  $2\frac{1}{2}$  million barrels a day. This production is being disposed of at rather high prices, up in the \$18, \$19, \$20 range, and that represents an upward pull on the price structure.

Indeed, today we have been monitoring this carefully. OPEC will meet with regard to price issues. I am fearful of the outcome of that meeting because I would expect to have a significant increase in price even though price is not formally on the agenda and this is normally a consultative meeting. I think it is likely that there will be an increase in price.

With the restoration of Iranian production there has been tenuous balance achieved once again between supply and demand or more precisely, production and use. [Deleted.]

Even though we have a tenuous balance at the moment, we are in some difficulty. That is the short-term situation. The short-term situation merely brings our longer term problems forward in time. [Deleted.]

We will remain dependent to an extraordinary degree on the security of the Persian Gulf area. The United States receives approximately 25 to 30 percent of its supplies from that area. Our European and Japanese allies receive an even higher proportion of their supplies, 75 to 80 percent. As a consequence, we face both a geopolitical problem of the security of that area and an energy supply and economic problem should, for whatever reason, there be an interruption of the flow of oil from the Persian Gulf.

We must anticipate in the years immediately ahead a steady increase of demand which presses against the available supplies. [Deleted.] Our own best estimate is 36 to 37 million barrels a day, given the events that have transpired in Iran. OPEC sources now tell us that we should not count on more than 35 million barrels a day of supply from OPEC.

In these countries there is a steady strengthening of the conservation impulse and desire, quite aside from political considerations of the sort that Senator Levin has referred to, to preserve the oil in the ground rather than to ship it out. If it is superfluous from the standpoint of economic requirements and the growing strength of that conservation impulse, the discipline to make the very heavy investments in productive capacity means that we will be in some difficulty with regard to long-term oil supply.

That points in the direction, I think, of reliance on other sources of energy, coal, nuclear power, conservation to whatever extent we can achieve it.

I think that is a brief summary, Mr. Chairman. I will be happy to deal with the details, either long term or short term.

Senator JACKSON. In sum, the OPEC countries are going the price route, are they not? Price is looming to be at least a larger part of the problem right now rather than supply?

Secretary SCHLESINGER. Yes sir. I think that is the case. Production and price decisions are closely interwoven. One of the responses to the restraint in the growth of capacity is to achieve a gradual increase in the level of price.

Senator JACKSON. Senator Warner?



Senator WARNER. Thank you, Mr. Chairman.

Senator JACKSON. Feel free, Senator Warner, to ask questions [deleted].

Senator WARNER. As part of the fiscal year 1980 consideration of the military budget we will be addressing again the subject of the carrier. Obviously there is a factor in the equation of the powerplant dictated by short term as well as long term energy supplies.

In your judgment has anything occurred in the past 12 months with respect to the projections of worldwide energy that would affect this decision as to whether to go nuclear or conventional power?

Secretary SCHLESINGER. Of course, the security of oil supplies overall has been reduced and to some slight extent that would bias a decision in favor of a nuclear powerplant rather than an oil-fired powerplant. I think that we should be taking the national security requirements of the country off the top and I am sure we would have adequate fuel supplies for an oil-fired carrier should that be the ultimate decision.

#### VERIFICATION

Senator WARNER. Returning again to the question of verification of test ban agreements, would you address the situation [deleted] with respect to the input and the monitoring [deleted] provided in the past and what is the likelihood in the future of our receiving the ability to get information that is essential?

Secretary SCHLESINGER. Mr. Chairman, I might suggest that this chart be included in the record of the committee because I think it summarizes all of the issues with regard to verification, the questions of detection and identification.

[The chart follows:]

#### SEISMIC NETWORK CAPABILITIES

[Deleted.]

Secretary SCHLESINGER. Explicitly with regard to your question, Senator Warner, [deleted].

Senator WARNER. What is the likelihood that we have other sources to compensate for that?

Secretary SCHLESINGER. [Chart.] We have been studying, as you know, for a year—this chart gives you the current Atomic Energy Detection System—our attempts to improve the Atomic Energy Detection System with facilities external to the Soviet Union, and these columns indicate what would occur if the Soviets and we agree to internal seismic stations within the Soviet Union.

Your question goes to the improvements of the existing Atomic Energy Detection System [deleted].

Senator WARNER. Thank you, Mr. Chairman.

Senator JACKSON. Senator Exon?

#### ENERGY

Senator EXON. Mr. Secretary I think we all have a concern about what we referred to earlier, and I am sorry I could not be here for your full testimony, but I am always gravely concerned about something coming along sometime where somebody might go to the Per-



sian Gulf and not declare war but to mine the area. We could get into a situation where the oil tankers would just not move because of fear.

I suppose I am treading in the defense area and not the Secretary of Energy's area but have we formulated a plan as a Government as to what we would or would not do in the event that the gulf was mined or something happened there, offshore guns or something, that would threaten those vital lifelines that we have to those necessary oil supplies? I am speaking primarily of our defense establishment?

Another question I would like to ask you is that if something such as this should happen to that percentage of our total energy needs, which is about 50 percent coming from OPEC nations in the form of imports, what would we do? Suddenly go to gasoline rationing?

My question is twofold. What would be our position if something happened over there to interrupt those supplies and second, if that happened, do we go immediately to gasoline rationing? Obviously the first thing we have to do is protect the supply of fuel for our defense establishment.

Secretary SCHLESINGER. [Deleted.]

Senator EXON. As a followup question, then, and we discussed this earlier when you were before the Commerce Committee last week; we have not only the real problem but the political problem of our oil from Alaska and the possibility of its being diverted to the Japanese as a tradeoff of some kind. As I understand it, with the serious situation that we are facing, and if we do go into some kind of arrangement with the Japanese, would that be immediately cancellable in case we should get into difficulties as you just outlined?

Secretary SCHLESINGER. Yes sir. [Deleted.]

I should mention, however, that because of our agreements with the other members of the International Energy Agency, we are under obligation within the context of those agreements to share our oil supplies in the event of a general loss of petroleum. So it is not clear how relevant such clauses in a agreement—hypothetical agreement—with the Japanese would be.

Senator EXON. One related but yet not directly related question. We are all going over this afternoon to witness the signing ceremony. As I understand it, as a part of that we are making guarantees of some type to the Israelis on guaranteeing them a certain amount of oil.

Are you in a position to tell us and under what conditions and how that might or might not affect the immediate future as far as shortages of supplies in the United States is concerned?

Secretary SCHLESINGER. Yes sir. I am at least in part in a position to answer that question. I did not check whether we worked out the final arrangement between the two countries this morning when I returned to the office.

As you know, [deleted].

Senator EXON. Thank you, Mr. Chairman.

Senator JACKSON. Senator Thurmond?

Senator THURMOND. Thank you, Mr. Chairman.

Senator JACKSON. The Chair might indicate that most Members will be going to the White House for the peace treaty signing. The Chair will excuse the Secretary as soon as he has completed his statement and



then we can move on to the two Assistant Secretaries, Dr. Wade and Mr. Sewell. We will resume at 3 p.m. today.

#### TESTING

Senator THURMOND. Dr. Schlesinger, I have a few questions here on the Comprehensive Test Ban Treaty. If you will just answer those for the record, it will save time and we will move on.

Secretary SCHLESINGER. Yes sir.

[Questions with answers supplied follow:]

#### QUESTIONS SUBMITTED BY SENATOR STROM THURMOND, ANSWERS SUPPLIED BY SECRETARY SCHLESINGER

*Question.* Dr. Schlesinger, it seems to me we give up a great deal by reducing tests in anticipation of a test ban treaty. Is this dictated by government policy?

*Answer.* The recognized decline in the number of underground nuclear tests is not dictated by a policy to constrain the level of testing activity. However, within the total program, we have focused upon first satisfying immediate Defense requirements with production of current weapons and then have made the best possible allocation of remaining resources to efforts in advanced development and to work in our science and engineering base, or development capability. We believe the planned nuclear testing program addresses this same ordering of priorities within a constrained allocation of resources.

*Question.* Mr. Secretary, the Soviets are testing at a high rate. What is the meaning of that action and how are we responding?

*Answer.* A total of [deleted] tests have been detected since the first Soviet explosion in 1949. The underground test program has remained fairly constant following the initial development of the proving grounds. For the five-year period 1973-1977, the yearly average number of tests at locations in the U.S.S.R. has been about [deleted]. The 1978 program [deleted] was a [deleted] increase over the yearly average for the preceding five years.

[Deleted.]

The Limited Test Ban Treaty forced nuclear weapons testing underground in 1963 and since then radioactive debris has not been readily available for analyses to estimate Soviet weapons designs or technologies. There are no data on which to base an estimate for technological breakthroughs. The Soviet underground test program is undoubtedly planned to meet the perceived needs for testing new and improved weapons designs.

The U.S. underground nuclear testing program represents the best balance achievable among requirements for current weaponization and longer term needs for defense. The program for FY 1980, involving [deleted] tests, emphasizes the requirements to support weaponization programs.

*Question.* Mr. Secretary, what would be the effect on weapons research and the activity at our laboratories of a comprehensive test ban?

*Answer.* In the short term, there should be shifts in emphasis within the nuclear weapons laboratories. Increased emphasis would be given to particular research and development activities [deleted]. This redirection of laboratory activities will require the shift of funds from testing to research and development areas. Additional capital funds might also be required for the acquisition of facilities and equipment necessary to conduct these activities.

In the event of a long duration test ban, it would be difficult for the United States to maintain the viability of the weapons laboratories. There would be a deterioration of the technology base and a gradual erosion of the existing cadre of scientists and engineers knowledgeable and experienced in the design and development of nuclear weapons. This, in turn, will result in a degradation of the capabilities of the nuclear weapons design laboratories with a corresponding impact on stockpile reliability and the national security posture.

*Question.* Do you feel we are at a development point where a comprehensive test ban would be favorable to our defense posture?

*Answer.* In terms of providing warheads for defense systems now in development, a Comprehensive Test Ban (CTB) would have minimal impact since a



variety of tested candidate designs are now, or soon will be, available. In terms of proceeding with long-term initiatives to capture new technology within nuclear weapon designs, a CTB would restrict our ability to stockpile such designs.

#### NUCLEAR MATERIALS

Senator THURMOND. I understand Senator Jackson has asked you some questions about weapons material. I have some questions along that line.

Mr. Secretary, as you know, we now only have three reactors producing nuclear weapons material such as plutonium and tritium at the Savannah River Plant. The 1980 budget now before us does not provide enough funds to operate these three reactors at two-thirds output. I understand that the management down there says it will not be quite two-thirds, it will be a little less than two-thirds?

Secretary SCHLESINGER. A little less than two-thirds.

Senator THURMOND. I wonder why are we lowering production to such an inefficient rate when we know greater output will be needed in the next few years?

Secretary SCHLESINGER. The decision was to save \$15 million in budget authority fiscal year 1980. It is a decision that is driven by budgetary considerations. [Deleted.] It is, as you indicate, an inefficient mode of operation.

Senator THURMOND. Mr. Secretary, would it not be more efficient to run these reactors at capacity and store plutonium since it does not deteriorate?

Secretary SCHLESINGER. Yes, sir, it would be more efficient to do so. The underlying question, I think, addresses the overall budget for this year and whether we can afford that kind of early on funding.

Senator THURMOND. Mr. Secretary, as I understand, our weapons needs over the next 12 years would require [deleted].

Secretary SCHLESINGER. Yes, sir. That is the reason that we are operating three reactors, all three reactors at two-thirds capacity because as I indicated before your arrival, Senator Thurmond, I was concerned that if we shut down one of those reactors, as we have other reactors, at Savannah River, we would never be able to restore production. That is the reason for the somewhat inefficient mode of operation.

Senator THURMOND. [Deleted.]

Secretary SCHLESINGER. Yes, sir.

Senator THURMOND. Are there any other reactors in our defense complex which can produce these needs as economically?

Secretary SCHLESINGER. No, sir.

Senator THURMOND. Mr. Secretary, it seems very shortsighted to throttle down now and then be forced into a possible inability to provide nuclear materials when the defense of our country is involved, is it not, because the planned two-thirds operation is inefficient?

Secretary SCHLESINGER. It is inefficient, sir. It is a question of balancing budget requirements against longer term needs.

Senator THURMOND. Mr. Secretary, is there any doubt in your mind that the President will eventually order production of a new land-based missile system such as the M-X?



Secretary SCHLESINGER. I think that the United States is likely to deploy the M-X system, yes, sir.

Senator THURMOND. Mr. Secretary, one final question on this subject. I believe this capacity operation could be accomplished with relatively small sums of money, possibly as little as \$30 million. Are you familiar with those cost estimates?

Secretary SCHLESINGER. About \$15 million in appropriations and \$21.5 million in outlays is the difference between the proposed budget and full capacity for those three reactors.

#### RESTORATION

Senator THURMOND. Mr. Secretary, moving on to the Savannah River plant modernization, last year this committee directed DOE to study the deterioration problem at the defense plants and initiate in the fiscal year 1980 a program to correct it. However, there are no funds in this budget to meet these problems at Savannah River although the plant operators requested funds. Why is this important modernization being delayed?

Secretary SCHLESINGER. We are very concerned about the upgrading question, Senator Thurmond. As you indicate, this reflects the report of the staff of this committee. We indicated to the Office of Management and Budget the needs for upgrading. We have a plan that will require over \$450 million, for the weapons complex as I recall it, of which about \$85 million in construction funding is requested for authorization in this budget as a start of that program.

Mr. SEWELL. The \$85 million in the fiscal year 1980 budget is for the weapons production facilities, not the nuclear materials production complex.

Secretary SCHLESINGER. That larger upgrading program that the committee staff reported on did not include Savannah River. We have about \$25 million in the budget for that purpose.

Senator THURMOND. \$25 million in the budget for upgrading at Savannah River?

Dr. GILBERT. \$25 million is in the total materials production upgrade program in fiscal year 1980. It includes the HB line upgrade at Savannah River. Roughly half would go to Savannah River.

Senator THURMOND. \$25 million in the budget for upgrading, about half of that would go to Savannah River plant?

Dr. GILBERT. Roughly.

Senator THURMOND. Mr. Secretary, is it not a fact that when we delay these badly needed repairs we increase the risk of interruption in plant operations? What about the safety factor also?

Secretary SCHLESINGER. We do not compromise on safety, Senator Thurmond. Unquestionably the possibility of an interruption is increased.

Senator THURMOND. Mr. Secretary, if the Congress saw fit to add money to this budget for this purpose, is there any reason why DOE would be unable to apply it to a needed project?

Secretary SCHLESINGER. If such an appropriation became law, if the President were to sign such an appropriation, and I underscore the seriousness of his position in regard to this year's budget, but if it became law unquestionably we would utilize the money as appropriated.



## HEAVY WATER

Senator THURMOND. Mr. Secretary, because of the low level of funding this budget anticipates the closing down of the only heavy water manufacturing facility in this country in the fiscal year 1980. If this plant closes it cannot be restarted and a new facility would cost \$260 million, is my understanding. What is your opinion of the sufficiency of our current heavy water stockpile and would you favor a period of high production prior to any shutdown?

Secretary SCHLESINGER. I think that the current position is that we will keep that going through 1980 with DOD funds and with funds from foreign sales of heavy water. So that it is not an immediate issue. Our stockpile of heavy water is very ample, Senator. It has been put together to handle the possibility of the restart of standby reactors at Savannah River and for other uses.

As a consequence we have a very ample stockpile through 1986 for weapons development in the absence of a large plutonium or tritium going ahead with the breeder requirement necessitating the restart of the two Savannah River reactors now in standby. There is, I think, no threat in the national security area.

Senator THURMOND. Mr. Secretary, if this heavy water plant should be closed down, my understanding is that it cannot be restarted. Is that correct?

Secretary SCHLESINGER. We cannot have confidence, Senator, that we can restart it. Our experience in the past with these old plants is such that we cannot give you assurances that we could restart it without the substantial expenditure of funds.

## RESTORATION

Senator THURMOND. Let me ask you again, are you sure that this budget contains \$25 million for modernization? It seems our staff has not been able to locate that—of which some would go to the Savannah River plant.

Dr. GILBERT. Yes, sir. Can we supply that for the record?

Senator THURMOND. Would you do that, please?

Dr. GILBERT. Yes, sir.

Senator THURMOND. I would appreciate that.

[The information follows:]

A sum of about \$25 million in budget authority is included in the FY 1980 Nuclear Materials Production Program budget for upgrading. This is broken down as follows:

|                                                                              | <i>Millions</i> |
|------------------------------------------------------------------------------|-----------------|
| HB-processing line at Savannah River-----                                    | \$8.2           |
| Steam Generating Facilities at Idaho-----                                    | 10.0            |
| Plant engineering and design, primarily at Savannah River-----               | 2.4             |
| General Plant projects at Idaho, Richland, Oak Ridge and Savannah River----- | 4.0             |

Senator THURMOND. Dr. Schlesinger, I am glad to see you again. Thank you very much.

Senator JACKSON. Thank you, Senator Thurmond.

Any further questions of Dr. Schlesinger?

Senator NUNN. Just very briefly.



## ENERGY

Senator Exon asked about possible scenarios that would jeopardize our national security. I know it is not the job of the Secretary of Energy to decide how to respond to those scenarios but could you give us two or three scenarios in your mind [deleted.] I am thinking of scenarios that jeopardize our energy supplies and that of our allies.

Secretary SCHLESINGER. [Deleted.]

Senator NUNN. Mr. Secretary, you are no longer involved with intelligence but have had considerable experience in that area. You are, I assume, one of the real customers of intelligence regarding the Middle East. I assume you are kept abreast on all intelligence development in the Middle East, are you not?

Secretary SCHLESINGER. Yes, sir

Senator NUNN. Are you satisfied with our intelligence capabilities regarding what is going on in the Middle East in general [deleted.]

As a customer of intelligence are you confident that we are doing an adequate, or let us put it, a fair or good job in regard to intelligence in that area?

Secretary SCHLESINGER. One is never satisfied with the quality of the intelligence, Senator, because it can always be improved with an additional investment of funds or with diversion of effort to a particular target area. I think we must face the fact that the events of the last 5 years when the intelligence community came under severe attack, I believe at the end of 1973, it may have been 1974, that consequences of that have been to reduce substantially the confidence that is placed by other countries in our intelligence establishment. This has weakened liaison relationships and, therefore, we know that we are losing material today that we would have gotten if these developments had not taken place.

I think it is fundamentally in the interest of the United States to rebuild and strengthen its intelligence establishment, and this will require efforts outside of the CIA in particular. The strengthening of the CIA will require actions by the Congress, by the President, and by informed groups, so that all of the people at the Agency know that their mission is valued. [Deleted.]

Senator NUNN. Do you have any specific suggestion for either the executive branch or the Congress in that regard?

Secretary SCHLESINGER. I am always hesitant to offer advice to the Congress, Senator.

Senator NUNN. Upon occasion you have, Mr. Secretary.

Secretary SCHLESINGER. Not with regard to structuring and I think that this goes to the question of structuring. But one must recognize that the present set of circumstances in which the CIA reports to, I believe, eight congressional committees makes it virtually impossible to conduct covert operations. One may be able to conduct operations that previously would have been described as covert but they would not be in effect covert.

One thing that can be done by the Congress is to simplify its procedures to assure that information of that nature would be kept confidential. I think that it is also very desirable for the Congress, as well as for the administration to make clear, by those kinds of actions toward



our intelligence establishment, that those in the establishment know that indeed they will be protected and valued and that the atmosphere of the last 5 years that has been destructive is something of the past.

Senator NUNN. I won't press forward on any other at the specific moment. I assume you have some others in the back of your mind though?

Secretary SCHLESINGER. Yes, sir.

Senator NUNN. Thank you, Mr. Chairman.

Senator JACKSON. Senator Warner?

Senator WARNER. Dr. Schlesinger, I would like to go back to the test ban treaty and particularly the question of the onsite inspection in the Soviet Union. What is the current status of those discussions and what is your judgment as to the likelihood of that ever being achieved as a part of the treaty.

Secretary SCHLESINGER. I believe that the Soviets have indicated to us that they have no objection in principle to internal seismic stations. Their notion as to the capability and number of those stations is different from our own. I believe that they have accepted in principle the notion of internal seismic stations. I think that we will have resistance with regard to getting the kinds of stations that we would require for adequate verification [chart deleted].

If you observe the chart, however, the existence of seismic stations does not necessarily solve the problem of verification. I think the critical part of the chart comes in this range, that as you increase the number of stations you increase the problem because you increase the number of detected events and thus the number of ambiguous events as well.

For example, with a complete array of such stations there would be [deleted] we anticipate that we would detect as opposed to something on the order [deleted] at the present time.

The number of events that would be unidentified would increase dramatically, too; the improvement in our detection capabilities adds to ambiguity. There would be [deleted] each year, [deleted] that we had detected but we could not identify. That would be, compared to the present situation, an [deleted] of such ambiguous events.

Therefore, I want to stress that I think that we will have the improvement that will permit a greater degree of detection capability; at the same time that we achieve those higher aspirations for detection it does create additional problems with regard to the ambiguity in the area of identification of such events.

#### COMPREHENSIVE TEST BAN

Senator WARNER. What would we hope to achieve by way of scheduling between the test ban treaty and SALT? What is the optimum?

Secretary SCHLESINGER. I am sorry—

Senator WARNER. What would be the optimum relationship between a SALT agreement, SALT II, and the test ban?

Secretary SCHLESINGER. I think that the sequencing is appropriate because the development of nuclear weapons is, of course a derivative activity. It is derivative from the decisions regarding the weapons systems of the Department of Defense, and what a CTB would do would be to cut off the ability to develop new designs.



Quite obviously, that takes place in a structured arms control environment. Rather than anticipating such a structured arms control environment, the CTB itself, could follow at almost any time a SALT agreement and, in principle, it does not matter what the timing is. [Deleted.]

The problem that a CTB potentially poses is that of assuring stockpile reliability. We do not know whether we will have any difficulties in the stockpile that would require nuclear tests. Every time there is a failure of a nonnuclear component, there has to be a change in the manufacture or type of material. There could be difficulties. In the past, on occasion, this has required a nuclear test. We do not know that we will have such difficulties, but with an extension of many years the assurance that we have in the reliability of the stockpile tends to diminish.

We have talked about a 3-year period for this treaty. Within a 3-year period, I do not think that we would have significant difficulties, but nobody can predict with certainty.

#### VERIFICATION

Senator WARNER. The chairman brought to my attention that in the fiscal year 1980 budget there are provisions, I think, for five stations. Is that correct?

Secretary SCHLESINGER. Yes, sir.

Senator JACKSON. In the Soviet Union?

Secretary SCHLESINGER. Yes, sir.

Senator WARNER. How did they arrive at that number?

Secretary SCHLESINGER. We proposed a number of stations to the Soviet Union. They came forward with a counterproposal. [Deleted.]

Senator WARNER. Mr. Chairman, I would like to put other questions. Do you wish to complete an answer to that, Dr. Schlesinger?

Secretary SCHLESINGER. Mr. Sewell tells me that the stations you refer are part of the —

Mr. SEWELL. The five stations that we will be producing are not agreed to yet to go into the Soviet Union. We will place them around in the United States and try them out, but they are not agreed to by the Soviet Union as of now.

Senator JACKSON. But they would be available?

Mr. SEWELL. They would be available.

Senator JACKSON. We understood that those five stations were in anticipation of an accord or understanding with the Russians.

Secretary SCHLESINGER. They would be available under those circumstances. The Soviets, in principle, have not raised objections to monitoring stations. They have, however, not agreed to any particular kind of monitoring stations. Whether they would agree to these particular types of monitoring stations remains an open question.

[Deleted.]

Senator JACKSON. Senator Hart?

Senator HART. Thank you, Mr. Chairman.

Since Senator Warner wandered off into intelligence, I would like to make two or three brief observations for the record as one who has been involved in that for years. First of all, I don't think all the events of the last 4 years have been destructive of our intelligence efforts, as some of your remarks suggested. I think there are those in



leadership positions in the intelligence community who think their hands have been strengthened by some of the actions taken by Congress. As you well know, there are covert operations going on that have been sanctioned by the Congress, at least the appropriate committees have been notified.

Finally, I will have to repeat a point that seems never to quite get across to people. There are a lot more leaks from the executive branch of Government overall than there are from Congress. I think anybody who has sought out to quantify this continually comes up with that judgment.

Secretary SCHLESINGER. Senator, let me fully confirm what you have just said. There are many leaks from the executive branch as you have indicated.

My response to Senator Nunn's request in this area about what Congress could do was not designed to suggest an invidious comparison between the two branches of the Government, but was in response to his inquiry as to what Congress could do. My observations with regard to the damage that has been done to the intelligence community were not to any specific measures. [Deleted.]

My comments were not directed toward anything other than what I regard as a national problem.

Senator HART. [Deleted.]

Secretary SCHLESINGER. [Deleted.]

Senator HART. [Deleted.]

Secretary SCHLESINGER. [Deleted.]

Senator HART. Thank you.

Senator JACKSON. Senator Levin?

#### INERTIAL CONFINEMENT FUSION

Senator LEVIN. I wonder if you can give us an estimate of the civilian utilization at some point in the future of inertial confinement fusion and how you estimate that timewise, what we can do now to shorten that timetable, how important a role it is going to play?

Secretary SCHLESINGER. The inertial confinement fusion is something of a late starter for fusion power. The main line of fusion effort and the chief expenditure of funds by the Department lies in the area of magnetic fusion. We have been trying to bring inertial confinement fusion up to the status, as it were, of magnetic fusion, but the larger amount of funding continues to go to magnetic fusion.

Mr. Sewell, of course, is in a far better position than I am to give you the technical aspects of that program. We continue to believe, I think, that the likeliest source of fusion power lies in the magnetic fusion area, but we do not want to overlook this one, because if we can solve the fusion problem by whichever route, it represents an enormous boon to mankind. At this stage of the game the likelier area of breakthrough continues to be in magnetic fusion.

Senator LEVIN. Is the expenditure in that area restricted by budget constraints or is it that we cannot efficiently spend additional money?

Secretary SCHLESINGER. It is mostly the latter but there have been requests for additional spending for inertial confinement fusion which were not included in the budget for reasons of overall budgetary balance. We could spend more in that program. That did not seem to be the best way to achieve balance as we put it together.



Senator LEVIN. What was the request in that area that was not granted?

Secretary SCHLESINGER. It was about \$10 million more.

Senator LEVIN. The other questions I will ask for the record, Mr. Chairman.

Senator JACKSON. Thank you.

Senator Exon, did you have any questions?

Senator EXON. No, Mr. Chairman.

Senator JACKSON. If there are no further questions of Dr. Schlesinger, he will be excused and we will turn to our next witnesses, Mr. Duane Sewell, the Assistant Secretary of Energy for Defense Programs; Dr. Jim Wade, Assistant Secretary of Defense for Atomic Energy; General Bratton, Director of the Office of Military Application; and Dr. Charles Gilbert, from the Office of Nuclear Materials Production.

What I would suggest, gentlemen, is that your statements go in the record.

General Bratton, do you want to come to the witness table? All three of you have statements, Mr. Sewell, General Bratton, Dr. Gilbert. Those statements can go in the record.

I believe Dr. Wade does not have a formal statement.

Mr. SEWELL. They are in my statement that I will provide for the record.

Senator JACKSON. Mr. Sewell, would you lead off?

# **STATEMENTS OF DUANE SEWELL, ASSISTANT SECRETARY OF ENERGY FOR DEFENSE PROGRAMS; ACCOMPANIED BY DR. JIM WADE, ASSISTANT SECRETARY OF DEFENSE FOR ATOMIC ENERGY**

## **DEFENSE PROGRAMS**

Mr. SEWELL. Yes, sir.

In the interest of time, Mr. Chairman, I would be happy to insert the statement in the record and receive your questions.

[The prepared statement follows:]

## **PREPARED STATEMENT OF DUANE C. SEWELL, ASSISTANT SECRETARY FOR DEFENSE PROGRAMS, U.S. DEPARTMENT OF ENERGY**

### **INTRODUCTION**

Mr. Chairman and members of the Committee: This morning Dr. Schlesinger introduced the Department's Atomic Energy Defense Activities. This afternoon, we will present the details of the request to you. As Assistant Secretary for Defense Programs, I am responsible for five of the DOE's programs which are included in our Atomic Energy Defense Activities. These are the nuclear weapons development and production, nuclear materials production, inertial confinement fusion, nuclear materials security and safeguards, and verification and control technology.

### **FISCAL YEAR 1980 AUTHORIZATION REQUEST**

This chart compares our fiscal year 1980 authorization request with the fiscal year 1979 authorization enacted for the DOE's Atomic Energy Defense Activities.



## CHART 1

## FISCAL YEAR 1980 DOE BUDGET REQUEST—ATOMIC ENERGY DEFENSE ACTIVITIES

[In thousands]

|                                                       | Fiscal year<br>1979<br>authorization<br>enacted | Fiscal year<br>1980<br>authorization<br>request |
|-------------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Weapons activities.....                               | \$1,498,944                                     | \$1,686,905                                     |
| Nuclear materials production.....                     | 485,655                                         | 524,848                                         |
| Inertial confinement fusion.....                      | 300,200                                         | 126,890                                         |
| Nuclear materials security and safeguards.....        | 48,089                                          | 46,627                                          |
| Verification and control technology.....              | 32,600                                          | 37,860                                          |
| Total, Assistant secretary for defense programs.....  | 2,365,488                                       | 2,423,130                                       |
| Defense waste management.....                         | 273,945                                         | 346,991                                         |
| Naval reactors development.....                       | 290,600                                         | 278,367                                         |
| Total, Assistant Secretary for Energy Technology..... | 564,545                                         | 625,358                                         |
| Personnel resources.....                              | 47,451                                          | ( <sup>1</sup> )                                |
| Total, atomic energy defense activities.....          | 2,977,484                                       | 3,048,488                                       |

<sup>1</sup> Fiscal year 1980 personnel resources are spread above.

## CHART 2

## FISCAL YEAR 1980 DOE BUDGET REQUEST—ASSISTANT SECRETARY FOR DEFENSE PROGRAMS—ATOMIC ENERGY DEFENSE ACTIVITIES

[In millions]

|                                                | Authorization | Appropriation | Outlays |
|------------------------------------------------|---------------|---------------|---------|
| Weapons activities.....                        | \$1,687       | \$1,659       | \$1,619 |
| Nuclear materials production.....              | 525           | 483           | 447     |
| Inertial confinement fusion.....               | 127           | 146           | 145     |
| Nuclear materials security and safeguards..... | 46            | 46            | 43      |
| Verification and control technology.....       | 38            | 38            | 38      |
| Total.....                                     | 2,423         | 2,372         | 2,291   |

This chart summarizes the fiscal year 1980 authorization, appropriation, and outlay requests for the ASDP programs. I will discuss the request for the inertial confinement fusion, nuclear materials security and safeguards, and verification and control technology programs. My directors of these three programs are here to assist me in responding to any questions you might have. They are: Dr. Richard Schriever, Mr. George Weisz, and Mr. Ray Chapman.

After my presentation, General Joseph Bratton, Director of Military Application, will discuss our fiscal year 1980 request for the nuclear weapons program. Dr. Charles Gilbert, Acting Director of Nuclear Materials Production will then testify on our request for that program.

The first program I will discuss is inertial confinement fusion.

## CHART 3

## FISCAL YEAR 1980 INERTIAL CONFINEMENT FUSION BUDGET—FUNDING REQUEST

[In millions]

|                          | Authorization | Appropriation | Outlays |
|--------------------------|---------------|---------------|---------|
| Operating:               |               |               |         |
| Program expenses.....    | \$107.8       | \$107.8       | \$113.4 |
| Personnel resources..... | 1.1           | 1.1           | 1.1     |
| Total, operating.....    | 108.9         | 108.9         | 114.5   |
| Equipment.....           | 8.5           | 8.5           | 8.0     |
| Construction.....        | 9.5           | 28.5          | 22.6    |
| Total.....               | 126.9         | 145.9         | 145.1   |



## CHART 4

*Objectives of the inertial confinement fusion program*

## Phase I (thru mid-80's) :

Understand and demonstrate burn physics for small D-T fuel masses

Select and evaluate the most promising driver/target approaches

## Phase II (mid-80's to beyond 2000) : Demonstrate technical and engineering feasibility of ICF

## INERTIAL CONFINEMENT FUSION

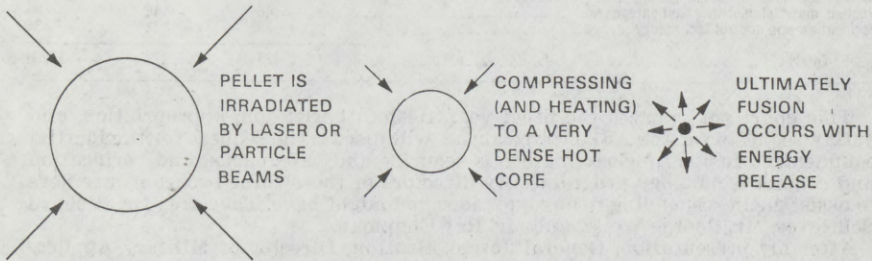
The total fiscal year 1980 authorization request for the inertial confinement fusion (ICF) program is \$126.9 million. We are requesting \$108.9 million for operating expenses, \$8.5 million for capital equipment, and \$9.5 for construction. I will discuss each area in more detail.

Before discussing the budget request I would like to describe briefly the objectives of this program and the inertial confinement fusion process. The objectives of the ICF program for the near-term are to ignite and burn fuel contained in a very small fuel pellet and gain an understanding of the physical process involved. This should enable us to predict with confidence the laser or particle beam energy and target design requirements for ICF applications.

[Chart deleted.]

The distinctive features of inertial confinement fusion are most apparent in the fuel pellet. The heavy forms of hydrogen, deuterium and tritium, compose the fuel, which is contained in a tiny sphere of glass or metal filled to many times atmospheric pressure.

## INERTIAL FUSION CONCEPT



The fuel in the pellet "burns" when very high temperature and density are reached through rapid compression of the pellet. If sufficient compression is achieved most of the fuel will burn before the temperature and density fall below the burn requirements and fusion will occur. Because the only force confining the fuel is its own inertia, this process is called inertial confinement fusion.

Inertial fusion technology promises to have a variety of applications. Instead of burning fuel pellets, we can use the laser or particle beam drivers with targets of various materials to study materials properties of interest to nuclear weapons technology. [Deleted.]

Therefore, before we are able to make fuel pellets burn with high energy gain, near-term applications are practical. They are very low risk or essentially no-risk applications, since some work of this kind is practical with existing facilities.

In the longer term, if high energy gain from pellets proves to be practical, there are both weapons technology and energy technology applications of the large amounts of energy that will be released. The energy output of the pellet can be used to simulate some nuclear weapon effects in the laboratory, thus supplementing existing simulation techniques. If a range of engineering problems can be



solved, relating to energy containment and transfer and repetitive operation that is safe and reliable, the pellet output can be used to breed fissile fuel, produce electricity, or produce hydrogen as a feedstock for synthetic liquid fuels. We should not underestimate the difficulties in front of us before these later applications become a reality. It is clear that inertial fusion has near-term, low-risk pay-offs for the nuclear weapons program and a long-term, high-risk, very-high-payoff potential for civilian energy production.

#### OPERATING FUNDS

The proposed FY 1980 operating budget authority and authorizations request of \$108.9 million is broken down on this chart. The majority of program operating resources supports programs of target experimentation to meet the first near-term goal of demonstration and understanding of deuterium-tritium (DT) fuel burn, and partially to meet the second major goal of driver and target evaluation. We usually distinguish these experiments by the type of energy source we use to interact with the targets. Researchers using these facilities, both in the nuclear weapons laboratories and in industry and universities, are investigating a range of physical phenomena that are the common basis for applications in both nuclear weapons [deleted] technology and energy technology.

CHART 7

#### INERTIAL CONFINEMENT FUSION—OPERATING EXPENSES—AUTHORIZATION/AUTHORITY

[In millions]

|                                                      | 1979             | 1980  |
|------------------------------------------------------|------------------|-------|
| Fusion experiments:                                  |                  |       |
| UV/visible experiments (glass lasers).....           | \$3.0            | \$2.1 |
| 1 $\mu$ m experiments (glass lasers).....            | 48.1             | 49.3  |
| 10 $\mu$ m experiments (CO <sub>2</sub> lasers)..... | 26.1             | 27.2  |
| Electron beam/light ion experiments.....             | 7.9              | 8.9   |
| Special studies.....                                 | .5               | 2.8   |
| Advanced drivers:                                    |                  |       |
| Advanced lasers.....                                 | 8.2              | 5.1   |
| Heavy ions.....                                      | 3.5              | 3.8   |
| Systems studies and weapons applications:            |                  |       |
| Systems and advanced technology.....                 | 3.8              | 5.1   |
| Weapons applications.....                            | 2.9              | 3.5   |
| Personnel resources.....                             | ( <sup>1</sup> ) | 1.1   |
| Total operating.....                                 | 104.0            | 108.9 |

<sup>1</sup> Personnel resources not allocated by program in authorization.

Experiments with glass lasers are performed mainly at the Lawrence Livermore Laboratory, KMS Fusion, Inc., the University of Rochester, and the Naval Research Laboratory. Most of the experimental data obtained up to now are from experiments with glass lasers. Thus, glass laser experiments serve as the basis of comparison for results with long wavelength carbon dioxide lasers operated at Los Alamos, experiments at very short wavelengths that are most easily accomplished using modified glass lasers, and experiments with electron and ion beams which are conducted mainly at Sandia Laboratories, Albuquerque. A relatively small part of the operating resources goes to investigating advanced lasers and heavy ion accelerators as drivers for longer term applicability to fusion energy, to systems studies of energy technology and to some experimentation of interest to the nuclear weapons program.

Our operating request also includes \$1.1 million to provide for the salaries, benefits, and travel for the 29 federal employees who perform the program management and support function.

Our fiscal year 1980 request for capital equipment budget authority and authorization is \$8.5 million. About \$2 million of our capital equipment request is for continued support for the 24-beam glass laser called OMEGA, which is under construction at the University of Rochester. This is a joint undertaking of the University, DOE, the State of New York, and a group of industrial and utility companies to provide a national laser users facility.

[Chart deleted.]



The first six beams, which we call the ZETA laser, have been operated successfully and are now in use for experiments. The University is in the process of seeking broad participation in and support for experiments with this facility.

CHART 8  
INERTIAL CONFINEMENT FUSION—AUTHORIZATION/AUTHORITY  
CAPITAL EQUIPMENT  
[In millions]

|                              | Fiscal year<br>1979 | Fiscal year<br>1980 |
|------------------------------|---------------------|---------------------|
| University of Rochester..... | \$1.5               | \$2.0               |
| Other.....                   | 6.7                 | 6.5                 |
| Total equipment.....         | 8.2                 | 8.5                 |

CHART 10  
FISCAL YEAR 1980 INERTIAL CONFINEMENT FUSION BUDGET—CONSTRUCTION PROJECTS  
[In millions]

|                                                                       | Total<br>estimated<br>cost | Through fiscal year 1979 |                    | Fiscal year 1980   |                    |
|-----------------------------------------------------------------------|----------------------------|--------------------------|--------------------|--------------------|--------------------|
|                                                                       |                            | Authori-<br>zation       | Appropri-<br>ation | Authori-<br>zation | Appropri-<br>ation |
| New projects: 80 P.E. & D., plant engineering and design, Sandia..... | \$1.5                      |                          |                    | \$1.5              | \$1.5              |
| Continuing projects:                                                  |                            |                          |                    |                    |                    |
| 78-4-a, high energy laser facility (Nova) LLL.....                    | 195.0                      | \$195.0                  | \$23.0             |                    | 15.0               |
| 75-3-b, high energy laser facility (Antares), LASL.....               | 62.5                       | 54.5                     | 26.7               | 8.0                | 12.0               |
| Total.....                                                            |                            |                          |                    | 9.5                | 28.5               |

The remainder of the fiscal year 1980 capital equipment requirements are necessary to support increased target fabrication, fusion experiments and advanced drivers.

The new authorization requested for construction is \$9.5 million. Of this amount, \$8 million would be used to continue construction of the ANTARES gas laser facility at LASL, project 75-3-b at the bottom of this chart. We are also requesting \$1.5 for plant engineering and design for the EBFA II (Electron Beam Fusion Accelerator facility) located at Sandia Laboratories.

To summarize these projects briefly:

Plant Engineering and Design. We are requesting plant engineering and design authorization to plan a possible upgrade which DOE has under consideration of the EBFA I located at Sandia Laboratories, New Mexico. EBFA I, the major particle beam experimental facility, is under construction. This facility will use multiple beams of electrons or light ions which overlap on the surface of a pellet. Using this technology, the interaction of electrons or light ions with a pellet is being studied on smaller accelerators now available to determine if these potentially very efficient and relatively simple drivers can be used to ignite and burn a deuterium-tritium fuel pellet. Present indications are that EBFA could be operated with beams of either electrons or light ions, for which several target designs are now under consideration.

#### ANTARES

[Chart deleted.]

In fiscal year 1980 we will continue the construction of the ANTARES carbon dioxide laser facility at Los Alamos, which compares in energy and power to the first operating portion of NOVA and which will permit us to resolve uncertainties about the effects of the long wavelength carbon dioxide laser light on targets. Experiments are in progress on the HELIOS carbon dioxide laser which was brought into operation at LASL last year and which is comparable to



SHIVA in its capability. These experiments are designed to explore the interaction physics of fusion pellets driven by the longer wavelength carbon dioxide laser. Results from HELIOS experiments indicate that the gaseous deuterium-tritium fuel has been compressed to greater than solid density. These and future experiments will assist in developing targets for the more powerful ANTARES, which will operate in fiscal year 1984. ANTARES is a larger carbon dioxide laser which should provide enough energy and power on targets to achieve energy breakeven.

## NOVA

[Chart deleted.]

Although we are not requesting any new authorization for the NOVA project, I think it appropriate to mention the project because of its importance to the program. The budget authority requested for the NOVA glass laser at Lawrence Livermore is to continue construction of the upgrade of the SHIVA laser. During the first year of operation, SHIVA has been used very successfully as an experimental tool. One of the key indicators of experimental progress is how much the fuel is compressed. Volume compression of over 1,000 fold, with densities of about 70 times that of solid deuterium-tritium, has been recently reported.

NOVA was authorized in fiscal year 1979 and we expect construction to begin shortly. When the east wing seen to the right in this view is completed, we will begin experiments with that section of the laser while the west wing, seen on the left, is rebuilt in the present SHIVA laser bay and target chamber bay. Using the full NOVA we expect to surpass breakeven, and determine the scaling of target gain to meet requirements for application.

This concludes my presentation for inertial confinement fusion.

## CHART 13

## FISCAL YEAR 1980 NUCLEAR MATERIALS SECURITY AND SAFEGUARDS BUDGET—FUNDING REQUEST

[In millions]

|                          | Authorization | Appropriation | Outlays |
|--------------------------|---------------|---------------|---------|
| Operating:               |               |               |         |
| Program expenses.....    | \$39.7        | \$39.7        | \$35.7  |
| Personnel resources..... | 3.5           | 3.5           | 3.5     |
| Equipment.....           | 3.4           | 3.4           | 3.4     |
| Total.....               | 46.6          | 46.6          | 42.6    |

## NUCLEAR MATERIALS SECURITY AND SAFEGUARDS

I will now address the nuclear materials security and safeguards program, an integral part of DOE's national security responsibilities. The total fiscal year 1980 authorization request is \$46.6 million—\$39.7 million in program expenses and \$3.4 million in capital equipment for the program effort, and \$3.5 in operating expenses for personnel resources. Before specifically addressing the budget request in each of these areas I would like to provide you with a brief overview of the program.

Our primary responsibility is to assure that adequate protection is provided to DOE nuclear weapons, facilities, materials and classified information against theft or sabotage by potential adversaries. DOE program and field managers are responsible for facilities and their operations and are supported by the security and safeguards program in a number of ways. We provide DOE-wide policies, standards and guidance on the threats these facilities and operations must be prepared to counter, and the features their safeguards and security systems must have to be effective. We conduct an extensive research and development program, a large part of which is aimed at developing and evaluating safeguards and security instruments, components, subsystems and procedures. We assist DOE contractors in putting together new and effective integrated safeguards and security systems. We exercise oversight responsibility for the actual implementation and operation of the systems, which are funded by the responsible program managers. This includes ensuring that the policies and standards are being adhered to and that the systems in place are indeed adequate and effective.

The same technology base used to support DOE managers supports other important activities of national security concern as well, including assuring that



important non-nuclear resources of DOE receive effective protection. We make available to the nuclear industry and the Nuclear Regulatory Commission (NRC), safeguards and security information which enables them to provide and assure adequate protection of nuclear materials and facilities in the private sector. We cooperate closely with the NRC to maintain comparably effective protection at DOE and licensed facilities. The program provides technical support to activities designed to minimize the possible proliferation of nuclear weapons. This includes participation in U.S. efforts to: identify and promote promising nuclear fuel cycles; support the International Atomic Energy Agency (IAEA) in its safeguards objectives; and cooperate with other nuclear nations in protecting their materials and facilities, particularly those supplied by the U.S.

#### OPERATING EXPENSES

The fiscal year 1980 authorization request for program expenses is \$39.7 million. This request supports two programs: a research and development program and an operational support program.

CHART 14

#### NUCLEAR MATERIALS SECURITY AND SAFEGUARDS—FISCAL YEAR 1980 BUDGET REQUEST

[Authorization/authority in millions]

|                                                         | Fiscal year<br>1979 | Fiscal year<br>1980 |
|---------------------------------------------------------|---------------------|---------------------|
| Program expenses:                                       |                     |                     |
| Research and development:                               |                     |                     |
| Threat characterization.....                            | \$0.6               | \$0.6               |
| Concept development.....                                | 3.0                 | 1.8                 |
| Safeguards technology development.....                  | 12.6                | 13.6                |
| Integrated safeguards systems.....                      | 18.5                | 18.4                |
| Operational support programs:                           |                     |                     |
| Assessments.....                                        | .9                  | .6                  |
| Safeguards analytical laboratory.....                   | 1.2                 | 1.1                 |
| Nuclear materials management and safeguards system..... | 2.3                 | 2.5                 |
| International activities.....                           | 1.1                 | 1.1                 |
| Subtotal, program expenses.....                         | 40.2                | 39.7                |
| Personnel resources.....                                | ( <sup>1</sup> )    | 3.5                 |
| Total operating.....                                    | 40.1                | 43.2                |
| Equipment.....                                          | 3.0                 | 3.4                 |
| Total.....                                              | \$43.1              | 46.6                |

<sup>1</sup> Personnel resources not provided by program in authorization.

<sup>2</sup> Excludes \$5,000,000 of authorization which was not appropriated.

#### Research and Development

The objective of the research and development program is to provide safeguards and security components and systems which are effective against a range of potential credible threats. This requires continuing development, application and refinement of an integrated set of activities. The first of these is a program to understand the range of possible adversaries we may face. This is fundamental to the entire program since in order to provide effective protection, we need to have an accurate, comprehensive profile of the attributes and intentions of these adversaries. The fiscal year 1980 effort, for which we are requesting \$0.6 million, will place particular emphasis on gaining a more complete characterization of possible "insider" adversaries, completing a study on the effectiveness of security clearances and identifying design features which may deter possible adversaries.

"Concept Development" (\$1.8 million) involves application of methods to systematically highlight design requirements of safeguards subsystems and deficiencies of existing subsystems. The fiscal year 1980 effort will include greater use of computer simulation models and data processing equipment to improve the design and evaluation of safeguards systems.

Vulnerabilities and potential countermeasures identified in the concepts are used as a basis for "Safeguards Technology Development" to adapt or design, develop and evaluate prototype instrumentation and components under controlled conditions as well as in an operational environment. For fiscal year 1980, we are requesting authorization of \$13.6 million, an increase of \$1.0 million over the fiscal year 1979 level. This increase reflects additional emphasis in several major



areas including the development, test and evaluation of advanced instrumentation to solve problems in measuring special nuclear materials in an accurate, timely way. We will be developing more reliable, efficient contraband detectors and positive identity verification equipment for use by DOE and commercial facility operators. Other specific applications include the development and evaluation of safeguards components for (1) the new LASL plutonium processing facility; (2) enrichment plants; (3) DOE nuclear production reactors; (4) defense program reprocessing facilities; (5) spent fuel storage; (6) nuclear critical facilities; and (7) meeting identified needs in support of selected alternative fuel cycles.

In fiscal year, \$18.4 million is identified for developing "Integrated Safeguards Systems" for the preceding types of facilities. Integrated safeguards concepts for many of these facility types were completed by early fiscal year 1979 and component development, test and evaluation is underway. Operational test and evaluation of the integrated systems will begin in fiscal year 1980. An integrated safeguards system which provides for more accurate, timely and stringent controls over nuclear materials will be instrumented and operationally tested and evaluated at the new LASL plutonium processing facility. In addition, technology developed in support of these programs will continue to provide input to the U.S. non-proliferation program, including support for follow-on activities to the International Nuclear Fuel Cycle Evaluation and the Non-Proliferation Alternative Systems Assessment Program.

#### *Operational Support Program*

Under the operational support program, the "Assessments" effort (\$0.6 million) involves operational reviews by Headquarters of DOE facilities for determination of system effectiveness over a wide range of credible threats, including the use of computer modeling of installed systems.

We are requesting \$1.1 million and \$2.5 million, respectively for the "Safeguards Analytical Laboratory" and the "Nuclear Materials Management and Safeguards System (NMMSS)". The Safeguards Analytical Laboratory provides nuclear materials measurement support to the defense programs, monitors DOE contractors' measurement performance and develops standards and analytical and measurement procedures. The laboratory provides similar services to the NRC and the IAEA on a full cost recovery basis. The NMMSS is a computerized data system that provides the central repository for storage and retrieval of information on nineteen nuclear materials vital to DOE production and defense programs. Input to the NMMSS is provided by all DOE contractors and private firms licensed by the NRC. U.S. nuclear materials furnished under international agreements to foreign countries are also tracked by the system.

The "International Activities" effort (\$1.1 million) provides for the rapid transfer of newly developed safeguards technology and information to the IAEA and to other countries to enhance international safeguards. These funds will be used to conduct International Training Courses as required by the Nuclear Non-Proliferation Act of 1978. This task is complementary to the Program for Technical Assistance to IAEA Safeguards (POTAS) which provides U.S. support for the transfer of DOE-developed technology to the IAEA under our technical management. This program of about \$8.0 million is primarily funded on a reimbursable basis by the State Department.

#### CAPITAL EQUIPMENT

We are also requesting authorization of \$3.4 million for capital equipment not related to construction. These funds will provide the capital equipment required for test and operational evaluation of the safeguards systems and subsystems modules mentioned earlier. The \$0.4 million increase over fiscal year 1979 is required to allow for the procurement of equipment for the prototype safeguards systems being evaluated at plutonium processing, enrichment, nuclear production, reprocessing, spent fuel storage, and alternative fuel cycle facilities.

#### PERSONNEL RESOURCES

The fiscal year 1980 budget request includes \$3.5 million for the Office of Safeguards and Security's program administration activities. These funds provide for the salaries, benefits, and travel expenses for 106 full-time, and 5 other than full-time Headquarters federal employees associated with the technical direction and management of the safeguards and security programs. This includes staff which operates and manages the Personnel Security Program which involves the processing and analysis of over 28,000 security investigations per year.



## NEW INITIATIVES

Important new responsibilities have been assigned to the program in the areas of protection of non-nuclear facilities of national security significance and incident management. In this regard, some effort is already underway to evaluate security system needs for Electrical Power Distribution and Strategic Petroleum Reserve Programs. The incident management responsibility will be expanded within Safeguards and Security for assuring that DOE is adequately prepared to respond to incidents or emergencies caused by adversaries affecting nuclear-related operations.

I will now discuss the verification and control technology program.

## VERIFICATION AND CONTROL TECHNOLOGY

DOE's verification and control technology program provides the technology base and production capability for the systems necessary to verify nuclear weapons-related treaties; carries out the Department's responsibilities to protect U.S. interests and national defense in the export licensing of nuclear and energy-related materials, equipment and technologies; and supports both Departmental and Intelligence Community requirements.

For the verification and control technology program we are requesting new authorization and authority of \$36.8 million for operating expenses and \$1.1 million for capital equipment. This program does not support any construction activities.

## OPERATING FUNDS

The proposed levels for programs activities includes [deleted] for verification technology and [deleted] for control technology. Our request also includes [deleted] for personnel and related expenses associated with the management of the program. I shall comment on each of these areas in more detail.

CHART 15

## VERIFICATION AND CONTROL TECHNOLOGY PROGRAM—FISCAL YEAR 1980 V. &amp; C.T. FUNDING REQUEST

[In millions]

|                              | Authorization | Appropriation | Outlays |
|------------------------------|---------------|---------------|---------|
| Operating:                   |               |               |         |
| Verification technology..... | [Deleted]     |               |         |
| Control technology.....      |               |               |         |
| Personnel resources.....     |               |               |         |
| Operating.....               | \$36.8        | \$36.8        | \$35.6  |
| Capital equipment.....       | 1.1           | 1.1           | 1.1     |
| Total.....                   | 37.9          | 37.9          | 36.7    |

CHART 16

## FISCAL YEAR 1980 VERIFICATION AND CONTROL TECHNOLOGY—OPERATING AND CAPITAL EQUIPMENT BUDGET

[Authorization/authority in millions]

|                                        | 1979                | 1980   |
|----------------------------------------|---------------------|--------|
| Operating:                             |                     |        |
| Verification technology.....           | [Deleted]           |        |
| Control technology.....                |                     |        |
| Personnel resources <sup>1</sup> ..... |                     |        |
| Subtotal, operating.....               | <sup>2</sup> \$28.4 | \$36.8 |
| Equipment.....                         | ( <sup>3</sup> )    | 1.1    |
| Total.....                             | 28.4                | 37.9   |

<sup>1</sup> Personnel resources not provided by program in authorization.

<sup>2</sup> Excludes of authorization.

<sup>3</sup> Funding contained in weapons program.



## CHART 17

## VERIFICATION AND CONTROL TECHNOLOGY PROGRAM TECHNICAL PROGRAMS/MANAGEMENT SUPPORT AREAS

Programs functions.  
 Verification technology:  
   Base technology.  
   Applications.  
   Operational component.  
 Control technology:  
   Verification services.  
   Energy and technology.  
 Staff functions.  
   Export control.  
   Arms control.  
   National security policy affairs.  
 Intelligence management and analysis.

*Verification Technology*

The fiscal year 1980 budget request [deleted] for verification technology is an increase [deleted] fiscal year 1979. This increase is primarily related [deleted] seismic stations at the sites agreed upon during the negotiation process. [Deleted] the fiscal year 1980 budget request contains funds to produce five stations; these will cost \$1.1 million each for a total of \$5.5 million. The operational component of verification technology involves continuing test, exercise and analysis of verification schemes, and supports both the maintenance of our verification capability and the negotiating process. This activity includes the operational aspects of the on-site inspection provisions of both the Peaceful Nuclear Explosives Treaty (PNET) and Threshold Test Ban Treaty (TTBT) [deleted].

*Control Technology*

The FY 1980 budget request [deleted] for control technology is an increase [deleted] over fiscal year 1979. The increase is primarily related to increased satellite nuclear detection instrumentation production costs and additional technical analysis in support of the national proliferation [deleted] program. [Deleted.] The verification services activity represents the principal national technology resource, analytical skill and data base relevant to nuclear non-proliferation [deleted]. The energy and technology activity provides the Department with assessments of foreign energy intentions, technology development programs and resources [deleted].

*Personnel Resources*

The fiscal year 1980 budget includes funding for Federal personnel managing verification and control technology program activities. The budget request [deleted] is an increase [deleted] over fiscal year 1979. This is to meet the salaries, benefits and travel expenses of 46 staff personnel who are responsible for Headquarters management and direction, as well as technical and administrative support.

This concludes my discussion of the operating expenses requested for DOE's verification and control technology program activities for fiscal year 1980.

## CAPITAL EQUIPMENT

The fiscal year 1980 request for capital equipment not related to construction totals \$1.1 million. In prior years, capital equipment for verification technology was contained within the weapons program. This year we have identified it separately. This expenditure will provide test equipment related to the verification technology program. The objective is to meet a significant need to update existing equipment and to procure specific equipment for production of the seismic stations expected to be required by the verification provisions of the CTBT.

This completes my overview statement. I would be pleased to respond to any questions you have at this point.

Senator JACKSON. Do you have a short summary you wish to make?

Mr. SEWELL. I have a short summary I could make.

Senator JACKSON. Why don't you do that and then we will hear General Bratton and Dr. Gilbert.



Mr. SEWELL. Dr. Schlesinger summarized at the start of his presentation, the DOE authorization request of about \$3 billion for atomic energy defense activities. About \$2.4 billion of that total is under my cognizance as Assistant Secretary for Defense Programs.

Since General Bratton will discuss the nuclear weapons program and Dr. Gilbert will discuss the nuclear materials production program, I will confine my remarks to our inertial confinement fusion, nuclear materials security and safeguards, and verification and control technology programs.

#### INERTIAL CONFINEMENT FUSION

The total fiscal 1980 authorization request for inertial confinement fusion is \$126.9 million. We are requesting \$108.9 million for operating expenses, \$8.5 million for capital equipment, and \$9.5 million for construction.

The objective, as we mentioned earlier, of the ICF program for the near term is to ignite and burn fuel contained in a very small fuel pellet and gain an understanding of the physical processes that are involved.

Inertial fusion technology promises to have a variety of applications. Instead of burning fuel pellets, we can use laser or particle beam drivers with targets of various materials to study material properties of interest to the nuclear weapons technology. [Deleted.]

These are some of the near-term weapons technology applications that we are pursuing in this program.

In the longer term, if inertial confinement fusion proves to be practical, there are nuclear weapons technology and energy technology applications of the large amounts of energy that will be released. If a range of engineering problems can be solved relating to energy containment, transfer, and repetitive operation of inertial confinement facilities in a manner that is safe and reliable, the pellet output can be used to breed fissile fuel, produce electricity, or produce such things as hydrogen as a feed stock for synthetic liquid fuels.

The operating funds in this area are \$108.9 million. I have charts in my statement for the record that break this funding into the various levels of activity. Experiments with glass lasers, which are in our main lines of investigation, are performed at the Lawrence Livermore Laboratory, KMS Fusion, Inc., the University of Rochester, and the Naval Research Laboratory.

Glass laser experiments serve as a basis of comparison for results with long wavelength carbon dioxide lasers operated at the Los Alamos Scientific Laboratory, experiments with electrons and ion beams which are conducted at Sandia Labs.

Our authorization request includes \$1.1 million to provide for the salaries, benefits and travel for the 29 Federal employees who perform the program management and support functions.

This, incidentally, is the first year that we have included the funding for program management and support in the program budgets. In the past, this funding has been included in the department's overall program direction budget.

For construction in this area we have requested \$9½ million in new authorization. Of this amount \$8 million would be used to continue construction of the Antares gas laser facility at Los Alamos.



We are also requesting \$11½ million for plant engineering design for the electron beam facility at Sandia Laboratories.

To summarize these projects briefly, we are requesting plant engineering and design authorization to plan a possible upgrade of the electron beam facility located at the Sandia Laboratories in New Mexico. This is the major particle beam experimental facility and is now under construction.

In fiscal 1980 we will continue construction of the Antares carbon dioxide laser facility at Los Alamos, which compares in energy and power to the first operating portion of the NOVA glass facility at Livermore. This will permit comparison between those two wave lengths, the 10 microns at Los Alamos and 1 micron at Livermore.

Although we are not requesting any new authorization for the NOVA project, I think it is appropriate to mention that project because of its importance to the program. The budget authority requested for the NOVA glass laser at the Lawrence Livermore Laboratory is to continue construction and the upgrade of the SHIVA laser. Experiments on the SHIVA have shown that a pellet compression of about 70 times the liquid density of deuterium-tritium has recently been accomplished.

#### NUCLEAR MATERIALS SECURITY AND SAFEGUARDS

Now, I would like to turn to the nuclear materials security and safeguards program. The total fiscal 1980 authorization request is \$46.6 million for this program, \$39.7 million in program expenses, \$3.4 million in capital equipment and \$3.5 million in operating expenses for personnel resources.

Our prime responsibility in this program is to assure that adequate protection is provided for DOE nuclear weapons facilities, materials, and classified information against theft or sabotage by potential adversaries. We conduct an extensive research and development program, a large part of which is aimed at developing and evaluating safeguards and security instruments, components, subsystems, and procedures.

We make available to the nuclear industry and the Nuclear Regulatory Commission safeguards and security information which enables them to provide and assure adequate protection of nuclear materials and facilities in the private sector.

The program provides technical support to activities designed to minimize the possible proliferation of nuclear weapons. This includes participation in U.S. efforts to identify and promote promising nuclear fuel cycles, support the International Atomic Energy Agency in its safeguards objectives, and cooperate with other nuclear nations in protecting their materials and facilities, particularly those supplied by the United States.

The fiscal 1980 authorization request for program expenses is \$39.7 million. This request supports two programs: a research and development program and an operational support program. The objective of the research and development part of the program is to provide safeguards and security components and systems which are effective against a range of potential credible threats.

This requires continuing development, application, and refinement of an integrated set of activities. The first of these is the program to understand the range of possible adversaries we may face. For safe-



guards technology development we are requesting authorization of \$13.6 million. We plan additional emphasis in several major areas including the development, test and evaluation of advanced instrumentation to solve problems in measuring special nuclear materials in an accurate, timely way.

We will be developing more reliable, efficient contraband detectors and positive identity verification equipment for use by DOE and commercial facility operators.

Other specific applications include the development and evaluation of safeguards components for the new Los Alamos plutonium processing facility, for the enrichment plants, for DOE nuclear production reactors, for defense programs reprocessing plants, for spent fuel storage, for nuclear critical facilities and for meeting identified needs in support of selective alternative cycles.

In fiscal 1980, \$18.4 million is identified for developing integrated safeguards systems for the preceding types of facilities. Integrated safeguards concepts for many of these facility types were completed by early fiscal 1979 and component development, test, and evaluation is underway. Operational test and evaluation of the integrated systems will begin in fiscal 1980.

Under the operational support program we are requesting \$1.1 million and \$2.5 million respectively for the Safeguards Analytical Laboratory and the Nuclear Materials Management and Safeguards System—NMMSS. The laboratory provides nuclear materials measurement support to the defense programs, monitors DOE contractor measurement performance, and develops standards and analytical measurement procedures. The NMMSS is a computerized data system and provides a central repository for storage and retrieval of information on 19 nuclear materials vital to the DOE production and defense programs.

The international activity effort of \$1.1 million provides for the rapid transfer of newly developed safeguards technology and information to the IAEA and to other countries to enhance international safeguards.

We are requesting \$3.4 million for capital equipment not related to construction for this program. These funds will provide the capital equipment required for test and operational evaluation of the safeguards systems and subsystem modules.

#### VERIFICATION AND CONTROL TECHNOLOGY

I will now discuss the verification and control technology program. This program provides the technology base and production capability for the systems necessary to verify nuclear weapons related treaties. It carries out the Department's responsibility to protect U.S. interests and national defense in the export licensing of nuclear and energy related materials, equipment and technologies and supports both the DOE departmental and the intelligence community requirements.

For the verification and control technology program we are requesting new authorization and authority of \$36.8 million for operating



expenses and \$1.1 million for capital equipment. The proposed level for operating funds includes [deleted] for verification technology and [deleted] for control technology. Our request also includes [deleted] for personnel and related expenses.

The fiscal 1980 budget of [deleted] for verification technology is an increase of [deleted] over fiscal 1979. This increase is primarily related to the verification activity directly dictated by the President's comprehensive test ban initiative. The overall level for the verification technology program will support detection, identification, location and characterization of underground nuclear explosions.

This work is vital under the present regime of the limited test ban treaty and the Threshold Test Ban Treaty which confines testing to underground and restricts explosive yield to 150 kilotons. It will even be more vital, of course, under a CTB.

Under the separate verification agreement of the CTB currently under trilateral negotiations with the United States, the United Kingdom, and the U.S.S.R., the United States could emplace [deleted] seismic stations at sites agreed upon during the negotiations process. However, to insure that the United States can meet the production [deleted] schedule within the expected duration of the treaty, which is expected to be about [deleted], the fiscal 1980 budget contains funds to produce five stations. These will cost \$1.1 million each for a total of \$5.5 million.

For control technology, fiscal year 1980 budget request of [deleted] is an increase [deleted] over 1979. The increase is primarily related to increased satellite nuclear detection instrumentation production cost and additional technical analysis in support of the national proliferation program.

Senator JACKSON. If you would summarize the balance of your statement, Mr. Sewell.

Mr. SEWELL. Mr. Chairman, that does conclude my summary.

#### NUCLEAR WEAPONS PROGRAM

Senator JACKSON. General Bratton?

General BRATTON. I will summarize mine.

Senator JACKSON. Your prepared statement will go in the record at this point.

#### STATEMENT OF GEN. JOSEPH BRATTON, OFFICE OF MILITARY APPLICATION

[The statement follows:]

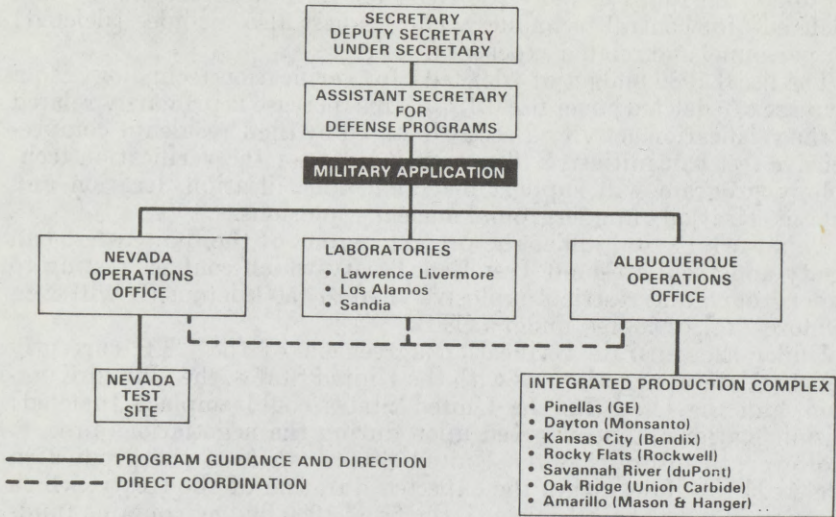
PREPARED STATEMENT BY MAJ. GEN. JOSEPH K. BRATTON, U.S.A., DIRECTOR OF MILITARY APPLICATION, U.S. DEPARTMENT OF ENERGY

#### INTRODUCTION

Mr. Chairman and Members of the Committee: It is my pleasure to appear again before this Committee. My statement will address the Department of Energy's fiscal year 1980 nuclear weapons program and the funding required to execute that program.



## WEAPONS GUIDANCE/COORDINATION



F-9-029

This chart illustrates how the weapons program is organized for program direction and coordination, with my Office of Military Application highlighted in red. My responsibilities include the research, development, testing, and production of nuclear weapons as well as the lifetime surveillance of the weapons stockpile. In view of the Committee's familiarity with the program, I shall not discuss our organization and operating procedures in detail as I did last year in our first formal testimony as a DOE entity.

### FISCAL YEAR 1980 BUDGET REQUEST

I shall present our fiscal year 1980 budget request by subactivity as noted on this chart. The fiscal year 1980 authorization request for the weapons program totals approximately \$1.7 billion in new obligational authority. I show here the Authorization, Appropriation or Budget Authority (B/A), and the associated Budget Outlays (B/O) for the program.

### FISCAL YEAR 1980 WEAPONS BUDGET—FUNDING REQUEST

[In millions]

|                                  | Authorization | Appropriation | Outlays |
|----------------------------------|---------------|---------------|---------|
| Operating:                       |               |               |         |
| Research and development.....    | \$421         | \$421         | \$409   |
| Testing.....                     | 198           | 198           | 201     |
| Production and surveillance..... | 732           | 732           | 695     |
| Personnel resources.....         | 37            | 37            | 37      |
| Total operating.....             | 1,388         | 1,388         | 1,342   |
| Equipment.....                   | 104           | 104           | 94      |
| Construction.....                | 195           | 167           | 183     |
| Total.....                       | 1,687         | 1,659         | 1,619   |

### OPERATING

Since we manage our subactivities on a cost performance basis, I will address them in terms of outlays or costs. The proposed outlay level for the weapons op-



erating program includes \$409 million for research and development, \$201 million for testing, \$695 million for the production of new weapons and for surveillance and maintenance of the stockpile of existing weapons, and \$37 million for DOE personnel and related expenses associated with the management of the weapons program. I shall comment on each of these areas in more detail.

#### FISCAL YEAR 1980 WEAPONS BUDGET—RESEARCH AND DEVELOPMENT

[Budget authority and outlays, in millions]

|                             | Fiscal year<br>1978 | Fiscal year<br>1979 | Fiscal year<br>1980 |
|-----------------------------|---------------------|---------------------|---------------------|
| Current weapons.....        | \$149               | \$165               | \$182               |
| Advanced development.....   | 63                  | 64                  | 85                  |
| Development capability..... | 119                 | 115                 | 116                 |
| Special projects.....       | 24                  | 28                  | 26                  |
| Total.....                  | 355                 | 372                 | 409                 |

The budget request of \$409 million for research and development proposes an increase of \$37 million, or about 10 percent, over fiscal year 1979. This level will support approximately 7,400 full-time laboratory employees—about the same level we are projecting for FY 1979.

The requested level provides the resources—manpower, materials, and services—needed to support the efforts of DOE's weapons laboratories in research, development, and engineering of nuclear weapons. These efforts include current weaponization of nuclear weapons for DOD systems; advanced development for future weapons applications; and maintenance of a development capability base in those scientific and engineering areas necessary to both current and future weapons development.

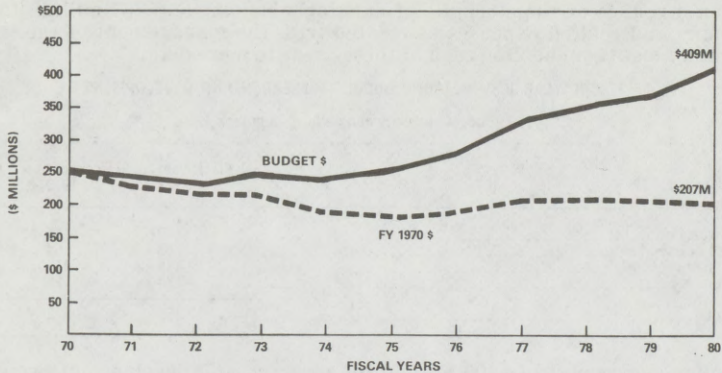
#### WEAPONS R&D FACILITIES



Our research and development programs are conducted principally at the three DOE weapons laboratories: the Lawrence Livermore Laboratory, the Los Alamos Scientific Laboratory, and the Sandia Laboratories. The laboratories perform complementary work on nuclear weapon development within an environment of specialized technical competition and independent pursuit. Their activities encompass R&D of nuclear devices; safing, arming, fuzing, and firing systems; and associated command and control, safety, and weapon disabling systems.



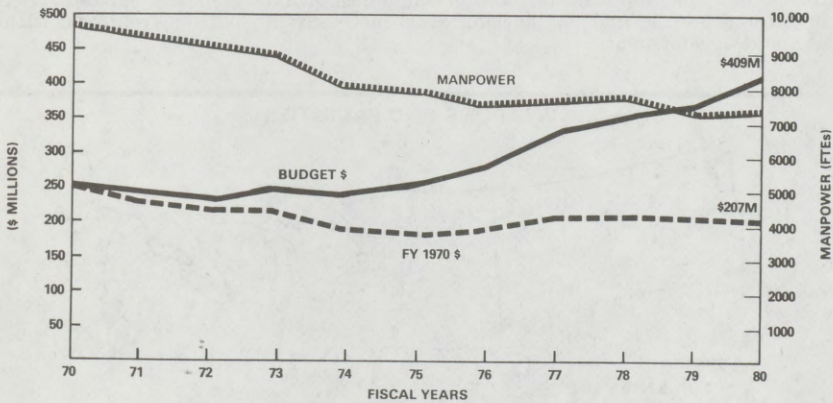
## R&amp;D HISTORY — OPERATING



F-9-034

This chart shows, both in actual year dollars and fiscal year 1970 dollars, the funding trend for our research and development activities since 1970.

## R&amp;D HISTORY — OPERATING/MANPOWER

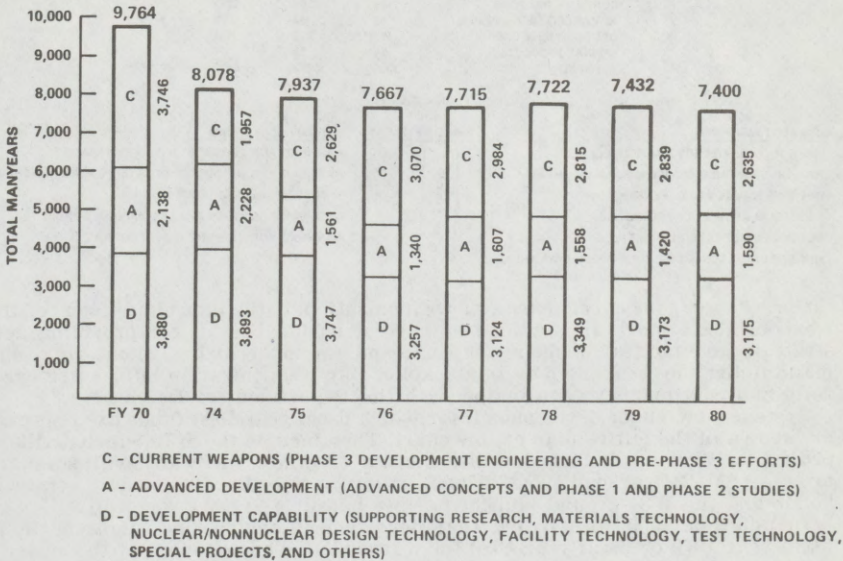


F-9-036

Superimposed here is a trend line indicating R&D manpower at the laboratories.



## FY 1980 WEAPONS BUDGET RESEARCH AND DEVELOPMENT MANYEARS



F-9-036

This chart shows the number of full-time employees engaged in nuclear weapons R&D at the laboratories. The employment level is our prime measure of capability and level of effort. The colored bars show employees dedicated to current weapons development, in red; future weapons, or advanced development, in white; and development capability, in blue. It is significant that weapons-associated manpower at the weapons labs—which forms the basis for the generation of new ideas, weapons concepts, and technologies, as well as the application of these elements to new or changing DOD system requirements—has been reduced by about 25 percent during this decade.

The impact of this trend has been lessened because other expanding laboratory programs now share a larger portion of indirect manpower and the weapons R&D community has been able to rely more heavily on experimental and design tools such as computers. Our decision to hold in fiscal year 1980 to our estimated fiscal year 1979 level reflects our conviction that the laboratory personnel strength associated with weapons R&D must not be permitted to decrease further if a viable and responsive program for the future is to be assured.



FY 1980 WEAPONS BUDGET  
RESEARCH AND DEVELOPMENT  
(B/O \$ MILLIONS)

|                        | FY 1978 | FY 1979 | FY 1980 |
|------------------------|---------|---------|---------|
| CURRENT WEAPONS        | \$149   | \$165   | \$182   |
| ADVANCED DEVELOPMENT   | 63      | 64      | 85      |
| DEVELOPMENT CAPABILITY | 119     | 115     | 116     |
| SPECIAL PROJECTS       | 24      | 28      | 26      |
| TOTAL                  | \$355   | \$372   | \$409   |

| CURRENT WEAPONS                            |  | PLANNED DATE<br>OF<br>FIRST DELIVERY      | POTENTIAL SYSTEMS                           |
|--------------------------------------------|--|-------------------------------------------|---------------------------------------------|
| W79 8-INCH ARTILLERY PROJECTILE            |  | [<br>D<br>E<br>L<br>E<br>T<br>E<br>D<br>] | WARHEAD FOR PERSHING II SYSTEM (ARMY)       |
| W80 AIR LAUNCHED CRUISE MISSILE WARHEAD    |  |                                           | WARHEAD FOR ADVANCED STRATEGIC AIR LAUNCHED |
| W81 SM-2 NAVAL AIR DEFENSE WARHEAD         |  |                                           | MISSILE (ASALM) (AIR FORCE)                 |
| W82 155MM ARTILLERY PROJECTILE             |  |                                           | WARHEAD FOR MISSILE-X SYSTEM (AIR FORCE)    |
| B83 MODERN STRATEGIC BOMB                  |  |                                           | WARHEAD FOR TRIDENT II SYSTEM (NAVY)        |
| W84 GROUND LAUNCHED CRUISE MISSILE WARHEAD |  |                                           |                                             |

*Current weapons development*, or weaponization, is the immediate focus of the weapons R&D effort. It is guided by current national needs for providing new strategic and tactical nuclear weapons; and for modernizing, monitoring, and maintaining the weapons now in stockpile. Our weaponization efforts are carefully and continuously coordinated with the Department of Defense.

Systems now under development, for which fiscal year 1980 funds are required, are shown in the left column of this chart. They include the W79 8-inch artillery projectile, W80 air launched cruise missile (ALCM) warhead, W81 standard missile (SM-2) warhead, W82 155mm artillery projectile, B83 modern strategic bomb, and the W84 ground launched cruise missile (GLCM) warhead.

In addition, it is anticipated that development engineering might begin in fiscal year 1979 or fiscal year 1980 for warheads for one or more of the systems shown in the right column: the PERSHING II surface-to-surface missile, advanced strategic air launched missile (ASALM), and the Missile-X intercontinental and TRIDENT II submarine launched ballistic missiles. We are taking the necessary R&D and testing actions to protect these options.

#### *Enhanced Radiation Warheads*

In October 1978, DOE was directed to resume efforts leading to production of the W70-3 and W79 warheads for the LANCE missile and 8-inch artillery systems. [Deleted.] The warheads can be converted to ER later if a decision is made to do so.

#### *Cruise Missile Warheads*

Development of the W80 warhead for air and sea launched cruise missile applications continues, with primary emphasis on the air launched system.

Compatibility with the sea launched cruise missile is being maintained to protect the option for future production if a decision is made to do so.

The W84 warhead entered engineering development in September 1978 to satisfy the DOD requirements for a warhead for a ground launched cruise missile.

#### *Modern Strategic Bomb*

Consistent with Congressional guidance in meeting DOD requirement for a modern strategic bomb, we have initiated design of a bomb designated the B83. It contains the essential features of the earlier B77 program, at reduced cost.



FY 1980 WEAPONS BUDGET  
RESEARCH AND DEVELOPMENT  
(B/O \$ MILLIONS)

|                        | FY 1978 | FY 1979 | FY 1980 |
|------------------------|---------|---------|---------|
| CURRENT WEAPONS        | \$149   | \$165   | \$182   |
| ADVANCED DEVELOPMENT   | 63      | 64      | 85      |
| DEVELOPMENT CAPABILITY | 119     | 115     | 116     |
| SPECIAL PROJECTS       | 24      | 28      | 26      |
| TOTAL                  | \$355   | \$372   | \$409   |

## WEAPON SYSTEM STUDIES

- CONCEPTUAL AND FEASIBILITY STUDIES AS REQUESTED BY THE DEPARTMENT OF DEFENSE
- TRIDENT II WARHEAD, ADVANCED STRATEGIC AIR LAUNCHED MISSILE, HARPOON WARHEAD, REDUCED RESIDUAL RADIATION (RRR) WEAPONS

[DELETED]

## WEAPON COMPONENTS AND SUBSYSTEMS

- IMPROVED ARMING, FIRING, AND FUZING SUBSYSTEMS
- WEAPONS SAFETY, SECURITY, AND COMMAND CONTROL
- INSENSITIVE HIGH EXPLOSIVES
- PERMISSIVE ACTION LINKS
- COMMAND DISABLEMENT

[DELETED]

*Advanced development* is the essential source of new concepts and designs needed to maintain the quality of the U.S. nuclear weapons deterrent and to meet future requirements for new nuclear systems. Some of the many types of advanced development efforts planned for fiscal year 1980 are shown. Particular emphasis will be given to improving the safety, security, and command/control of nuclear weapons.

Historically, advanced development has provided the United States a means of attaining and maintaining the effectiveness of our nuclear deterrent. The current weapons activities are based on advanced development activities of years past. Today's activities are being conducted to extend our nuclear capabilities so that evolving Defense system requirements can be met effectively and efficiently.

FY 1980 WEAPONS BUDGET  
RESEARCH AND DEVELOPMENT  
(B/O \$ MILLIONS)

|                        | FY 1978 | FY 1979 | FY 1980 |
|------------------------|---------|---------|---------|
| CURRENT WEAPONS        | \$149   | \$165   | \$182   |
| ADVANCED DEVELOPMENT   | 63      | 64      | 85      |
| DEVELOPMENT CAPABILITY | 119     | 115     | 116     |
| SPECIAL PROJECTS       | 24      | 28      | 26      |
| TOTAL                  | \$355   | \$372   | \$409   |

F:9:041

Finally, I refer to the *development capability* and *special projects* categories. Development capability is the essential technology base that ensures the continued evaluation of new concepts. It includes supporting research in those applications of physics, chemistry, mathematics, and the engineering sciences necessary for nuclear weapons design and development. Special projects include efforts in such areas as nuclear weapons safeguards and detection and emergency response activities.

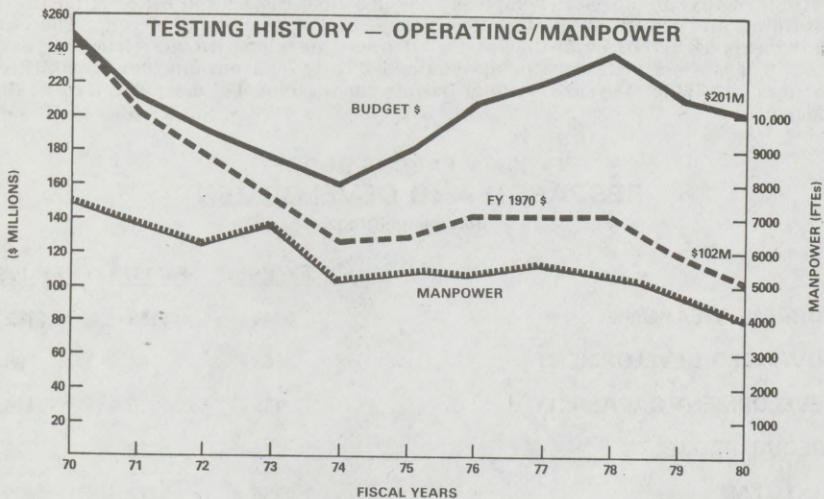


**FY 1980 WEAPONS BUDGET  
TESTING**  
(B/O \$ MILLIONS)

|                                        | FY 1978      | FY 1979      | FY 1980      |
|----------------------------------------|--------------|--------------|--------------|
| <b>TESTS</b>                           | <b>\$170</b> | <b>\$149</b> | <b>\$143</b> |
| <b>LABORATORY PARTICIPATION-COMMON</b> | <b>67</b>    | <b>62</b>    | <b>58</b>    |
| <b>TOTAL</b>                           | <b>\$237</b> | <b>\$211</b> | <b>\$201</b> |

F-9-042

I shall now discuss our weapons testing activities, which have always been an important part of our weapons R&D program. The DOE budget request for fiscal year 1980 for underground nuclear testing is \$201 million, a decrease of \$10 million, or about five percent, below fiscal year 1979. Our testing program is presented in two categories. The first covers the funding for the Nevada Test Site operations and procurement of test devices and instrumentation by the weapons labs; the second includes funding for laboratory personnel who are involved in the testing program.



F-9-043

This chart shows the budget and manpower trends for testing since 1970. The manpower levels include personnel at the Nevada Test Site as well as at the weapons design laboratories.

Costs identified with testing activities at the Nevada Test Site are for field construction, technical and logistical support, and maintenance and operation of the overall site.



## FISCAL YEAR WEAPONS BUDGET—TEST SUMMARY (U.S. TEST DEVICE)

|                             | Fiscal year |      |      |      |      |      |      |      |      |      |      |
|-----------------------------|-------------|------|------|------|------|------|------|------|------|------|------|
|                             | 1970        | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
| Current weapons.....        |             |      |      |      |      |      |      |      |      |      |      |
| Advanced development.....   |             |      |      |      |      |      |      |      |      |      |      |
| Development capability..... |             |      |      |      |      |      |      |      |      |      |      |
| Total.....                  |             |      |      |      |      |      |      |      |      |      |      |

[Deleted]

The requested funding, will accommodate a level of testing of [deleted] devices—[deleted] decrease from fiscal year 1979. This is the least number of tests in any year since we resumed testing in 1962 following the moratorium. The fiscal year 1980 tests will be in support of high priority current and advanced development programs.

*Fiscal year 1980 weapons budget—testing objectives*

Develop nuclear warheads.

Further nuclear weapon science and technology.

Determine nuclear weapon effects.

Certify stockpile performance.

Underground nuclear testing is a key element in our current weapons research and development effort and is essential to new or improved nuclear designs. It is important for the general advancement of nuclear weapon technology and for continued assurance of a capable technology base.

The fiscal year 1980 budget request assumes that a Comprehensive Test Ban (CTB) will not be implemented prior to or during fiscal year 1980. The test program, however, is under constant review to assure that at any given time it is consistent with programmatic goals and optimized in content and schedule to meet our current assessment of the test ban negotiations. In the event of a CTB, some changes in program emphasis and some new or different activities would be needed. The nature and extent of such adjustments would be dependent on the specific terms of a test ban agreement and on test ban safeguards policies.

In addition to our request for the fiscal year 1980 test program, we have submitted a supplemental request for the fiscal year 1979 budget for \$12.8 million [deleted].

## FISCAL YEAR 1980 WEAPONS BUDGET—PRODUCTION AND SURVEILLANCE

[Budget authority and outlays, in millions]

|                                 | Fiscal year<br>1978 | Fiscal year<br>1979 | Fiscal year<br>1980 |
|---------------------------------|---------------------|---------------------|---------------------|
| War reserve new production..... | \$267               | \$335               | \$415               |
| Stockpile maintenance.....      | 56                  | 56                  | 66                  |
| Stockpile reliability.....      | 64                  | 77                  | 80                  |
| Process development.....        | 41                  | 47                  | 51                  |
| Other costs.....                | 64                  | 73                  | 83                  |
| Total.....                      | 492                 | 588                 | 695                 |

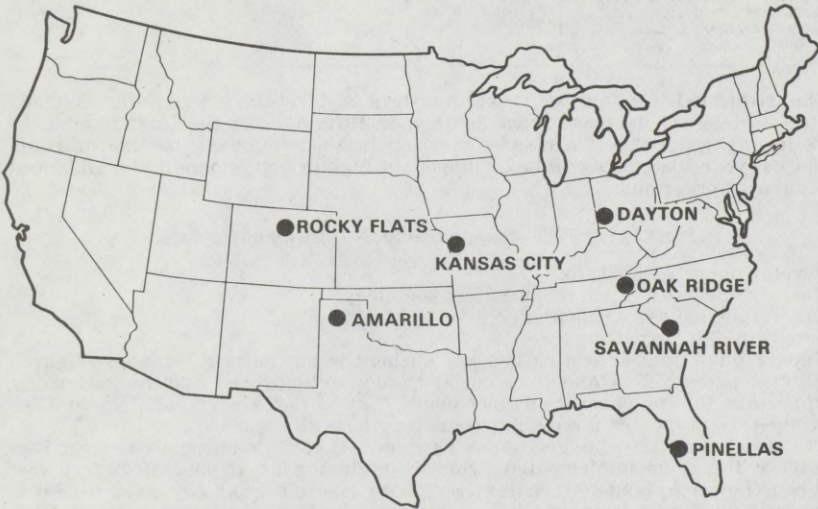
The fiscal year 1980 outlays requested for production and surveillance total \$695 million. The increase of \$107 million, or about 18 percent, over fiscal year 1979 is primarily for production of new war reserve weapons.

The funds requested are for production of nuclear weapons as approved by the President; production engineering related to future delivery of weapons cur-



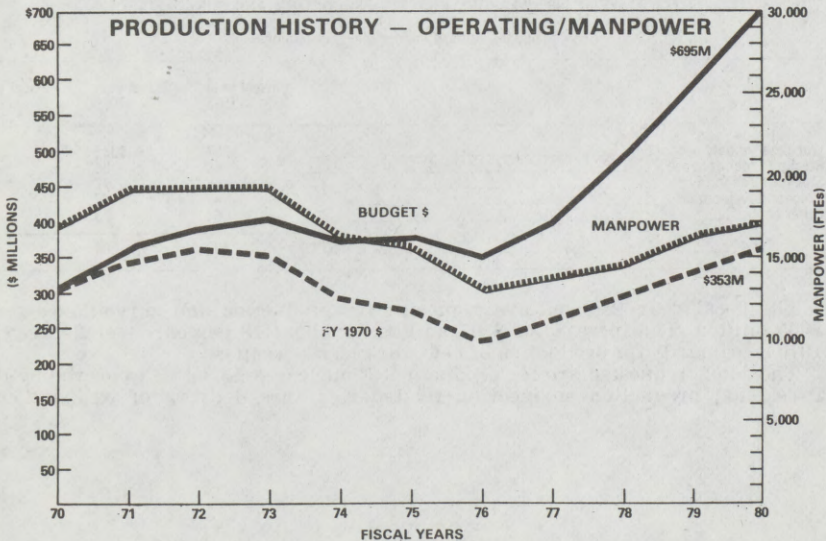
rently under development; and lifetime surveillance and maintenance of the weapons stockpile to assure its high state of readiness and reliability. Also included are funds for the retirement of warheads as designated by the President and the recovery and processing of special nuclear materials.

### WEAPONS PRODUCTION FACILITIES



F-9-047

The production funds requested are for our seven plants at which components are manufactured and nuclear weapons are assembled. These plants have a wide range of industrial engineering skills and special capabilities generally not found in private industry.



F-9-048

The trends for production funding and manpower are shown here. Our resource allocations are rising to accommodate increases in DOD delivery requirements approved by the President. A modest increase in plant employment will be necessary. [Chart deleted.]



This next chart is a graphical display of planned nuclear weapons deliveries through fiscal year 1986. Strategic systems are shown in red.

[Chart deleted.]

This same planned production of new bombs and warheads is summarized here for the period fiscal year 1978 through fiscal year 1986. Our planned deliveries to the DOD are shown by weapon types and by years. The figures are based on the latest stockpile approved by the President on January 5, 1979. They represent directive production authority for fiscal year 1979 through fiscal year 1981, authority to initiate long lead-time activities to prepare for fiscal year 1982-fiscal year 1983 production for warheads for approved forces, and noted planning projections for fiscal year 1984-fiscal year 1986. Within the guidelines of the Presidential directive approving the stockpile, there is provision for minor changes in production capabilities, military requirements, or delivery system assets.

[Chart deleted.]

This chart shows new production funding for the period fiscal year 1978-fiscal year 1980 by specific bomb and warhead and indicates in the right-hand column the date of initial delivery as coordinated with the Department of Defense. The production basis for these figures is consistent with the two previous charts.

[Chart deleted.]

Finally, this chart shows the overall profile by category of the Nation's stockpile of nuclear weapons through fiscal year 1986.

[Chart deleted.]

Total yield, usually measured in megatons, is another indication of the content of the stockpile. [Deleted.] We believe this trend [deleted] illustrates the progress made in changing from the earlier large weapons to the more sophisticated, modernized MIRVed warheads and improved delivery systems.

With respect to this Nation's nuclear weapons stockpile and production/delivery activities, I should like to call the Committee's attention to a few areas of special interest in which changes have occurred since last year.

#### *B61 Bomb*

[Chart deleted.]

#### *Enhanced Radiation Warheads*

[Deleted.]

#### *W76 Warhead*

[Deleted.]

#### *W78 Warhead*

The W78 MINUTEMAN warhead production is on schedule. [Deleted.]

#### *W80 Warhead*

The W80 cruise missile warhead program is on schedule, [deleted]. The production funds requested for fiscal year 1980 are for warheads for the air launched missile only, with the option left open of producing W80 warheads compatible with the sea launched version if a decision is made later to do so.

#### *Other*

There is no funding for production of warhead parts in fiscal year 1980 for the W81 Standard Missile-2 warhead, the W82 155mm artillery projectile warhead, or for warheads for the PERSHING II, M-X, or HARPOON.

#### *Insensitive High Explosives (IHE)*

At the request of this Committee, we have prepared jointly with the DOD an analysis of the impact of incorporating IHE into all or part of the nuclear weapons in the Nation's stockpile. The results of this review have recently been provided to the Committee.

#### *Reliability of Nuclear Weapons*

In response to a request from this Committee, the Secretaries of Energy and Defense are submitting a report on the reliability of nuclear weapons currently and formerly in the U.S. arsenal. The report presents a detailed review of the nuclear test program as related to reliability and a discussion of the nonnuclear test program—quality assurance/reliability testing. The report also discusses stockpile-related nuclear testing activities in the current fiscal year 1979 program.



### Stockpile Modernization

Although no production funding is specifically provided in the fiscal year 1980 budget request for stockpile modernization actions, including IHE retrofits, the stockpile is being examined jointly by the DOE and DOD for the purpose of initiating an effort to modernize selected weapons with long-term retainability—to ensure their sustained reliability and enhance their safety, security, and command and control features. Beginning in fiscal year 1981 and for some years thereafter, we expect to address this need more fully in our budget requests.

#### FISCAL YEAR 1980 WEAPONS BUDGET—PERSONNEL RESOURCES

[Budget authority and outlays in millions]

|                                                | Fiscal year<br>1978 | Fiscal year<br>1979 | Fiscal year<br>1980 |
|------------------------------------------------|---------------------|---------------------|---------------------|
| Full-time employment:                          |                     |                     |                     |
| Headquarters.....                              | \$4                 | \$5                 | \$5                 |
| Albuquerque operations office.....             | 18                  | 20                  | 20                  |
| Nevada operations office.....                  | 8                   | 9                   | 9                   |
| Total.....                                     | 30                  | 34                  | 34                  |
| Contractual services, supplies, and equipment: |                     |                     |                     |
| Albuquerque operations office.....             | 2                   | 2                   | 2                   |
| Nevada operations office.....                  | 1                   | 1                   | 1                   |
| Total.....                                     | 3                   | 3                   | 3                   |
| Total.....                                     | 33                  | 37                  | 37                  |

### Personnel Resources

This budget category, formerly carried in the Policy and Management part of the DOE budget, provides for the salary, benefits, and travel expenses of those 1,000 Federal employees associated with the technical direction and management of the weapons program. Also included is the funding required for the contractual services, supplies, and equipment necessary to support the DOE Albuquerque and Nevada Operations Offices.

#### FISCAL YEAR 1980 WEAPONS BUDGET—PERSONNEL RESOURCES

|                                    | Fiscal year<br>1978 | Fiscal year<br>1979 | Fiscal year<br>1980 |
|------------------------------------|---------------------|---------------------|---------------------|
| Full-time employment—Yearend:      |                     |                     |                     |
| Headquarters.....                  | 134                 | 143                 | 141                 |
| Albuquerque operations office..... | 665                 | 637                 | 620                 |
| Nevada operations office.....      | 248                 | 239                 | 239                 |
| Total.....                         | 1,047               | 1,019               | 1,000               |

This chart indicates the employment levels, by location, associated with the funding request. There are additional Federal employees in direct support of the weapons program—for example, those involved in quality assurance activities—who are funded through the operating accounts of the DOE Operations Offices.

This concludes my discussion of the operating expenses requested for DOE's weapons program activities for fiscal year 1980.

#### CAPITAL EQUIPMENT

The fiscal year 1980 authorization and budget authority requested for capital equipment not related to construction totals \$104 million, an increase of \$18 million, or about 17 percent, over fiscal year 1979. Included are \$97 million for basic equipment and \$7 million for major computer acquisitions.

### Restoration

As noted in the footnote, we have included equipment restoration funding in the R&D and testing accounts. This item accounts for the increase in this year's



request. In compliance with last year's authorization, the Secretary of Energy conducted a review of the overall condition of equipment and utility systems at the weapons laboratories, at the Nevada Test Site, and at the production plants. This study, as well as independent assessments, indicated a major equipment and utility systems replacement problem throughout the weapons complex. In January 1979, we informed the Committee of this activity in a special report.

Authorization and appropriation of \$28 million is included in our fiscal year 1980 capital equipment request for beginning this restoration effort at our R&D and testing sites.

The balance of the equipment request is adequate for meeting essential weapons program equipment needs for the budget year and fulfilling near-term mission requirements.

#### FISCAL YEAR 1980 WEAPONS BUDGET—EQUIPMENT

[Budget authority and outlays, in millions]

|                                               | Fiscal year<br>1978 | Fiscal year<br>1979 | Fiscal year<br>1980 |
|-----------------------------------------------|---------------------|---------------------|---------------------|
| Research and development.....                 | \$36                | \$38                | \$55                |
| Testing.....                                  | 16                  | 16                  | 21                  |
| Production and surveillance.....              | 18                  | 24                  | 20                  |
| Other capital equipment.....                  | 9                   | 8                   | 8                   |
| Total.....                                    | 79                  | 86                  | 104                 |
| Computers (included above) <sup>2</sup> ..... | 10                  | 6                   | 7                   |

<sup>1</sup> Includes restoration.

<sup>2</sup> Excludes leased computers.

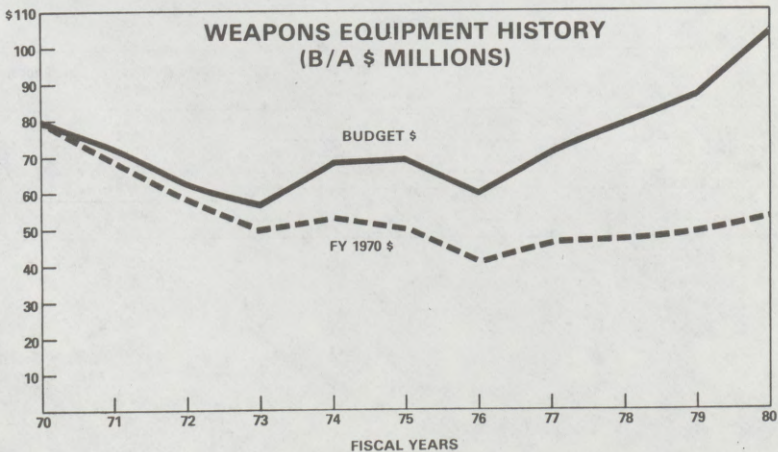
#### Fiscal year 1980 weapons budget—Weapons complex restoration initiative

[B/A \$ millions]

|                                                             |                            |
|-------------------------------------------------------------|----------------------------|
| Research and development capital equipment restoration..... | Fiscal year 1980<br>\$21.5 |
| Testing: Capital equipment restoration.....                 | 6.5                        |
| Total equipment.....                                        | \$28.0                     |

#### Computers

Included in the equipment purchase request are four new computer items. These are peripheral equipment at LASL, a mass storage system at each of Sandia's locations, and a memory unit at Kansas City. In addition, we plan to lease the 15 items shown on this chart.





## Fiscal year 1980 weapons budget—Computers

[\$ millions]

## Purchase:

|                                      |       |
|--------------------------------------|-------|
| Peripheral equipment, LASL           | \$1.4 |
| Mass storage, SLA                    | 3.5   |
| Mass storage, SLL                    | 1.1   |
| General purpose computer memory, BKC | 1.3   |
| Total                                | \$7.3 |

## Lease:

|                               |        |
|-------------------------------|--------|
| Administrative computer, LLL  | \$ .4  |
| Class VI computer, LLL        | 2.7    |
| Support processors, LLL       | .2     |
| Peripheral equipment, LLL     | .3     |
| Communication processors, LLL | .1     |
| Cray-1 computer, LASL         | 2.6    |
| Distributed processors, LASL  | .4     |
| Class VI computer, LASL       | 2.1    |
| Peripheral equipment, LASL    | .6     |
| Administrative computer, LASL | .1     |
| Engineering computer, SLA     | 1.6    |
| Scientific computer, SLL      | 2.1    |
| General purpose computer, RF  | 1.5    |
| General purpose computer, BKC | 1.7    |
| General purpose computer, MD  | .1     |
| Total                         | \$16.5 |

The trend lines for purchase of capital equipment are shown here in the same format used for the operating accounts. Equipment funding increases have generally been offset by inflation. Additional costs due to the growing complexity of required equipment and the necessity to accommodate increased requirements for indirect programmatic needs such as those involving health, safety, safeguards and security have also had an adverse impact upon our capital equipment posture.

## Construction

Our last budget category is for construction. The amount requested for authorization is \$194.5 million, while associated appropriations total \$166.5 million. The requested authorization includes \$95.4 million for seven new construction projects, \$70.1 million for 13 continuing construction projects, \$25.4 million for general plant projects, and \$3.6 million for plant engineering and design.

## FISCAL YEAR 1980 WEAPONS BUDGET—CONSTRUCTION

[In millions]

|                              | New authoriza-<br>tion | New appropria-<br>tion |
|------------------------------|------------------------|------------------------|
| New projects (7)             | \$95.4                 | \$60.5                 |
| Continuing projects          | 70.1                   | 77.0                   |
| General plant projects       | 25.4                   | 25.4                   |
| Plant engineering and design | 3.6                    | 3.6                    |
| Total                        | 194.5                  | 166.5                  |



## FISCAL YEAR 1980 WEAPONS BUDGET—WEAPONS COMPLEX RESTORATION INITIATIVE

[In millions]

|                                                                                                     | Total<br>estimated<br>cost | Authorized<br>through<br>fiscal year<br>1979 | New authori-<br>zation,<br>fiscal year<br>1980 |
|-----------------------------------------------------------------------------------------------------|----------------------------|----------------------------------------------|------------------------------------------------|
| Research and development: Capital equipment restoration .....                                       | \$21.5                     |                                              | \$21.5                                         |
| Testing: Capital equipment restoration .....                                                        | 6.5                        |                                              | 6.5                                            |
| Total equipment .....                                                                               |                            |                                              | 28.0                                           |
| Production and surveillance:                                                                        |                            |                                              |                                                |
| Utilities and equipment restoration, replacement, and upgrade,<br>various locations (80-AE-6) ..... | 69.3                       |                                              | 69.3                                           |
| Utilities system restoration, Y-12 (79-7-n) .....                                                   | 18.0                       | \$2.2                                        | 15.8                                           |
| Total construction .....                                                                            |                            | 2.2                                          | 85.1                                           |
| Total .....                                                                                         |                            | 2.2                                          | 113.1                                          |

*Restoration*

This chart identifies the capital equipment and construction projects included in our budget for refurbishment, restoration, and modernization of our weapons production facilities. These projects, coupled with the previously mentioned equipment funding, comprise the first phase of a multiyear program to correct deterioration which has been currently estimated internally to require about half a billion dollars. This restoration project, our major new start in fiscal year 1980, includes utilities and equipment at five weapons production facilities. The Y-12 project, initially authorized in fiscal year 1979, will restore the most critical utilities at the Y-12 Plant at Oak Ridge, Tennessee.

## NEW PROJECTS

This chart lists the other new projects. To summarize briefly:

The addition to the computer facility at the Sandia Laboratories in Livermore, California, is required to alleviate an overcrowded condition in the existing building and to accommodate additional automatic data processing equipment.

Production of the ground launched cruise missile warhead requires \$7.0 million in fiscal year 1980 for modification of existing facilities and equipment and for additional new equipment.

The relocation of water towers at the Mound Facility is required to protect the plutonium processing building and the powerhouse from damage in the event of collapse of existing elevated water tanks immediately adjacent to these building.

## FISCAL YEAR 1980 WEAPONS BUDGET, NEW CONSTRUCTION PROJECTS

[In millions of dollars]

|                                                                                                           | Total<br>estimated<br>cost | New<br>authori-<br>zation | New<br>appro-<br>priation |
|-----------------------------------------------------------------------------------------------------------|----------------------------|---------------------------|---------------------------|
| 80-AE-4..... Addition to computer facility, Sandia Laboratories,<br>Livermore, Calif.                     | 2.8                        | 2.8                       | 2.8                       |
| 80-AE-5..... Ground launched cruise missile (GLCM) warhead pro-<br>duction facilities, various locations. | 9.0                        | 7.0                       | 7.0                       |
| 80-AE-6..... Utilities and equipment restoration, replacement, and<br>upgrade, various locations.         | 69.3                       | 69.3                      | 39.4                      |
| 80-AE-7..... Relocate water towers, mound facility, Miamisburg,<br>Ohio.                                  | 1.5                        | 1.4                       | 1.4                       |
| 80-AE-8..... Advanced size reduction facility, Rocky Flats, Golden,<br>Colo.                              | 10.0                       | 10.0                      | 5.0                       |
| 80-AE-9..... New polymer production facility, Bendix Plant, Kansas<br>City, Mo.                           | 1.4                        | 1.4                       | 1.4                       |
| 80-AE-10..... Additional loading facilities, Savannah River Plant,<br>Aiken S.C.                          | 3.5                        | 3.5                       | 3.5                       |
| Total .....                                                                                               |                            | 95.4                      | 60.5                      |



The advanced size reduction facility at Rocky Flats will provide an improved capability in an existing facility, and in a shielded chamber, for the remote processing and decontamination of scrap metal, plastics, tools, plutonium processing equipment, and machinery.

The polymer production facility at Bendix will provide a capability to produce new resin used in the manufacture of nuclear weapons to replace a foreign sole source of questionable dependability.

The additional loading facilities at the Savannah River Plant are necessary to provide the capacity required by fiscal year 1982 and will significantly improve operating efficiency.

#### *Continuing Projects*

This chart and the following chart list projects continued from fiscal year 1979 and earlier. They show the amounts requested in fiscal year 1980.

#### FISCAL YEAR 1980 WEAPONS BUDGET, CONTINUING CONSTRUCTION PROJECTS

[In millions of dollars]

|                                                                                                        | Total<br>Esti-<br>mated<br>cost | Through fiscal year<br>1979 |                    | New<br>authori-<br>zation | New<br>appropri-<br>ation |
|--------------------------------------------------------------------------------------------------------|---------------------------------|-----------------------------|--------------------|---------------------------|---------------------------|
|                                                                                                        |                                 | Authori-<br>zation          | Appropri-<br>ation |                           |                           |
| 79-7-b----- Fire protection improvements, Los Alamos Scientific Laboratory, New Mexico.                | 4.5                             | 2.0                         | 2.0                | 2.5                       | 2.5                       |
| 79-7-c----- Proton storage ring, Los Alamos Scientific Laboratory, New Mexico.                         | 21.1                            | 5.0                         | 2.0                | 16.1                      | 14.7                      |
| 79-7-e----- Production and assembly facility, Pantex Plant, Amarillo, Tex.                             | 10.0                            | 10.0                        | 2.0                | 0                         | 8.0                       |
| 79-7-l----- Systems Research and Development Laboratory, Sandia Laboratories, Albuquerque, N. Mex.     | 13.0                            | 1.0                         | 1.0                | 12.0                      | 12.0                      |
| 79-7-n----- Utilities System Restoration, Y-12 Plant, Oak Ridge, Tenn.                                 | 18.0                            | 2.2                         | 2.2                | 15.8                      | 13.3                      |
| 79-7-o----- Universal Pilot Plant, Pantex Plant, Amarillo, Tex.                                        | 7.4                             | 3.5                         | 3.5                | 3.9                       | 3.9                       |
| 78-16-c----- High Explosive Flash Radiography Facility, Lawrence Livermore Laboratory, California      | 10.9                            | 10.9                        | 8.9                | 0                         | 2.0                       |
| 78-16-d----- Weapons safeguards, various locations                                                     | 28.0                            | 26.0                        | 26.0               | 2.0                       | 2.0                       |
| 78-16-g----- Radioactive liquid waste improvements, Los Alamos Scientific Laboratory, New Mexico.      | 12.5                            | 6.3                         | 8.5                | 6.2                       | 4.0                       |
| 78-16-l----- Laboratory Support Complex, Los Alamos Scientific Laboratory, New Mexico.                 | 16.0                            | 16.0                        | 13.0               | 0                         | 3.0                       |
| 78-17-d----- Steam plant improvements, Y-12 Plant, Oak Ridge, Tenn.                                    | 18.5                            | 18.5                        | 18.5               | 0                         | 0                         |
| 77-11-c----- 8-inch artillery fired atomic projectile (AFAP) production facilities, various locations. | 27.2                            | 0                           | 0                  | 4.6                       | 4.6                       |
| 71-9----- Fire, safety, and adequacy of operating conditions projects, various locations.              | 315.0                           | 280.0                       | 303.5              | 7.0                       | 7.0                       |
| Total-----                                                                                             |                                 |                             |                    | 70.1                      | 77.0                      |

<sup>1</sup> Includes supplemental.

#### *FY 1979 Supplemental Budget*

Of these projects, I will comment on only two—the steam plant project at Oak Ridge, for which we are not requesting fiscal year 1980 funds, and the new plutonium facility at Rocky Flats. These projects have been included in a request for additional fiscal year 1979 funding which is now before the Congress.

The funding shown for the steam plant improvements includes a supplemental authorization and appropriation request of \$8.5 million to provide particulate emission control facilities for the coal-fired boilers at the Y-12 steam plant. Recent tests have shown that the four boilers do not comply with the Clean Air Act Amendments of 1977. The Environmental Protection Agency has served formal notice of the noncompliance.

The other construction project included in the fiscal year 1979 supplemental request identifies funding required to meet increased costs for construction of the plutonium recovery facility at Rocky Flats. The major cause of the increase in



costs, as well as a one-year schedule extension was, primarily, lower than anticipated work productivity by construction craftsmen. There were also problems with engineering, procurement, and material deliveries.

The total estimated cost of the Rocky Flats subproject is \$215 million; the completion date has been extended from February 1979 to March 1980. The supplemental request is for \$23.5 million in new obligational authority. With the 25 percent allowable overrun, no additional authorization has been requested in fiscal year 1979 related to this supplemental.

Mr. Chairman, this concludes my overview of our fiscal year 1980 budget request, which had the personal review and approval of Secretary Schlesinger. In addition, I should emphasize that this request has been coordinated with the Defense Department, is responsive to that Department's needs and operational planning, and is supported by the DOD.

I appreciate this opportunity to review with the Committee the Department of Energy weapons program for fiscal year 1980. Thank you.

General BRATTON. My responsibilities as Director of Military Application have to do with the R. & D., testing, and production and surveillance of nuclear weapons.

Senator JACKSON. I want to explain to our new colleagues that the gentlemen at the witness table have, in effect, stepped into the shoes of the former Atomic Energy Commission. We have retained the dual system here. The customer for nuclear weapons, of course, is over in the Department of Defense. Dr. Wade has that responsibility.

Proceed, General Bratton.

#### FISCAL YEAR 1980 WEAPONS BUDGET, FUNDING REQUEST

[In millions of dollars]

|                                  | Authorization | Appropriation | Outlays |
|----------------------------------|---------------|---------------|---------|
| Operating:                       |               |               |         |
| Research and development.....    | 421           | 421           | 409     |
| Testing.....                     | 198           | 198           | 201     |
| Production and surveillance..... | 732           | 732           | 695     |
| Personnel resources.....         | 37            | 37            | 37      |
| Total operating.....             | 1,388         | 1,388         | 1,342   |
| Equipment.....                   | 104           | 104           | 94      |
| Construction.....                | 195           | 167           | 183     |
| Total.....                       | 1,687         | 1,659         | 1,619   |

General BRATTON. My budget is divided into six categories: Four operating categories of R. & D., testing, production, and personnel, and two capital categories, one for capital equipment and the other for construction items. I will refer first to our operating categories.

We have requested \$409 million for research and development, \$201 million for testing, \$695 million for production and surveillance, and \$37 million for personnel.

#### RESEARCH AND DEVELOPMENT

Research and development is designed this year to hold the strength of three weapons laboratories at 7,400 personnel devoted to the research and development of nuclear weapons, the same strength as in fiscal 1979.



|                        | FY 1978 | FY 1979 | FY 1980 |
|------------------------|---------|---------|---------|
| CURRENT WEAPONS        | \$149   | \$165   | \$182   |
| ADVANCED DEVELOPMENT   | 63      | 64      | 85      |
| DEVELOPMENT CAPABILITY | 119     | 115     | 116     |
| SPECIAL PROJECTS       | 24      | 28      | 26      |
| TOTAL                  | \$355   | \$372   | \$409   |

| CURRENT WEAPONS                            | PLANNED DATE<br>OF<br>FIRST DELIVERY      | POTENTIAL SYSTEMS                           |
|--------------------------------------------|-------------------------------------------|---------------------------------------------|
| W79 8-INCH ARTILLERY PROJECTILE            | [<br>D<br>E<br>L<br>E<br>T<br>E<br>D<br>] | WARHEAD FOR PERSHING II SYSTEM (ARMY)       |
| W80 AIR LAUNCHED CRUISE MISSILE WARHEAD    |                                           | WARHEAD FOR ADVANCED STRATEGIC AIR LAUNCHED |
| W81 SM-2 NAVAL AIR DEFENSE WARHEAD         |                                           | MISSILE (ASALM) (AIR FORCE)                 |
| W82 155MM ARTILLERY PROJECTILE             |                                           | WARHEAD FOR MISSILE-X SYSTEM (AIR FORCE)    |
| B83 MODERN STRATEGIC BOMB                  |                                           | WARHEAD FOR TRIDENT II SYSTEM (NAVY)        |
| W84 GROUND LAUNCHED CRUISE MISSILE WARHEAD |                                           |                                             |

The principal weapons which are under development in the laboratories now, which have been identified as engineering development weapons for our customer, the Department of Defense, are the W-79 8-inch artillery projectile, W-80 air launched cruise missile warhead; W-81 standard missile II warhead; W-82 155-millimeter artillery projectile; B-83 modern strategic bomb; and the W-84 ground launched cruise missile warhead.

There are others which have the prospect of entering engineering development either this year or next. They would be the warheads for the Pershing II missile; the MX or Trident II missile; and possibly the advanced strategic missile, known as ASALM.

A word on the modern strategic bomb. Last year the Congress directed us to design and produce a new modern strategic bomb as an outgrowth of the former B-77 bomb program. The B-83 I mentioned a moment ago is our response to the direction of Congress for the modern strategic bomb.

## FISCAL YEAR 1980 WEAPONS BUDGET, TESTING

[B/O in millions of dollars]

|                                      | Fiscal year— |      |      |
|--------------------------------------|--------------|------|------|
|                                      | 1978         | 1979 | 1980 |
| Tests.....                           | 170          | 149  | 143  |
| Laboratory participation-common..... | 67           | 62   | 58   |
| Total.....                           | 237          | 211  | 201  |

## TESTING

I would like to say a word about testing. Our test budget shows a slight decrease this year down about 5 percent below fiscal year 1979.

## FISCAL YEAR 1980 WEAPONS BUDGET, TEST SUMMARY

[U.S. test device]

[illegible]



Now, that amount of money provides for an estimated [deleted] nuclear tests in fiscal 1980. That is down [deleted] in the number of tests from fiscal 1979 and represents the lowest number of any nuclear tests since 1962 when we resumed testing following the moratorium.

The fiscal 1980 budget assumes that there will be no CTB during the fiscal 1980. We will keep the program under constant review to make sure that it makes sense at any given time and is optimized as we follow the CTB negotiations.

We have requested a supplemental of \$12.8 million.

#### FISCAL YEAR 1980 WEAPONS BUDGET PRODUCTION AND SURVEILLANCE

[B/O in millions of dollars]

|                                 | Fiscal year— |      |      |
|---------------------------------|--------------|------|------|
|                                 | 1978         | 1979 | 1980 |
| War reserve new production..... | 267          | 335  | 415  |
| Stockpile maintenance.....      | 56           | 56   | 66   |
| Stockpile reliability.....      | 64           | 77   | 80   |
| Process development.....        | 41           | 47   | 51   |
| Other costs.....                | 64           | 73   | 83   |
| Total.....                      | 492          | 588  | 695  |

#### PRODUCTION

I would like to turn quickly to production. The production amount in my budget represents the largest single category of the budget at \$695 million in outlays for fiscal 1980. That is up about 18 percent from last year's [deleted.]

[Chart deleted.]

[Deleted.] The money goes to production plants that we operate around the country that make the components, parts, and finally assemble the weapons.

All of my production figures are based on the approved stockpile paper, a paper that the President approves each year, the latest one having been approved on January 5 of this year.

[Chart deleted.]

I would like to say just a few words about the stockpile and a quick comment or two on the weapons in production.

[Chart deleted.]

[Deleted.]

#### NUCLEAR WEAPONS

Specific comments. We are now about to enter production of the new B-61 modified bomb. [Deleted.] They are the latest and most modern of our tactical bombs. On the enhanced radiation warheads, after the delay throughout fiscal 1978 when we were not permitted to spend any production money on the Lance or eight-inch, we resumed activity in October of last year.

[Deleted.] The W-78 Minuteman warhead is on schedule.

[Deleted.]

[Deleted.]

The cruise missile warhead program is on schedule [deleted].

The W-80 warhead when we testified last year, was also to be used in the submarine-launched cruise missile. There are at this time, how-



ever, no production plans for the submarine-launched version of that warhead. We do not have any money in this fiscal 1980 budget for the W-81 Standard II missile, 155 millimeter projectiles, or Harpoon because the production decisions have not been made on the warheads.

We were instructed last year in the committee report to send you a report on the use of insensitive high explosives in the stockpile and I have just recently done that. We were also instructed to prepare and forward to your committee a comprehensive report on the reliability of nuclear weapons and in particular, how the testing of nuclear weapons was related to this reliability. The report has been completed. It is a joint report from Defense and Energy. It has been signed out of Energy. It awaits Secretary Brown's signature. I would expect the committee to have it very shortly.

#### FISCAL YEAR 1980 WEAPONS BUDGET, EQUIPMENT

[B/A in millions]

|                                               | Fiscal year |      |      |
|-----------------------------------------------|-------------|------|------|
|                                               | 1978        | 1979 | 1980 |
| Research and development.....                 | \$36        | \$38 | \$55 |
| Testing.....                                  | 16          | 16   | 21   |
| Production and surveillance.....              | 18          | 24   | 20   |
| Other capital equipment.....                  | 9           | 8    | 8    |
| Total.....                                    | 79          | 86   | 104  |
| Computers (included above) <sup>2</sup> ..... | 10          | 6    | 7    |

<sup>1</sup> Includes restoration.

<sup>2</sup> Excludes leased computers.

#### PLANT AND CAPITAL EQUIPMENT

For capital equipment we are requesting an amount of \$104 million this year.

#### FISCAL YEAR 1980 WEAPONS BUDGET, CONSTRUCTION

[In millions]

|                                   | New<br>authorization | New<br>appropriation |
|-----------------------------------|----------------------|----------------------|
| New projects (7).....             | \$95.4               | \$60.5               |
| Continuing projects.....          | 70.1                 | 77.0                 |
| General plant projects.....       | 25.4                 | 25.4                 |
| Plant engineering and design..... | 3.6                  | 3.6                  |
| Total.....                        | 194.5                | 166.5                |

In our construction program our authorization request is \$194.5 million. We have seven new projects. The first money for our long-term multiyear restoration of equipment and utilities is in this year's budget.



## FISCAL YEAR 1980 WEAPONS BUDGET, WEAPONS COMPLEX RESTORATION INITIATIVE

[In millions]

|                                                                                                    | Total<br>estimated<br>cost | Authorized<br>through<br>fiscal year<br>1979 | New<br>authorization,<br>fiscal year<br>1980 |
|----------------------------------------------------------------------------------------------------|----------------------------|----------------------------------------------|----------------------------------------------|
| Research and development: Capital equipment restoration.....                                       | \$21.5                     |                                              | \$21.5                                       |
| Testing: Capital equipment restoration.....                                                        | 6.5                        |                                              | 6.5                                          |
| Total, equipment.....                                                                              |                            |                                              | 28.0                                         |
| Production and surveillance:                                                                       |                            |                                              |                                              |
| Utilities and equipment restoration, replacement, and upgrade,<br>various locations (80-AE-6)..... | 69.3                       |                                              | 69.3                                         |
| Utilities system restoration, Y-12 (79-7-n).....                                                   | 18.0                       | \$2.2                                        | 15.8                                         |
| Total, construction.....                                                                           |                            | 2.2                                          | 85.1                                         |
| Total.....                                                                                         |                            | 2.2                                          | 113.1                                        |

As noted on this chart, the total authorization requested is \$113 million. The \$85 million referenced by the Secretary and Mr. Sewell, is the construction portion. This money will be spread over the three nuclear weapons laboratories, the Nevada test site, and the production complex. We expect this to be a multiyear program because we have identified the requirement in the weapons program of over \$450 million to complete the project.

## FISCAL YEAR 1980 WEAPONS BUDGET, NEW CONSTRUCTION PROJECTS

[In millions]

|                                                                                                     | Total<br>estimated<br>cost | New<br>authorization | New<br>appropriation |
|-----------------------------------------------------------------------------------------------------|----------------------------|----------------------|----------------------|
| 80-AE-4 Addition to computer facility, Sandia Laboratories, Livermore, Calif.....                   | \$2.8                      | \$2.8                | \$2.8                |
| 80-AE-5 Ground launched cruise missile (GLCM) warhead production facilities, various locations..... | 9.0                        | 7.0                  | 7.0                  |
| 80-AE-6 Utilities and equipment restoration, replacement, and upgrade, various locations.....       | 69.3                       | 69.3                 | 39.4                 |
| 80-AE-7 Relocate water towers, mound facility, Miamisburg, Ohio.....                                | 1.5                        | 1.4                  | 1.4                  |
| 80-AE-8 Advanced size reduction facility, Rocky Flats, Golden, Colo.....                            | 10.0                       | 10.0                 | 5.0                  |
| 80-AE-9 New polymer production facility, Bendix plant, Kansas City, Mo.....                         | 1.4                        | 1.4                  | 1.4                  |
| 80-AE-10 Additional loading facilities, Savannah River Plant, Aiken S.C.....                        | 3.5                        | 3.5                  | 3.5                  |
| Total.....                                                                                          |                            | 95.4                 | 60.5                 |

Finally, I have six other new projects besides the restoration project. I will just mention them quickly. One is the addition of the computer facility at Sandia, Livermore.

Another is the production facilities for the ground-launched cruise missile, the W-84.

Others are the relocation of water towers at the Mound facility, the advanced size reduction facility at Rocky Flats, Colo., the new polymer



facility at Bendix, Kansas City, and additional tritium loading facilities at Savannah River.

I do have a supplemental budget request which includes the authorization and appropriation required, \$8.5 million, to bring the steam plant at Oak Ridge, Tenn., into compliance with the Clean Air Act of 1977. We have been cited in violation of that act.

Within the supplemental, we also are requesting \$23.5 million be appropriated to complete the Rocky Flats new plutonium processing facility.

That completes my statement.

Senator JACKSON. Thank you, General Bratton.

Gentlemen, we are nearing the time for us to have a quick lunch prior to the peace treaty signing at 1 o'clock. Maybe we ought to defer now until 3 o'clock. Dr. Gilbert has a statement to be put in the record.

Senator THURMOND. May I ask one question?

Senator JACKSON. I would like to hear Dr. Gilbert first.

Why don't we have all three statements submitted for the record. Dr. Wade is here from the Department of Defense, not to make a formal presentation, but he will be available for questions.

Go ahead, Sen. Thurmond, with your questions.

#### NUCLEAR MATERIALS

Senator THURMOND. Thank you, Mr. Chairman.

Dr. Gilbert, I have a few questions here that you can answer for the record. I just have two to ask now.

There seems to be some question as to the \$15 million in the budget that would provide for two-thirds operation of the reactors at Savannah River plant. Can you tell us whether or not there is \$15 million in the budget for that purpose?

Dr. GILBERT. That is to operate at two-thirds, sir?

Senator THURMOND. Yes.

Dr. GILBERT. My understanding from the manager of the Savannah River plant is that he is short about \$9.4 million in budget outlays to operate at two-thirds. He has stated he will not quite be able to make a two-thirds operating capacity with the present budget.

To operate at full capacity would require an additional \$14.7 million in appropriations and authorizations. Because of the shortfall in outlays he states that he needs about \$21 million in outlays to get to full capacity. I hope that sets those numbers straight.

Senator THURMOND. As to the obsolescence, how much money is in the budget? Someone said that you need at least \$10 million more?

Dr. GILBERT. Let me try to clarify that. I stated there was about \$25 million in the 1980 budget in upgrading funds. Prior to doing the study that had been requested by Mr. Price and then also required in the last year's DOE budget authorization, we had already put in some upgrading projects. One is the \$20 million upgrading for the HB processing line at Savannah River. We are asking for \$8.2 million for that project in fiscal 1980 in appropriations.

In addition, we have identified in our \$15 million request for general plant projects, \$7.2 million for Savannah River projects, some,



not all, but a goodly portion of that \$7.2 million will go toward upgrading.

In addition, we have asked for \$3.4 million in engineering design funds. Of that, \$2.4 million will go to Savannah River, and all of that is basically for upgrading projects. So roughly, out of the 1980 budget for Savannah River, I would estimate that we have around \$12 to \$13 million devoted to upgrading projects that we had planned before we did this study.

Senator THURMOND. Mr. Sewell, is any action being taken further to evaluate the reprocessing plant at Barnwell for military applications?

Mr. SEWELL. No. We have looked at that. As you know, we sent a report to you just recently that evaluates part of that and comes to the conclusion that it is not economically advisable to process material there.

Perhaps Dr. Gilbert can give you some more details on it.

Dr. GILBERT. As you know, we have looked at both the possibility of processing Savannah River fuel right there at Barnwell or at processing some 4,000 metric tons of Richland N-reactor fuel at Barnwell. In either case, it appears that we would have to do about \$200 million worth of capital investment, further capital investment in Barnwell, to be able to do that.

In addition, we would suffer an operating cost penalty in the case of Savannah River of roughly \$30 million per year.

Senator THURMOND. You don't think any further study is needed?

Dr. GILBERT. No, sir.

[Questions submitted for the record with answers supplied follow:]

#### QUESTIONS SUBMITTED BY SENATOR STROM THURMOND

Senator THURMOND. Dr. Gilbert, in your budget for fiscal year 1980 the funds for the three Savannah River Plant production reactor facilities reflects operations at two-thirds capacity or less. Since Savannah River represents the only fully operational site to sustain our nuclear weapons material capability, should we not operate at full capacity?

Dr. GILBERT. Our most recent analysis of the supply and demand for nuclear materials in the DOE Materials Management Plan (MMP) indicates that requirements projected for [deleted]. However, we are also studying ways of efficiently implementing the soon-to-be proposed production and waste management facilities upgrading program during fiscal years 1981-1985. One option is to shut down a Savannah River reactor for a predetermined time period, perform the necessary upgrading, restart that reactor, and repeat the process on the remaining two reactors. To upgrade all three reactors serially might take from three to four years. To make up the production shortfall which would accrue during the upgrading activity, we could change the mode of operation of N-reactor from fuel-grade plutonium production to weapons-grade production or, if necessary, to a coproduction mode where both tritium and plutonium would be produced at the same time. These and other potential options, such [deleted] are currently being evaluated. A DOE decision is planned as a part of the fiscal year 1981 budget formulation process.

Senator THURMOND. How much additional money is needed to operate these reactors at two-thirds capacity?

Dr. GILBERT. The fiscal year 1980 budget request for operating expenses at Savannah River is \$182.8 million in budget authority and \$172.2 million in budget outlays. This provides for production reactor operations, processing of nuclear materials, and supporting services at Savannah River. The requested budget authority is adequate to support operation of the three Savannah River production reactors at two-thirds of normal operating capacity, limited operation of the two prime Savannah River chemical processing plants, operation of the Savannah River tritium extraction facilities, and other Nuclear Materials Production (NMP)



program activities at Savannah River. However, the requested budget outlays are about \$9.4 million below the amount necessary to support two-thirds capacity operation of the Savannah River production reactor and other NMP program activities. While the impact of this shortfall in budget outlays is still being assessed, preliminary indications are that it may force Savannah River to operate the three reactors at less than two-thirds capacity or, possibly, to place one reactor in hot standby during fiscal year 1980.

Senator THURMOND. Will not our projected weapons program require a higher rate of production very shortly and if so, why chance losing skilled personnel by this slowdown?

Dr. GILBERT. Forecast weapons requirements in the 1980's can be met only with a level of nuclear material production [deleted]. However, implementing the upgrading program on these facilities at Savannah River in fiscal year 1981 or sooner may require shutting down one reactor at a time for a period of 9 to 18 months. To compensate for this loss of production capacity, we could change the operation of N-reactor to weapons-grade plutonium production.

Senator THURMOND. Dr. Gilbert, since DOE could store the plutonium it would seem that the minimum operation should be two-thirds capacity for the three reactors. You would support that if the money was provided, I assume?

Dr. GILBERT. Yes sir. If the funds were authorized and appropriated we would utilize the moneys for that purpose.

Senator THURMOND. Dr. Gilbert, moving to another point, will the reduced budget allow sufficient funding to remedy the obsolescence in the plant? If not, how much should be added to provide for this?

Dr. GILBERT. Since we did not complete our upgrading study in time for the fiscal year 1980 budget, it does not provide sufficient funding to remedy the obsolescence and other deficiencies identified at the Savannah River Plant. Our long-range plans are to initiate the upgrading program in fiscal year 1981 and to have it fully funded by fiscal year 1985. However, if additional funds for upgrading were to be authorized and appropriated in fiscal year 1980, we estimate we could productively utilize about \$45 million, of which about \$24 million could be used at Savannah River to get an earlier start on this activity.

Senator THURMOND. Why has this modernization urged by the Committee last year been delayed at Savannah River Plant?

Dr. GILBERT. The time required to appraise the condition of the production facilities during calendar year 1978 and to assess the upgrading program requirements did not permit completion of the study and inclusion of the overall program in the fiscal year 1980 budget. A sum of about \$25 million is included in fiscal year 1980 to permit early initiation of a portion of the program.

Senator THURMOND. I note that your budget assumes the heavy water plant will be shut down in fiscal year 1980. Do you have demand-supply analyses that justify closing down the only US heavy water production source?

Dr. GILBERT. The fiscal year 1980 budget request does not provide for heavy water production. However, it now appears that the heavy water production plant can be operated through fiscal year 1980 based on forecasts of sales of heavy water to domestic firms, foreign nations, and other government agencies. Our demand-supply analysis indicates that the existing stockpile of heavy water will meet requirements through fiscal year 1986. After 1986 and to about 1990, DOE requirements could be met by utilizing heavy water reserved for possible startup of the standby production reactors at Savannah River.

Senator THURMOND. Why operate the facility at less than full capacity?

Dr. GILBERT. The heavy water production plant is being operated at three-eighths capacity, about 65 MT per year, in order to allow additional time for non-DOE requirements for heavy water to firm up. Reduced capacity operation does maintain the capability to return the plant to full capacity operation, about 180 MT per year, should additional requirements emerge.

Senator THURMOND. What is the programmatic and economic impact of operating at less than capacity and how much additional funds are required for full operations?

Dr. GILBERT. We see no programmatic impact from reduced capacity operation of the heavy water plant. However, the economic impact is a less cost-effective operation since heavy water costs less to produce at full capacity operation. The fiscal year 1980 budget does not provide for heavy water production. About \$6.25 (B/A) million would be required to operate the plant at three-eighths capacity, 65 MT per year. We expect to achieve three-eighths capacity in fiscal year 1980



through the use of forecast sales revenue. An additional \$9 million (B/A) would be required to return the plant to full capacity operation, 180 MT per year.

Senator THURMOND. What is the status of your negotiation to sell heavy water to other governments and how do these sales affect your plans for continued operations of the plant?

Dr. GILBERT. In view of the forecasted sales of heavy water, it now appears that the heavy water production plant can continue to be operated through fiscal year 1980.

We have a firm order from the Japanese Power Reactor and Nuclear Fuels Development Corporation for \$2.1 million of heavy water, about 10 MT for delivery in fiscal year 1980. [Deleted.]

We recently offered to negotiate with the Italian Advanced Nuclear Reactor Corporation regarding a possible sale of 430 MT which could amount to about \$92 million. [Deleted.]

In discussions between the U.S. Department of State and Argentina last year on nuclear cooperation, the U.S. offered to supply heavy water under certain conditions. The Federal Republic of Germany and Canada are competing for the sale of heavy water moderated power reactors to Argentina and the State Department officials have discussed with both governments the possible supply of heavy water to Argentina.

We would have to reevaluate plans for future operation of the heavy water production plant should the above sales of heavy water to Italy, [deleted] or Argentina be consummated.

Senator THURMOND. What would be the cost in dollars and time to restart the heavy water plant?

Dr. GILBERT. U.S. and Canadian experience has shown that due to corrosion, heavy water production plants utilizing the hydrogen sulfide process cannot be restarted. Damage due to corrosion has been determined to be excessive for shutdowns of six months or more. The replacement cost of the heavy water production plant is estimated to be \$250 million and require five years for construction.

Senator THURMOND. Your budget indicates that the Savannah River reactors will operate at two-thirds of normal capacity and that the chemical operations plant will be at a limited operations level. In relation to your fiscal year 79 staffing levels, how many positions will be reduced at Savannah River?

Dr. GILBERT. Current experience is that the contractor operating force is decreasing by about 20 per month or about 240 per year by attrition. We froze contractor hiring at October 1, 1978. We anticipate reducing a total of 350 to 400 positions by attrition by mid fiscal year 1980. This may create operational problems due to an imbalance in skills and disciplines which could be corrected by a selective reduction-in-force and hiring of specific craftpersons. A further reduction in force might be required if energy and material costs further impact our funding as we move through fiscal year 1979 and fiscal year 1980.

Senator THURMOND. Is it your intention to continue at the lower level at Savannah River or are you going to replace the staff losses in fiscal year 1981?

Dr. GILBERT. If the facilities upgrading program is implemented in fiscal year 1981 at Savannah River, we would plan to shut a reactor down and upgrade the three reactors one-at-a-time over a three to five year period. As a result we would continue at the fiscal year 1980 reduced employment level for reactor operations but the upgrading program would require the hiring of additional people during this period to some higher but, as yet, undetermined level.

Senator THURMOND. [Deleted.]

Dr. GILBERT. [Deleted.]

[Deleted.]

Senator THURMOND. General Bratton, under the President's policy, the warheads for the neutron weapons will not have an enhanced radiation capability. [Deleted.]

General BRATTON. [Deleted.]

Senator THURMOND. How long would it take to convert weapons in Europe to the ER capability should an emergency arise?

General BRATTON. [Deleted.]

Senator THURMOND. [Deleted.]

General BRATTON. [Deleted.]

Senator THURMOND. [Deleted.]

General BRATTON. [Deleted.]



Senator JACKSON. Thank you very much.

We will stand in recess until 3 o'clock.

[Whereupon, at 12:30 p.m., the subcommittee was recessed, to reconvene at 3 p.m. of the afternoon of the same day.]

### AFTERNOON SESSION

The subcommittee met at 3:25 p.m. in room 212, Russell Senate Office Building, Senator Henry M. Jackson (chairman) presiding.

Present: Senators Jackson, Exon, Thurmond, Warner, and Cohen.

Also present: Rhett B. Dawson, minority staff director; John T. Ticer, chief clerk; Edward B. Kenney; Ronald L. Lehman; James C. Smith, professional staff members; Marie Fabrizio Dickinson, clerical assistant; Frank Gaffney, assistant to Senator Jackson; Gregg Pallas, assistant to Senator Exon; and Peter Lennon, assistant to Senator Levin.

Senator JACKSON. The subcommittee will come to order.

No one is to be in the room who does not have a Q clearance.

Dr. Gilbert, would you like to give your summary.

### STATEMENT OF CHARLES GILBERT, OFFICE OF NUCLEAR MATERIALS PRODUCTION

Dr. GILBERT. Thank you, Mr. Chairman.

I am going to discuss this afternoon the nuclear materials production program, and that program includes both the production of nuclear materials as well as the processing of naval propulsion reactor and DOE test reactor fuels. With your permission, I will summarize my statement now, and submit my full statement for the record.

Senator JACKSON. Yes; your entire statement with the charts will go into the record following your summary.

#### NUCLEAR MATERIALS PRODUCTION, FISCAL YEAR 1980 BUDGET REQUEST—TOTAL REQUEST

[In millions of dollars]

|                                       | Fiscal year 1979 budget |               | Fiscal year 1980 request |               |
|---------------------------------------|-------------------------|---------------|--------------------------|---------------|
|                                       | Authorization           | Appropriation | Authorization            | Appropriation |
| Production reactor operations .....   | 172.6                   | 174.6         | 181.2                    | 181.2         |
| Processing of nuclear materials ..... | 102.7                   | 94.5          | 117.5                    | 112.2         |
| Supporting services .....             | 124.2                   | 97.9          | 87.9                     | 92.3          |
| Fluorinel processing (Idaho) .....    | 86.2                    | 76.0          | 137.3                    | 96.0          |
| Personnel resources .....             | (1)                     | (1)           | .95                      | .95           |
| Total .....                           | 485.7                   | 443.0         | 524.9                    | 482.7         |

<sup>1</sup> Included in department program management and support budget.

Mr. GILBERT. These activities are supported by our 1980 authorization request for \$525 million, as you can see on this table, for operating expenses, capital equipment, and our construction projects. This request is about \$39 million above the 1979 authorization. I would like to give you some details of that increase.

I would like to comment first that the Office of Nuclear Materials Production was just recently placed under the Assistant Secretary for Defense Programs, in December 1978. We have program management



responsibility for the production of nuclear materials, the management of reactors and other facilities which are dedicated to this purpose.

In addition, included in this budget request is the processing of naval propulsion reactor fuels and the DOD test reactor fuels that is done at Idaho. Although they are in this budget request, the management of that portion of the program has remained with the Assistant Secretary for Energy Technology. I believe Dr. Don Kerr is here today with us and can answer questions concerning that program. As well, we also have here Mr. LaScalzo from Energy Technology.

*Nuclear materials production program—program objectives*

To provide nuclear materials, primarily: tritium, plutonium, and deuterium.

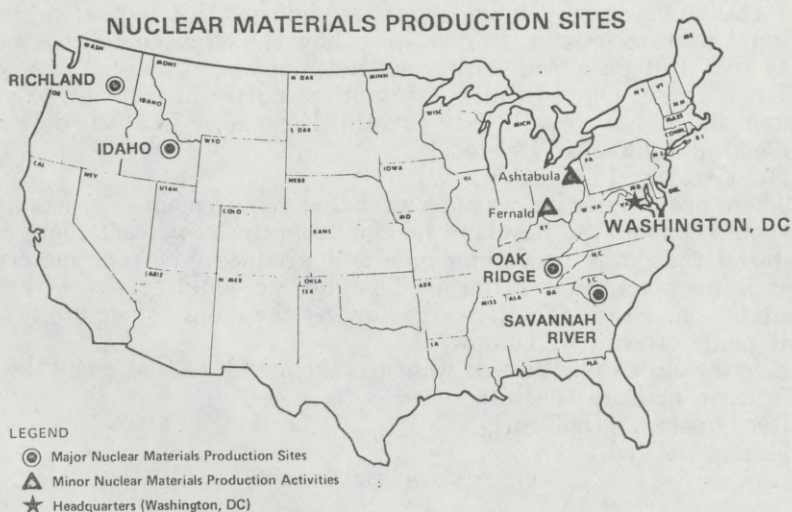
To process reactor fuels for recovery of enriched uranium and plutonium.

To deliver N-reactor by-product steam to the Washington public power supply system.

To develop improved methods for nuclear materials production.

To operate facilities in a manner that is: safe and secure, environmentally acceptable, and cost effective.

The objectives of this program are shown on the next vugraph. I will not read these, I will let you look at them, in the interest of saving some time.



To accomplish these objectives, this budget request provides for the operation of production reactor feed plants at Fernald and Ashtabula, Ohio, at Oak Ridge, Tenn., a dual purpose "N" reactor at Richland, Wash., three nuclear production reactors at Savannah River, S.C., and chemical processing plants at Oak Ridge, Richland, and Savannah River.

As I mentioned, this budget request provides for receipt, storage, and processing of nonproduction reactor fuels at the Idaho chemical processing plant at Idaho Falls, Idaho.

The tritium and plutonium production plan that we work against is based primarily on a projection of the U.S. nuclear weapons program



requirements as reflected in the nuclear weapons stockpile memorandum which is submitted to the President annually for his approval.

The President has recently approved the 1979 plan, and in so doing has directed weapons production for the years 1979, 1980, and 1981. In addition, he has approved long-lead procurement through 1983, and has noted for planning purposes our planned production through 1986.

The production plans in this period include some important strategic warheads. For example, the Minuteman III system, the Trident warhead, and the cruise missile, as well as several new theater nuclear systems which were previously described to you by General Bratton.

[Chart deleted.]

#### TRITIUM PRODUCTION

[Deleted.]

Senator JACKSON. I do not mean to interrupt, Dr. Gilbert, but it seems to me that we are going to be in a squeeze in meeting our fissionable material requirements and our tritium requirements. We are going down to two-thirds capacity, as I understand, a reduction by a third, to keep the three reactors going.

Dr. GILBERT. That is right.

Senator JACKSON. The amount of money involved there is so small, \$15 million, but the risk can be substantial.

I realize you have the budget to defend, but this request is something I want to look at. I don't know how the other committee members feel. But go ahead with your testimony.

Dr. GILBERT. Our planning assumption, partly in response to your statement, is that we will have two-thirds capacity in 1980 [deleted].

Senator JACKSON. [Deleted.]

Dr. GILBERT. [Deleted.]

There are alternative ways to meet that requirement. For example, we could convert the Richland reactor from the 12-percent fuel grade material that it is producing now and produce 6-percent material; that is weapons grade material. Thereby, we could get by with less need for one Savannah River reactor. At the moment, we are not in that mode, as you well know.

Senator JACKSON. We will want to take a look at that general area before we markup the bill.

Dr. GILBERT. [Deleted.]

[Chart deleted.]

#### PLUTONIUM PRODUCTION

Dr. GILBERT. I want to proceed now with the plutonium. The plutonium requirements for the projected nuclear weapons stockpile will be met through existing inventories and through the remaining output of the three Savannah River reactors from [deleted] as shown on that Vu-Graph. [Deleted.]

Senator JACKSON. There again, you are doing away with the reserve on this, or have we done away with most of the plutonium reserve?

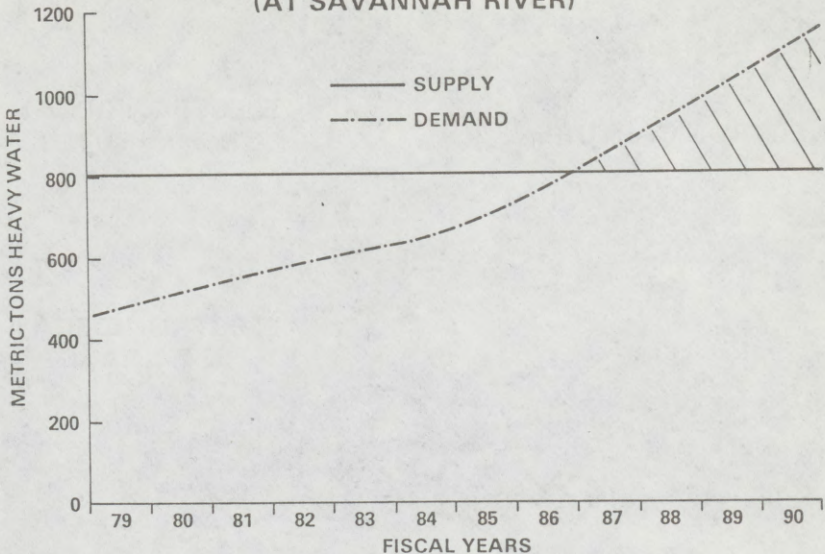
Dr. GILBERT. There is [deleted] reserve called for in the President's stockpile memorandum [deleted.]

Senator JACKSON. [Deleted.]

Dr. GILBERT. [Deleted.]



### HEAVY WATER SUPPLY/DEMAND (AT SAVANNAH RIVER)



#### HEAVY WATER

Turning now to heavy water. Deuterium in the form of heavy water is used as a moderator in the Savannah River production reactors and other DOE reactors, private reactors, and foreign reactors. I have a bottle of heavy water here on the end of the table if anyone would like to look at it later.

In addition to DOE requirements there is also a forecast for heavy water requirements for a DOD classified program and deuterium is also used in the nuclear weapons program. We currently have a reserve of 800 metric tons of heavy water at Savannah River which will meet known requirements through 1986, as you can see from that viewgraph.

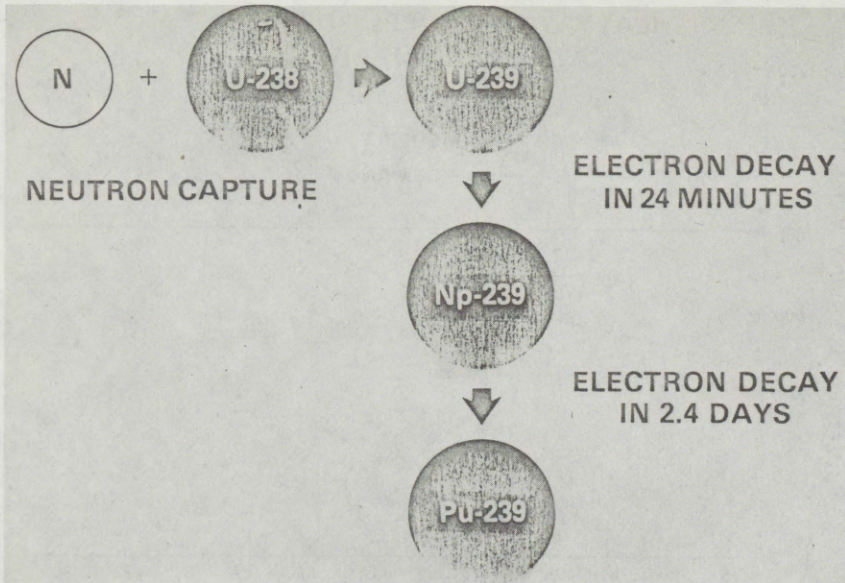
[Chart deleted.]

Dr. GILBERT. The 1980 budget contemplated shutdown of the heavy water plant in 1980. However, as was discussed this morning, if it is shut down for a period as long as 6 months, it will destroy itself through corrosive action and cannot be restarted. However, the Department of Defense has committed to heavy water purchases for fiscal 1979 and 1980 such that, along with other sales, we will probably be able to continue operation of this plant at least through 1980.

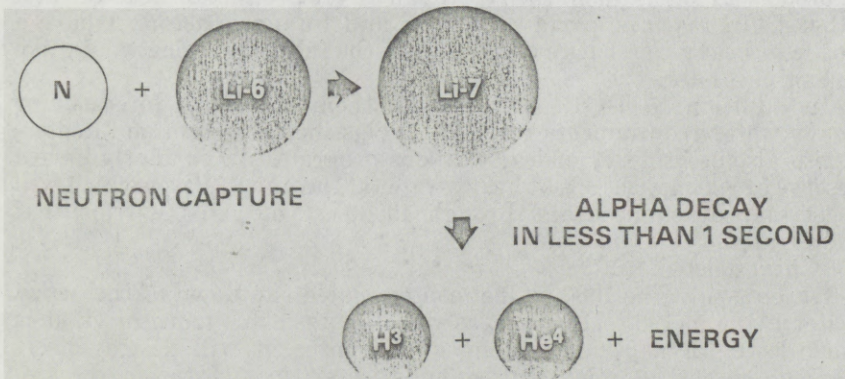
#### PRODUCTION PROCESS

Now I would like to quickly describe to you how our production process works for producing these materials.





The basic nuclear process for producing plutonium-239 is the capture of a neutron in uranium-238 which subsequently decays to plutonium-239 as you see there.



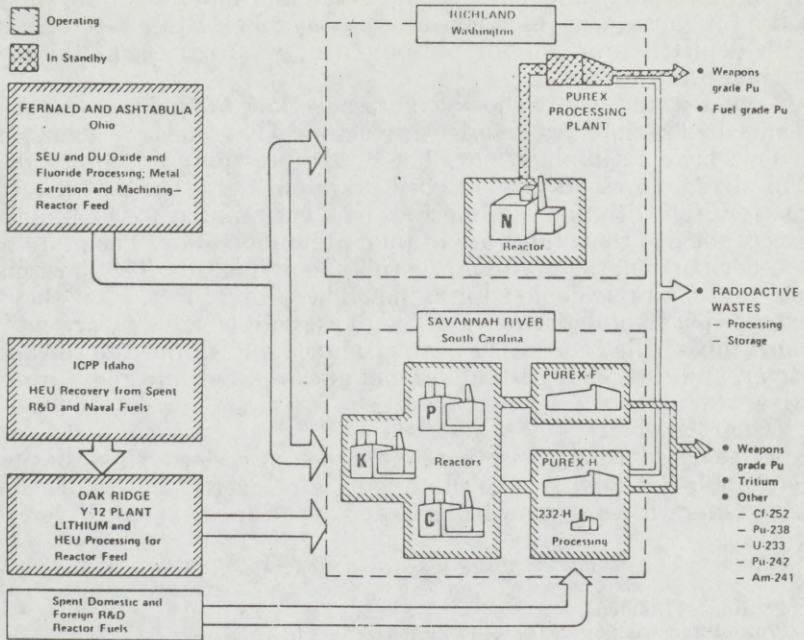
The fundamental method for producing tritium is the capture of a neutron by lithium-6 in a nuclear reactor to produce a metastable lithium-7 which decays to get tritium and helium byproduct.

The input to our reactors, the feed material that we get before we make the reactor fuel rods, is illustrated in these bottles here on the table that show you different salts of uranium, as it comes from the refineries.

[Chart deleted.]

Dr. GILBERT. The N-reactor at Richland uses slightly enriched uranium fuel containing 99 percent inert  $U^{238}$  and 1 percent fissile  $U^{235}$  which is used to drive the reactor.



DOE NUCLEAR MATERIALS PRODUCTION  
AND WASTE MANAGEMENT OPERATIONS

To drive the reactor, slightly enriched uranium is converted to metal at the Fernald plant in Ohio and cast into ingots which are shipped to Ashtabula where a very large extrusion press extrudes this material into cylindrical billets.

[Chart deleted.]

Dr. GILBERT. These billets are then shipped to the fuel fabrication facility at Richland, Wash., where they are simultaneously extruded and clad with zirconium to provide finished fuel elements for the "N" reactor.

I have here a full-size copy of a Richland N-reactor fuel rod for your examination. This would normally be this slightly enriched uranium. This copy is made out of steel.

After several months in the reactor, the irradiated fuel is removed and is stored in water-cooled basins on site at Richland until such time as the Richland Purex Plant should be restarted for processing of this fuel to recover plutonium and also the remaining uranium for re-use. No tritium is produced at Richland.

[Chart deleted.]

Dr. GILBERT. The Savannah River reactors, rather than using slightly enriched uranium fuel rods, uses highly enriched uranium to drive the reactor, and to irradiate uranium-238 targets to produce plutonium or lithium-aluminum rods to produce tritium.

Highly enriched uranium, that is, in the range of 50- to 95-percent  $U^{235}$ , is recovered from spent naval and test reactor fuels at Idaho and shipped [deleted] to the Oak Ridge Y-12 plant [deleted]. This material is shipped to Savannah River where it may be mixed either with virgin  $U^{235}$  or with other uranium recovered at Savannah River from



spent production, or domestic or foreign R. & D. reactor fuels. This enriched uranium is alloyed with aluminum and fabricated into the fuel tubes for subsequent insertion into the Savannah River reactors along with depleted uranium for plutonium or with enriched lithium for tritium production.

Now, I would like to show you cross sections of fuel and target elements used in the Savannah River reactors. These rods are about 8 feet long. I have a sample of one. The blue represents the cooling water. The silver represents the enriched uranium fuel tubes that drive the reactors. The lithium breeding rods look very similar to the fuel tubes except some of these tubes are lithium-aluminum alloy. The plutonium breeder portion, the uranium 238 tubes look like this. The dark material in this case is depleted uranium. These long tubes, after they are extruded at Ashtabula, are returned to Fernald where they are cut into short tubes called cores. They are machined and shipped to Savannah River, and then clad with aluminum and inserted into the Savannah River reactors.

[Chart deleted.]

After irradiation, these cores are then processed right onsite at Savannah River where the plutonium is recovered and the chemical processing wastes are now being stored onsite at Savannah River.

#### *Nuclear Materials Production in FY 1980*

Tritium—[Deleted].

Plutonium (weapon grade)—[Deleted].

Plutonium (fuel grade)—600 kilograms.

Heavy water (deuterium)—65 metric tons.

Various special isotopes—For example: Am<sup>241</sup>, Pu<sup>238</sup>, Pu<sup>242</sup>, Cf<sup>252</sup>.

In 1980 we will [deleted] of tritium, [deleted] weapon grade plutonium, 600 kilograms of fuel grade plutonium, 65 metric tons of heavy water, and smaller quantities of other special isotopes.

#### BUDGET REQUEST

Now I would like to describe a little bit of detail in our budget request.

#### NUCLEAR MATERIALS PRODUCTION, FISCAL YEAR 1980 BUDGET REQUEST—OPERATING EXPENSES

[Dollar amounts in millions]

|                                      | Fiscal year 1979 budget |               | Fiscal year 1980 request, authorization and appropriation | Percent change (authorization) |
|--------------------------------------|-------------------------|---------------|-----------------------------------------------------------|--------------------------------|
|                                      | Authorization           | Appropriation |                                                           |                                |
| Production reactor operations.....   | \$164.2                 | \$164.2       | \$170.8                                                   | +3.9                           |
| Processing of nuclear materials..... | 76.8                    | 75.0          | 77.2                                                      | +1.1                           |
| Supporting services.....             | 80.6                    | 62.4          | 55.7                                                      | -30.9                          |
| Fluorinel processing (Idaho).....    | 20.7                    | 19.7          | 21.4                                                      | +3.2                           |
| Personnel resources.....             | (1)                     | (1)           | 0.95                                                      | -----                          |
| Subtotal.....                        | 343.3                   | 321.3         | 326.0                                                     | -5.0                           |

<sup>1</sup> Included in department program management and support budget.

The nuclear materials production budget is broken down into five categories: production reactor operations, the processing of nuclear materials, supporting services, the fluorinel processing of nonproduction fuel at Idaho, and personnel resources.



About \$950,000 in authorization in operating funds is requested for the salaries, benefits, and travel expenses of those headquarters Federal employees associated with the technical direction and management of this program.

The 1980 authorization request for operating expenses is \$326 million, which is \$16.3 million, or 5 percent, below the 1979 authorization. This budget decrease clearly does not meet projected inflation. However, nuclear materials requirements will be met by operating the three Savannah River reactors at the equivalent of two-thirds of normal operating capacity as we have already discussed, by operating the two prime Savannah River chemical processing plants in a limited manner, by reducing the Richland Purex processing plant to a lower level of standby condition, by reducing process development activity at Richland and Savannah River, and by retiring four Richland production reactors, which are now in standby.

If you are following the written, longer presentation, I will skip now to page 9.

#### NUCLEAR MATERIALS PRODUCTION, FISCAL YEAR 1980 BUDGET REQUEST—CAPITAL EQUIPMENT

[In millions]

|                                      | Fiscal year 1979<br>budget author-<br>ization and<br>appropriation | Fiscal year 1980<br>request author-<br>ization and<br>appropriation |
|--------------------------------------|--------------------------------------------------------------------|---------------------------------------------------------------------|
| Production reactor operations.....   | \$10.4                                                             | \$10.4                                                              |
| Processing of nuclear materials..... | 6.5                                                                | 9.8                                                                 |
| Supporting services.....             | 10.8                                                               | 9.8                                                                 |
| Fluorinel processing (Idaho).....    | 3.5                                                                | 5.0                                                                 |
| Subtotal.....                        | 31.2                                                               | 35.0                                                                |

#### PLANT AND CAPITAL EQUIPMENT

The 1980 request for capital equipment is \$35 million, which is \$3.8 million above the 1979 authorization. This request will be used primarily to replace deteriorated equipment. It represents less than one-half of 1 percent of the original acquisition cost of the existing equipment and facilities in this program.

The capital equipment request reflects the need to replace equipment which has reached the end of its service life and to provide improved equipment needed to upgrade facilities. A majority of existing equipment and facilities is over 25 years old. To keep this aging equipment operating, repair and replacement is required to correct the accumulating deficiencies.

#### NUCLEAR MATERIALS PRODUCTION, FISCAL YEAR 1980 BUDGET REQUEST—CONSTRUCTION

[In millions]

|                                      | Fiscal year 1979 budget |               | Fiscal year 1980 request |               |
|--------------------------------------|-------------------------|---------------|--------------------------|---------------|
|                                      | Authorization           | Appropriation | Authorization            | Appropriation |
| Production reactor operations.....   | 0                       | 0             | 0                        | 0             |
| Processing of nuclear materials..... | \$15.1                  | \$13.0        | \$30.5                   | \$25.2        |
| Supporting services.....             | 35.2                    | 24.7          | 22.4                     | 26.8          |
| Fluorinel processing (Idaho).....    | 61.8                    | 52.8          | 110.9                    | 69.6          |
| Subtotal.....                        | 112.1                   | 90.5          | 163.8                    | 121.6         |



Our request in 1980 for construction projects is \$163.8 million in new authorization, which is an increase of \$51.7 million above the authorization provided in 1979. This includes \$102.9 million in new authorization for four projects which were previously authorized, and a request for \$60.9 million for four new projects.

NUCLEAR MATERIALS PRODUCTION, FISCAL YEAR 1980 BUDGET REQUEST—PRIOR YEAR CONSTRUCTION PROJECTS  
[In millions]

|                                                                                                                           | Total<br>estimated<br>cost | Through fiscal year 1979 |                   | Fiscal year 1980 request |                   |
|---------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------------|-------------------|--------------------------|-------------------|
|                                                                                                                           |                            | Autho-<br>rization       | Appro-<br>piation | Autho-<br>rization       | Appro-<br>piation |
| 77-13-A Fluorinel dissolution process and fuel receiving improvements, ICPP.....                                          | \$150.0                    | \$65.0                   | \$62.0            | \$84.4                   | \$53.4            |
| 78-18-E Environmental, safety, and security improvements to waste management and materials processing facilities, RL..... | 40.0                       | 28.5                     | 23.0              | 11.5                     | 17.0              |
| 79-7-H Utilities replacement and expansion, ICPP.....                                                                     | 10.5                       | 10.5                     | 5.0               | 0                        | 3.2               |
| 79-7-I Transmission and distribution systems upgrading, RL.....                                                           | 14.0                       | 7.0                      | 2.6               | 7.0                      | 11.4              |

The requested additional authorization for the previously authorized projects is shown on this vugraph.

NUCLEAR MATERIALS PRODUCTION, FISCAL YEAR 1980 BUDGET REQUEST—FISCAL YEAR 1980 CONSTRUCTION  
[In millions]

|                                                                  | Total<br>estimated cost | Fiscal year 1980 request |               |
|------------------------------------------------------------------|-------------------------|--------------------------|---------------|
|                                                                  |                         | Authorization            | Appropriation |
| 80-GPP-1 General plant projects.....                             | \$15.0                  | \$15.0                   | \$15.0        |
| 80-P.E. & D.-1 Plant engineering and design.....                 | 3.4                     | 3.4                      | 3.4           |
| 80-AE-2 Replace obsolete processing facilities, HB-line, SR..... | 20.0                    | 19.0                     | 8.2           |
| 80-AE-3 Steam generation facilities, ICPP.....                   | 24.0                    | 23.5                     | 10.0          |

Unless there are some questions, I will skip on to describe the four new projects.

The first of the four new projects is for general plant projects. We are asking for \$15 million in new authorization. This project supports general program needs and includes some funds to initiate facility upgrading. Of this, \$2 million goes for Idaho projects, and \$13 million for Savannah River, Richland, and Oak Ridge projects.

The second project is plant engineering and design with a request for \$3.4 million in new authorization; the majority of that will be used for upgrading and support projects in future years. Of that, \$1 million, is for Idaho and \$2.4 million for Savannah River, Richland, and Oak Ridge.

The third project is to replace obsolete processing facilities at Savannah River with a request for \$19 million in new authorization. This is what I was referring to this morning when I answered Senator Thurmond's question about upgrading. This is basically an upgrading project that we included in the 1980 budget prior to completion of



the upgrading study. This project will initiate a phased upgrading of the existing processing line at Savannah River and provides in this case a replacement facility for recovering plutonium 238 and U-235 from scrap material.

The existing facility is marginal in meeting the current criteria for containment of radioactive material and minimizing radiation exposure to personnel.

The final project is the steam generation facility at Idaho with a request for \$23.5 million for new authorization. This project provides for a coal-fired steam generator which will replace in part existing oil-fired equipment. This project would save about 65,000 barrels of oil annually.

I might comment that the Richland "N" reactor producing 4½ billion kilowatt-hours of electricity annually saves about 7 million barrels of oil for the United States annually.

I did want to comment on the upgrading program which Senator Thurmond asked about this morning. We have completed the review of the facilities—

Senator JACKSON. You are near the end of your statement?

Dr. GILBERT. Very near finishing; yes, sir.

Senator JACKSON. Why don't you summarize it. I only have a few questions.

Dr. GILBERT. We have completed the upgrading study. It is now being reviewed by the DOE Controller. We hope shortly to provide you with the result of that study. Along with the results of the study we will include a recommended plan beginning in fiscal 1981 for upgrading the facilities in the nuclear material production program.

Senator JACKSON. What would it cost to upgrade the Hanford facility so that you would have weapons grade plutonium produced, and tritium?

Dr. GILBERT. What we could do with the Hanford N-reactor is shift from 12 percent plutonium to plutonium that contains only 6 percent plutonium 240, which would then be usable in our weapons. To do that we would have to process fuel through the reactor at twice the rate that we are processing now.

Maybe Dick Hahn of my staff can tell us what the approximate cost is.

Senator JACKSON. I am talking about Hanford.

Mr. SEWELL. It is Hanford you are talking about?

*Issues/concerns—N-reactor conversion from fuel-grade to weapons-grade plutonium production*

Pro: Provides 750 KG per year weapons-grade plutonium; permits early shift to hot standby of one SR reactor; leads to potential long-term (through 1990) savings of several hundred million dollars.

Con: Requires purex startup by 1983 or additional spent fuel storage; requires about \$100 million in 1981-1983 to convert N-reactor and to restart purex; loss of 600 KG per year fuel-grade plutonium reduces flexibility to meet changing DOE reactor R&D requirements.



Dr. GILBERT. It would require about \$100 million total cost, fiscal year 1981 to fiscal year 1983, to convert the "N" reactor as indicated on this chart. That includes the conversion of Purex to process the fuel. The reactor operating costs just to produce the weapons grade plutonium are how much—Dick?

Mr. HAHN. \$24 million, I believe.

Mr. GILBERT. Per year?

*Estimated incremental cost for N-reactor conversion from fuel-grade to weapons-grade plutonium production*

Three-year sequence (actual reactor conversion requires one year).

First year—Buildup year: Long-lead procurement of zirconium and special process spares; buildup or slightly enriched uranium pipeline.

Estimated cost:

|                     | <i>Million</i> |
|---------------------|----------------|
| OR operating-----   | \$1.0          |
| RL inventories----- | 2.9            |
| Total -----         | 3.9            |

Second year—Transition year: Procure and install additional fabrication and reactor equipment (one time expenditure); procure zirconium and special process spares; buildup OR slightly enriched uranium pipeline; buildup RL finished fuel inventories; hire and train additional fabrication and reactor operating personnel.

Estimated cost:

|                     | <i>Million</i> |
|---------------------|----------------|
| OR operating-----   | \$2.0          |
| RL operating-----   | 10.2           |
| RL inventories----- | 6.4            |
| RL equipment-----   | 1.7            |
| Total -----         | 20.3           |

Third year—steady-state year: Procure zirconium and special process spares; operate OR feed plants to support N-reactor production of WG Pu; operate N-reactor to produce WG Pu.

Estimated cost:

|                   | <i>Million</i> |
|-------------------|----------------|
| OR operating----- | \$3.0          |
| RL operating----- | 13.9           |
| Total -----       | 16.9           |

Mr. HAHN. Yes. About \$24 million the first year because of leadtime for material followed by steady state operation of around \$17 or \$18 million per year. This chart indicates our estimated incremental cost for conversion of the reactor.

Senator JACKSON. Suppose you supply for the record a complete statement on the Hanford upgrading—what the cost would be the first year and so on.

Dr. GILBERT. We will do that.

[The information follows:]

The following table summarizes the estimated costs associated with the change in N-reactor operations from producing fuel grade (12% Pu-240) plutonium to producing weapons grade (6% Pu-240) plutonium, and associated with the Richland PUREX Plant startup. These estimated costs are incremental to the ongoing program funding.



[Millions of dollars]

|                            | Fiscal year— |                   |                  |                  |
|----------------------------|--------------|-------------------|------------------|------------------|
|                            | 1981         | 1982              | 1983             | 1984             |
| Operating:                 |              |                   |                  |                  |
| N-reactor conversion ..... | 3.9          | <sup>1</sup> 13.5 | 0                | 0                |
| N-reactor operating .....  | 0            | 5.1               | 16.9             | 16.9             |
| Purex startup .....        | 12.5         | 11.3              | <sup>2</sup> 5.9 | 0                |
| Purex operating .....      | 0            | 0                 | 12.3             | 22.0             |
| B-plant operating .....    | 0            | 0                 | <sup>3</sup> 9.3 | <sup>3</sup> 9.8 |
| Subtotal .....             | 16.4         | 29.9              | 44.4             | 48.7             |
| Capital equipment:         |              |                   |                  |                  |
| Purex .....                | 3.5          | 3.9               | 2.5              | 2.2              |
| N-reactor .....            | 0            | 1.4               | 0                | 0                |
| Subtotal .....             | 3.5          | 5.3               | 2.5              | 2.2              |
| Construction:              |              |                   |                  |                  |
| Fuel storage .....         | 5.0          | 0                 | 0                | 0                |
| Purex .....                | 14.7         | 5.8               | 2.0              | 2.0              |
| Subtotal .....             | 19.7         | 5.8               | 2.0              | 2.0              |
| Total .....                | 39.6         | 41.0              | 48.9             | 52.9             |

<sup>1</sup> N-reactor conversion to 6 percent Pu-<sup>240</sup> plutonium production completed in fiscal year 1982.<sup>2</sup> Purex startup completed in fiscal year 1983.<sup>3</sup> Funded by Defense Waste Management, ET.

Senator JACKSON. Proceed, Dr. Gilbert.  
Dr. GILBERT. I have one more vugraph.

*Major elements of fiscal year 1980 budget*

Savannah River reactors—Operate at  $\frac{2}{3}$  of normal operating capacity [deleted].

N-reactor—Continues to produce 600 kg of fuel-grade plutonium and byproduct steam.

Savannah River chemical processing plants—Continue limited operations.

Purex processing plant—Placed in reduced standby condition.

Idaho chemical processing plant—Continues to operate.

New fluorinel facility—Continued construction.

Richland standby reactors (B, C, KE, KW)—Retired.

Facilities upgrade—Initial steps taken.

This is basically a summary of the major elements of this budget for the nuclear material production.

In summary, we will be able to produce [deleted] tritium, [deleted] weapon grade plutonium equal to [deleted] plutonium equivalent. "N" reactor will continue in its present mode of operation to produce 600 kilograms of fuel grade plutonium 240 and byproduct steam sufficient to generate  $4\frac{1}{2}$  billion kilowatts of electricity per year.

Savannah River chemical processing plants will continue operations but in a limited manner. The Purex processing plant at Richland will be placed in a reduced standby status. The Idaho chemical processing plant will continue to operate as before. The fluorinel construction project at Idaho will be continued.

Four Richland standby reactors will be retired and initial steps, as I had discussed with Senator Thurmond this morning, will be taken to upgrade the materials production facility.

Mr. Chairman, this concludes my summary presentation. I am now prepared to answer further questions.



[Dr. Gilbert's prepared statement follows:]

PREPARED STATEMENT OF F. CHARLES GILBERT, ACTING DIRECTOR, OFFICE OF  
NUCLEAR MATERIALS PRODUCTION, U.S. DEPARTMENT OF ENERGY

NUCLEAR MATERIALS PRODUCTION PROGRAM

Mr. Chairman and Members of the Committee: It is a pleasure to appear before your Committee to discuss the Department of Energy (DOE) Nuclear Materials Production Program which includes both Nuclear Materials Production and processing of Naval propulsion reactor fuels and DOE test reactor fuels.

NUCLEAR MATERIALS PRODUCTION, FISCAL YEAR 1980 BUDGET REQUEST

[In millions of dollars]

|                                      | Fiscal year 1979 budget |               | Fiscal year 1980 request |               |
|--------------------------------------|-------------------------|---------------|--------------------------|---------------|
|                                      | Authorization           | Appropriation | Authorization            | Appropriation |
| Production reactor operations.....   | 172.6                   | 174.6         | 181.2                    | 181.2         |
| Processing of nuclear materials..... | 102.7                   | 94.5          | 117.5                    | 112.2         |
| Supporting services.....             | 124.2                   | 97.9          | 87.9                     | 92.3          |
| Fluorinel processing (Idaho).....    | 86.2                    | 76.0          | 137.3                    | 96.0          |
| Personnel resources.....             | (1)                     | (1)           | 0.95                     | 0.95          |
| Total.....                           | 485.7                   | 443.0         | 524.9                    | 482.7         |

<sup>1</sup> Included in department program management and support budget.

These activities are supported by our fiscal year 1980 request for \$524.9 million in authorization for Nuclear Materials Production Program operating expenses, capital equipment and construction projects. The fiscal year 1980 request provides for a \$39.2 million increase in authorization. I will discuss the details of this budget increase later in this testimony. The Office of Nuclear Materials Production, which recently has been placed under the Assistant Secretary for Defense Programs, has program management responsibility for production of nuclear materials, primarily materials produced in nuclear reactors dedicated to nuclear materials production.

Although included in this budget request, the management responsibility for the processing of Naval propulsion reactor fuels and DOE test reactor fuels at the Idaho Chemical Processing Plant has remained with the Assistant Secretary for Energy Technology. Dr. Neal Goldenberg, Acting Director of the Advanced Nuclear Systems and Projects Division of Energy Technology, is here to answer any questions you may have concerning this latter program.

*Nuclear materials production program—program objectives*

To provide nuclear materials, primarily: tritium, plutonium, and deuterium.

To process reactor fuels for recovery of enriched uranium and plutonium.

To deliver N-reactor by-product steam to the Washington Public Power Supply System.

To develop improved methods for nuclear materials production.

To operate facilities in a manner that is: safe and secure, environmentally acceptable, and cost effective.

The objectives of the Nuclear Materials Production Program are:

To provide nuclear materials, primarily tritium, plutonium, and deuterium, for national defense requirements, DOE reactor systems research and development programs, other Federal programs and industry;

To process production reactor fuels and nonproduction reactor fuels such as fuels from Navy propulsion reactors, and research and test reactors, for recovery of enriched uranium and plutonium, as appropriate;

To deliver sufficient N-reactor by-product steam to the Washington Public Power Supply System to generate 4.5 billion kilowatt-hours of electricity for the DOE Bonneville Power Administration power grid;

To develop improved and advanced methods for nuclear materials production;



To operate and maintain the reactors, processing plants, and other facilities, consistent with production requirements, in a safe, secure, environmentally-acceptable, and cost-effective manner.

To accomplish these objectives, the Nuclear Materials Production program provides for operation of: production reactor feed plants at Fernald and Ashtabula, Ohio and Oak Ridge, Tennessee; the dual-purpose N-reactor at Richland, Washington; three nuclear materials production reactors at Savannah River, South Carolina; chemical processing plants at Oak Ridge, Richland and Savannah River; and supporting facilities at the production sites. This program also maintains production facilities in standby.

The program included in this budget request also provides for receipt, storage and processing of non-production reactor fuels including fuels from Navy propulsion reactors and research and test reactors at the Idaho Chemical Processing Plant, Idaho Falls, Idaho, for recovery and reuse of the remaining enriched uranium.

The DOE tritium and plutonium production program is based primarily upon the projection of the U.S. nuclear weapons program requirements as reflected in the nuclear weapons stockpile memorandum which is submitted to the President annually for approval. The President has recently approved the fiscal year 1979 plan and in so doing has directed weapons production for the years 1979 through 1981, authorized long-lead procurement through 1983 and has noted the planned weapons deliveries for the years 1984 through 1986. The production plans in this period include the new Minuteman III warhead, the Trident warhead, the Cruise missiles and several new theater nuclear systems, as previously described to you by General Bratton.

[Deleted.]

The plutonium requirements for the projected nuclear weapons stockpile will be met through existing inventories and through the remaining output of the three operating Savannah River reactors [deleted]. There are other alternatives for operating the Savannah River reactors and the Richland N-reactor to satisfy these requirements. These alternatives are now under study and may lead to a different operating strategy in the future.

Deuterium, in the form of heavy water, is used as a moderator in the Savannah River production reactors and other DOE reactors, U.S. private reactors and foreign reactors. In addition, a potential demand for heavy water is forecast for use by the DOD. Deuterium is also used in the nuclear weapons program. We currently have a stock of 800 metric tons of heavy water at Savannah River which will meet known requirements through 1986. The fiscal year 1980 budget contemplates the shutdown of the heavy water production plant at Savannah River. If this plant is shutdown for a period as long as six months, it destroys itself through corrosive action and cannot be restarted. However, the Department of Defense has committed to heavy water purchases in 1979 and 1980 which, along with other sales, probably will permit continued operation through fiscal year 1980.

I will describe now the production activities supported by our request.

The basic nuclear process for producing plutonium-239 is the capture of a neutron by uranium-238 in a nuclear materials production reactor to give uranium of atomic weight 239 which decays within a few days, by electron emission, to plutonium-239. The fundamental method for producing tritium, hydrogen-3, is the capture of a neutron by lithium-6 in a nuclear reactor to give tritium and helium as a byproduct.

The N-reactor at Richland uses slightly-enriched uranium fuel containing 99 percent uranium-238 to produce plutonium and about 1 percent fissile uranium-235, to drive the reactor. To obtain fuel for the Richland reactor, slightly-enriched uranium is converted to metal at the Fernald, Ohio plant, and cast into ingots which are shipped to the Ashtabula, Ohio plant. The extrusion press at Ashtabula extrudes this material into cylindrical billets of carefully controlled dimensions, and these billets are shipped to the fuel fabrication facilities at Richland, Washington. The billets are then simultaneously extruded and clad with zirconium to provide finished fuel elements for the N-reactor. After several months in the reactor, the irradiated fuel is removed and is being stored temporarily in basins onsite until such time as the Richland PUREX plant is restarted for processing this fuel to recover the plutonium and also to recover the remaining uranium for reuse. No tritium is being produced at Richland at the present time.



The Savannah River reactors, rather than using slightly-enriched uranium fuel rods as at Richland, use highly-enriched uranium tubes to drive the reactors and depleted uranium target elements to produce plutonium or lithium-aluminum rods to produce tritium.

Highly-enriched uranium (50-93 percent U-235) is recovered from spent Naval and test reactor fuels at Idaho, and shipped [deleted] to the Oak Ridge Y-12 plant, [deleted]. This material is shipped to Savannah River, where it may be mixed either with virgin enriched U-235 from the DOE enrichment plants or with material recovered at Savannah River from spent domestic and foreign R&D reactor fuels. This enriched uranium is then alloyed with aluminum and fabricated into fuel tubes for subsequent insertion into the reactor along with depleted uranium for plutonium production or with enriched lithium targets for tritium production. The irradiated enriched uranium and lithium are processed at the H chemical processing plant at Savannah River for recovery of tritium and recycle of the enriched uranium. Other reactor products used for defense, research, medical and commercial applications are also produced in these reactors.

The depleted uranium (0.2-0.3 percent U-235) is received as tails from the gaseous diffusion cascades and is processed at Fernald into metallic uranium, and is cast into large cylinders. These castings are shipped to the extrusion press at Ashtabula, which processes them into tubular rods of dimensions needed for the Savannah River reactors. The long rods are returned to Fernald, where they are cut into small cores, machined and then shipped to the fabrication facilities at Savannah River. The cores are clad with aluminum and prepared for loading into the Savannah River reactors. Irradiated cores are processed in the F chemical processing plant at Savannah River for plutonium recovery for weapon use. Chemical processing wastes from the F and H chemical processing plants are now stored onsite at Savannah River.

In 1980 we will produce [deleted] tritium, [deleted] weapons-grade plutonium, 600 kilograms of fuel-grade plutonium, 65 metric tons of heavy water, and smaller quantities of other special materials.

The Nuclear Materials Production budget is broken down into five categories: production reactor operations; processing of nuclear materials; supporting services; FLUORINEL processing of nonproduction fuel and related activities at Idaho; and personnel resources. Authorization is requested for \$950,000 in operating funds for the salaries, benefits and travel expenses of those headquarters Federal employees associated with the technical direction and management of this program.

The 1980 authorization request for Nuclear Materials Production operating expenses is \$326.0 million, which is \$16.3 million or 5 percent below the 1979 authorization. Nuclear materials requirements will be met by operating the Savannah River production reactors at the equivalent of about two-thirds of normal operating capacity; by operating the two prime Savannah River chemical processing plants in a limited manner; by reducing the Richland PUREX processing plant to a lower level of standby condition; by reducing process development activities at Richland and Savannah River; and by retiring four Richland production reactors now in standby.

As a result of national policy, Federal statutory requirements, and state regulations, new criteria and constraints have been introduced into this program which substantially increase annual funding needs. The benefits produced by these activities do not contribute directly to nuclear materials production but are essential to permit continued operations. Examples of these are stricter radiation exposure standards, new occupational and public health and safety requirements, more rigorous environmental protection requirements, and additional safeguards and security requirements.

The fiscal year 1980 request for Nuclear Materials Production Program capital equipment is \$35 million in authorization, which is an increase of \$3.8 million above the 1979 authorization. The request, to be used primarily to replace deteriorated equipment, represents less than one-half of one percent of the original acquisition cost of the existing equipment and facilities in the Nuclear Materials Production Program, as expressed in fiscal year 1980 dollars. The capital equipment request reflects the need to replace equipment which has reached the end of its service life and to provide improved equipment needed to upgrade facilities. A majority of the existing equipment and facilities is over 25 years old. To keep this aging equipment operating, significant annual repair and replacement is required to correct accumulating deficiencies.

The 1980 request for Nuclear Materials Production Program construction projects is \$163.8 million in new authorizations, an increase of \$51.65 million above



the authorizations provided in fiscal year 1979. This amount includes additional authorization of \$102.9 million for four projects authorized in previous years and new authorization of \$60.9 million for four new projects.

The requested additional authorization for continuing projects includes the following:

The first project is 77-13-a, FLUORINEL Dissolution Process and Fuel Receiving Improvements at Idaho, with an additional request of \$84.4 million in new authorization. This project provides a new facility at Idaho to receive, store, and perform chemical dissolution of a variety of irradiated Naval and other fuels to recover the unused uranium. The project TEC is \$150 million and has increased from the previous estimate of \$116 million due to better material and labor estimates and to design changes to the facility.

The second project is 78-18-e, Environmental, Safety, and Security Improvements to Waste Management and Materials Processing Facilities at Richland, with an additional request of \$11.5 million in new authorization. This project provides for upgrading facilities needed to ensure safe and environmentally acceptable operating conditions in chemical processing operations. Included are criticality alarm systems, an exhaust ventilation filter for a primary plant, security and physical protection improvements, a new plutonium oxide conversion facility, and ventilation system improvements in the Plutonium Finishing Plant.

The third project is 79-7-h, Utilities Replacement and Expansion at Idaho, with no request for new authorization, but an additional request of \$3.2 million in appropriation. This project provides for the replacement of aging and deteriorated utilities at the Idaho Chemical Processing Plant, including electrical, raw and processed water, and expansion of existing utility production and distribution systems to provide services required for new facilities.

The fourth project is 79-7-i, Transmission and Distribution Systems Upgrading at Richland, with an additional request of \$7.0 million in new authorization. Project 79-7-i provides for upgrading about 25 miles of 250 kilovolt electrical transmission systems for the Hanford Plant to provide highly-reliable electrical power to the reactor, chemical processing, and waste management facilities. These electrical facilities are 33 years old and seriously deteriorated. There is an urgent need to complete this work as soon as possible.

We now turn to the four new projects:

The first project is 80-GPP-1, General Plant Projects, with a request of \$15.0 million in new authorization. This project supports program needs including some funds to initiate facility upgrading projects. \$2.0 million will be used for Idaho projects, and \$13.0 million for Savannah River, Richland and Oak Ridge projects.

The second project is 80-PED-1, Plant Engineering and Design, with a request of \$3.4 million in new authorization. These funds are to initiate design for various upgrading and support projects in future years. \$1.0 million will be used for Idaho projects and \$2.4 million for Savannah River, Richland and Oak Ridge projects.

The third project is 80-AE-2, Replace Obsolete Processing Facilities, HB-Line, at Savannah River, with a request for \$19.0 million in new authorization. This project initiates the phased upgrading of the existing HB-Line chemical processing facility in the H chemical processing plant and provides a replacement facility to recover plutonium-238 and uranium-235 from scrap material. The existing facilities only marginally meet current criteria for containment of radioactive materials and for minimizing radiation exposure to personnel, and would eventually result in an unacceptable risk to personnel and the environment and inability to meet production schedules.

The final project is 80-AE-3, Steam Generation Facilities at Idaho, with a request for \$23.5 million in new authorization. This project provides for a coal-fired steam generator facility which will replace, in part, existing oil-fired equipment to meet present and projected steam requirements for new facilities. This project would save about 65,000 barrels of oil annually.

#### UPGRADING PROGRAM

We have completed a comprehensive review of the condition of the facilities in the Nuclear Materials Production and Defense Waste Management complex. We plan to provide this report to you soon. It will provide an assessment of the extent of deterioration and obsolescence of these facilities and defines schedules and estimated incremental resources required to eliminate the identified accumulation of deficiencies. The correction of the deficiencies is expected to achieve



increased reliability and efficiency of the production complex operations, consistent with projected program needs.

The FY 1980 budget request will initiate limited upgrading efforts at several sites. These are the construction projects proposed at Savannah River to replace the obsolete HB-Line in the H chemical processing plant, and at the Idaho Chemical Processing Plant to upgrade the steam generating facilities and expand capacity necessary to support operations. Also included in the request are Plant Engineering and Design funds for future upgrading construction projects and some General Plant Project and Capital Equipment funds to initiate a reduction of accumulated deficiencies. However, since the upgrading assessment for this program was not completed until January 1979, the majority of this effort is planned to be initiated in subsequent budget requests, beginning in fiscal year 1981.

In conclusion, Mr. Chairman, I would like to summarize the major elements of the proposed fiscal year 1980 budget.

Savannah River reactors operate at two-thirds of normal operating capacity to produce [deleted] tritium, [deleted] plutonium-239 and other isotopes, equal to [deleted] of plutonium equivalent;

N-reactor will continue to operate to produce 600 kg of 12 percent plutonium-240 and by-product steam sufficient to generate 4.5 billion kwh electricity per year;

Savannah River chemical processing plants continue limited operations;  
PUREX processing plant at Richland placed in reduced standby condition;  
Idaho Chemical Processing Plant continues to operate;  
Continue FLUORINEL construction project at Idaho;  
Richland standby reactors (B, C, KE, KW) are retired;  
Initial steps taken to upgrade production facilities.

#### NUCLEAR WEAPONS STOCKPILE

Senator JACKSON. Thank you, Dr. Gilbert.

I want to ask a general question here. As I understand it, the course that we are following is one in which the total number of [deleted]. Is that right?

Dr. GILBERT. No; that is not right—

General BRATTON. [Deleted.]

Senator JACKSON. [Deleted.]

General BRATTON. The big bombs have been retired during this period, and the smaller more sophisticated RV's for the intercontinental and submarine launched missiles—

Senator JACKSON. Our earlier generation missiles; namely, the Titan I which has a high yield in terms of megatonnage, and before that at the same time we had Atlas, did we not, [deleted].

Dr. GILBERT. However, the Minuteman III warhead [deleted].

Senator JACKSON. [Deleted.]

Dr. GILBERT. [Deleted.]

Senator JACKSON. I understand.

Senator Exon?

Senator Exon. No questions.

Senator JACKSON. Gentlemen, we will go over and vote now and then come right back.

Dr. Wade, do you have any comments at this point?

Dr. WADE. No, sir.

Senator JACKSON. We will move right along as soon as we get back and hear Admiral Rickover, Dr. Deutch, and others. I will find out if Senator Cohen has any questions.

Gentlemen, if you will stand by, we will recess, while we vote.

[Brief recess.]



## DEFENSE WASTE MANAGEMENT

Senator JACKSON. The committee will resume.

We now turn to the Department of Energy budget for defense waste management and naval reactor development.

Dr. John M. Deutch, Acting Assistant Secretary for Energy Technology, is here.

Dr. Kerr, Acting Deputy Assistant Secretary for Energy Technology, and Admiral Rickover.

Dr. Deutch, I would suggest we have your entire statement placed in the record. If you could give us a summary, then we will hear the other gentlemen. They will make their statements and then we will ask questions.

Dr. Deutch, we are delighted to have you here today.

**STATEMENT OF JOHN M. DEUTCH, ACTING ASSISTANT SECRETARY FOR ENERGY TECHNOLOGY; ACCOMPANIED BY DON KERR, ACTING DEPUTY ASSISTANT SECRETARY FOR ENERGY TECHNOLOGY**

Mr. DEUTCH. Thank you very much, Mr. Chairman; it is a pleasure to appear before the committee.

Before proceeding with the waste management summary, sir, I would like to emphasize that the Office of Naval Reactor's, Admiral Rickover's program, is housed in the Office of the Assistant Secretary for Energy Technology. I would like to emphasize the importance that we place and the Department places on these programs.

We are all familiar with the admiral's accomplishments. I just want to go on record here, myself, with the great support that we give these programs and how much we enjoy working with the admiral.

Mr. Chairman, with your permission I would like to submit my entire statement for the record and discuss the defense waste management programs in summary form.

There are five subjects that I would like to draw to your attention in very brief form, sir. The first has to do with how we are organized to manage defense waste in the Department of Energy.

The second is to summarize some initiatives taken by the Department of Energy and the administration dealing with our defense wastes.

The third is a very brief overview of the fiscal year 1980 program that is under consideration today for defense waste.

The fourth concerns the Department of Energy's position on licensing of DOE facilities and activities relating to defense waste and, indeed, any part of our defense activity.

The fifth is the very controversial subject related to the waste isolation pilot project. Chairman Price refers to it as the "most confused" subject. I must say that I agree with him and I am happy to have this opportunity to present to you today the Department's views on the waste isolation pilot project.

## DEFENSE WASTE ORGANIZATION

Let me begin with the discussion of the organization and management for defense wastes in the Department of Energy. The commercial



wastes and defense wastes are managed jointly in the Office of the Assistant Secretary for Energy Technology. There are several reasons for this joint management.

While there is a difference in the origin of the wastes, whether they are from defense activities or from Department of Energy research and development activities, or from our commercial sector, the handling of the technology for dealing with these wastes is indeed quite common. A common management approach involving common technology in my judgment is essential for effective and economical treatment and handling of our waste issues. Let me give you two examples.

In the transportation of radioactive wastes, the Federal Government is responsible for the transportation of defense waste but it is not responsible for the transportation of commercial waste between different sites. The technology that we learn in our defense transportation activities is of value to our commercial enterprise. Furthermore, as is well known, commercial reprocessing has been indefinitely deferred. However, our understanding of how to deal with reprocessed military waste will be of value in subsequent years if and when commercial reprocessing is once again permitted in the Nation and we will have the technology on hand, as much as it is possible, to transfer that technology by joint management of our commercial and defense programs.

#### WASTE MANAGEMENT INITIATIVES

The second subject that I would like to touch upon is the recent Department of Energy and administration initiatives in the areas of waste management.

Mr. Chairman, I do not want to go at length to report to you here the result of the deliberations of the Interagency Review Group established by the President over a year ago whose final report was issued last week. Let me just say there was unanimous accord among all the 14 participating agencies on the importance of responsible and timely treatment and management of defense wastes. I am very pleased to report that all concerned Government agencies recognize the need to move ahead and manage our defense wastes, wherever they are located, in a timely and efficient manner.

There has been very good cooperation in this area and I expect it will continue in the succeeding years, that common concern with progress in this area is exhibited in the fiscal 1980 budget which is before you today.

In 1979 we requested \$257 million in budget authority for all aspects dealing with our defense waste management activities. This year we are requesting \$372 million, an increase, a very substantial increase, of \$115 million.

This type of program growth is going to be necessary in the succeeding years if we are to gradually, in a prudent manner, but nevertheless in a successful manner, proceed to the solidification of existing high-level liquid wastes and to construction of facilities for treatment of these wastes.

So, I am pleased with the strong waste management program that is presented to you here today. Included in this program is approxi-



mately \$14 million for the first major step in the handling of the high-level liquid wastes. The \$14 million is for the defense waste processing facility scheduled for construction and subsequent operations at Savannah River to vitrify or to solidify the waste presently there in a form which will then be suitable for geological disposal.

#### LICENSING

The next subject I would like to touch upon is the Department of Energy position regarding the licensing of DOE facilities or activities. This is a very controversial subject, Mr. Chairman. I would like to make absolutely clear what the position of our Department is, and to the best of my knowledge, what the present position of the administration is.

When I report the position of my Department, I report it in the context of unequivocal statements made by the Secretary, by the Deputy Secretary and by myself before various congressional committees. In this regard, the Secretary has just expressed himself in response to a congressionally mandated study by the Nuclear Regulatory Commission which was investigating the licensing of Department of Energy activities and facilities.

With your permission, Mr. Chairman, I would like to have Secretary Schlesinger's summary judgment to the NRC submitted for the record here, because it is a very unequivocal statement of our position with regard to extended licensing for Department of Energy activities or facilities which, of course, include as an important subset our defense facilities.

Senator JACKSON. Without objection it will be included in the record. [The information follows:]

DEPARTMENT OF ENERGY,  
Washington, D.C., March 2, 1979.

HON. JOSEPH M. HENDRIE,  
Chairman, Nuclear Regulatory Commission,  
Washington, D.C.

DEAR CHAIRMAN HENDRIE: This letter is to convey my initial reaction to the NRC draft report on "Regulation of Federal Radioactive Waste Activities" (NUREG-0527, ES) dated February 15, 1979, and revised by letter dated February 23 to Dale Myers.

The majority of existing and anticipated future DOE waste activities and facilities results from the Defense Program activities of the Department. Our paramount concern must be that no form of regulatory oversight lead to interference with DOE's national security responsibilities such as materials or weapons production. I am pleased to note that the draft NRC study supports this view.

My understanding is that the report recommends NRC licensing of new permanent disposal facilities for DOE high level waste (presently required except for R&D facilities), TRU waste, and low level waste. Subject to the concern expressed above, it seems to me that this recommendation is identical to DOE's position with one exception: DOE believes that licensing authority for new DOE low level waste facilities primarily employed for wastes generated from defense activities should be excluded from the licensing requirement.

In addition, the draft report recommends a process of "consultation and concurrence" between DOE and the NRC for a variety of DOE activities including storage and disposal of existing low level waste, existing storage of TRU waste, existing and future storage for high level waste, and decontamination and decommissioning. As you know, DOE and its predecessor agencies and NRC have been working closely in these areas for a number of years quite effectively. While



the proposed "consultation and concurrence" procedures outlined in the report are as yet insufficiently precise to reach a final determination, the proposed procedures might well lead to some of the same difficulties of potential interference with defense programs that we agree should be avoided. On the other hand, there are waste activities arising from non-defense DOE R&D programs, where a more structured consultation procedure with NRC might be useful. Thus, I believe the proposed "consultation and concurrence" procedures contained in the draft report require a great deal of further cooperative study on an activity-by-activity basis. Accordingly, at the present time I cannot support this recommendation.

We shall be pleased to work in cooperation with the Commission on this draft in the future on this important subject. More detailed comments on the draft study will be forwarded to you shortly.

Sincerely,

JAMES R. SCHLESINGER,  
*Secretary.*

Mr. DEUTCH. Thank you very much, Mr. Chairman.

Let me summarize our position as follows:

Our position is that there should be no independent regulatory oversight of Defense activities under the responsibility of the Department of Energy that have any potential for interfering with those Defense activities. It is that rule that will govern our positions and does govern our positions on all matters with regard to independent regulatory oversight.

We do not believe—I know I speak for the Secretary on this as well as for other members of the Department—that independent regulatory oversight cannot be permitted to interfere, have even the potential for interference, in our Defense activities.

Other Department of Energy activities such as research and development activities not associated with Defense programs are another matter. These are special purpose activities. We are not sure in what way reasonable regulatory participation might occur. However, in our judgment the provision of the present law as expressed by Congress calls for licensing of ultimate disposal of high-level waste.

We believe this is the correct position as expressed by congressional law, the correct position for NRC licensing oversight, namely, that high level waste disposal, not storage, not treatment, not handling, not facilities at existing sites, but NRC licensing for ultimate disposal in new facilities for high level waste as the present law requires is indeed a satisfactory situation because it does not have the potential for backing into our Department of Energy activity.

We do believe that the same rule should apply to transuranic waste, which at the time the present law was enacted, was not classified as a separate type of waste. That is that new ultimate disposal facilities for transuranic waste should also be licensed by the Nuclear Regulatory Commission.

With regard to low level wastes, we would argue that new non-Defense low-level burial sites sponsored by the Department of Energy, should such occasion arise, should be licensed. However, new Defense low-level burial sites, that is, burial sites for primarily Defense wastes, should not be licensed by the NRC.

That, in summary form, is the position of our Department, Mr. Chairman. I am pleased to inform you that I believe that the overwhelming administration view takes the same position. We do not wish



to introduce licensing where it will not add to any substantive improvement in public health and safety and we do not wish to introduce independent regulatory oversight that has the possibility of interfering with our national security activities.

#### WASTE ISOLATION PILOT PLANT

The final point, Mr. Chairman, that I would like to mention concerns the waste isolation pilot project. The waste isolation pilot project is a candidate project authorized by Congress, presently scheduled for location near Carlsbad, N. Mex. We have proposed a mission for the waste isolation pilot project for a number of reasons. The proposed mission for the waste isolation project is threefold.

One, ultimate disposal of transuranic waste of military origin presently stored in Idaho. The second is a small part of this proposed waste isolation pilot project for research and development on high-level waste disposal.

The third is a small area of the waste isolation pilot project, up to 20 acres in extent, for disposal of up to 1,000 commercial spent fuel assemblies.

We would propose that the facility be licensed. The licensing of this facility would be true whether the commercial spent fuel were included or not because it would be a new ultimate disposal repository for transuranic wastes.

There has been a great deal of concern expressed by certain Members of Congress about two aspects of this proposal. The first is the proposal for licensing the facility. The second is in some degree a separate concern about the wisdom of an early demonstration of disposal of up to 1,000 commercial spent fuel assemblies.

I would like to urge you, Mr. Chairman and members of the committee, to view this project and our proposed mission for it with some favor.

Our effort has two purposes. The first is that we believe that the licensing of such a facility does follow the standard that we established earlier, that it is only for ultimate disposal in the new facility.

The second is that the proposed waste isolation pilot project is going to be an expensive facility and the opportunity exists to take care of the TRU wastes and to demonstrate for our Nation, which we believe is important for the future of commercial power, the possibility in a responsible manner to dispose of a limited number—I want to emphasize limited number—of spent fuel assemblies, no more than 1,000.

I might add that in 1979—fiscal 1979—the Congress placed a prohibition on the Department spending any funds for licensing or for activities related to the disposal of up to 1,000 commercial spent fuel assemblies and we are scrupulously living up to that prohibition placed in the fiscal 1979 authorization and appropriation acts.

I believe that I have written to the committee informing them of our activities here to indicate exactly what we are doing to abide by that prohibition.

The waste isolation pilot project is an important project for the future of our waste management activity. It provides an opportunity not only for the responsible disposal of transuranic waste but also pro-



vides the opportunity to close the back end of the fuel cycle and make real progress and demonstrate to the American people our capability both institutionally and technically to dispose of our radioactive waste.

Thank you, Mr. Chairman.

[Mr. Deutch's prepared statement follows:]

PREPARED STATEMENT OF JOHN M. DEUTCH, ACTING ASSISTANT SECRETARY FOR  
ENERGY TECHNOLOGY

DEFENSE WASTE MANAGEMENT

Mr. Chairman, it is a pleasure to appear before you today to describe the fiscal year 1980 Defense Nuclear Waste Management Program of the Department and to present for your consideration the approach we are taking to defense wastes in DOE. I am accompanied today by Donald Kerr, Acting Deputy Assistant Secretary for Programs and Operations, and by Sheldon Meyers, Program Director for Nuclear Waste Management, both in the Office of Energy Technology. Don Kerr is, of course, well known to the Committee from his previous assignment in Defense Programs. Both he and Mr. Meyers will be available to answer questions following my presentations.

There are five broad subjects I would like to review for you today. These are:

The Department's organization and management approach to nuclear waste programs; in particular, the relationship of the civilian and military waste efforts.

Recent Department and Administration initiatives on nuclear waste programs.

A brief overview of our fiscal year 1980 program for Defense Nuclear Waste Management.

The Department's position regarding licensing of DOE facilities and activities.

The Department's proposed mission for the Waste Isolation Pilot Plant (WIPP), presently authorized as a defense facility for the disposal of Transuranic (TRU) waste and for R&D on military high level waste.

I am very aware of the Committee's interest in all these subjects and I am most pleased to have the opportunity to present our views on these issues. During the past year there may have been occasions when DOE did not communicate either sufficiently clearly or sufficiently early, on the direction and nature of our thinking.

We further recognize that our policies and programs cannot be successful without widespread Congressional support both from this Committee and other concerned Committees in the Senate and House.

DOE'S ORGANIZATION AND MANAGEMENT APPROACH TO NUCLEAR WASTE PROGRAMS

In May 1978, Secretary Schlesinger approved a reorganization within the DOE which established an Office of Nuclear Waste Management reporting directly to the Assistant Secretary for Energy Technology. Within that office, there are three programmatic divisions and a project staff for the Waste Isolation Pilot Plant. The Division of Fuel Storage and Transfer deals with spent fuel storage and all waste-related transportation requirements. The Division of Waste Isolation is responsible for all efforts related to deep geologic repository disposal of defense and commercial waste. The Division of Waste Products is responsible for technology development and operations for both commercial and defense wastes, and also for handling and treatment requirements leading to disposal of wastes.

The long-term waste management technology programs for each type of radioactive waste have been assigned to lead DOE field offices supported by lead contractors as tabulated. These lead organizations provide overall planning direction and assessment of technology development. Each lead field office/contractor is also responsible for the corresponding technology under the commercial program. This integration provides complementary development of commercial and defense waste technologies, avoids duplication, and encourages technology transfer. This management approach will also greatly enhance manpower efforts devoted to more detailed planning in the near-term and to implementation of these programs. We are pleased to report, Mr. Chairman, that this approach is working very well.



*Waste technology  
program*

High-Level  
Low-Level  
Transuranic  
Airborne  
Decommissioning  
Transportation  
Geologic Disposal  
Spent Fuel

*Lead field office*

Savannah River  
Idaho  
Albuquerque  
Idaho  
Richland  
Albuquerque  
Richland  
Savannah River

*Lead contractor*

du Pont  
EG&G  
Rockwell International  
Allied Chemical  
United Nuclear  
Sandia  
Battelle/Columbus  
du Pont

## RECENT INITIATIVES ON NUCLEAR WASTE MANAGEMENT

The disposal of radioactive waste is receiving the highest level of attention in the Administration and the DOE. The most recent significant Administrative initiative was the establishment of the Interagency Review Group (IRG).

As you know, the IRG (comprised of representatives of 14 Federal agencies and offices) was given the mandate to undertake a comprehensive review of nuclear waste management in its broadest sense, and to make policy recommendations to the President, as another step towards the ultimate establishment of a National waste management policy.

Over 15,000 copies of the Report were distributed during the ensuing public comment period, and about 3,300 replies were received from private citizens, State and Congressional sources, public interest groups, academicians, and the industry. Taken together with the very considerable response in the course of three large public meetings held during the preparation of the Report, the IRG had the benefit of a wide range of views on the issues it had identified. I am sure that the Committee members and staff are already familiar with many of the findings and policy recommendations of the IRG, but I would be most pleased to discuss the substance of any of these if you wish. At this time, however, I wish to outline the actions that are being taken, and which must yet be taken to implement the work of the IRG. Following its review of public comment on the draft Report, the IRG reconvened to prepare a Decision Paper on Nuclear Waste Management, in fulfillment of its directive from the President. It is anticipated that this paper will be forwarded for the consideration of the President within the next two weeks. An updated IRG report, which contains a summary of the extensive public comments, was issued in mid-March. The Committee received copies at that time.

## BRIEF OVERVIEW OF FISCAL YEAR 1980 PROGRAM

The defense wastes—high-level, low-level and transuranic-contaminated (TRU) wastes—which currently exist and continue to be generated, will be managed in a manner which provides for both safe interim storage and, ultimately, final disposal. To this end, the Defense Waste Program consists of both interim and long-term operations. Activities in these areas include:

## INTERIM OPERATIONS

In fiscal year 1979 we expect to:

Complete construction of 6 high-level storage tanks at Richland, 4 at Savannah River, and a new waste evaporator at that latter site.

Continue the efforts to deactivate single-shell tanks at Richland.

Convert 200,000 gallons of liquid high-level waste to granular calcine at Idaho.

Continue to dispose of low-level solid waste by shallow land burial. Upgrading efforts include implementation of improved technology, establishment of comprehensive criteria, and stabilization of sites no longer needed. We will continue to reduce the quantity of these wastes.

In this area, our planned program for fiscal year 1980 will allow us to:

Maintain safety of 75 million gallons of high-level waste in interim storage and storage of 2.6 million cubic feet of TRU waste.

Begin operation to transfer liquid and salt from the old tanks to new tanks at Savannah River.

Continue the program to deactivate single-shell tanks at Richland. All 149 tanks will be deactivated by early 1981.

Continue to convert high-level liquid waste to granular calcine at Idaho.



Complete construction of 17 double shell tanks (10 at Savannah River, 7 at Richland); another new waste evaporator at Savannah River; a new shale fracture facility at Oak Ridge National Laboratory; and complete construction of the New Waste Calciner Facility at Idaho and begin cold testing.

#### LONG-TERM WASTE MANAGEMENT PROGRAMS

As to our long-term program, I will highlight what we expect to accomplish in fiscal year 1979 and what we plan to do in fiscal year 1980. In fiscal year 1979 we expect to:

- Pursue technology for alternatives for disposition at the three major sites (Savannah River, Richland, and Idaho).

- Complete pre-conceptual design for Idaho TRU Processing Facility (Slagging Pyrolysis Incinerator) and initiate conceptual design, and initiate title I design of Savannah River Defense Waste Processing Facility (PE&D).

- Issue final programmatic Environmental Impact Statement (EIS) for managing high-level waste at Savannah River and complete draft EIS for Idaho and Richland.

- Initiate field demonstration of low-level waste disposal facility technology.

In addition to providing technology input into the operating program for disposal of solid low-level waste by shallow land burial, alternative disposal methods will be developed to provide for potential volume increases from facility decommissioning and to provide for future disposal of any wastes not suitable for shallow land burial.

Our long-term program plan for fiscal year 1980 includes the following activities.

- Title I design will continue for the defense waste processing facility at Savannah River to provide for immobilization and packaging of these wastes in a form suitable for repository disposal. A companion effort will emphasize the development and evaluation of alternative high-level waste forms in addition to glass. Alternate technology and analysis, risk assessment and National Environmental Policy Act (NEPA) documentation will continue as major efforts.

TRU waste technology development is underway to demonstrate treatment of these wastes in a form suitable for safe storage, transportation and final disposal in a repository. Incineration demonstrations will be nearing completion. Design efforts will be well under way for the first major TRU waste processing facility in Idaho. Risk assessments and alternatives analyses for NEPA documentation are also a major fiscal year 1980 effort.

The WIPP facility for repository disposal of defense TRU waste is a major fiscal year 1980 effort—it will be discussed in more detail later as a matter of special interest to the Committee.

In fiscal year 1980, defense waste transportation will focus on continuing development of equipment and systems to support the WIPP facility and continuing base technology for transporting all DOE radioactive wastes. The need is for cost-effective transportation equipment, package integrity, system utility and reliability and vulnerability to malevolent attacks.

#### DOE'S POSITION ON EXTENSION OF NRC LICENSING AUTHORITY

During the past year, there have been proposals, both from Members of Congress and parts of the Administration, to extend the present licensing authority of NRC, as contained in The Energy Reorganization Act of 1974, to additional DOE facilities and activities. This has been a matter of concern to both DOE and to this Committee since NRC licensing of defense related activities has the potential to interrupt these activities and to reveal National security information. As you may know, the NRC is currently undertaking a Congressionally mandated study to examine the implications of extended NRC licensing authority including, but not restricted to, defense waste facilities.

In general, DOE is opposed to any extension of NRC licensing of DOE defense activities and facilities at the present time. There is a single exception to this position, i.e., new terminal disposal facilities for DOE TRU wastes and new non-defense DOE low-level waste sites, that I shall discuss in more detail momentarily.

The position of the Department has been expressed vigorously and repeatedly on a number of occasions, most recently in Secretary Schlesinger's letter to Chair-



man Price dated December 22, 1978, and in the Secretary's letter to Chairman Hendrie, dated March 3, 1979. Deputy Secretary O'Leary and I have testified to this same view both together and separately before a number of Congressional Committees, including the Subcommittee on Energy, Nuclear Proliferation and Federal Services, chaired by Senator Glenn (July 26, 1978), and the House Interior Committee, chaired by Congressman Udall (July 11, 1978). The Department has also expressed this view in the deliberations of the Interagency Review Group on Nuclear Waste Management and to the NRC. We believe that the Department's position, which is very close to our understanding of the views of this Committee, will prevail within the Administration although it is not possible to state this with assurance until the President has fully considered the IRG recommendations and has acted on the Decision Paper I mentioned earlier.

There are several reasons for DOE's position concerning extension of NRC licensing to DOE activities or facilities.

We believe that DOE nuclear activities are conducted in a safe and prudent manner. Additional regulation by the NRC would not provide any significant increase in confidence beyond that which presently exists based on DOE actions which include, incidentally, considerable interaction with the NRC.

DOE nuclear R&D activities are, unlike commercial power reactors, of a unique and temporary nature due to their R&D character; such activities and facilities do not lend themselves to the conventional licensing process.

DOE defense activities are essential to our National security, and regulatory procedures should not be put into place if there is any potential for interference with these activities or for compromising National security information or restricted data.

The NRC has limited regulatory resources and much of the NRC's technical expertise is based on DOE laboratories or contractors. NRC regulation of DOE activities would inevitably have the appearance of Federal self-regulation and would shift some NRC resources away from their primary mission of civilian nuclear power.

The major exception where DOE believes that an expanded NRC role is justified concerns the licensing of new terminal disposal facilities for DOE TRU wastes and new non-defense DOE low-level waste sites. We believe that this extension of NRC licensing authority is consistent with the expressed wish of Congress; present law requires NRC licensing of defense high-level long-term storage; i.e., disposal facilities. When the present law was passed, TRU waste (wastes slightly contaminated with plutonium or other transuranic elements) was not separately categorized as a distinct waste form. Today, TRU wastes are recognized as a special category because of the very long-lived nature of the radionuclides they contain. The concern embodied in the present law for ultimate disposal of high-level waste should be extended to TRU waste disposal as well. This proposition would not be contentious except for the fact that it implies NRC licensing of WIPP, a TRU disposal facility presently authorized as a defense waste facility. Concerns have been expressed that permitting licensing of WIPP would be viewed by some as a precedent for NRC licensing of additional defense waste activities, such as new high-level waste tanks, liquid waste solidification facilities, and so forth. While we recognize the legitimacy of these concerns, we believe that it is both logical and practical to restrict NRC licensing activities for DOE waste activities to ultimate disposal. We hope that this Committee will lend its support to this approach.

#### DOE'S PROPOSED MISSION FOR WIPP

The proposed mission of WIPP has been accurately termed by Chairman Price of the House Armed Services Committee a "most confused subject." I welcome the opportunity to clarify for the Committee our reasoning with regard to this important project.

When DOE undertook a review of waste management programs in late 1977, we found that the WIPP project was experiencing a projected cost increase based upon more detailed design work. During the course of that review, we saw an opportunity for economic and technical benefits to both the defense and commercial waste management programs by modifying the mission of WIPP. However, it was recognized that this opportunity would be accompanied by certain difficulties, in particular, those presented by the issues of licensing discussed above and the problems of dealing with both civilian and military generated waste in a single facility.



The basic proposal that emerged from DOE's review of its nuclear waste management programs was that WIPP should be licensed and that its mission should be broadened to include the disposal of up to 1000 spent fuel assemblies from commercial power reactors. Thus, the present proposed WIPP mission is:

Defense TRU waste disposal

R&D on high-level waste forms

Disposal of up to 1000 commercial spent fuel assemblies which are initially emplaced in a retrievable manner.

I should emphasize that this proposal for WIPP is consistent with overall Administration waste management policy; however, the proposed mission has not as yet been formally adopted by the Administration. There are several reasons for this. First, as you are aware, Congress passed in the fiscal year 1979 appropriation bill a prohibition on DOE expending any funds for licensing WIPP or for disposal of non-defense waste or spent fuel. We are scrupulously adhering to this restriction. Second, the EIS for WIPP has not yet been issued; final action on WIPP must await completion of the NEPA process.

Third, the Administration has yet to complete its review of the overall waste management strategy as outlined by the IRG.

Our reasons for proposing the mission for WIPP outlined above were quite straightforward. First, the "demonstration" of the closing of the backend of the fuel cycle that included both technical and institutional considerations is of paramount importance to the viability of commercial nuclear power in the U.S. The WIPP project presented an opportunity of an "intermediate scale facility" (ISF) to demonstrate commercial spent fuel disposal at least two years earlier than at any other potential repository site. Second, by combining an ISF with WIPP, a substantial amount of resources could be saved in connection with the ISF since site preparation work, engineered handling and loading facilities, etc., would be common with those proposed for the WIPP facility.

Secretary Schlesinger described this proposed mission for WIPP to the New Mexico Congressional Delegation first and Deputy Secretary O'Leary and I spent one week in the State of New Mexico expressing the Department's proposed mission for WIPP (including both licensing and limited spent fuel disposal) in three public meetings early in 1978. Reception to the Department's proposal has been generally favorable in the Congress and has been well received in the State of New Mexico, elsewhere in the Administration, and among interested public groups. We recognize, of course, that to proceed with the DOE proposed mission for WIPP it is essential that we reach an accommodation with this Committee and other concerned Committees in the House and Senate. We are most anxious to arrive at a mutual understanding and agreement as soon as possible.

I wish to emphasize, however, that currently the Department is complying with the Congressional direction to expend no funds for storage of spent fuel at WIPP or for licensing that facility. I hope that this issue can be resolved expeditiously.

Currently, the WIPP project is included in the defense authorization. We would hope to work out an arrangement with the Congress to construct this facility outside the defense appropriation with the mission described above. We hope that this procedure will have strong support of the Committee. The Nation has too long delayed the proper handling and disposition of nuclear wastes. The WIPP project is one near-term project capable of demonstrating real progress in this program. It needs your continuing support to do so.

Senator JACKSON. Very good.

Admiral Rickover, we will be delighted to have your comments, formal or informal.

#### **STATEMENT OF ADM. H. G. RICKOVER, USN, DIRECTOR, NAVAL NUCLEAR PROPULSION PROGRAM**

Admiral RICKOVER. I have a lengthy statement. With your permission I would like to introduce it for the record.

Senator JACKSON. Without objection, the entire statement will go in the record at this time.



## [Admiral Rickover's statement follows:]

## PREPARED STATEMENT OF ADMIRAL H. G. RICKOVER, USN, DIRECTOR, NAVAL NUCLEAR PROPULSION PROGRAM

Mr. Chairman, I deeply appreciate this opportunity to state my views concerning the Naval Reactors Development Program.

## INTRODUCTION

In some of my remarks I may express views contrary to those of some of my superiors. You are aware that since the inception of the Naval Nuclear Propulsion Program there have been basic differences between my opinions and those of many of my superiors. My superiors have more responsibilities and problems different and more onerous than mine, and these responsibilities and problems may require different solutions than I propose. I claim no superior wisdom. I make no claim that my views are right and theirs are wrong. As I have in the past, I will give you my personal and professional views based on the information available to me and leave it to you to make your judgments as you see fit.

## NAVAL NUCLEAR PROPULSION PROGRAM

The Naval Nuclear Propulsion Program is a joint program of the Departments of Energy and Navy. I serve both as the Director of the Division of Naval Reactors, in the the Department of Energy, and the Deputy Commander for Nuclear Propulsion in the Navy's Naval Sea Systems Command. The combination of the responsibilities of the Departments of Energy and Navy for naval nuclear propulsion under one organization eliminates duplication of programs and resources and provides close coordination of technical work.

## DIVISION OF RESPONSIBILITIES BETWEEN NAVY AND ENERGY DEPARTMENTS

The Department of the Navy is responsible for the military application of nuclear propulsion including constructing, operating, and maintaining nuclear powered ships, and for developing the nonreactor portions of the nuclear propulsion plants.

The naval nuclear propulsion work funded by the Department of Energy provides for the research and development of nuclear reactors for warships. In this regard, I am responsible for reactor plant research, design, development, construction, operation and health matters pertaining to naval nuclear propulsion plants and for all related safety aspects. Furthermore, my responsibilities also include selection, training and qualification of personnel for operating and maintaining these plants. Within the Department of Energy, I am also responsible for the Water Cooled Breeder program; a civilian reactor development program which is not under the cognizance of the Armed Services Committee.

*Fiscal year 1980 Department of Energy budget for the naval reactors development program—Requested budget authority*

|                                                               | <i>Millions</i> |
|---------------------------------------------------------------|-----------------|
| Operating funds:                                              |                 |
| Submarine propulsion reactors.....                            | \$160.1         |
| Surface ship propulsion reactors.....                         | 55.6            |
| Supporting research and development.....                      | 16.9            |
| Personnel resources.....                                      | 8.8             |
| Total, operating funds.....                                   | 241.4           |
| Capital equipment funds.....                                  | 15.8            |
| Construction funds:                                           |                 |
| Fluids and corrosion test facilities upgrading (80-AE-1)..... | 17.9            |
| General plant projects.....                                   | 3.3             |
| Total, naval reactors development.....                        | 278.4           |

NOTE.—An unclassified description of the fiscal year 1980 naval reactors development program is attached as app. II.



## NAVAL REACTORS DEVELOPMENT PROGRAM

The joint Naval Nuclear Propulsion Program involves many activities. These include two Department of Energy owned, contractor operated, laboratories; Bettis Atomic Power Laboratory operated by Westinghouse Electric Corporation and Knolls Atomic Power Laboratory operated by General Electric Company, where research and development work is performed. Other activities include land prototypes owned by the Department of Energy; reactor component manufacturing plants owned by the private sector; also shipyards, private and Navy, where nuclear ships are designed, built, and overhauled.

## LAND PROTOTYPES

In carrying out these responsibilities, the Naval Nuclear Propulsion Program conducts research and development programs in conjunction with building, testing and operating land prototype nuclear propulsion plants. Seven land prototype propulsion plants are now in operation; these are used to test and evaluate reactor and reactor propulsion plant designs, and to train and qualify Navy personnel for operating and maintaining naval nuclear propulsion plants. In addition, the propulsion plant prototype for the Trident ballistic missile firing submarine will commence operation at West Milton, New York, this year.

## NUCLEAR WARSHIPS

In the quarter century since 1953, when the Nautilus land prototype first operated, the number of nuclear powered warships has grown to a present total of 125 warships. These represent more than 40 percent of the Navy's combatant ships. This figure includes 41 ballistic missile submarines (SSBN's), 73 attack submarines (SSN's), three aircraft carriers (CVN's), and eight cruisers (CGN's). We also have one nuclear powered deep submergence research vehicle, the NR-1. These ships have steamed a total of more than 40 million miles; yet there has never been an accident involving a reactor nor has there been any release of radioactivity which has had a significant effect on the environment. In addition to the ships in operation, seven Trident ballistic missile submarines, 24 Los Angeles Class high speed attack submarines, one Nimitz Class carrier, and one Virginia Class cruiser have been authorized by Congress or are under construction.

The Naval Nuclear Propulsion Program is responsible for more operating reactors than the combined total of all U.S. civilian power reactors. Altogether, there are 152 reactors in operation, which have accumulated over 1700 reactor-years of operating experience.

## LONG LIFE REACTOR CORES

The goal of the Department of Energy's Naval Reactors Development portion of the Naval Nuclear Propulsion Program is to design, develop, and test improved nuclear propulsion plants and reactor cores having long fuel life, increased reliability, improved performance, and simplified operation and maintenance requirements and, ultimately, to develop reactor cores that will last the lifetime of a ship.

Particular emphasis is placed on obtaining advanced long life cores necessary for increased ship performance and availability. Extending the operating lives of these cores will materially benefit the Navy from the standpoint of both cost and operations. A longer nuclear core operating life will increase the percentage of time the nuclear fleet units are able to undertake operational duties. This will allow greater operational flexibility and provide additional assurance of availability and endurance to fight a war. This is a most important consideration, because any future naval war will have to be fought with the ships available at the start of hostilities.

An additional benefit of developing long life cores is that as core lives increase the number of refuelings will be reduced, thereby reducing costs and minimizing radiation exposure and radioactive waste. As an example, the first core for the USS Nautilus propelled the submarine 2 years and 62,000 miles, while a modern core is capable of propelling nuclear ships for 10 to 15 years and over 400,000 miles.



## LOW-LEVEL RADIATION

There is considerable interest in the question of health effects due to low-level radiation involved in naval nuclear work. In recent Congressional testimony I made a comprehensive statement on this subject. Mr. Chairman; with your permission, I would like to submit it for the record. I will mention only a few of the key points at this time, but I recommend you read the full statement.

The radiation exposure data for ships and shipyards is covered in detail in a Navy report, NT-79-2, which I would also like to include in the record. The maximum total exposure received by an individual in 1978 was 3.068 rem; this is well below the 5 rem annual exposure limit used by the Navy and the Department of Energy. This was the only person to exceed 3 rem out of 37,387 military and civilian personnel. The last time a person exceeded the quarterly or annual radiation exposure limits in ships or shipyards was in 1967.

The Department of Energy facilities under my cognizance have a similar record; their data is reported annually by the Department of Energy. These Department of Energy facilities include two laboratories, the central station nuclear power plant at Shippingport, and three sites with a total of nine reactors which are prototypes of ship reactor plants. Only one person received more than two rem in 1978 in my Department of Energy facilities; he received 2.376 rem, less than half the allowable annual dose. In 1978 the total radiation exposure for these facilities was the lowest in 20 years.

The Navy report on radioactive waste, NT-79-1, which I would also like to include in the record, shows that the total gamma radioactivity discharged to all harbors of the world by the Navy's nuclear ships during each of the last eight years has been less than two thousandths of a curie. If one person were able to drink the entire amount of radioactivity discharged into any harbor in 1978, he would not exceed the annual radiation exposure permitted by federal regulations for an individual worker. In 1978 the total gamma radioactivity discharged in liquid waste from all the Department of Energy facilities under my cognizance was also less than two thousandths of a curie.

In February 1978 Dr. Thomas Najarian and The Boston Globe published the results of a joint venture they undertook to study the effects of radiation on the health of workers at Portsmouth Naval Shipyard. This study has received wide publicity and has created the impression that the health of these workers is being jeopardized by radiation. But I understand that his conclusions were highly questionable. In addition, neither Dr. Najarian nor The Boston Globe has permitted an independent review of their full data. They belatedly provided some data to the Center of Disease Control, but for a study of this importance, full and prompt disclosure of data is their public and professional obligation. If Dr. Najarian and The Boston Globe are genuinely interested in the health of the shipyard workers, and not just in publicity, they would have cooperated fully and immediately.

Much of what the public reads on the effects of low-level radiation is distorted and improperly creates anxiety and fear.

A balanced perspective on radiation is difficult to obtain if the stories do not even present the radiation data required to assess the significance of the radiation exposure.

We have learned too much to settle for a simple yes or no answer to such questions as "Is the air safe to breathe?" or "Is it safe to drive a car?". Everything we do has some risk, including breathing.

I accept the same premise as the scientists and regulators that any exposure to radiation no matter how small, involves some risk. The way to answer the question "Is radiation safe?", is by determining how much the risks are from certain amounts of exposure. Similar evaluations of risks are made frequently for other subjects; one example is the calculation that each cigarette smoked shortens your life expectancy by about five minutes. Another is, your risk of dying in an automobile accident in any year is about one in five thousand.

The knowledge of radiation is not as uncertain as is frequently stated. More is known about the effects of radiation than almost any other substance encountered by humans in industry. One example can help put both the knowledge and the uncertainty in perspective:

In a typical group of 10,000 people in the U.S., a total of 1,600 will die of cancer. Risk estimates for radiation based on examining large amounts of



data from exposure to humans and animals have been made by the United Nations Scientific Committee on the Effects of Atomic Radiation, and by the U.S. National Academy of Sciences Committee on Biological Effects of Ionizing Radiation. These risk estimates agree that if each of these 10,000 received over his lifetime one rem more than he was already receiving from background and medical sources, then one extra person would die of cancer. Therefore, the 1,600 cancer deaths would increase to 1,601 for this group of 10,000. This example is directly applicable to the combined Navy and Department of Energy Naval Reactors Program where the average lifetime occupational radiation exposure is one rem.

However, a few highly controversial studies have concluded that more people would die from radiation than the Academy of Sciences and United Nations committees predict. If the higher risk estimate of one well known study is applied to the same population group of 10,000, then the 1,600 cancer deaths would increase to 1,610.

This example illustrates the conflict. The controversy is whether one extra rem to each of 10,000 people will cause the normal number of 1,600 cancer deaths to increase to 1,601, or to 1,610. The 1,601 figure is the current best estimate. Studies are now underway to attempt to refine the accuracy of the estimates.

My conclusion is that the risk to the group of people occupationally exposed to radiation in the Naval Reactors Program is small compared to the risks accepted in normal industrial activities, and it is small compared to the risks regularly accepted in daily life.

I know one apparently healthy person who forty years ago received more radiation exposure from medical X-rays to his chest than the total exposure all 15,000 radiation workers at the nine shipyards received in 1978 from Naval nuclear propulsion plant work. There are others who have had similar radiation exposures and are alive and well years later.

I trust that these examples and the other examples in the material I have provided will put the small radiation exposure from the Naval Reactors Program into better perspective.

#### SSN 688 CLASS ATTACK SUBMARINES

The shipbuilding program proposed by the Department of Defense for fiscal year 1980 includes funds for the 34th high speed Los Angeles Class submarine. Nine have already been delivered to the Navy. Fourteen more are being built at Electric Boat and eight at Newport News. The contract for the remaining two already authorized is expected to be awarded in a few weeks.

These high speed nuclear submarines, whose principal mission is anti-submarine warfare, are meant to counter the rapid increase in both quantity and speed capability of the Soviet nuclear submarine fleet.

The high speed capability in the SSN 688 Class permits them to be used in direct support of high speed surface task forces in an escort role. High speed also provides tactical advantages over previous, slower classes of U.S. submarines. Ships of the SSN 688 Class are currently participating in a tactical development and assessment program which is designed to determine the best tactics to employ in the various missions which this ship will perform. The program is only partly completed; but it has already shown that the high speed of the SSN 688 Class considerably expands the tactical options and capabilities available to attack submarines.

#### TRIDENT

The shipbuilding program proposed by the Department of Defense for fiscal year 1980 includes funds for the eighth Trident submarine. The Trident submarines will have increased survivability compared to our existing Polaris and Poseidon submarines because they are being built with all the latest technology. They will be more difficult to detect than existing Polaris and Poseidon submarines because the Trident submarines will be quieter and their longer range missiles will give the submarines 10 to 20 times more ocean area in which to hide. Our existing Polaris and Poseidon submarines are noisy compared to current standards. They were all built with the technology of the 1950's. Quieter submarines are necessary to decrease the probability of detection and to ensure the survivability of our seaborne strategic deterrent.

The Polaris and Poseidon submarines are wearing out and we must plan now for an orderly construction program to provide replacement. Unless we do so we



will be confronted with block obsolescence. Our current force of 41 ballistic missile submarines was commissioned during the seven-year period from 1959 to 1967, and were built to specifications based on a 20-year life. These ships have been operated hard, with two crews, to allow them to be on station the maximum possible time. It is unreasonable to expect them to operate for more than 20 years without the possibility of breakdowns.

The longer range of the Trident missiles will permit basing our ballistic missile submarines in the United States—no foreign basing will be required. This will eliminate the vulnerability of our ballistic missile submarine force to international political action that could deny us the use of foreign bases. This is extremely important because we are always in danger of losing our foreign bases.

I recommend that Congress continue to support the Trident program which is vital to our national survival.

#### GENERAL PURPOSE NAVAL FORCES

The bulk of our naval ships, the general purpose forces, are designed to carry out naval missions in conflicts short of all-out nuclear war. Less than half of these are submarine and surface combatants and aircraft carriers designed to fight in areas of high threat; they are our naval strike force ships.

The majority of general purpose force ships are assigned to non-strike force functions, such as underway replenishment groups, amphibious assault forces, convoy escorts, and support ships which service the Fleet. I have never recommended, and I know of no serious consideration ever having been given to providing nuclear propulsion for ships in the non-strike forces.

Aside from submarines, the only warships I have recommended to be provided nuclear propulsion are aircraft carriers and guided-missile firing ships. I will address my views on nuclear propulsion for surface warships shortly, but first I want to summarize the growing Soviet Naval threat.

#### THE SOVIET NAVAL THREAT

Admiral of the Fleet, Gorshkov, the Commander-in-Chief of the Soviet Navy, took command of a defense oriented extension of the Soviet Army 23 years ago. Under his leadership development of the Soviet Navy was assigned highest national priority. As a result, since 1958 the Soviet Navy has taken delivery of at least 1800 new ships and combatant craft in 137 different classes, a program of naval expansion that surpasses the efforts of any other naval power. From a defensive posture in World War II, the Soviet fleet has evolved into a major blue-water Navy that today can challenge the U.S. for control of the seas. More important, the Soviet momentum for superiority in all phases of naval warfare continues while U.S. naval plans are far from certain and fluctuate every year. There has never in peacetime been anything comparable to the current growth of Russian naval power. We need to view these efforts critically because such actions appear to be inconsistent with, if not a repudiation of, efforts to reduce tensions between the superpowers.

From 1969 through today the Soviet Navy has increased in numbers of ships and in capability. For example, the nuclear submarines in the Soviet fleet increased from 69 in 1969 to about 155 today, surpassing us in this area in 1970. During this time period, the number of Soviet surface combatants and aircraft carriers have increased from 220 to 272 while the number of U.S. major surface combatants and aircraft carriers fell from 301 to 174. While their numbers have continued to increase, ours have continued to decline.

Looking at the submarine situation specifically, the comparison is particularly ominous. Currently the Soviets have a total of about 355 submarines, consisting of about 155 nuclear powered and 200 diesel powered ships, all of which have been built since World War II. The total U.S. force is 122 submarines with 114 nuclear powered and 8 diesel powered. By 1985 the 7 Trident and 24 Los Angeles Class nuclear attack submarines already authorized are expected to be delivered, averaging about 5 new nuclear submarines a year. The current Department of Defense plan is to authorize only two additional nuclear submarines a year. Thus, after 1985 our deliveries will drop to that rate. If the Soviets continue delivering at the rate of ten nuclear submarines a year, as they have averaged for the past four years, the nuclear submarine gap will continue to widen rapidly.



## SOVIET BALLISTIC MISSILE SUBMARINES

In the critical area of strategic submarines the Soviets have built about 71 nuclear powered ballistic missile submarines compared to our 41. They have 34 Yankee Class submarines which are equivalent to our Polaris and Poseidon submarines, but their submarines are all newer than ours.

The Soviets also have at sea 29 ships of their Delta Class ballistic missile submarines, with more under construction. These ships carry missiles with a 4,200 mile range. This means that from their operating areas in the Barents Sea and Northern waters they can cover the entire United States, Canada, and most of Mexico. In total, the Soviets have almost twice as many nuclear-powered ballistic missile submarines as we, and they are continuing to build new ones. Our first Trident submarine will not be delivered until 1980. Even then our building rate will only be about one a year.

## SOVIET ATTACK AND CRUISE MISSILE SUBMARINES

In attack and cruise missile submarines the Soviets have a total of 260 units to our 81. Of their total, about 84 are nuclear powered, while the U.S. has 73 nuclear powered attack submarines. We do not have any submarines capable of firing cruise missiles, although the Navy is developing a version of the Harpoon missile which will be capable of being fired from submarine torpedo tubes.

The Soviets have the largest and most modern submarine yards in the world. They are credited with a nuclear submarine production capability of 20 ships a year on a single shift basis. While not fully utilizing this vast building capacity, they have since 1974 completed 40 submarines. As late as 1966, the Russians had only two new construction yards for building nuclear submarines; today they have four with this capability, and further expansion of such facilities is currently in progress. At present, the maximum U.S. capacity to build nuclear submarines is less than half that of the Soviets.

Of greater concern than total numbers is the fact that since 1968 the Soviets have introduced over nine new submarine designs, or major modifications in design, besides converting older submarines to improve their capabilities. They have introduced significantly improved versions of their attack, cruise missile, and ballistic missile nuclear submarines. In the past 10 years they have introduced more new submarine designs than have ever been put to sea, during a comparable period, in all of naval history. The U.S., on the other hand, has introduced only two new submarine designs in this period.

## SOVIET SURFACE WARSHIPS

The trends in the surface navy are also of concern. Today, the Soviets have more major surface combatants than we, and many of their ships carry surface-to-surface missiles, which our ships do not yet have. They presently have 272 surface combatants and aircraft carriers compared to our 174. Since 1969 the Soviets have built over 800 major and minor surface combatants, mine warfare, and amphibious ships, while the U.S. has built 85, or about one-tenth as many. The Soviets have recently shown that they have a place in their Navy for aircraft carriers. The recent operation of the *Kiev* and *Minsk* along with construction of a sister ship shows that the Soviets intend to enter into the area of naval aviation capability which has been the major strength of the U.S. Navy.

## SOVIET CRUISER PROBABLY NUCLEAR POWERED

The Soviets have begun construction of a new class of cruiser, which will probably be nuclear powered and which, at an estimated 25,000 tons, would be the world's largest nuclear powered cruiser. Our largest nuclear powered cruiser, the U.S.S. *Long Beach*, is about 700 feet long and displaces 17,000 tons. The new



Soviet cruiser will be larger than the nuclear-powered Strike Cruiser (CSGN), that was proposed for construction by the Ford administration. The tables that follow compare the Soviet and U.S. submarine and surface fleets.

COMPARISON OF UNITED STATES AND SOVIET SUBMARINES, MARCH 1979

| Submarine type     | Soviets <sup>1</sup> | United States |
|--------------------|----------------------|---------------|
| Ballistic missile: |                      |               |
| Nuclear.....       | <sup>2</sup> 71      | 41            |
| Nonnuclear.....    | 20                   | 0             |
| Cruise missile:    |                      |               |
| Nuclear.....       | 40                   | 0             |
| Nonnuclear.....    | 25                   | 0             |
| Attack:            |                      |               |
| Nuclear.....       | 44                   | 73            |
| Nonnuclear.....    | 155                  | 8             |
| Total:             |                      |               |
| Nuclear.....       | 155                  | 114           |
| Nonnuclear.....    | 200                  | 8             |
| Grand total.....   | 355                  | 122           |

<sup>1</sup> Numbers are approximate.

<sup>2</sup> Ballistic missile submarine includes 34 Yankee's, 29 Delta's and 8 older units. Not all units are capable modern launcher platforms.

COMPARISON OF UNITED STATES AND SOVIET ACTIVE SURFACE SHIPS, MARCH 1979

|                               | Soviets | United States |
|-------------------------------|---------|---------------|
| Aircraft carriers.....        | 2       | 13            |
| Surface combat type:          |         |               |
| Aviation cruiser.....         | 2       | 0             |
| Cruisers.....                 | 35      | 18            |
| Destroyers.....               | 71      | 68            |
| Frigates.....                 | 162     | 65            |
| Subtotal.....                 | 272     | 174           |
| Other type ships/craft:       |         |               |
| Patrol combatant type.....    | 100     | 3             |
| Coastal patrol craft.....     | 470     | 0             |
| Amphibious ships/craft.....   | 101     | 64            |
| Mine warfare ships/craft..... | 430     | 3             |
| Auxiliaries.....              | 755     | 87            |
| Subtotal.....                 | 1,856   | 157           |
| Total.....                    | 2,128   | 331           |

SURFACE WARSHIPS

The question of the direction to be followed for our surface naval strike forces continues to be the central argument concerning the Navy's future shipbuilding program.

Overall, I believe that in a non-nuclear war our Navy still has a slight edge over the Soviet Navy because of our aircraft carriers, listed in the following table. However, even this is not reassuring since, as a land power, the Soviets do not have to depend on sea lines of communication to conduct military operations. Further, the number of deployable carriers in our fleet continues to decline, and no new carrier has been authorized since the Carl Vinson six years ago. This is the longest gap in carrier authorization at any time in the past quarter century.



## CURRENT CARRIER FORCE

| Name                 | Number | Commission-<br>ing date | Age as of<br>July 1, 1979 | Age as of<br>July 1, 1988<br>when<br>CVN-71 is<br>operational |
|----------------------|--------|-------------------------|---------------------------|---------------------------------------------------------------|
|                      |        |                         |                           |                                                               |
| Unnamed              | CVN 71 | 1 1987                  |                           |                                                               |
| Carl Vinson          | CVN 70 | 1982                    |                           | 6                                                             |
| Dwight D. Eisenhower | CVN 69 | Oct. 18, 1977           | 1                         | 10                                                            |
| Nimitz               | CVN 68 | May 3, 1975             | 4                         | 13                                                            |
| John F. Kennedy      | CV 67  | Sept. 7, 1968           | 10                        | 19                                                            |
| America              | CV 66  | Jan. 23, 1965           | 14                        | 23                                                            |
| Enterprise           | CVN 65 | Nov. 25, 1961           | 17                        | 26                                                            |
| Constellation        | CV 64  | Oct. 27, 1961           | 17                        | 26                                                            |
| Kitty Hawk           | CV 63  | Apr. 29, 1961           | 18                        | 27                                                            |
| Independence         | CV 62  | Jan. 10, 1959           | 20                        | 29                                                            |
| Ranger               | CV 61  | Aug. 10, 1957           | 21                        | 30                                                            |
| Saratoga             | CV 60  | Apr. 14, 1956           | 23                        | 2 32                                                          |
| Forrestal            | CV 59  | Oct. 1, 1955            | 24                        | 2 32                                                          |
| Coral Sea            | CV 43  | Oct. 1, 1947            | 2 31                      | 2 40                                                          |
| Midway               | CV 41  | Sept. 10, 1945          | 2 33                      | 2 42                                                          |

<sup>1</sup> If authorized in fiscal year 1980 with passive protection Option D.

<sup>2</sup> Beyond expected life.

Apparently, it is now planned that one more carrier will be built in the foreseeable future. Even so, the ship included in the budget this year is substantially inferior in almost every respect to any carrier, nuclear or conventional, authorized in the past 25 years.

Any comparison of the Soviet and U.S. navies must be viewed in the context that we are a maritime power dependent upon being able to maintain sea lines of communication in order to conduct military operations overseas and to support our allies. The mission assigned to our Navy is a far more difficult task than the Soviet Navy mission of denying us free use of the seas.

The United States has long since given up any chance of matching the Soviet Navy in numbers of ships. Therefore, the quality of our ships must be superior, if we are to be able to withstand their attacks and protect the sea lines of communication. It is axiomatic in war that a nation dependent on the quality of its weapons to prevail over numerically superior forces must design its forces around an offensive strategy. A nation whose forces are outnumbered cannot afford to fight a defensive war of attrition. If we expect to be able to prevent defeat in a non-nuclear conflict, then we must be able to penetrate the opposing forces and strike their bases and sources of supply.

#### FISCAL YEAR 1980 BUDGET PROPOSES NON-NUCLEAR CARRIER AND AEGIS SHIP

As you may know, the fiscal year 1980 shipbuilding program includes a medium size, oil-fired aircraft carrier known as the CVV; also the second ship of the DDG-47 Class AEGIS Fleet air defense ship, the DDG 48, which is an oil-fired, gas turbine powered ship.

Aircraft carriers and AEGIS fleet air defense ships will form the backbone of our firstline naval strike forces. Thus they will have to be capable of fighting in the areas of highest threat. Considering the difficulties of providing logistic support in such areas, in my view it is essential that our firstline warships be given the mobility and flexibility that only nuclear propulsion can provide. In my opinion, in the 1980's and beyond, in any area where the Soviets challenge us, we will need all-nuclear carrier task forces if we are to be able to keep our sea lines of communication open.

The decisions Congress reaches this year concerning whether to authorize these non-nuclear ships, or to take on the uphill fight to reestablish the nuclear powered ships the Congress and the Department of Defense once agreed upon—the nuclear carrier CVN 71 and the nuclear AEGIS cruiser CGN 42—are of fundamental importance to the future of the U.S. Navy.

The justification for providing nuclear propulsion for major combatants has been documented in detail through analysis, the military judgment of senior naval commanders, and experience in the fleet. I have seen nothing in recent world events which diminishes the need for the mobility in our naval strike forces which only nuclear propulsion can provide.



## OPPOSITION TO NUCLEAR PROPULSION BY SYSTEMS ANALYSTS

The Defense Department systems analysts in opposing nuclear propulsion have relied on the argument that since nuclear propulsion costs more, conventional ships should be built instead. The analysts include the cost of nuclear fuel in the acquisition cost of nuclear warships, but ignore the cost of buying and delivering oil to the conventional ships. Nowhere in their arguments do they address the difficulty the Navy can expect to encounter in providing and delivering oil to its major combatants in high threat areas. In their analyses they study the effects to be expected when combatant ships are attacked by aircraft, missiles, and torpedoes. But in the same analyses they assume that the much more vulnerable logistic support forces will not be attacked, and that the combatants will be supplied propulsion fuel whenever and wherever they need it. Even then, the studies show that on a life-cycle cost basis, a nuclear task force costs about the same as an oil-fired task force, when all costs are considered.

## ROLE OF CONGRESS IN CREATING NUCLEAR NAVY

The cognizant congressional committees have studied this matter in great detail over a period of many years. Three decades ago it was the Congress that overrode the cost analysts' arguments against the nuclear submarine, to get the program established.

It was the Congress that authorized the Atomic Energy Commission to buy and pay for the nuclear propulsion plants for our first two nuclear submarines, the *Nautilus* and the *Seawolf*, because the Department of Defense could not envision the worth of nuclear propulsion. Congress has had to step in many times since, to keep the nuclear submarine program going. Even so, the nuclear submarine building program has now been slowed to a trickle. And the talk of reverting to diesel submarines grows louder every day.

The *Nimitz* class nuclear carriers and the *Truxtun*, *California*, and *Virginia* classes of nuclear cruisers evolved from similar arguments between Congress and the Department of Defense. This argument led to enactment by Congress, 5 years ago, of title VIII of the Department of Defense Appropriations Authorization Act, 1975, which established as a matter of law that the policy of the United States is to provide nuclear propulsion for major combatants built for naval strike forces. The systems analysts did not accept that policy and worked to circumvent it; this culminated last year in the repeal of title VIII. No nuclear powered surface warship has been authorized for construction since title VIII became law. The closest was the CVN 71 last year, but this ship was removed from the Authorization Act consequent to the President's veto. Also, Congress authorized advance procurement funds 2 years ago for a nuclear-powered *Aegis* cruiser, the CGN 42, with four such ships included in the Department of Defense plan at that time. However, that program now appears to have been shelved by the Department of Defense.

## CREDIBILITY OF NONNUCLEAR WAR

Perhaps the opposition to nuclear propulsion is based on the assumption that we do not need to be prepared to fight a nonnuclear war against a technologically sophisticated enemy. But if that is so, why do we need another carrier at all? Or why do we need *Aegis* ships designed to counter sophisticated air attack? If a confrontation between U.S. and Soviet naval forces is not credible, why are the Soviets embarked on such a major upgrading of their naval capability?

It takes many years to build a major warship. What if we miscalculate and do not build ships adequate to meet the threats we can expect to face? What alternative will we then face—giving in on all issues for which we are not willing to resort to nuclear war? The price of investing in adequate strength to ensure peace may appear high, but it is small compared to the cost of war.

## AIRCRAFT CARRIERS

For the foreseeable future, the aircraft carrier will continue to be the principal offensive striking arm of the Navy in a nonnuclear war. No other weapon system existing or under development can replace the long-range, sustained, concentrated firepower of the carrier air wing. Torpedo-firing nuclear submarines, cruise-missile-firing nuclear submarines, nuclear cruisers with anti-war, anti-surface,



and anti-submarine capabilities—all are needed to supplement and augment the capabilities of the nuclear carrier. But without the tactical airpower provided by carriers, all of our other surface forces would have greatly increased vulnerability. If an opponent is successful in developing weapons that can sink a number of our carriers, and we are not successful in developing adequate counter weapons—or if we simply do not have a sufficient modern carrier force to protect our sealanes—the United States will have to change its national objectives to make them consistent with our inability to conduct overseas military operations.

How many carriers the Navy must have is not my responsibility to determine. However, I note that the number of overseas airbases available to us continues to decline, and political considerations can prevent us from using some of those we retain. Since there is no known alternative to carriers for providing significant tactical airpower beyond the range of provisioned and protected land bases, and the capabilities of the Soviets to attack us at sea continue to increase, our need for carriers appears to me to be increasing rather than decreasing.

#### AIRCRAFT CARRIER IN FISCAL YEAR 1980 PROGRAM

The Department of Defense Fiscal Year 1980 shipbuilding program includes a request for \$1.617 billion for an oil-fired aircraft carrier with a full load displacement of about 62,500 tons, called the CVV. It is planned to build this ship in lieu of the fourth carrier of the Nimitz Class, the CVN 71, for which \$268 million was appropriated in fiscal year 1977 for advance procurement of nuclear propulsion plant components.

Since the President vetoed the fiscal year 1979 Department of Defense Appropriations Authorization Act because it authorized the funds to construct the CVN 71, it is currently planned that the nuclear propulsion plant components will be used as spare parts for the first three ships of the Class, the Nimitz, the Dwight D. Eisenhower, and the Carl Vinson.

#### CVV VERSUS CVN 71

The CVV will be about two-thirds the size of the CVN 71; it will be able to operate and service an air wing about two-thirds as large; it will carry about 40 percent of the aircraft fuel and about two-thirds the aircraft ammunition; it will have one-half, the number of aircraft elevator, catapults, and propulsion shafts; it will be about five knots slower; and it will require refueling every few days.

The acquisition cost of the CVV without fuel will be about two-thirds the \$2.403 billion acquisition cost of the CVN 71, but whose cost includes the initial nuclear reactor cores which would provide for about 15 years of operation.

When all costs over a 30-year life-cycle are considered, the cost per aircraft is expected to be about the same for the CVV as for the CVN 71, and the CVN 71 would be much more effective.

#### SEA-BASED AIR PLATFORMS PROJECT REPORT

Last year I summarized to the Congress the results of the Assessment of Sea-Based Air Platforms Project Report issued in February 1978 by the Office of the Secretary of the Navy. I pointed out that the study showed that, overall, the Nimitz Class carrier would be more cost-effective than the CVV even though:

(1) The costs of nuclear power were included in the analysis but the advantages of nuclear power were omitted.

(2) The engagement analyses were performed on the basis that all carrier forces were deployed on station, and fully replenished at the time the postulated attacks strated. Thus, the capability of nuclear powered ships to transit long distances at higher speed, arriving in the trouble area earlier, ready to enter combat without replenishment, was given no consideration in the analysis. Nor was consideration given to the ability to reposition nuclear-powered ships rapidly and without concern for logistic support; this ability greatly reduces vulnerability to preemptive attack and could be decisive in many actual combat situations.

(3) The analysis assumed that replenishment groups were available whenever and wherever needed, and that replenishment forces were not attacked.



Thus, the nuclear carrier's advantage of requiring less frequent replenishment, and its ability to steam at high speed to rendezvous with replenishment forces in safer areas without concern for propulsion fuel, were not considered.

(4) The scenarios postulated in the analyses called for ship speeds within the capability of all ships studied. Therefore the higher top speed of the nuclear carrier was not considered in the analyses.

(5) Nor was weather considered in the analyses. Thus, the greater seakeeping capability of the Nimitz Class carrier was not considered. In this regard, carrier studies furnished to Congress in 1974 by the Chief of Naval Operations showed that sea conditions in the North Atlantic are such that a carrier of CVV size would not be able to operate aircraft about 21 percent of the time in winter, as compared to about 12 percent for a Nimitz size carrier—a factor of nearly two in favor of the larger carrier. Further an advantage of nuclear surface warships is their ability to take circuitous routes and use high speed to avoid storm areas during transits. This is possible because of their freedom from propulsion fuel constraints.

Overall, the engagement and cost analyses showed the Nimitz Class nuclear carrier to be the most cost-effective carrier. When all the advantages of the nuclear carrier that were omitted from the study are actually considered, it seems to me that the nuclear carrier is overwhelmingly superior to the conventional carrier on a cost-effective—or on any other basis.

#### IMPORTANCE OF CARRIER PLATFORM

A smaller conventional carrier such as the CVV costs less to procure on a ship-for-ship basis than a CVN. However, it would be shortsighted to base the decision on the type carrier to be built entirely on initial procurement cost. The Navy study showed that the initial procurement cost of the carrier is only about 10 percent of the total life-cycle cost of buying and operating aircraft at sea. However, the survivability of aircraft and their effectiveness in combat are heavily dependent upon the platform from which they operate. The study showed that, even without considering the advantages of nuclear propulsion, the nuclear carrier is the most survivable platform. This is so even when the dispersal of forces through building larger numbers of cheaper ships is considered in the analyses. Further, the greater mobility, tactical flexibility, and capacity for combat consumables of the nuclear carrier makes its relative survivability even greater than calculated in the analyses.

#### NUMBERS OF CARRIERS

It is frequently argued that by buying smaller conventional carriers, like the 62,500 ton conventional CVV, the Navy could have more ships in more places for the same cost.

In this regard, it should be noted that if three conventional CVV's and their air wings were procured in lieu of two Nimitz Class carriers and their larger air wings, the Navy would get the same number of aircraft and one more ship. But the study also showed that even without considering the advantages of nuclear propulsion, the three conventional ships would cost more, be more vulnerable, and provide less military effectiveness. Further, it would require an additional investment in more carrier escorts and replenishment forces before the three CVV's could be operated in more places at one time than the two nuclear carriers.

Besides the present plan is to build only one more carrier in the foreseeable future. Therefore, the real choice that faces Congress is what type of ship that one carrier should be. The study I have been describing is not one I made. It was a study commissioned by the Secretary of the Navy in response to a Congressional directive.

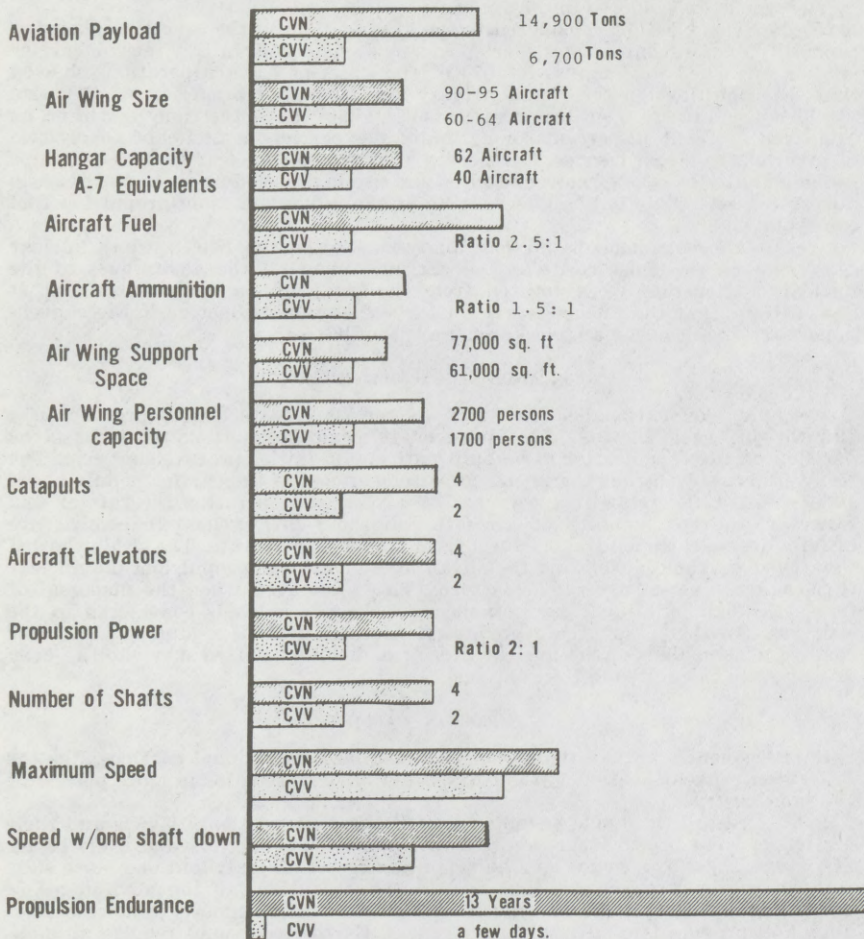
#### COMPARISON OF CVV AND CVN 71 MILITARY CHARACTERISTICS

A comparison of CVV and CVN 71 military characteristics and life-cycle costs is summarized in the following chart which is an update of the chart I furnished to Congress last year to show the latest information about both ships.



1 March 1979

## Comparison of CVV and CVN 71 Military Characteristics



### CVN/CVV 30-YEAR LIFE CYCLE COSTS (FEBRUARY 1978 STUDY)

#### Without aircraft:

One CVN equals 1.26 CVV.

Two CVN's equal 2.5 CVV's.

#### With aircraft:

One CVN equals 1.38 CVV's.

Two CVN's equal 2.75 CVV's.

Cost per sea-based aircraft is about the same.

CVN: Is more cost effective overall; is more survivable; carries more aviation fuel per aircraft; has more aircraft support facilities; has better sea-keeping ability; is about 5 knots faster, and has all advantages of nuclear propulsion.



## MODIFIED JOHN F. KENNEDY CLASS CARRIER

I note that some are recommending a compromise position of building a carrier like the John F. Kennedy, CV-67, which was the last oil-fired carrier built.

The proponents of this compromise point out that the Kennedy can operate and support an air wing the same size as the Nimitz Class carrier air wing, and that it has the same maximum speed and redundancy of aircraft elevators and catapults as the Nimitz Class carrier. An oil-fired modified Kennedy is estimated to cost \$1.76 billion in the fiscal year 1980 program, \$143 million more than the CVV.

The Kennedy was authorized in 1962 for the fiscal year 1963 Shipbuilding Program. At that time the first nuclear surface warships, the cruiser Long Beach, CGN 9, and the carrier Enterprise, CVN 65, had been commissioned only a few months. The Navy had originally recommended that both the America, CV-66, and the Kennedy be nuclear powered, but the Secretary of Defense "persuaded" the Navy to change its recommendation from nuclear to conventional for these two ships.

By late 1962 the Enterprise had proved her worth in the Cuban Missile Crisis. Many in Congress considered it a mistake for the Kennedy to be oil-fired and tried to get Secretary McNamara to change his mind. In 1963 the Joint Committee on Atomic Energy held extensive hearings on the subject of "Nuclear Propulsion for Naval Surface Vessels." The Chairman of the Atomic Energy Commission, Dr. Glenn T. Seaborg; the Chief of Naval Operations, Admiral David L. McDonald; Secretary of the Navy Fred Korth; and the Director, Defense Research and Engineering, Dr. Harold Brown, testified that they favored making the Kennedy nuclear. Secretary of Defense Robert S. McNamara testified against it.

The Joint Committee analyzed the testimony and all the classified studies of the matter furnished by the Department of Defense. The Joint Committee issued a report setting forth their analysis and the basis for their recommendations:

1. That the decision to install conventional propulsion in the new aircraft carrier, CVA-67, should be set aside and plans made to install nuclear propulsion in this ship; and
2. That the United States adopt the policy of utilizing nuclear propulsion in all future major surface warships; and
3. That a vigorous research and development program for surface warship nuclear propulsion be continued.

I recommend that the Joint Committee Hearing Record and the December 1963 Report be read by anyone who is interested in building an oil-fired Kennedy Class carrier. The arguments we hear today are the same ones made then. The difference is that now we have 15 years more experience with successful operation of nuclear warships in the Fleet where the advantages of nuclear propulsion have been demonstrated over and over again, and the potential vulnerability of oil supplies has become increasingly evident to everyone.

Following the Joint Committee's December 1963 Report, Secretary McNamara had the Navy make an extensive cost-effectiveness study entitled: "Nuclear Power for Surface Warships, Naval Warfare Analysis Group Study No. 33."

For the first time—and as far as I know the only time—the war-gaming analyses took into consideration the effects of attack on logistic support forces. The study showed that the peacetime costs of a Nimitz Class carrier over its life would be essentially the same as a Kennedy Class carrier, and that the nuclear ship would be more effective. The study also showed that when attacks on logistic support forces were considered, losses could be expected to be less if the carrier were nuclear powered.

Following this study and additional successful operational experience with nuclear ships, Secretary McNamara in 1966 changed the three additional carriers planned at that time to nuclear propulsion. That was the origin of the Nimitz, the Dwight D. Eisenhower, and the Carl Vinson.

When I testified before the House Armed Services Committee in May 1966 in support of the Authorization of the Nimitz in the fiscal year 1967 Shipbuilding Program, I said:

When the Navy changed their recommendation from nuclear to conventional propulsion in the two aircraft carriers following the Enterprise, I know that a major concern was that they felt they wouldn't get these carriers if they asked for nuclear. So they asked for conventional. I think they would have asked for an aircraft carrier with sails, if they hadn't been able to get any other. After all a Navy without ships is not a Navy at all . . .



In order to carry out his responsibilities, the Chief of Naval Operations certainly must have real ships, not paper ships. In order to get real ships, he must ask for the ships he thinks he can get.

I can see how today some who believe another carrier is needed, but do not see any point in building the CVV, could turn to a Kennedy Class ship as a compromise. There is no question that the superiority of a Kennedy over a CVV is worth the increase in cost involved. But, it is important to remember that study after study made by the Navy over the past 15 years shows that the overall cost of a Nimitz is essentially the same as the overall cost of a Kennedy, while the nuclear ship is markedly superior. It should be borne in mind that a Nimitz Class carrier, with the same overall cost, carries almost twice as much aviation fuel and 50 percent more aircraft ammunition than a Kennedy Class carrier, as well as having all the advantages of nuclear propulsion. These features increase the fighting capability of the ship and the air wing it operates and supports. They also reduce the vulnerability of the ship and air wing as a weapon system because they reduce dependence on highly vulnerable logistic support forces.

When all is said and done, it must be remembered that the cost of the carrier is only a small fraction of the total cost of operating sea-based aircraft. Yet the capability, availability, and survivability of those aircraft are directly dependent upon the characteristics of the carrier platform from which they operate.

#### TURNING THE CLOCK BACK

In my view, to build an oil-fired Kennedy would be turning the clock of carrier technology back over 15 years. To build a CVV would be turning the clock back over 30 years.

If we are to have another carrier, we must use the best technology we have. The Enterprise, the Nimitz, and the Dwight D. Eisenhower have proven their capabilities in operation. They are clearly superior to any oil-fired carrier. Whatever carrier we build will not join the Fleet until 1987 and will have to operate at least 30 years after that. If we are to spend the money it takes to provide and operate an air wing at sea, it makes no sense not to provide the best platform. I do not understand the arguments that have been presented for canceling the CVN 71 and substituting either a CVV or a Kennedy Class carrier in its place.

Of course, the decision is not mine to make, so it is not necessary that I understand the basis for it. On the other hand, under our Constitution the decision is up to Congress to make. Therefore, I urge that you in Congress find an explanation that makes sense to you for whatever decision you make in this matter.

#### NEED FOR NUCLEAR-POWERED GUIDED-MISSILE SHIPS

Some argue that we should not build another nuclear carrier because to do so would require providing nuclear power for the guided-missile firing ships which accompany it. I do not consider that argument valid. Studies furnished to your Committee have shown that each time a nuclear ship is substituted for a non-nuclear ship in a carrier task force group, the capability of the force as a whole will improve, even if all the other ships are oil-fired.

However, it is also true that there is an incentive to provide nuclear propulsion in missile-firing ships, whether or not the carrier they accompany is nuclear powered. Further, a nuclear-powered guided-missile ship has the unique capability for independent operations not available to oil-fired ships.

Of course, the greatest gain is made when all the ships in a task group are nuclear. The all-nuclear carrier task group has greater capability to penetrate and counter the projected Soviet naval threat than any other naval surface force we know how to build.

When a nuclear carrier is substituted for a conventional carrier, the range of a carrier task group, with four conventional escorts, is doubled. When two of the four escorts with the nuclear carrier are nuclear, the range of the carrier task group is double again. When all the escorts are nuclear, the range of the carrier task group is essentially unlimited.

Each nuclear escort substituted for a conventional escort also increases task force flexibility and mobility through advantages which are difficult to describe in numerical form.



## VULNERABILITY OF REPLENISHMENT SHIPS

For example, none of the comparisons of the relative effectiveness and cost of the nuclear and conventional escorts cited in current Navy cost studies take into consideration losses due to enemy action. One older Navy study, "Nuclear Power for Surface Warships," to which I referred earlier, showed that:

(1) Losses of underway replenishment ships can be expected to be greater when supporting conventional than when supporting nuclear warships;

(2) Under several of the threat conditions studied, the number of replenishment ships lost supporting conventional warships was more than twice the number lost supporting nuclear warships; and

(3) The greater the threat to the underway replenishment ships, the larger is the loss differential to be expected—owing to the larger replenishment force required for the conventional warships.

If we are concerned that the expanding Soviet naval capability will increase the vulnerability of our first-line strike forces, then it is not reasonable to assume that our underway replenishment groups can be operated with impunity. The all-nuclear carrier task group, having essentially unlimited high-speed endurance, carrying more combat consumables which permits longer periods between replenishments, and with the capability to retire at high speed for replenishment in low-threat areas, has far greater capability to conduct sustained combat operations than any other surface naval force we know how to build.

Against a sophisticated naval threat, it could quickly turn out that our ability to conduct sustained combat operations would be controlled by the logistic support available. Under such circumstances, each ship with nuclear propulsion improves the capability of the entire force. The all-nuclear task group has far greater striking capability than a conventional group.

When logistic supply lines are attacked during a real war, the decrease in the requirement for ships' fuel for the strike forces will have a compounding beneficial effect. The surviving fuel transportation and storage facilities can then all be concentrated on getting fuel for aircraft and other military vehicles to the forward areas. The escorts that would otherwise be required for the tanker which carry ships' fuel could then be assigned to assuring the safety of other supplies.

## FIFTEEN YEARS WITHOUT REFUELING

With existing designs of naval nuclear propulsion plants it is possible to provide enough energy for 15 years of warship operation without need to refuel. In contrast, oil-fired naval warships must be refueled every few days. Of what value is an oil-fired warship if it is unable to get oil when and where it needs it?

## STUDIES OF NUCLEAR PROPULSION FOR SURFACE WARSHIPS

The studies that have been made of the issue of nuclear propulsion for surface warships have cost millions of dollars and countless man-years of effort, including that of many high-level people. Every aspect of the advantages and cost of nuclear surface warships has been exhaustively studied in minute detail over a period of many years by numerous analysts, civilian and military. These studies have brought out time and again that a nuclear surface warship has a higher initial investment cost than its conventional counterpart, but that when overall costs are taken into consideration the nuclear ships are not much more expensive, but provide greatly increased military capabilities. I do not believe that further studies can produce any more facts.

## NO NUCLEAR CRUISERS AUTHORIZED SINCE FISCAL YEAR 1975

This year again the Department of Defense request for naval ship construction authorization does not include a request for construction of any nuclear-powered guided-missile cruisers.

The last nuclear cruiser authorized was the Arkansas, CGN 41, in the Fiscal Year 1975 program, which followed by three years the authorization of the Mississippi, CGN 40. In acting on the Fiscal Year 1976 DOD budget request, the Congress canceled the fifth ship of the Virginia Class, the CGN 42, on the basis that it should be built with the AEGIS air defense weapons system. Each year since then plans for building nuclear powered AEGIS ships have been cut back or deferred. None are now planned.



## NEED FOR NUCLEAR-POWERED AEGIS CRUISERS

Navy witnesses have testified for the past several years that the AEGIS system is needed to protect our surface ships against the projected Soviet air threat in the 1980's. AEGIS ships are needed in the areas of highest threat, the same areas where our nuclear carrier task forces will be most needed, and where the military advantages of nuclear power may be essential to their mission. Unfortunately, repeated reductions in the planned program have raised the question of whether our nuclear carrier task groups will ever have the nuclear-powered AEGIS ships they need.

In January 1977, President Ford submitted a five-year shipbuilding program from Fiscal Year 1978 through Fiscal Year 1982 which included two nuclear-powered strike cruisers, CSGN's, and ten DDG-47 Class conventionally powered AEGIS ships. The Ford Administration's Fiscal Year 1978 budget request included funds for the lead DDG-47 Class ship and long-lead funds for the first CSGN planned to be authorized in Fiscal Year 1979.

The Carter administration subsequently canceled the nuclear strike cruiser program entirely and directed that instead the Navy adopt an alternative of putting AEGIS in a smaller ship of the VIRGINIA, CGN 38, Class size.

Funds were authorized and appropriated in fiscal year 1978 to buy long-lead material needed to support the new Administration's stated plans to request authorization for construction of the first of four ships, the CGN 42, in the Fiscal Year 1979 program. However, in December 1977 the Navy budget request for construction of CGN 42 in fiscal year 1979 was disapproved in favor of slipping the ship authorization one year to the fiscal year 1980 program. The DOD subsequently slipped the CGN 42 to the fiscal year 1983 program. A few months ago, the DOD deleted any ships of this Class from the current 5-year shipbuilding program.

The issue is whether nuclear-powered AEGIS ships are needed to counter the projected Soviet threat. Aegis is planned as our most capable AAW weapons system. Because AEGIS ships will be expensive, regardless of their means of propulsion, there will never be a larger number. In a naval war against an enemy employing sophisticated weapon systems, all strike force AEGIS ships will be needed in the areas of highest threat. It is under just such circumstances that the advantages of nuclear propulsion are most urgently needed to maximize mobility and minimize logistic support. It is into such high-threat areas that the nuclear carrier task forces will be sent in time of war, and they will need nuclear-powered Aegis ships to accompany them. The Aegis ships should be nuclear for the same reasons that carriers should be nuclear.

In areas where the threat is great enough to require nuclear carriers and AEGIS ships—our first-line naval strike forces—it is highly unlikely that oilers can survive. When a non-nuclear Aegis ship runs low on fuel, it will be necessary to remove the Aegis ship to an area of lower threat to meet the oiler, losing the Aegis protection just when it is most needed.

Another consideration is that to have a credible nuclear-powered guided-missile ship capability in both the Atlantic and Pacific Fleets, it is necessary to build a reasonable number of nuclear ships so that some ships are available for immediate deployment of all times. Only nine nuclear cruisers have been authorized over the past 23 years, and none of these has Aegis.

Unless nuclear-powered AEGIS cruisers are built, our nuclear carriers will have to be accompanied by DDG-47 Class Aegis ships when they enter the highest threat areas, thus giving up the significant military advantages of the all-nuclear carrier task force in the very areas where nuclear propulsion is most needed. Study after study has shown that the small additional life-cycle cost of the all-nuclear-powered carrier task group is more than justified by the added military capability it would provide.

The decisions Congress makes this year on the naval ship-building program will not affect the Fleet until a decade from now. It is always tempting not to make investments for the future when today's problems are so pressing. But where would we be today, if Congress had refused to take the long-range view in the past? Our Forefathers were wise to put the decision-making authority in the hands of Congress. That is the only body in Government where the leaders stay in office long enough to face personally the long-range results of their decisions.



## THE NUCLEAR INDUSTRIAL BASE

The current reduced rates of nuclear ship authorizations threaten the industrial base for the manufacture of nuclear propulsion plant components. For example, the levels of procurement of nuclear equipment in both the fiscal year 1979 and fiscal year 1980 budgets result in significant under-utilization of the present industrial base. The procurement level for major nuclear components in fiscal year 1979 is less than 30 percent of the industrial capacity. In fiscal year 1980 it will be less than 20 percent.

Sustained under-utilization of the industrial base at these low levels increases substantially the risk that suppliers will be unwilling to commit resources to Navy nuclear work. If present suppliers divert their resources to other business, the nuclear industrial base will shrink to levels which may not be adequate for the long term support of the nuclear Navy and for future shipbuilding programs. For example, if the nuclear equipment industrial base were to shrink to capacity levels represented by the fiscal year 1979 and fiscal year 1980 budgets there would be inadequate component vendor capacity to support programs currently projected or under consideration for building nuclear powered ships. Once lost, rebuilding the industrial base will be costly and time consuming and could adversely affect options for future shipbuilding programs.

Mr. Chairman, that completes my formal statement. As I stated earlier, I would like to submit an appendix for the record which covers the Naval Reactors Development program.

## APPENDIX I

## FISCAL YEAR 1980 DEPARTMENT OF ENERGY BUDGET FOR THE NAVAL REACTORS DEVELOPMENT PROGRAM

The fiscal year 1980 Naval Reactors Development budget request is \$278.4 million. This is a decrease of \$18.4 million from the fiscal year 1979 authorized amount. The major areas of this budget request are as follows:

## OPERATING FUNDS

The fiscal year 1980 operating budget for the Naval Reactors Development program is \$241.4, a decrease of \$30.4 million from fiscal year 1979. While funding needs decrease in fiscal year 1980, development efforts remain at a high level. Efforts for fiscal year 1980 include:

- Studies to obtain a broader understanding of the response of reactor materials to various conditions.

- Continuing efforts to design, develop, and procure new prototype cores such as, the Submarine Test Core and the Advanced Fleet Core.

- Upgrading fluids and corrosion test facilities.

- Long-term tests to identify predicted failure modes.

- Improving techniques and equipment for monitoring and controlling new design and operating reactors.

- Developing instrumentation and control equipment for both primary and secondary systems required to support installation of new long life, high performance reactor cores.

- Preparing for fuel inspection and fuel test assembly removal from prototype plants.

- Replacing and examining selected reactor control devices.

- Irradiation testing of improved materials capable of longer core life and higher performance.

- Improving analysis methods for accurately predicting nuclear performance of long life cores.

- The continuing follow, testing, and operational support of the reactors in operating submarines and surface ships to improve operating techniques.

- Continued operation and testing of eight land prototypes which are used to test and evaluate reactor and propulsion plant design.

- Evaluating reactor plant equipment operating in land prototypes and test facilities.

- Examining reactor plant equipment removed from land prototypes in order to forecast operating lifetimes.



| The breakdown of the fiscal year 1980 operating funds is: | Millions |
|-----------------------------------------------------------|----------|
| I. Submarine propulsion reactors-----                     | \$160.1  |
| II. Surface ship propulsion reactors-----                 | 55.6     |
| III. Supporting research and development-----             | 16.9     |
| IV. Personnel resources-----                              | 8.8      |
| Total, operating funds-----                               | 241.4    |

#### SUBMARINE PROPULSION REACTORS

The purpose of the Submarine Propulsion Reactors program is to develop and support nuclear propulsion plants for submarines through the operation of six land prototypes and the continued engineering and physics design, follow, testing, and operational support of the reactors in 114 operating submarines and 31 submarines authorized by Congress or under construction. This work is accomplished through six ongoing programs. Submarine Advanced, Small Submarine, Attack Submarine, Improved Submarine and Deep Submergence Research Vehicle Nuclear Propulsion Plant programs and the S1W Reactor Facility. During FY 1980, effort will continue in all programs. The major developmental areas in these ongoing programs and the work anticipated is summarized below.

##### 1. Advanced Reactor Concept

The advanced reactor concept developmental effort consists of an advanced core designated the S7G. This concept has the potential of increasing on-line reliability. The concept is potentially applicable to future submarine and surface ship designs. This advanced reactor is currently in operation at the Modifications and Additions to Reactor Facilities in West Milton, New York. Work in fiscal year 1980 will include: evaluating S7G prototype reactor nuclear, thermal and mechanical performance; performing life testing of equipment for the S7G design for potential shipboard application; for post operations inspection of various equipment; and developing, qualifying and applying analysis methods and conducting test programs to determine various characteristics necessary to meet long life performance goals.

##### 2. Submarine Test Core

The Submarine Test Core is being developed and will be installed in a prototype reactor plant. The core will consist of modules containing advanced materials. These materials are expected to offer improved performance and increased lifetime. Efforts involving the Submarine Test Core in fiscal year 1980 will include: continuing procurement of modules; conducting tests of module configurations; continuing nuclear design analysis to define parameters for reactor design and development work; and carrying out irradiation testing of improved materials.

##### 3. Nuclear Propulsion Plant for the Los Angeles Class Attack Submarine

Developmental efforts for the reactor plant used in the SSN 688 Class submarines will continue in fiscal year 1980. This plant provides propulsion power approximately equivalent to that of earlier attack submarine. Included in this program are design and development efforts for a new core to extend fuel lifetime.

Work to be undertaken in this program for fiscal year 1980 will include: providing nuclear design lifetime performance information for advanced core ship application, conducting and evaluating periodic ship physics tests to ensure that the reactor plant is operating within design limits; providing information to support reactor structural and material evaluations; providing reactor plant analyses to assure adequacy of the reactor plant systems; and continuing development of an improved process for welding components using advanced welding techniques required to reduce the potential for contamination and fiber optic defects.

##### 4. Advanced Design Nuclear Propulsion Plant for Future Classes of Submarines

An advanced design reactor plant is being designed and developed to provide substantially higher performance than any other submarine propulsion plant now in use or being developed. This plant incorporates technological improvements and will provide the option of developing various improved submarines configurations, incorporating new weapon systems and advanced sonars. This will enable greater exploitation of the technical advantages of the modern submarine



weapon system in either an offensive or defensive role. Efforts in fiscal year 1980 will include: designing and procuring prototype maintenance and refueling equipment to support servicing of the prototype reactor after startup and initiating design and procurement of equipment for a scale model test.

#### *5. Nuclear Propulsion Plant for the Trident Strategic Ballistic Missile Submarine*

Emphasis will continue to be placed on the design, development, test and support of a nuclear propulsion plant for installation in the Trident strategic ballistic missile submarine. The Trident SSG design builds on advanced submarine technology and represents a major reactor plant advancement. The SSG highly instrumented prototype is being built to confirm the performance of the reactor plant for the Trident Class submarine.

In fiscal year 1980, operation and testing of the instrumented core installed in the new SSG prototype reactor plant located at West Milton, New York will continue. This effort will include: initiating detailed planning for interim inspection of a reactor fuel assembly and control rod to verify design; completing nuclear and thermal/hydraulic evaluation of test results to confirm reactor design and operating procedures; and completing evaluation of the prototypical test to verify end of life effects. Further efforts will include developing inspection requirements and acceptance criteria for support adaptors and control rods and surveillance of core manufacturing and reactor equipment modifications.

### **SURFACE SHIP PROPULSION REACTORS**

The purpose of the Surface Ship Propulsion Reactors program is to support and develop nuclear propulsion plants for combatant surface ships, operate and test two land prototypes, and providing testing, engineering follow and operational support for the reactor plants in 11 operating ships and two ships under construction. This work is accomplished through three ongoing programs: Large Ship, Destroyer Type Dual, and Aircraft Carrier Type Dual Nuclear Propulsion Plants. During fiscal year 1980, effort will continue in all programs. The major developmental areas and anticipated work in these ongoing programs are as follows:

#### *1. Nuclear Propulsion Plant for the Nimitz Class Aircraft Carrier*

The two reactor nuclear propulsion plant for these carriers is capable of developing enough shaft horsepower to propel the ship at high speeds and supply adequate auxiliary power for operation of advanced weapons and electronics systems. The core, designated A1G, is the largest core yet developed for naval nuclear propulsion. Fuel life is expected to provide at least 13 years of normal ship operation. As part of this effort, a prototype reactor core has been installed and is operating in an existing prototype reactor plant. Efforts anticipated for fiscal year 1980 include: following, operating and periodically testing the A1G prototype core installed in the A1W-B prototype plant, including designing, developing and procuring equipment required for refueling the prototype and completing advanced planning for the prototype refueling; and designing and initiating procurement of a replacement core for the A1W-B prototype plant.

#### *2. D2W Reactor Core for Cruisers*

The D2W reactor core is operating in the D1G reactor plant at the K. A. Keselring Site, West Milton, N.Y. Emphasis will continue to be placed on prototype testing of the D2W core which incorporates the latest proven technological advances in nuclear system and component design.

Efforts in fiscal year 1980 include: monitoring the D1G prototype reactor for any changes in the characteristics of the D2W core; factoring the results of these evaluations into the design and operating procedures for follow shipboard cores; providing analysis necessary to support the establishment of plant operating restrictions; continuing redesign of structural components and evaluating potential modifications to support the shipboard core design.

#### *3. Advanced Fleet Core*

The Advanced Fleet Core is being designed to utilize new concepts in fuel element manufacture. This is expected to extend fuel element performance resulting in a longer lifetime. Due to the extensive design, development, testing and manufacturing phases associated with this new core, efforts need to be initiated many years in advance of when the core will be available for shipboard use.



Efforts involving the Advanced Fleet Core in fiscal year 1980 will include: developing vendor equipment; initiating pre-production efforts to qualify the reactor core manufacturing equipment; continuing core design and procurement efforts; and initiating work on fuel and nuclear design justification to support procurement of the Advanced Fleet Core.

#### SUPPORTING RESEARCH AND DEVELOPMENT

During fiscal year 1980 supporting research and development will continue to be provided in three areas: examination and analysis of expended cores and test reactor irradiation tests at the Expended Core Facility, operation of a High Temperature Test Facility for obtaining reactor physics information, and development of advanced methods and techniques that can be used in the Naval Reactors programs.

The examination of expended cores and fuel element irradiation test samples and assemblies will continue at the Expended Core Facility, providing valuable technical data on fuel element performance and the long term corrosion effects of irradiation on fuel element cladding and core structural materials. Various ship cores will be analyzed to aid in confirmation of current core designs and form an essential part of the research and development effort necessary to develop longer lived naval reactor cores. Furnishing basic data on materials performance is also part of the effort. This will provide valuable support data for the design, fabrication and operation of fuel systems and materials employed in current naval cores.

Operation of the High Temperature Test Facility will continue providing valuable data regarding physics characteristics being developed for use in naval nuclear propulsion plants, and providing data needed to design and analyze cores.

The Naval Reactors Design Studies effort is continuing development of extended analytical methods and models to improve predictions of material properties and structural response under steady state temperature transient and cyclic use. Work will continue to improve naval fuel performance prediction capability through modification of the naval fuel element performance computer program. This is required for design of longer-lived and high performance cores. The development and application of improved methods of analysis will continue.

Irradiation experiments will be conducted in the Advanced Test Reactor including irradiation testing and evaluation which will provide data of value to operating ships as well as additional confirmation of the adequacy of core designs.

#### PERSONNEL RESOURCES

The 235 personnel requested for the Division of Naval Reactors, including the Pittsburgh Naval Reactors Office and the Schenectady Naval Reactors Office are necessary to meet anticipated programmatic requirements including support of the expanding Navy nuclear powered fleet and the ongoing Water Cooled Breeder effort.

Naval Reactors maintains a minimal personnel level and has been able to operate with austere staffing through careful management of personnel to meet work requirements. Existing personnel have been used to the greatest extent practicable in staffing new programs and expansions to existing programs. Improvements in work force productivity have been achieved over the years by maximum use of available staff to carry out increasing workloads. This approach has resulted in limited changes in the personnel level.

Naval Reactors' personnel maintain close program management and technical direction of the Bettis and Knolls Atomic Power Laboratories and associated facilities, with a combined employment in excess of 6,500. These laboratories are Government-owned, contractor-operated facilities solely devoted to the Naval Reactors program.

#### PLANT AND CAPITAL EQUIPMENT FUNDS

Capital equipment funds (\$15,800,000) are requested in fiscal year 1980 to support continuing research and development activities aimed toward producing technologically advanced nuclear propulsion plants and reactor cores having long fuel life, high reliability, improved performance, and simplified operating and maintenance requirements necessary for enhanced ship lifetime performance. To accomplish these activities, the following types of capital equipment are necessary: quality assurance equipment, process development equipment, irradiation design engineering equipment, analytical, spectrochemical and other laboratory



equipment; fabrication and inspection equipment; and radiation and other equipment such as survey meters, assay gages, and a tape spectra system. Equipment upgrading will continue to provide significant improvements in reliability and increase the efficiency of training naval personnel. Additional capital equipment is also needed to provide for the analysis and examination of spent fuel assemblies and other components operated in nuclear propulsion plants.

Major construction funds (\$17,900,000) are requested in fiscal year 1980 for the Fluids and Corrosion Test Facilities Upgrading, project number 80-AE-f. This project provides for the fabrication of two test loops, additions to and upgrading of corrosion laboratory equipment, the procurement of attendant supporting equipment, and modifications to existing buildings and facilities to accommodate these systems. One test loop will be used for testing small scale components and the other test loop will be used for testing full size reactor plant components. These test facilities are needed to develop design techniques used in naval reactor plants.

General plant project funds (\$3,300,000) provides for minor plant improvements, alterations, additions and minor new construction at Naval Reactors' laboratories. In general, this project consists of performing land improvements, building alterations, utility improvements, additions of existing facilities and upgrading present facilities. The work contemplated under this project will provide continuity of present and planned operations, contribute to operating efficiencies, eliminate potential health, fire, and safety hazards, reduce maintenance and operating costs, and provide facilities to take full advantage of technological advances.

#### NAVAL NUCLEAR PROPULSION PROGRAM

Admiral RICKOVER. I have a few facts which may be of interest particularly to the new members on the committee.

We have today 114 atomic submarines in operation which consists of 41 Polaris-type submarines and 73 attack submarines; 24 additional attack submarines and 7 Tridents are authorized. There are three nuclear carriers in operation with one more building. There are eight nuclear cruisers in operation with one more building.

The number of miles steamed by all our nuclear ships to date is over 40 million miles. That gives some idea of the vast amount of experience we have had in this program in the last quarter of a century. In this program 152 nuclear reactors are in operation which is a greater number than all the commercial reactors in the United States. The number of reactor-years of operation we have accumulated is over 1,700. During 1978 the total radioactivity less tritium, in liquid discharged within 12 miles of shore from all nuclear-powered ships, supporting tenders, naval bases and shipyards was less than two-thousandths of 1 curie.

The radiation to which people are potentially exposed from this amount is the equivalent of what a person would get from about seven or eight chest X-rays. For the 25 years of the naval nuclear program since the *Nautilus*, there has never been an accident involving a reactor nor has there been any release of radioactivity which has had a significant effect on the environment.

The reactor core's lifetime starting with the first one, in *Nautilus*, enabled it to travel 62,000 miles. Now our standard core lasts 400,000 miles. Incidentally the higher lifetime cores are at a decreased cost, allowing for inflation as compared with the *Nautilus* core.

We have trained about 7,000 officers in this program and about 30,000 enlisted men. I would say the majority of these officers and men by far



have gone on to civilian industry where it costs today about \$100,000 to \$140,000 to train a person. If you add that up you can see that we have not taken much out of the national Treasury, compared to the contributions that have been made to the economy.

Our ninth 688-class submarine, the USS *New York City* was commissioned on the 3d of March. These nine ships have obtained higher speeds than any other U.S. submarines developed to date. Some war games have shown that they are far superior to anything we have had. The advantage of these is that they are [deleted] faster than our SSN 637 class. The power required goes up as the cube of the speed.

Our eighth nuclear-powered cruiser, the USS *Mississippi* was commissioned in August of this year. The naval reactor's program also maintains and operates seven land prototype reactor plants which are used for development purposes and for training people. One additional prototype for, the Trident, is under construction and will commence power operation this May.

I hope some of the members of the committee will go up and see that because it is quite an impressive sight.

We have a [deleted] which has been operating well. I could go on with some more but I know your time is limited. I will supply all this for the record if that is satisfactory.

#### AIRCRAFT CARRIER

I would now like to take up the 62,000- or 63,000-ton aircraft carrier presently being recommended by the administration. The Defense Department at one time recommended a conventional Kennedy carrier. I believe they were overruled. The budget includes the smaller one. I have, in previous testimony, recommended the carrier be nuclear. I would like to show you the differences in cost.

Whereas the conventional carrier can only operate for a few days without refueling, the nuclear carrier can operate for 13 years before refueling is required. The conventional carrier does not carry as much ammunition and it has to have an oiler with it. It has to slow down to refuel. I think if you will take a look at these charts I have given you they make the case better than anything I can say.

Senator JACKSON. Have you made any computation on the price of fuel since the first nuclear ships, submarines and then the carriers, cruisers—what the fuel costs were at that time vis-a-vis nuclear and what the fuel costs are now?

Admiral RICKOVER. Show what it was then and what it is now? I would like to supply that for the record.

[The information follows:]

#### COST OF NUCLEAR FUEL

The first core for the submarine *Nautilus* cost about \$2 million to build and provided enough fuel for the *Nautilus* to travel 62,000 miles. The latest cores for submarines with S5W nuclear propulsion plants cost about \$5 million to build and provide fuel for more than 400,000 miles. Thus the cost per mile steamed of a submarine core has come down by a factor of 2½ even without accounting for the inflation that has taken place in the last 25 years. When inflation is considered, the cost per mile steamed of a submarine core has come down by a factor of about 9 since the early days of the naval nuclear propulsion program.



Senator JACKSON. Will you do that, because I think that is a rather startling set of figures, especially when the nuclear cores will last for about 14 years, 15 years.

Admiral RICKOVER. That is right, sir. We are doing better than that now. I am developing cores which will last for [deleted]. I would hope eventually to develop a core that will last for the life of the ship. The thing that stops us mostly is that we have limited knowledge of what the materials in the reactor can do over extremely long periods. Take zirconium, for example. In commercial plants, cores only need to last 2 or 3 years. We have some cores in now that will have to last 15 years [deleted]. There is no knowledge in the world at the present time to show what will happen to these materials because they are operating in a very hostile environment wherein over a period of that many years [deleted] it can change the dimensions. That is under irradiation conditions.

We don't know for sure what will happen. We are trying to find out. My opinion is that we can make cores which ultimately will last the life of a ship. This is where we will apply some of the money that we are asking for.

[Additional information follows:]

#### NUCLEAR VERSUS OIL-FIRED WARSHIP FUEL COST COMPARISON (EQUIVALENT ENERGY BASIS)

For long-life reactor cores containing large amounts of fissionable material, such as cores for nuclear powered aircraft carriers (CVN's) or guided missile ships (CGN's), the operational life of the cores may be limited by the length of time the core materials will hold up in the hostile environment to which they are subjected. Based on the technical information available to date, it is expected that cores being built today will provide for 15 years of satisfactory operation. As additional data is accumulated, it is expected that it will prove feasible to assure satisfactory core life for longer periods for future cores and possibly for present cores.

A set of reactor cores for a Nimitz Class carrier or a new construction nuclear cruiser contains much more energy than would be expended during a 15-year period if the nuclear ships were steamed at the same low, peacetime steaming rates for which oil-fired ship fuel costs are computed by the systems analysts when they make cost comparisons between nuclear and oil-fired surface warships. The result is that the two sets of cores costed for each nuclear ship over the 30-year ship life assumed in DOD cost studies could propel the nuclear ships substantially farther or at higher speeds than the amount of oil costed in these studies for comparable oil-fired ships would propel the oil-fired ships. Thus for the total fuel cost for two sets of reactor cores, the nuclear ships could be operated at a much higher tempo than that assumed by the analysts in the cost estimates for the oil-fired ships; or alternately, it may prove possible to operate the nuclear ships much longer on two sets of cores than the assumed 30 years.

One approach to account for the nuclear ship's core energy is to compare the nuclear fuel cost with the cost of the fuel that would be required to operate the comparable oil-fired ship as much as the nuclear ship could operate using two sets of cores. This comparison is made below for nuclear cruisers and Nimitz Class carriers.

The fuel oil equivalent in each set of new construction cruiser cores (starting with initial installation in CGN 42 and in first refueling of CGN 36 and later cruisers) is 3 million barrels and in each set of Nimitz Class carrier cores is 11 million barrels. Thus, the total oil equivalence in the initial and one replacement set of cores is 6 million barrels for new construction nuclear cruisers and 22 million barrels of fuel oil for Nimitz Class carriers. The total equivalent cost of this fuel can be estimated by using the current purchase cost, storage, and handling cost and average Navy peacetime fuel delivery cost.

However, as explained below, using current average costs for purchase and delivery of propulsion fuel oil can only approximate the relative cost of nuclear



and conventional fuel; the actual relative cost is dependent on indeterminate future events.

For example, using today's purchase prices for oil and nuclear fuel results in an underestimation of the relative cost of oil, since it is expected that the cost of oil will rise much faster than the increase in general inflation affecting the cost of nuclear fuel. In this regard, it should be noted that the oil for a new oil-fired aircraft carrier or guided-missile ship would be purchased in the 1987-2017 period. Oil is expected to become increasingly scarce, and its cost can be expected to rise rapidly during this period. Since most of the cost of naval nuclear fuel is independent of the cost of uranium or the cost of energy, the cost of naval nuclear fuel is not expected to increase nearly as rapidly as the cost of oil.

The average Navy peacetime fuel delivery cost has been calculated by the Naval Sea Systems Command to be \$32.27 per barrel. This was computed using current ship values amortized over 30 years, current operating costs, and actual amounts of ship propulsion fuel oil delivered in a period of a year and takes into account the portion of fuel oil delivered to ships in port. If the tempo of operations of the oil-fired ships were increased, the average delivery cost per barrel would probably be different than the current peacetime average cost. If the tempo were increased by more operations close to U.S. shores in the 2nd and 3rd Fleets, the average cost of delivery would probably decrease. However, if the tempo were increased by added operations away from U.S. shores such as 6th Fleet or 7th Fleet operations or addition of a 5th Fleet in the Indian Ocean, the average cost of propulsion fuel oil delivery might actually increase as existing assets become overloaded requiring additional underway replenishment forces and associated escorts. This would also result if our foreign sources of fuel oil were reduced requiring more fuel to be transported from the United States.

There are many factors affecting the tempo of operations that can be expected to change over the next 40 years, even without a war. For example, as the size of the Fleet decreases without a commensurate reduction in naval commitments, or these commitments increase, the tendency will be to require an increase in operating tempo of major combatants.

On the other hand, as the availability of propulsion fuel oil decreases, there will be a tendency to limit operations of oil-fired ships to minimize oil consumption. This will have an adverse impact on training and readiness for combat. Nuclear ships are not subject to the same constraint.

The total cost of buying, installing, removing and reprocessing the initial fuel for a new nuclear cruiser in fiscal year 1979 dollars is estimated to be \$55.6 million broken down as follows:

|                                                        | <i>Millions</i> |
|--------------------------------------------------------|-----------------|
| Procurement of initial reactor cores (SCN budget)----- | \$31.8          |
| Fuel installation (SCN budget)-----                    | 1.0             |
| Uranium burnup charge (OMN budget)-----                | 2.7             |
| Defueling cost (OMN budget)-----                       | 14.0            |
| Fuel reprocessing (OMN budget)-----                    | 6.1             |
| <b>Total -----</b>                                     | <b>55.6</b>     |

The total cost of buying, installing, removing and reprocessing each set of replacement fuel for a new nuclear cruiser in fiscal year 1979 dollars is estimated to be \$64.6 million broken down as follows:

|                                                            | <i>Millions</i> |
|------------------------------------------------------------|-----------------|
| Procurement of replacement reactor cores (OPN budget)----- | \$31.8          |
| Fuel installation (OMN budget)-----                        | 10.0            |
| Uranium burnup charge (OMN budget)-----                    | 2.7             |
| Fuel removal (OMN budget)-----                             | 14.0            |
| Fuel reprocessing (OMN budget)-----                        | 6.1             |
| <b>Total -----</b>                                         | <b>64.6</b>     |

Thus, the total fuel related costs for two sets of cores in fiscal year 1979 dollars is estimated to be \$120.2 million. A DDG 47 Class ship would require about 6 million barrels of oil to travel the same distance as a new nuclear cruiser could travel with two sets of cores. It should be noted that to consume this much oil



would require more than twice as much travel over the useful life of a DDG 47 Class ship than the 94,000 barrels per year assumed by the analysts for cost comparisons would provide.

The total equivalent cost of 6 million barrels of fuel oil in fiscal year 1979 dollars using the current purchase cost, storage, and handling cost and the NAVSEA estimate of the average delivery cost of oil delivered to Navy ships is:

|                                                                             | Barrel       |
|-----------------------------------------------------------------------------|--------------|
| Storage & terminal facilities.....                                          | \$0.72       |
| Fuel Procurement.....                                                       | 18.86        |
| Average delivery cost of oil delivered to Navy ships (NAVSEA estimate)..... | 32.27        |
| <b>Total .....</b>                                                          | <b>51.85</b> |

\$51.85 per barrel times 6 million barrels equals \$311.2 million.

The total cost of buying, installing, removing, and reprocessing the initial fuel for a Nimitz Class carrier in fiscal year 1979 dollars is estimated to be \$196.5 million broken down as follows:

|                                                        | Millions     |
|--------------------------------------------------------|--------------|
| Procurement of initial reactor cores (SCN budget)..... | \$118.9      |
| Fuel installation (SCN budget).....                    | 30.6         |
| Uranium burnup charge (OMN budget).....                | 10.8         |
| Defueling cost (OMN budget).....                       | 19.8         |
| Fuel reprocessing (OMN budget).....                    | 21.4         |
| <b>Total .....</b>                                     | <b>196.5</b> |

The total cost of buying, installing, removing, and reprocessing each set of replacement fuel for a Nimitz Class carrier in fiscal year 1979 dollars is estimated to be \$193.5 million broken down as follows:

|                                                            | Millions     |
|------------------------------------------------------------|--------------|
| Procurement of replacement reactor cores (OPN budget)..... | \$95.9       |
| Fuel installation (OMN budget).....                        | 45.6         |
| Uranium burnup charge (OMN budget).....                    | 10.8         |
| Fuel removal (OMN budget).....                             | 19.8         |
| Fuel reprocessing (OMN budget).....                        | 21.4         |
| <b>Total .....</b>                                         | <b>193.5</b> |

erration the much greater energy available in two sets of nuclear cores is estimated to be \$390 million. An oil-fired carrier would require about 22 million barrels of oil to steam the same amount as a Nimitz Class carrier could steam with two sets of cores. It should be noted that to consume this much oil would require the non-nuclear carrier to steam at a 47 percent higher tempo or for a 47 percent longer period than would be provided by the 500,000 barrels per year assumed by the analysts for cost comparisons.

The total equivalent cost of 22 million barrels of fuel oil in fiscal year 1979 dollars using the current cost factors cited above is:

\$51.85 per barrel times 22 million barrels equals \$1,140 million.

Thus, using the current propulsion fuel oil purchase, storage, and handling costs and average Navy peacetime fuel delivery cost, it is estimated that the cost of buying and delivering propulsion fuel oil equivalent to two sets of reactor cores would be on the order of 2.5 to 3 times as much as the cost of the nuclear fuel for new nuclear cruisers or Nimitz Class carriers. This is much more than the propulsion fuel oil cost typically allocated to oil-fired ships by cost analysts because those costs are calculated on the basis of current average peacetime fuel usage rates applied over 30 years and do not take into consideration the much greater energy available in two sets of nuclear cores.

I would also like to include in the record if I may, some letters that I have received from captains of nuclear-powered vessels to show from their actual operating experience, and not with any charts, the great advantages that nuclear power provides.

[Letters and excerpts referred to for the record follow:]



EXCERPT FROM LETTER TO ADMIRAL RICKOVER FROM COMDR. D. R. OLIVER, COMMANDING OFFICER, U.S.S. "PLUNGER" (SSN595) DATED JULY 25, 1978

"During the transit from Pearl Harbor to Guam, *Plunger* was assigned to oppose a deploying nuclear task force which included the nuclear ships *Enterprise*, *Long Beach*, *Truxtun*, two towed array (TASS) equipped destroyers (*Albert David* and *Bronstein*), two other conventional destroyers (*Hull* and *John Paul Jones*), and the high value units *Mars*, *Pyro* and *Roanoke*. This exercise was entitled TRANSITEX 2-78 and arrayed against *Plunger* were the destroyers, the helo units attached to the various units and the S-3A units aboard *Enterprise*.

"PLUNGER was directed to oppose the task force [deleted].

"I had not previously been in an exercise in which the full speed and depth capability of PLUNGER could be used so effectively (upon reflection I believe these capabilities may suffer in analysis when an exercise has artificial area limits). [Deleted.]

"The second significant result of the exercise, as far as I was concerned, was [deleted].

EXCERPT FROM LETTER OF OCTOBER 18, 1978 FROM CAPT. E. B. BOSSART, JR., COMMANDING OFFICER U.S.S. "LONG BEACH" (CGN 9)

Indian Ocean operations in company with U.S.S. *Enterprise* and U.S.S. *Truxtun* again demonstrated the superior mobility and flexibility of nuclear powered surface combatants. Under deteriorating weather conditions and heavy seas, the nuclear powered task group was able to sustain a high speed of advance (SOA) and full readiness for multithreat combat operations. Had the task group been composed of conventionally powered ships, the necessity to conduct underway refueling would have seriously degraded task force flexibility and may have resulted in significantly reduced SOAs to conserve fuel when replenishment was impossible due to inclement weather.

DEPARTMENT OF THE NAVY,  
USS DWIGHT D. EISENHOWER (CVN 69),  
FPO New York, February 3, 1979.

Admiral H. G. RICKOVER, USN,  
NAVSEA 08,  
Washington, D.C.

DEAR ADMIRAL RICKOVER: This is a special letter.

*Dwight D. Eisenhower* (CVN 69) departed Norfolk on 16 January for an extended deployment with the SIXTHFLT. The projected transit route was along the 30th parallel to avoid the major storm high probability area located further to the north. As it happened, on the 18th an intensive low pressure area developed rapidly which affected our weather and sea conditions dramatically.

For the remainder of the entire transit *IKE* was subjected to winds ranging from 25-45 kts and seas and swells 18-24 feet. *IKE* experienced rolls up to 15 degrees and pitching deck motion up to 11 degrees. Under these conditions flight operations would have been impossible on any other class of aircraft carrier. However, the capabilities designed into the NIMITZ class carrier permitted flight operations everyday except one.

Two methods were employed to provide a relatively stable flight deck for operations. The first method was to utilize the advantages of a nuclear powered propulsion plant to run downwind at high speed with the stern into the swell. Although this resulted in at times only 5-10 kts of positive wind over the deck the high energy arresting gear systems built into the ship were able to accommodate all the high performance aircraft aboard. The second method employed was to put the bow into the wind and sea and then back down at a high bell. In this manner wind over the deck was maintained at about 25-30 kts and the deck was steady. Flight operations were conducted an entire day utilizing this technique with only a slight loss of speed along PIM.

The marriage of catapult and arresting gear technology with the obvious advantages of nuclear power continue to impress and amaze me as to the broad spectrum of tactical flexibility I have at my disposal. In essence, *IKE* is not a slave to wind conditions; instead, with a well trained air wing, almost any course is available in response to the existing tactical situation. The significance of this to an embarked tactical commander is of course obvious and greatly expands the boundaries for operational planning.

WILLIAM E. RAMSEY.



DEPARTMENT OF THE NAVY,  
USS DWIGHT D. EISENHOWER (CVN 69),  
FPO New York, February 4, 1979.

ADMIRAL H. G. RICKOVER, USN,  
NAVSEA 08,  
Washington, D.C.

DEAR ADMIRAL RICKOVER: This is a special letter.

During the period 16 November through 4 December 1978 *Dwight D. Eisenhower* (CVN 69) participated in a major joint exercise in the Gulf of Mexico called Gulfex 79. Additional participating forces were units of the U.S. Navy, the Royal Navy and tactical squadrons from the USAF. In addition the nuclear cruisers, U.S.S. *Virginia* (CGN 38), U.S.S. *California* (CGN 36), and the U.S.S. *South Carolina* (CGN 37) joined with IKE to form the Nuclear Power Task Group (NPTG) element of naval forces. IKE was the Flagship for the exercise with COMCRUDESGRU EIGHT embarked.

The exercise was one of the most complex and intensive conducted in recent times. The opposition was highly sophisticated—two nuclear submarines, the *RN Conqueror* and *Batfish*—and approximately 600 strike sorties flown against the task force by USAF units.

In the face of such opposition the tactical flexibility designed into IKE enabled us to conduct operations with very few engagements with aggressor forces. In situations where a submarine datum was established flight operations were conducted away from the datum unconstrained by wind over the deck requirements. This was possible by utilizing the high speed capability provided by our nuclear powered propulsion plants combined with the installed high energy catapult and arresting gear systems and a well trained air wing used to operating in cross wind and low winds over the deck. Rather than being constrained to setting a course into the wind we maneuvered as necessary to avoid coming under attack.

The same capabilities were utilized to negate the effectiveness of the high density raids flown against the task force by USAF tactical aircraft. Complementing tactical measures were taken such as dispersion of forces, deception and emission control to confuse the tactical picture which successfully reduced the numbers of aircraft penetrating to the carriers. Those aircraft which did locate IKE were all detected and engaged by missile ships and CAP.

The Gulfex 79 scenario contained a high speed transit to the Western Gulf 100NM off the coast of Mexico and thence southward through the Yucatan straits. This high speed transit was conducted by the NPTG under emission control to determine the effectiveness of Cuban forces in maintaining track of the force. On arriving at a position 100NM southwest of the Western tip of Cuba, flight operations were conducted for a day. Subsequently another high speed transit was conducted south of the Florida Keys to homeports. During this transit Cuban air activity was noted which monitored the force movement until east of Key Largo at which time they broke contact.

During the entire 17 day period of high speed and intensive flight operations IKE only refueled from an oiler once and still returned to homeport with over [deleted] gallons of JP-5 aboard [deleted]. The exercise demonstrated dramatically the expanded tactical options available to an embarked commander employing the capability designed into the NIMITZ class carrier.

WILLIAM E. RAMSEY.

Admiral RICKOVER. A nuclear carrier does not have to have an oiler for ship propulsion. You can send it out wherever you want in an emergency and it will operate. With the other one it only lasts for several days. What are you going to do at that time, particularly with a shortage of oil? The cost is immaterial compared with the ability to get oil delivered in the combat zone. That is the real thing.

Senator JACKSON. We can use a nuclear fleet right now in the Indian Ocean.

#### KNOWLEDGE OF RADIATION

Admiral RICKOVER. In the few minutes remaining I will try to tell you a little bit about radiation. I have one page and since so many



questions have been raised about radiation, and I am sure that is true in Senator Cohen's State, too, I would like to give you some facts if I may. Is that all right, sir?

Senator JACKSON. Yes, go ahead.

Admiral RICKOVER. The knowledge of radiation is not as uncertain as is frequently stated. More is known about the effects of radiation than almost any other substance encountered by humans in industry. One example can help put the knowledge and certainty in perspective. In a typical group of 10,000 people in the United States a total of 1,600 will die of cancer. Risk estimates for radiation based on examining large amounts of data from exposure to humans and animals have been made by the National Academy of Sciences and the United Nations Scientific Committee on the Effects of ionizing radiation. These risk estimates agree that if each of the 10,000 received over his lifetime 1 rem more than he was already receiving from background and medical sources, then one extra person would die of cancer. Therefore, the 1,600 cancer deaths would increase to 1,601 in this group of 10,000.

This example is directly applicable to the combined Navy and Department of Energy naval reactors program where the average lifetime occupational radiation exposure is one rem.

However, a few highly controversial studies have concluded that more people will die from radiation than the National Academy of Sciences and United Nations' committees predict. If the higher risk estimate of one well-known study is applied to the same population group of 10,000, then the 1,600 cancer deaths would increase to 1,610. That is the real issue in radiation. Probably it may cause 1 to at most 10 additional deaths in 10,000 people.

This has been blown out of all proportion and it is very difficult to put it in any proper context.

That is all I have to say. Now I will be very happy to answer questions.

Senator JACKSON. Senator Cohen?

Senator COHEN. Thank you, Mr. Chairman.

I believe, Admiral Rickover, you testified before the House Armed Services Committee and you released it today?

Admiral RICKOVER. Yes, I testified at length.

Senator COHEN. As I understand it, your testimony has been released for publication in the House?

Admiral RICKOVER. Yes, sir. I will provide a copy of my remarks for the record.

[The information follows:]

#### STATEMENT OF ADMIRAL H. G. RICKOVER, USN, DIRECTOR, NAVAL NUCLEAR PROPULSION PROGRAM

#### LOW LEVEL RADIATION EXPOSURE IN THE NAVAL NUCLEAR PROPULSION PROGRAM

##### INTRODUCTION

Mr. Chairman, an issue which is receiving considerable attention presently is the question of the health effects due to low level radiation. This is not a new issue but there are those, particularly some in the news media, who would have us believe they just discovered it. I am aware there is considerable interest in this matter on the part of the members of this Committee as it pertains to shipyard employees involved in naval nuclear work and I have been assisting your staff in the review they are conducting.



Because this is a complex issue that has involved many organizations and activities. I have prepared a statement devoted only to low level radiation exposure. I have another statement that deals with other programmatic aspects of the Naval Nuclear Propulsion Program. As I have been engaged in work involving radiation for over 30 years, I will address some of the recent issues in order to clarify the coverage provided by the news media. I should point out that the views I am expressing to you this morning are my own and they do not necessarily reflect those of my superiors.

#### RADIATION EXPOSURE LIMITS

Since the beginning of the Naval Nuclear Propulsion Program, I have followed the radiation exposure limits used in the United States and internationally. These limits are not established by me or by the Navy. I do not have the authority, responsibility, or means to carry out the extensive work that is necessary to determine radiation exposure limits.

International and national organizations have been established to develop recommended radiation limits. The U.S. occupational radiation limits were approved by the President based on recommendations of the Federal Radiation Council in 1960. That Council no longer exists; its functions have been taken over by the Environmental Protection Agency.

The basic U.S. occupational radiation limits for an individual are (1) three rem per quarter year and (2) five rem accumulated dose for each year beyond the age of eighteen. Thus, twelve rem per year is allowable so long as one does not exceed his cumulative limit.

In my work I have always used the most restrictive official standards on radiation. For example, in 1966, when I learned of the suggestion by the International Commission on Radiological Protection that exceeding five rem in one year should be infrequent, I implemented a rigorous 5 rem limit. In 1974, the Department of Energy implemented 5 rem as a yearly limit for its contractors. In 1979, the Nuclear Regulatory Commission and other government agencies are also considering adopting 5 rem as a yearly limit.

There has been suggestions that the limit should be reduced even more. What the limit should be is not for me to say. It must be based on careful research and weighing the potential risks with the benefits. I assure you, however, that if it is determined that the radiation limit should be reduced, I will implement the change for my work. Of course if such a change were to result in curtailment of nuclear ship operations, I will report that to Congress where the final decision on what to do must be made.

#### NAVY RECORD ON OCCUPATIONAL RADIATION EXPOSURE

Last year I testified before you on the record of the Naval Nuclear Propulsion Program in controlling radiation exposure and provided a report for the record. I understand copies of this report were circulated to the members earlier this week. An updated report has just been issued that includes data covering 1978. I would like to provide copies to the members and, with your permission, include a copy in the record.

Page 2 of this report, NT-79-2, shows a graph of the total occupational radiation exposures to personnel operating ships and to employees in the shipyards. In 1978 the total exposure was about one quarter the amount in the peak year 1966, even though the number of nuclear-powered ships nearly doubled.

No civilian or military personnel in the Naval Nuclear Propulsion Program have exceeded quarterly or annual radiation exposure limits since 1967. The maximum exposure received in 1978 by an individual was 3.068 rem, the only person out of 37,387 military and civilians to receive more than 3 rem in 1978. The average annual exposure of shipyard workers in 1978 was one quarter of a rem. The average annual exposure of ship operators in 1978 was one tenth of a rem.

As a related matter there is another report which describes the record of the Naval Nuclear Propulsion Program in handling radioactive waste. I have copies of this report, NT-79-1, for the members and, with your permission, I would also like to include a copy in the record. This is the fourteenth annual report I have made on this subject.

The results show that the total gamma radioactivity discharged to all harbors in each of the last eight years has been less than two thousandths of a curie. If



one person were able to drink the entire amount of radioactivity discharged into any harbor in 1978, he would not exceed the annual radiation exposure permitted by the Nuclear Regulatory Commission for an individual worker.

#### DEVELOPMENTS REGARDING DR. NAJARIAN AND BOSTON GLOBE STUDY

With regard to actions concerning health effects due to radiation exposure, I first received the report of radiation studies of the workers at Hanford in December 1977. Since the report cited some apparent health effects, I requested those responsible within the Department of Energy to arrange for an independent study of the effects of radiation on the health of shipyard workers. This study is being performed by Johns Hopkins University and they have visited and obtained data from all six naval shipyards which do nuclear propulsion work and the Electric Boat Division of General Dynamics.

In February 1978, Dr. Thomas Najarian and The Boston Globe, in a joint venture published a study they had conducted which caused wide concern. Their study alleged that radiation had caused increased cancer death rates at Portsmouth Naval Shipyard. They had reviewed state records and found 1,722 death certificates of persons identified on the certificates as shipyard workers. They contacted the next of kin of about one-third of these to identify which were radiation workers. The report alleged that shipyard employees in the study determined to have been exposed to radiation had a cancer death rate twice the national average, and 80 percent higher than the rate for shipyard workers who, according to the study, did no nuclear work.

Since issuing this report, Dr. Najarian has spoken before many gatherings, and many newspapers have repeatedly reported on this study in a manner which leads the readers to believe its findings are accurate. In a number of cases it has been erroneously summarized; the conclusion being that the overall death rate for Portsmouth radiation workers is six times normal. All of this has resulted in strong public and congressional interest and the establishment of the Center for Disease Control's epidemiological study of Portsmouth.

There are some important developments which have not received much attention. One is that the Najarian study has been reviewed by other experts who found it to contain serious deficiencies. The British National Radiological Protection Board found a number of problems ranging from biased and inadequate data collection to failure to account for the effects of other carcinogens. I understand that even Dr. Najarian has recently determined that some of his original leukemia cases he thought to have occurred in radiation workers were not in fact nuclear workers. That the results of the Najarian study are highly questionable has received virtually no public notice.

A second important fact is that neither Dr. Najarian nor The Boston Globe have been willing to cooperate fully with the Center for Disease Control or some other independent organization in verifying the study. This is particularly reprehensible since it is leaving the public under a continuing cloud of anxiety. For a doctor and a newspaper to be unwilling to provide all of their data in a situation like this is contrary to the public interest and certainly inconsistent with their public and professional obligation. I have yet to see an article in The Boston Globe reporting on their and Dr. Najarian's reluctance to cooperate, and the reasons for it. If they are genuinely interested in the health of the public and of the shipyard workers, and not just in publicity, they would have cooperated fully and immediately. That they have not is, in my opinion, unconscionable.

#### NAVY COOPERATION WITH CENTER FOR DISEASE CONTROL

With regard to the study by the Center for Disease Control (CDC) I have ensured full cooperation by the Navy to the CDC people and their panel of independent scientific and medical experts established to monitor and review the study. The Navy has provided CDC personnel records of the 25 000 workers who worked at Portsmouth for at least one day since January 1, 1954. The Navy has also provided CDC with the radiation histories for the approximately 10,000 workers who had potential radiation exposure since 1959. CDC states that their efforts will take several years to complete. On January 31, 1979 personnel from CDC and five members of their oversight panel visited Portsmouth Naval Shipyard. The shipyard provided them all information they requested. At the end of the visit, the Shipyard Commander invited CDC and its consultants to return to the yard as an entire group or as smaller groups to obtain any additional information they needed or to investigate such other areas as they desired.



## UNION ACCESS TO CDC CONFERENCE

You may have read news reports regarding the unions not being allowed to attend meetings between the shipyard and the oversight panel. One union representative charged this was a coverup. The conference at Portsmouth attended by CDC and the members of the oversight panel was at the express request of CDC. Throughout preparations for the visit, we met all of CDC's requests. There were two cases where persons, not associated with the CDC team or the oversight panel, requested permission to join the one day conference. The Navy deferred the decisions to CDC since this was CDC's conference, not the Navy's. It would have been inappropriate for the Navy to decide who should or should not be party to their conference.

Another complicating factor was the consideration that CDC had requested access to personnel records of shipyard employees; records which contain information falling within the restrictions of the Privacy Act. Due to their status as official members of a government sponsored investigation, the CDC team and their group of consultants were given access to these records which were to be reviewed on the day of the conference. Unless CDC was willing to designate outsiders as official members of their team, access could not be granted to these records without violating the Privacy Act.

Thus, when the Department of Labor requested that two representatives involved in occupational, safety, and health activities be allowed to join the conference, CDC was asked if they wanted these individuals added to their official list. CDC replied that they did, and the Navy arranged for the two OSHA representatives to be given status as team members with full access to all records and proceedings. Although the Navy had accepted these Department of Labor representatives, they eventually withdrew and did not participate.

On the request of a representative of the international union, the same procedure was followed. However, in this case CDC did not elect to add the name to the list; accordingly, union involvement was limited. Recognizing the interest of the unions in this matter, the Navy arranged with CDC to have the local union representatives meet separately with the group of consultants so they could air their views and ask any questions regarding what the consultants had received from the shipyard. At this meeting the representative of the international union was also invited and did attend.

There was no similar problem during the more recent visit to the Portsmouth Shipyard by staff members of the House Armed Services Committee. The congressional staff specifically requested to have union representatives in their meeting. Since this was their meeting, the Navy had no objections, and union representatives were present at all meetings and tours during the entire visit.

## COMMENTS ON STATEMENTS ALLEGING EARLY PROBLEMS IN RADIATION CONTROL

An issue I will now discuss is the statements made by a few former shipyard workers who have claimed that workers died from radiation exposure during early employment in nuclear propulsion work.

One worker has recently claimed he knows of more than 40 shipyard nuclear workers who have died of cancer. I am not surprised. There have been almost 10,000 workers at Portsmouth who have received radiation exposure since nuclear work started in the shipyard. Of these, 1600 would be expected to die at some time of cancer from causes other than radiation. What is surprising is that he doesn't know of more cases.

Charges have been made that film badges were sometimes worn incorrectly or that some workers wore film badges assigned to others. Undoubtedly a few workers violated rules without getting caught. But there were detailed procedures to prevent such mistakes as summarized on pages 7 and 8 of the Navy radiation report referred to earlier.

It is probably more significant that numerous tests at shipyards have shown that radiation exposures measured by film badges averaged fifteen percent higher than actual radiation exposures. Perhaps I should accede to the claims that radiation exposure records are inaccurate and reduce the film badge exposure records by fifteen percent.

## RADIATION INJURY CLAIMS

In 1978, a private contractor worker in New Mexico was awarded \$75,000 in worker's compensation because he feared radiation. No physical injury was claimed. No excessive exposure to radiation was claimed. In 1979, the Connecticut



State Supreme Court awarded compensation to a municipal employee for injuring his ankle playing ping pong before his work shift started. A compensation claim was approved for a Navy worker for headaches allegedly caused by sitting at a desk with his head down; the implications of this award are enormous. In the last ten years, over \$75,000,000 has been awarded to Naval Shipyard employees for alleged hearing loss in a compensation program that the General Accounting Office investigated and found riddled with fraud and abuse.

Three claims for radiation induced injury have been awarded to Naval Shipyard employees; all are awards which I believe to be improper.

I am not against the payment of legitimate claims wherein the causes can be substantiated and it can be clearly shown that the government is at fault. I recognize this is a difficult and perplexing area that the government is going to have to face and I am glad to see that Secretary Califano has made this an item of priority.

I have heard suggestions that the Navy should pay all shipyard worker claims for cancer just to be sure that we don't miss any that may be related to radiation. At a typical shipyard, there have been about 10,000 workers authorized to receive radiation exposure from Naval Nuclear Propulsion work since the beginning of the program. Their average exposure is about 1.5 rem, which is only one one-hundredth of that which they are authorized to receive during their working lifetime. This is only one tenth of that which they receive from medical and natural background during their lifetime.

Scientific estimates indicate that an average of 1.5 rem of radiation exposure for 10,000 people may cause one to two extra cancer deaths. In a typical group of 10,000 in the U.S. 1600 will die from cancer. In fact, anyone who lives long enough is likely to die of cancer. Adding shipyard radiation work changes the expected number of cancer deaths from 1600 to 1601 or 1602. To pay compensation to 1600 individuals so that one or two possibly deserving ones are not denied is ridiculous and unaffordable.

The Navy's experience with hearing loss claims demonstrates there would be no lack of claims if such a program were offered; only a lack of money in the U.S. Treasury would stop the stampede. But today, there is still enough money left in the Treasury, and some government agencies appear willing to hand it out readily, by encouraging claims. Inflation may soon solve this problem. Either it will not pay to make claims, or the taxpayers will go on strike against government officials who are so generous with their taxes.

#### SHIPYARD INSPECTION REPORTS AND CONGRESSIONAL TESTIMONY

Another issue I would like to address is an accusation made in December of last year by the Critical Mass Energy Project. This group charged that I misled a congressional committee when I testified before the Subcommittee on Health and the Environment of the Committee on Interstate and Foreign Commerce. They stated I failed to mention a strongly worded 37 page radiological inspection report I issued three months before the hearing. They stated the report contradicted my testimony regarding the state of affairs at Portsmouth Naval Shipyard.

In all my testimony before Congress I have always presented the facts as I know them, and when my opinion has been sought I have given it as straightforwardly as I could. I assure you I will continue to give the most forthright testimony I can before any Congressional committee.

The accusation by the Critical Mass group and treatment by the media were directed at me personally. It is popular to attack the government or anyone who represents it, especially if the topic is a nuclear one. The government representative is automatically in the wrong, and the so-called "Public Interest" groups are always right. The fact is that the issue before the Subcommittee during the February 1978 hearings was the effects of radiation on the health of shipyard workers, particularly at Portsmouth Naval Shipyard. And this is precisely the topic I dealt with in some detail. As was discussed at the hearing, a final answer will require extensive epidemiological analysis such as is now being done by the Center for Disease Control and the Johns Hopkins University.

The idea that there was in some way a conflict, because I did not in my testimony specifically refer to the findings of a Portsmouth radiological control inspection conducted prior to the hearing, was just not correct. Of course I was aware of the inspection but this was just one of many actions going on all the



time at all the yards to check their performance. Had the inspection discovered anything indicating that shipyard workers were exceeding their radiation exposure limits, or being adversely affected by radiation, this would have had a bearing on the Subcommittee's investigation.

At the hearing I was dealing with the results of my efforts as they related to the question of "the effects of low level radiation on health" which was the express topic the Chairman had indicated to be the purpose of the hearing. To my recollection, no one raised other aspects of radiological controls during the hearing. Had they been raised I would certainly have addressed them. In fact, the Chairman emphasized several times that the Subcommittee's concern was the effects of radiation on human health.

The text of the hearing, when it is published, will show I did not say there were no problems in carrying out radiological work at the Portsmouth Shipyard. Of course there are problems at Portsmouth. There are problems at any shipyard or, for that matter, at any industrial activity engaged in significant work involving radiation or any other type of work. If there are no problems, why would anyone be looking for them? If they look but find no deficiencies, they are either not looking hard enough or they have finally discovered perfect human beings. So far I have found such perfect persons only in the news media; they never make mistakes.

Inspecting a shipyard is one of the methods I use to determine if it is performing its job to my standards. In my testimony, I stated that I conduct regular radiological control audits and that in several cases I have had to stop radioactive work because I was not satisfied with a yard's performance. I have required that any condition which can be improved should be improved, and I consider such a condition a deficiency until improvement has been demonstrated.

My inspection report on Portsmouth is typical of inspection reports I issue periodically on all shipyards engaged in Naval nuclear propulsion work. These inspections review every facet of the yards performance in a most critical way: training, drills, work practices, radiation, etc.

Although the Portsmouth inspection report contains 37 pages of deficiencies there were no observations during this inspection which would likely be cited as violations of the requirements in the code of Federal Regulations used by other Government agencies to regulate the handling of radioactive material. The deficiencies can only be called so in comparison with the high performance standards of radiological control implemented by me at shipyards. The language used is strong because that is the way I approach the control of radiological work and all other work. I do not let even the most minor aspect pass without requiring it to be recorded and brought to the attention of senior management, in writing.

The shipyard inspection reports are written in a very critical style for a specific purpose. I want all concerned to realize I mean business. However, if the inspection reports are reviewed carefully, it will be seen that they do not alter the conclusions I presented in my testimony or in the two Navy reports I have previously discussed. It is because of this kind of tight scrutiny that shipyard workers are not being over-exposed, and are staying well within the Federal limits specified for occupational radiation exposure.

#### NEED FOR PERSPECTIVE ON RADIATION

I have tried to address some of the current issues being raised in the area of low level radiation and health effects as they relate to matters for which I am responsible. I realize this statement is lengthy, but the complexity of the issues makes it difficult to deal with them briefly. In closing, I would like to cover one final aspect, the need for perspective on radiation as it relates to the actual world in which we live.

A proper perspective on radiation is essential if we are to continue to achieve the benefits of nuclear power, medical diagnosis, and medical treatment using radiation. Most of the press coverage on radiation is biased and not provide a balanced view. Probably this is because most newspapermen have little technical background in the field, and obtain their stories from a few highly vocal opponents of nuclear power. These people have to justify their own particular theories and ideas. As a result much of what the public reads is distorted and creates needless anxiety and fear, particularly because of the pejorative nature of most headlines.



The fear of radioactivity today can be likened to the fear of electricity following the invention of the electric light bulb 99 years ago by Thomas Edison. Public fears of electricity were so inflamed that wall plaques had to be installed in rooms with electric lights assuring people that "the use of electricity for lighting is in no way harmful to health, nor does it affect the soundness of sleep." Yet the use of electricity has transformed man's life on earth from a relative short one of drudgery to one where long life and higher aspirations can be realized.

Radiation is a natural part of man's environment. The average person in the United States receives each year from natural radioactivity in the earth and cosmic radiation about 0.1 rem. Yet rarely do accounts which the public reads give them this simple and well known fact. It is clear that the public needs more balanced information on radiation from man's activities if they are to make informed choices.

In May 1978 the President requested an interagency task force to formulate a program of low-level radiation. Two days ago Secretary Califano released the draft reports from this task force. These reports provide a signal service in getting more balanced information on radiation in the hands of the public.

In my program one of the best tools we have to minimize a worker's radiation exposure is training. We train him to understand the technical aspects of radiation, and give him information on its effects so he can place his exposure in proper perspective. Many of the ideas on ways to minimize radiation exposure while performing nuclear work have come from workers themselves, in direct response to this training. This has also resulted in more efficient maintenance work on nuclear propulsion plants. In the same manner, I believe a proper public information program can go a long way towards helping the public minimize unnecessary radiation exposure, while permitting the benefits we derive from its many legitimate and valuable uses.

A number of newspaper accounts over the past year have reported on the occupational radiation exposure by shipyard personnel engaged in naval nuclear propulsion work. The thrust in many cases is that their occupational radiation exposure is resulting in some unique health hazards. How this occupational exposure compares to other sources of radiation normally encountered in life or to other common risks in life is rarely touched upon.

Here are some facts: The average lifetime occupational radiation exposure of 1.5 rem for shipyard personnel is about one tenth the amount of radiation exposure the same people receive over their lifetimes from natural background and medical X-rays. This 1.5 rem average lifetime occupational radiation exposure can be compared roughly to the 5 rem received in a year from smoking one pack of cigarettes per day.

Another way of looking at this is to compare the total occupational exposure of shipyard workers to other sources of exposure. In 1978 the total occupational radiation to all shipyard workers involved in naval nuclear propulsion work was 3700 man-rem. This compares to:

20,000,000 man-rem to the population of the U.S. each year from natural background radiation;

17,000,000 man-rem to the population of the U.S. each year from medical and dental radiation;

625,000 man-rem to the population of the U.S. each year from radioactivity in natural gas used for cooking;

100,000 man-rem the one million inhabitants of Denver could avoid each year if they moved to a region such as Washington, D.C. which has lower natural background radiation levels. I assure you I own no real estate in Washington;

12,000 man-rem total to passengers in jet airplane flights in the U.S. each year from cosmic radiation at the high altitudes.

From this comparison it is evident that if the total of 3,700 man-rem of occupational radiation exposure is of great concern, there are many other common activities and situations that should be of far greater concern and the subject of immediate investigation.

I trust that these examples should put the small radiation exposure from the Naval Nuclear Propulsion Program into some perspective.

Nevertheless, let me express it in one last example which is particularly relevant to Members of Congress. The total radiation exposure received last year by the Members of Congress and their staffs from natural background and medical



sources was about the same as the total occupational radiation exposure received by the employees of all nine shipyards from their work associated with Naval nuclear propulsion plants.

From these examples, I think you can see just how out of balance most of the news coverage has been on this subject.

Senator COHEN. And I would assume that even though we are in executive session now, any of the answers you might give to me would not be classified?

Admiral RICKOVER. Any answer I give on radiation can be made public.

#### REDUCING HEALTH HAZARDS

Senator COHEN. I think you are quite correct that we are both interested in reducing the unnecessary apprehension and fear that have been generated by a lot of reports. I think to the extent that we have some, like yourself, who are expert in the field, it will be helpful to get your responses out to the public.

Admiral RICKOVER. Yes; I read in the paper yesterday that 495 people in this country were killed by accidents due to lawnmowers. There ought to be an extensive investigation into why we have 495 deaths from lawnmowers. One remedy would be not have any lawns.

Senator COHEN. Just to elaborate on that, something like 60,000 people are actually injured through lawnmowers because of what has been described as negligent design with the chute propelling an object like a nail or metal object on the lawn directly back in the face and limbs of the operator. So they have made some significant changes in the design of lawnmowers.

I don't think we should diminish the fact that a lawnmower is a dangerous instrument, and I think they have made some significant improvements.

Admiral RICKOVER. Sir, I am merely pointing out that all any pressure group today in the United States has to do is yell loud enough and millions of dollars are spent, and all kinds of investigations are made.

Senator COHEN. I assume you would disagree with the Nuclear Regulatory Commission shutdown of the Maine Yankee atomic powerplant?

Admiral RICKOVER. Are you asking my opinion about that, Senator Cohen? The NRC has a legal duty to perform. I am not privy to all the facts they have. You must realize there are those whose position today is that if anyone makes a complaint about the safety of a nuclear plant, the NRC should shut it down. Even Congress, if somebody makes a complaint about Congress, people recommend that it ought to be shut down too. [Laughter.]

Senator COHEN. I hope you would not put that to a public referendum.

Admiral RICKOVER. May I eliminate that from the record, sir?

Senator JACKSON. We will consider it.

#### RADIATION STUDIES

Senator COHEN. Admiral, as an official both in the Department of Energy and Department of the Navy, what steps have you taken to insure that the study Johns Hopkins is doing is expedited?

Admiral RICKOVER. We do not run that, sir.



We recommended that such a study be initiated by the Department of Energy. It is actually being conducted by Johns Hopkins. I understand that for them to get anything really meaningful will take several years. It is a matter of good fortune that the navy yards have excellent radiation records so you can have a controlled study of many people who are working in the same place. Of course, they must take into account the various factors other than radiation which could cause disease.

There are lead burners and there are all kinds of people. This will be more than a 3-year study, I believe. This will be a very valuable study because it will put radiation in comparison with all other things.

All six navy yards which do nuclear propulsion plant work are involved in this study. These yards are really ideal places.

Senator COHEN. Do you have information concerning their methodology, what they are using?

Admiral RICKOVER. Yes.

Senator COHEN. You don't have to take the time now but perhaps supply it for the record. I will ask a series of questions for the record.

Admiral RICKOVER. Yes; I would appreciate that very much because I don't want to take too much of your time.

Senator COHEN. Are you familiar with Dr. Thomas Mancuso who quit the panel of civilian scientists which acted as a sort of watchdog over CDC?

Admiral RICKOVER. He was the watchdog that I think was self-appointed. Generally the agency appoints them. In this case he has made himself watchdog.

Senator COHEN. He was not appointed by anybody?

Admiral RICKOVER. His appointment was requested by several Members of Congress. He had an opportunity to join one of the groups that was at Portsmouth. I think he is acting for himself.

Senator COHEN. Do you know why he quit the panel?

Admiral RICKOVER. He chose to do it. The best I know is that it was not anything that had to do with the panel itself. It was a voluntary and unilateral decision on his part.

Senator COHEN. He charges that the Government refused him access to health records.

Admiral RICKOVER. They did because the health records are being studied by the official group but we cannot permit individuals to go in and look at the personnel records of people. That is against the law. We can't do it. When an official body is appointed they have access to them and they have access to any record that there is in the yard.

We cannot permit an individual on his own to come in and say, "I would like to see everybody's records."

Senator COHEN. I may be in error on this, and I will try to clear it up for myself.

Admiral RICKOVER. I may be in error too, sir.

Senator COHEN. That Congress had ordered a group of civilian scientists to oversee the CDC study and he quit because he could not have access. So, if he were in fact appointed as part of a panel—

Admiral RICKOVER. I believe he was asked to join it and he could have come in and looked at them. He had the opportunity to do that.

[Subsequent to the hearing, the following information was provided for the record:]



Admiral Rickover was referring to Dr. Irwin Bross rather than Dr. Mancuso. Dr. Bross was appointed by the National Institute of Occupational Safety and Health to the panel for the CDC study of Portsmouth Naval Shipyard workers to oversee CDC efforts. However, Dr. Bross has made statements to the press that he is a self-appointed watchdog for the people. He is still a member of the panel although he has not participated in a review of shipyard records with other members of the panel.

Dr. Mancuso was requested by NIOSH to be a panel member also, but he refused.

Senator COHEN. Admiral, in the Naval Sea Systems Command February 1979 report, there are exposure levels contained in that report from 1954 for shipyard personnel involved in nuclear propulsion work. Again, for the record, I would like to have the same kind of detail for the Portsmouth shipyard as well.

Admiral RICKOVER. Yes, sir, I will put that in the record. In addition to that, if you are interested in any yard we will be happy to give you an answer. As you know I have volunteered to give you a personal briefing on that subject.

[The information follows:]

PORTSMOUTH NAVAL SHIPYARD

| Year       | Number of personnel monitored who received exposures in the following ranges of rem for the year |     |     |     |     |        | Total number of personnel monitored | Total man-rem |
|------------|--------------------------------------------------------------------------------------------------|-----|-----|-----|-----|--------|-------------------------------------|---------------|
|            | 0-1                                                                                              | 1-2 | 2-3 | 3-4 | 4-5 | Over 5 |                                     |               |
| 1959.....  | 1,661                                                                                            | 178 | 116 | 71  | 44  | 21     | 2,091                               | 1,344         |
| 1960.....  | 1,163                                                                                            | 135 | 64  | 20  | 3   | 0      | 1,385                               | 622           |
| 1961.....  | 412                                                                                              | 0   | 0   | 0   | 0   | 0      | 412                                 | 18            |
| 1962.....  | 1,359                                                                                            | 197 | 127 | 93  | 51  | 18     | 1,845                               | 1,562         |
| 1963.....  | 1,186                                                                                            | 2   | 0   | 0   | 0   | 0      | 1,188                               | 90            |
| 1964.....  | 1,849                                                                                            | 167 | 78  | 49  | 30  | 9      | 2,182                               | 1,111         |
| 1965.....  | 1,781                                                                                            | 358 | 197 | 118 | 97  | 100    | 2,651                               | 2,866         |
| 1966.....  | 4,485                                                                                            | 195 | 126 | 80  | 172 | 48     | 5,106                               | 2,323         |
| 1967.....  | 3,367                                                                                            | 215 | 148 | 122 | 47  | 0      | 3,899                               | 1,653         |
| 1968.....  | 3,293                                                                                            | 202 | 125 | 81  | 0   | 0      | 3,701                               | 1,218         |
| 1969.....  | 3,125                                                                                            | 51  | 2   | 0   | 0   | 0      | 3,178                               | 272           |
| 1970.....  | 2,506                                                                                            | 182 | 112 | 64  | 1   | 0      | 2,865                               | 994           |
| 1971.....  | 2,458                                                                                            | 205 | 102 | 56  | 2   | 0      | 2,823                               | 998           |
| 1972.....  | 2,330                                                                                            | 116 | 15  | 0   | 0   | 0      | 2,461                               | 410           |
| 1973.....  | 969                                                                                              | 118 | 46  | 26  | 0   | 0      | 1,159                               | 546           |
| 1974.....  | 974                                                                                              | 140 | 70  | 0   | 0   | 0      | 1,184                               | 547           |
| 1975.....  | 910                                                                                              | 190 | 78  | 0   | 0   | 0      | 1,178                               | 654           |
| 1976.....  | 1,004                                                                                            | 271 | 69  | 0   | 0   | 0      | 1,344                               | 805           |
| 1977.....  | 1,209                                                                                            | 276 | 52  | 1   | 0   | 0      | 1,538                               | 772           |
| 1978.....  | 1,415                                                                                            | 122 | 0   | 0   | 0   | 0      | 1,537                               | 394           |
| Total..... |                                                                                                  |     |     |     |     |        |                                     | 19,199        |

Note: Number of persons authorized for exposure to ionizing radiation since the beginning of the naval nuclear propulsion program: 9,300.

Senator COHEN. There were 37 pages of deficiencies mentioned in your House report. What was the nature of those deficiencies?

Admiral RICKOVER. Pardon me sir?

SHIPYARD RADIATION INSPECTIONS

Senator COHEN. In the House testimony, you point out that there are some 37 pages of deficiencies listed in the Portsmouth inspection report filed last year. You indicated there does not seem to be much difficulty, from your inspection of the records now.

Admiral RICKOVER. You see, those inspection reports are deliberately very critical. They point out everything that is wrong because that is the major function of an inspection. We could find large num-



bers in any Navy yard, no matter how good it is, because we are looking for even very minor deficiencies to make people keep on the job. That does not mean you would find any less in any other large industrial organization.

Senator COHEN. Let me read to you page 16 of your statement.

Although the Portsmouth inspection report contains 37 pages of deficiencies, there were no observations during this inspection which would likely be said to be in violation of the requirements of the code of Federal regulations.

I would ask if you would supply for the record the nature of those 37 pages of deficiencies, it would be helpful to me.

Admiral RICKOVER. Yes, sir, I will do that. I will provide a response previously released that deals with the significant deficiencies.

[The information follows:]

#### CORRECTIVE ACTION ON DEFICIENCIES IN PORTSMOUTH NAVAL SHIPYARD'S RADIOLOGICAL CONTROLS

A press release from the Critical Mass Energy Project and a story in the Boston Globe on 17 December 1978 highlighted deficiencies in radiological controls at Portsmouth Naval Shipyard which were discussed in a report of a Navy inspection of the shipyard which were discussed in a report of a Navy inspection of the ship yard in December 1977. Discussed on the following pages are the deficiencies highlighted by Critical Mass and the Boston Globe, Navy comments on the deficiencies, corrective action reported by the shipyard, and findings in a similar Navy inspection of the Portsmouth Naval Shipyard performed in November 1978. In several cases the deficiencies as cited by Critical Mass Energy Project and the Boston Globe has been combined to facilitate explanation.

The Navy statement of 16 December 1978 describes the manner Admiral Rickover uses to improve radiological controls at shipyards. As this statement points out, the language used is strong because that is the way Admiral Rickover approaches the control of radioactive work. He does not let even the most minor aspect pass without requiring it to be recorded and brought to the attention of senior management, in writing. The inspection deals only in deficiencies as identified by the inspection; it does not comment on the areas where the yard is found to be satisfactory. Each report includes a section describing all of the areas covered by the inspection. The fact that there are no findings in a report on some of these areas means the matter was reviewed and no deficiencies were found.

In order to make these reports as effective as possible the inspections review military aspects of Naval nuclear propulsion which are of foreign intelligence value and which may also involve classified security information. In addition, the inspection must be conducted in such a manner that anyone who has concerns or suggestions can freely convey them to the inspector without fear of subsequent disclosure that could adversely affect them personally or professionally. Thus, reports on such inspections are held within official channels in order to ensure they remain an effective and critical evaluation of shipyard performance.

It should be emphasized that the deficiencies listed in the 1977 Portsmouth inspection report are not deficiencies which would likely be noted as violations of the requirements of the Code of Federal Regulations which other Government Agencies use to regulate the handling of radioactive material. None of the observations made during the 1977 inspection cited problems that resulted in endangering the health and safety of shipyard workers or the public. None alter the conclusions noted in the 16 December 1978 Navy release regarding the excellent record of occupational radiation exposure and the handling of radioactivity at shipyards involved in Naval nuclear propulsion work. These results are described in considerable detail in two Navy reports, copies of which are attached.

1.a. *Critical mass energy project highlight of the Navy inspection report.*— "Eighty percent of the technicians taking a written exam on radiological controls failed to achieve a passing score. The Shipyard's performance on the NAVSEA-prepared examination was the worst performance of all nine shipyards performing radioactive work,' the Naval Command noted.



"The average test score of the technicians and supervisors who protect Portsmouth nuclear workers from radiation hazards has been deteriorating since 1974, while the percentage of these radiation controllers failing the exams has dramatically increased. In 1974, 16% failed the tests. In 1977, 80% failed to pass. 'The shipyard's performance on the examination identified weaknesses in fundamental radiological control knowledge . . . and in radiological control knowledge of postulated casualties involving operating Naval nuclear propulsion plants,' the report noted."

1.b. *Navy comments.*—The exam given the radiological control personnel in December 1977 was upgraded in difficulty. The knowledge level of the Portsmouth technicians had not improved commensurate with the more difficult exam. As a result their overall performance level in academic knowledge appeared to drop. In contrast, their practical performance had improved, as demonstrated by the fact that the number of radiological incidents had decreased from the previous year.

1.c. *Corrective action reported by the Commander, Portsmouth Naval Shipyard in March 1978.*—The shipyard reported that it had revised its weekly training sessions to include training in the academic areas where technicians and supervisors performed poorly on the examination. The shipyard also stated each technician would receive supplementary instructions in mathematics, since weaknesses in this area contributed to poor test performance.

The Naval Reactors Representative checked the shipyard's actions to verify reported corrective actions had been implemented.

1.d. *Naval Sea Systems Command (NAVSEA) inspection in November 1978.*—The average score on the 1978 NAVSEA examination improved from 64 percent to 80 percent. The failure rate decreased from 80 percent to 22 percent.

2.a. *Critical mass energy project highlight of the Navy inspection report.*—"There is an 'unsatisfactory rate of occurrence of high radiation area control incidents' at Portsmouth. The naval yard has experienced nearly twice the number of high radiation area incidents in 1977 than in 1976."

2.b. *Navy comments.*—The improper controls referred to were violations of procedures for control of high radiation areas. A violation of procedure, however, does not equate to personnel over-exposures. It means that some aspect of the existing procedural control was not followed or that control could be improved by changing the procedure. None of these incidents resulted in workers exceeding any occupational radiation exposure limit.

2.c. *Corrective action reported by the Commander, Portsmouth Naval Shipyard in March 1978.*—The shipyard reported it had issued revised procedures for more positive controls in high radiation areas. The shipyard also modified several facilities to gain more positive access control. Radiological control personnel and engineering personnel were re-instructed in high radiation area procedures. A Radiological Control Training Bulletin was issued to nuclear workers.

The Naval Reactors Representative confirmed that the shipyard's corrective action had been taken.

2.d. *NAVSEA inspection in November 1978.*—The 1978 inspection report did not discuss high radiation area incidents at Portsmouth in 1978, since the number of incidents had been reduced from 7 in 1977 to 2 in 1978. Only two shipyards have fewer incidents in this subject than Portsmouth in 1978. Both of these shipyards have significantly less radioactive work than Portsmouth.

3.a. *Critical mass energy project highlight of the Navy inspection reports.*—"Problems in the yard's radiation protection program caused Portsmouth to exceed the 1977 radiation exposure goal by over 170 man-rem and led to over 80 specific radiological deficiencies that year."

3.b. *Navy comment.*—Radiation exposure goals are intentionally set below the expected level of radiation exposure performance to provide incentive to improve performance and to reduce overall personnel radiation exposure.

The goals are difficult to meet. Although the Portsmouth goal was not met, and a number of shipyard identified deficiencies contributed to not meeting the goal, no worker was exposed to radiation greater than the limits.

3.c. *Corrective action reported by the Commander, Portsmouth Naval Shipyard in March 1978.*—The shipyard reported an extensive set of actions designed to correct each specific deficiency which had caused more exposure than potentially achievable. These actions included revisions to written work instructions, re-training of supervisors and workers, upgrading procedures for shielding, as well as improved radiation survey procedures.

The Naval Reactor Representative made spot-checks to verify that these corrective actions had been taken.



3.d. *NAVSEA inspection in November 1978.*—The number of deficiencies resulting in personnel radiation exposure were reduced in 1978. Total personnel radiation exposure was also reduced in 1978 as shown below.

|                                       | <i>Rems</i> |
|---------------------------------------|-------------|
| 1976 total exposure-----              | 805         |
| 1977 total exposure-----              | 722         |
| 1978 total exposure thru October----- | 345         |

The 345 rem compares to a shipyard annual goal of 341 rem. Portsmouth will be closer to meeting its 1978 goal than it was to meeting the 1977 goal.

4.a. *Critical mass energy project highlight of the Navy inspection report.*—"In 1977 six Portsmouth personnel received radiation contamination on their skin and a total of nineteen radiological control incidents were experienced throughout the shipyard. Although these figures represented improvement over the previous year, Portsmouth Naval Shipyard nevertheless had the largest number of contaminated workers and experienced one of the largest numbers of radiological incidents of any naval shipyards for nuclear vessels."

4.b. *Navy comment.*—The six personnel received very low levels of radioactivity on their skin as a result of errors. In each case the radioactivity was immediately removed from the worker; the radiation exposure was insignificant.

4.c. *Corrective action reported by the Commander, Portsmouth Naval Shipyard in March 1978.*—The shipyard reported a number of actions taken to reduce the number of radiological incidents. These actions included management emphasis on worker radiological awareness, increased use of containment methods, and improvements in technical work instructions. Corrective actions as outlined in the other items are also pertinent here.

The Naval Reactors Representative routinely checked the shipyard's practices to verify the implementation of these corrective actions.

4.d. *NAVSEA inspection in November 1978.*—The 1978 NAVSEA Inspection Report did not discuss excessive rates of skin contamination incidents or excessive number of incidents because the shipyard had improved its performance in these areas as shown below:

Skin contamination incidents:

|                              |   |
|------------------------------|---|
| 1977-----                    | 6 |
| 1978 (through November)----- | 0 |

Total radiological incidents:

|                              |    |
|------------------------------|----|
| 1977-----                    | 19 |
| 1978 (through November)----- | 7  |

5.a. *Critical mass energy project highlight of Navy inspection report.*—"The shipyard inspection and auditing 'lack sufficient depth to identify significant radiological problems for correction.' Moreover, 'most audit findings are not routinely followed up to ensure corrective action is adequate.' The team also discovered that there is not independent auditing, which compromises the findings."

5.b. *Navy comment.* This resulted from inadequate supervision of engineers performing audits.

5.c. *Corrective action reported by the Commander, Portsmouth Naval Shipyard in March 1978.* The Manager responsible for radiological control audits was replaced in January 1978.

Engineers who perform audits were re-trained, and the requirements for following up on audits were made more strict.

The Naval Reactors Representative followed up on these actions and found that not all had been effective. Areas needing further improvement were brought to the attention of the Shipyard Commander.

5.d. *NAVSEA inspection in November 1978.*—The 1978 NAVSEA Inspection found that the shipyard was not entirely successful in correcting this problem.

Problems still remained in that not all areas of radiological control were being audited, the auditors were not adequately determining the causes, and some audits were superficial. However there had been progress from the results of the 1977 inspection.

6.a. *Critical mass energy project highlight of the Navy inspection report.*—"Grading the examinations was inaccurate and inconsistent and prevented a meaningful assessment of examination results," the inspection team further reported. Seven of the eleven exams were downgraded by the Naval Command following review.

"There is no training or certification of radiological control instructors at Portsmouth, as recommended by the Naval Sea Command.



"The Navy has also discovered a 'high rate of failure on the practical radio-logical controls exam.'"

6.b. *Navy comment.*—As already discussed, the Navy requires high standards in the grading of examinations.

6.c. *Corrective action reported by the Commander, Portsmouth Naval Shipyard in March 1978.*—The shipyard reported that the examination answer keys, and instructions for grading examinations, had been reviewed and upgraded. Further, the shipyard now holds each instructor accountable for his grading of examinations. The instructors were also provided 80 hours of additional training on how to teach effectively.

To improve abilities of workers on the job the shipyard provided refresher training.

The Naval Reactors Representative spot checked the shipyards corrective actions.

6.d. *NAVSEA inspection in November 1978.*—The 1978 NAVSEA inspection found that examinations were being accurately and consistently graded. Therefore, no comments on this subject were contained in the 1978 report.

On an examination given during the 1978 inspection the average score of 127 workers was 81 percent; 18—about 14 percent—failed. This is typical of other shipyards' performance on this type of examination.

As the problem of training instructors had been corrected, it was not discussed in the 1978 inspection report.

7.a. *Critical mass energy project highlight of the Navy inspection report.*—"There is not a single medical doctor involved in all medical aspects of the radiation health program at the shipyard."

7.b. *Navy comments.*—This statement is apparently being erroneously interpreted as "no doctors were involved in the radiation health program." The problem was that no single doctor was coordinating the radiation health aspects of the work all the doctors at the shipyard were performing.

7.c. *Corrective action reported by the Commander, Portsmouth Naval Shipyard, in March 1978.*—A doctor was assigned to coordinate all the radiation health aspects of the work of the doctors at the shipyard.

The Naval Reactors Representative verified this was done.

7.d. *NAVSEA inspection in November 1978.*—This problem was not discussed in the 1978 inspection report since a doctor had been assigned.

8.a. *Boston Globe highlight of the Navy inspection report.*—"Radioactive waste left unattended for one day in a work area."

8.b. *Navy comment.*—A 5 gallon bottle of radioactive water was left in a submarine reactor compartment for 21 hours longer than necessary. Because access to this compartment is controlled, no personnel received more radiation exposure than they ordinarily received.

8.c. *Corrective action reported by the Commander, Portsmouth Naval Shipyard in March 1978.*—The bottle was removed. Personnel responsible for the deficiency were reinstructed.

The Naval Reactors representative verified that the bottle was removed and properly handled.

8.d. *NAVSEA inspection in November 1978.*—The 1978 inspection identified no deficiencies similar to this one.

9.a. *Boston Globe highlight of Navy inspection report.*—"Discharge of contaminated material into nearby harbor."

9.b. *Navy comments.*—During the inspection about 100 gallons of highly purified water containing a small amount of radioactivity was released to the Piscataqua River by error. An indication of the significance of this small amount of radioactivity is that if a single person were able to drink the entire 100 gallons, he would not exceed the annual Federal radiation exposure limit. However, Navy procedures required that it be controlled. Since the error could have been prevented, it was labeled a deficiency in the Navy report.

9.c. *Corrective action reported by the Commander, Portsmouth Naval Shipyard in March 1978.*—The shipyard reported actions to improve handling of radioactive liquid wastes. These include a revision to operating instructions; improved inspection procedures; and retraining of workers who perform liquid waste processing.

The Naval Reactors Representative spot checked the shipyard's corrective action.

9.d. *NAVSEA inspection in 1978.*—The shipyard reduced the number of incidents involving release of radioactive liquids from 2 in 1977 to 1 in 1978.



## RADIATION CLAIMS

Senator COHEN. Also on page 42 of the February report, there is mention made of the six radiation claims now pending in the Portsmouth yard. Perhaps you could supply for the record once again the nature of those claims?

Admiral RICKOVER. Yes, sir. Those are discussed on page 33 in the February report which I will provide for the record. We have recommended against those. We think they should not be granted. This is another thing that Congress should consider. Pretty soon you will have everybody submitting claims against the Government. I think this whole thing, whether it is radiation or anything else, is getting out of hand and the Department of Labor in the past has been too much inclined to grant such claims.

For example, one man near Los Alamos claimed some \$75,000 because he was afraid of radiation. The Federal judge gave him \$75,000. I have been thinking of going and living out there, myself.

[The information follows:]

OCCUPATIONAL RADIATION EXPOSURE FROM U.S. NAVAL NUCLEAR PROPULSION  
PLANTS AND THEIR SUPPORT FACILITIES

(Report NT-79-2, February 1979)

CLAIMS FOR RADIATION INJURY TO PERSONNEL

Personnel who consider they have or might have had occupational injury are encouraged to file claims. The compensation systems make allowance for the long latent period for radiation-induced cancer. Naval shipyard personnel are employees of the U.S. Government and therefore file claims with the U.S. Department of Labor's Office of Workmen's Compensation. Shipyards hold no hearing on injury claims. They are not handled in an adversary procedure. The Navy has no rights to present a case to the Labor Department. The claim does not even have to be filed through the shipyard. The shipyard is not permitted to appeal a decision but the employee may appeal. The primary consideration in the Federal laws and procedures set up for injury compensation is to take care of the Federal employee. The program to compensate Federal employees is well publicized as shown by more than 25,000 claims being paid for Navy employees in 1978. Over half of these claims were filed by shipyard workers. As noted below, however, only a few were related to radiation exposure.

In private shipyards injury compensation claims are handled under the Longshoreman's and Harbor Workers' Compensation Act. The claim may be handled through the shipyard's insurance carrier or by a U.S. Department of Labor claims examiner. Either the employee or the employer may appeal.

Claims for military personnel concerning prior duty are handled through the Veterans Administration.

There have been a total of 58 claims filed for injury from radiation associated with Naval nuclear propulsion plants. Fifty-five originated from employees of the six Naval shipyards, three from one private shipyard, and none that the Navy is aware of from Navy personnel. These claims are summarized in Table 7 and in more detail in the appendix. A number of claims have previously been listed by the Navy as radiation-related because radiation was mentioned as one of a large number of possible causes of an injury. Those which have been handled by the Department of Labor as other than radiation claims have been removed from the Navy list. Two suits have been filed in court alleging injury from radiation. Neither person claims cancer. They are not summarized in this report since these cases are in litigation.

Three claims have been awarded to employees, one for leukemia in 1968 and two for cataracts of the eyes in 1971 and in 1977. The Navy considers all three of these awards were incorrect:



The leukemia case developed within two years of the occupational exposure of 5.38 rem. This is too short a latency period. The claimant had received hundreds of rem in medical radiation exposure for adenoids. If radiation were to be selected as the cause for this leukemia, then the occupational exposure could not have been more than a tiny part of this total radiation.

The two cataract cases each had total lifetime radiation exposures of about 3 rem, which is hundreds of times smaller than needed to produce cataracts in the eyes.

From the radiation injury claims filed to date, the Navy has been unable to draw any conclusions concerning radiation injury to personnel occupationally exposed to radiation associated with Naval nuclear propulsion plants.

TABLE 7.—CLAIMS FOR RADIATION INJURY TO PERSONNEL

| Injury claimed                  | Claims filed | Claims awarded | Claims rejected or deferred | Claims active |
|---------------------------------|--------------|----------------|-----------------------------|---------------|
| Leukemia.....                   | 8            | 1              | 3                           | 4             |
| Cancer other than leukemia..... | 11           | 0              | 6                           | 5             |
| Other.....                      | 39           | 2              | 26                          | 11            |
| Total.....                      | 58           | 3              | 35                          | 20            |

Senator COHEN. In the six claims that have been filed there is one claim by a marine mechanic of cataracts, and I am told his exposure level seems to be dramatically higher than the level——

Admiral RICKOVER. I would like to supply that for the record.

[The information follows:]

This marine machinist is one of the most skilled machinists in the shipyard. He frequently worked the most critical and important radioactive jobs requiring his skills. He worked on radioactive jobs for 16 years and averaged a little over 2 rem each year for a lifetime total of 35.5 rem.

His medical problem is cataracts. Cataract formation appears to have more evidence of having a threshold radiation dose than any other type of radiation-caused disease. The International Commission on Radiological Protection in 1977 concluded that more than 1500 rem is required to produce damage to the lens of the eye sufficient to interfere with vision. Since the marine machinist's 35 rem of radiation exposure is far below the 1500 rem required to produce cataracts, the Navy disagreed with his claim that his cataracts were caused by his work.

Senator COHEN. Finally, I have a constituent who has contacted my office, who I believe is a retiree from the Portsmouth yard and who indicated that perhaps those workers should have the opportunity upon retirement for annual physical checkups. No. 1, perhaps you are not qualified to testify as to whether that would be beneficial in detecting some early development of cancer and, No. 2, I would like your estimate of perhaps how much that would cost?

Admiral RICKOVER. May I supply that answer for the record?

Senator COHEN. Yes. That is all I have, Mr. Chairman.

[The information follows:]

The following response was obtained from the Navy's Bureau of Medicine and Surgery:

The Navy fully supports the concept that it is beneficial for individuals to receive periodic medical examinations. Such programs increase the opportunity for definitive medical treatment of some serious illnesses.

In the history of the Naval Nuclear Power Program there have been approximately 54,000 naval shipyard employees who have been monitored for occupational radiation exposure. Their mean total life radiation exposure has been approximately 1.5 rem. Estimated total man-rem for the group is 1.5 rem x 54,000



or 81,000 man-rem. A total radiation exposure of 81,000 man-rem means that as a maximum there might eventually be as many as 8 or 9 cancer illnesses from occupational radiation exposure in the group of 54,000 individuals. (These estimates of risk are derived from Report 27 of the International Commission on Radiological Protection titled "Problems Involved in Developing an Index of Harm", published May 1977).

In addition, approximately 8,640 of these employees (16%) can be expected to develop cancer totally unrelated to their occupational radiation exposure.

Based upon present evidence there are limited prospects of determining any of these conditions in a symptom-free individual. The cost of providing a yearly medical examination to 54,000 individuals would be between \$8,000,000 and \$10,000,000.

Considering the low probability of detecting an occult case of cancer, the limited possible cases of radiation induced cancers, and the expense involved; it is not felt that such a program would be cost-beneficial.

[Subsequent to the hearing the following questions were submitted by Senator Cohen to Admiral Rickover to be answered for the hearing record. The questions with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR WILLIAM S. COHEN; ANSWERS SUPPLIED BY  
ADMIRAL RICKOVER, U.S. NAVAL NUCLEAR SUBMARINE PROGRAM

*Question.* You refer to the level of radiation people encounter in their daily lives as a comparison with the levels encountered by nuclear propulsion workers. Are these outside sources of radiation taken into account as you establish the maximum permissible levels for the workers?

*Answer.* First, maximum permissible occupational radiation exposure limits are not established by the Navy. In my March 1, 1979 testimony, a copy of which was inserted in the record, I discussed how occupational radiation exposure limits have been established. Specifically these limits are the radiation exposures permitted in addition to natural background and medical radiation exposure. However, the fact that other radiation exposures occur was taken into account in establishing federal limits.

*Question.* You express criticism of Dr. Najarian for his lack of cooperation with CDC. Similar criticism was recently leveled against the Navy for refusing permission for a union official to join a CDC inspection team at Portsmouth. How do you respond to that criticism? Have there been any points of disagreement between the Navy and researchers either on the workplace safety program for workers exposed to low-level radiation or on the way researchers are undertaking their studies and the information they are seeking?

*Answer.* The Navy was restrained by the Privacy Act from permitting the union official from seeing information from personnel medical records unless the CDC made him an official member of their team. CDC did not choose to include the union member and thus, private information could not be released. I have discussed this situation in detail in the March 1, 1979 testimony, a copy of which was earlier inserted in the record.

I note, that there was no similar problem when the staff of a House Armed Services subcommittee requested union representatives to be part of their official team that visited the yard to review this matter.

*Question.* As an Energy Department official, can you tell me what the Johns Hopkins University study entails? What is the methodology to be employed? How inclusive will it be? How will the sampling be done? How long is this study expected to take?

*Answer.* I am not familiar with the methods used to conduct epidemiology studies. I do know that Johns Hopkins plans a very thorough study of all workers in the six Navy yards and Electric Boat Division of General Dynamics. This study will probably take more than three years.

*Question.* Has the Navy done any study to determine whether Dr. Najarian's research included a representative cross section of workers at the Portsmouth Naval Shipyard? Do you think researchers should seek a comparison with cancer rates among people in the area not involved in this sort of work?

*Answer.* One purpose of the Center for Disease Control study is to look into Dr. Najarian's allegations. This study and the one to be conducted by Johns Hopkins are independent of the Navy. The Navy has no plans to study Dr. Na-



jarians' research. Since both studies are independent of the Navy, it would be inappropriate for me to comment on how they should be conducted.

*Question.* In the February report, there is detailed information on procedures taken to provide workplace safety. For the record, would you detail the Navy's procedures for insuring the health and safety of the workers?

*Answer.* The Navy has extensive detailed radiological control procedures using the latest state-of-the-art instrumentation to ensure the health and safety of workers. Navy report NT-79-2. "Occupational Radiological Exposure from Naval Nuclear Propulsion Plants and their Support Facilities" a copy of which was inserted in the record earlier, summarizes most of these controls.

*Question.* I've read reports that some workers may have switched their radiation level badges. In your investigations, have you found any instances of that occurring? What measures do you have in place to prevent that from happening? How do you ensure the accuracy of the badges?

*Answer.* Undoubtedly a few workers may have violated rules without getting caught. But there were detailed procedures to prevent such mistakes in the early days as there are now. Navy Report NT-79-2 previously inserted in the record summarizes these controls.

In press conferences about a month ago, Dr. Matanoski, who is in charge of conducting the Johns Hopkins University study, answered from her experience in inspecting the seven shipyards. "We can check on abuse of dosimeters by looking at records because there would be an incident report for each such abuse. The work areas were also policed by monitors which would minimize such abuse. In each case where a dosimeter was lost or damaged, an estimate of his radiation was put in the record based on other people working alongside him and measured radiation levels. Overall we think the estimates are pretty good."

*Question.* I'm impressed with the apparent strides made in reducing exposure levels, as reflected in Table 3 of the February report. One thing that stands out, though, is the high level of exposure in 1965-66. What is the explanation for that?

*Answer.* The level of exposure in 1965-1966 was due to radiation levels in reactor compartments of submarines being overhauled at that time. Since that time, the Navy has learned how to reduce radiation levels in ships in order to reduce radiation exposure to personnel working on them.

Senator EXON. I have a question or two. I am very pleased to have you here today. There are many of us who recognize you as a tremendously important American in the past and I am sure for a long time in the future.

#### DEVELOPMENT IN NUCLEAR REACTORS

I would like to ask you a question about what is new in nuclear reactors?

Admiral RICKOVER. You mean in the whole reactor field, sir?

Senator EXON. In the whole reactor field. You know, generally when we develop our technology we come up with things that are bigger and better and also sometimes that are smaller and better. Again, back to the thing you talked about and have been asked about on many occasions. Are we considering the development of a smaller reactor that could be used both on submarines and surface ships? It has been talked about for a long time. Have there been any new developments on it at all? Do you think such a thing is impractical?

Admiral RICKOVER. That is almost a philosophical question sir. One trouble is that when you make a lot of heat you have to dissipate the heat. There is no short cut to dissipate heat. We have condensers on board ships. These people who propose these ideas don't go thoroughly enough into the whole heat cycle process.

For example, one of them has proposed that we put coils around the ship and we won't need large condensers, the exhaust steam would go through these coils and be condensed by the cold sea water. But when you analyze the proposal you find out that you need three



times as many coils as in a regular condenser and that this scheme would slow the ship several knots and make it more vulnerable to damage. Many people wonder why after all these years we can't make smaller, lighter, cheaper condensers, whereas in fact, to make them safe and capable of accomplishing their mission, you have to make them larger and thus more expensive.

Senator EXON. Something like our seeking perpetual motion, something that just won't work?

Admiral RICKOVER. As far as I know we are going to have these small, light, cheap reactors when some scientist comes up with perpetual motion sir. We don't know how to do it. Then they say, "You are the inventor of this thing, therefore you are against any new inventions." We started with reactor cores that lasted for 2 years. Now we have some that last [deleted] years. You don't get that without work.

It is very expensive to take a core out at the end of 2 years and replace it. The ship is tied up for months. There is a lot of radiation involved. Every time you take out a core you have to process it and it results in a lot of radioactive waste. If you have one core that lasts the life of eight cores that to me is a pretty great advance. Furthermore, any reactor has to have enough volume to give out the necessary heat. You can't do that in a small volume. That is why we have to have cores of a certain size. There is no way to get enough heat out of a core that is too small.

These are details that the proponents of small reactors don't think about. When we point out why you can't do it they think we are just deliberately trying to hold back the Navy. Yet every other country has copied us in Navy reactors. None has gone to a small, light, cheap reactor. How do the critics account for that sir?

#### COMPARING UNITED STATES VERSUS SOVIET NAVAL STRENGTH

Senator EXON. Thank you, Admiral.

That leads me into my next question. Since we are dealing here in this committee all the time with the defense posture of the United States and our possible enemies, for the record would you care to elaborate on the U.S. naval reactors today and their design and compare that with the Soviet reactors and their designs as far as the naval establishment is concerned and in your opinion how far are we ahead?

Admiral RICKOVER. I will be glad to supply that information for the record, but I will tell you right now from what we know they are not ahead. Is that an adequate answer sir?

Senator EXON. I would like to have you maybe, if you could for the record, give us your expertise and opinion on how far we are ahead because those are some of the decisions we have to make in this committee.

Admiral RICKOVER. That is a very difficult question to answer because we don't know specifically what goes on in any Russian ship. They know a great deal about what goes on in our ships. We just don't know. I can't be more specific than that. We do know generally what they are doing.

We know how large their ships are and a general idea of the size of their machinery plants. We have one great disadvantage that they



don't have. We have to have good living conditions for our people. The Soviets don't. We do all sorts of things that take up room, space, and weight which they don't have to do. In their society people are ordered to man these ships. We can't do that. You must bear that in mind sir.

Senator EXON. Thank you, Admiral.

Thank you, Mr. Chairman.

Admiral RICKOVER. The Soviets probably don't have pregnant sailors either. We do. In this country women are brought in to help the Navy, but some of them become pregnant. They have to take time off. Children are absolutely essential, but I don't know why the Navy should have to bear the loss in time and money due to pregnant sailors.

Senator EXON. They are not blaming you directly for that, are they Admiral?

[Laughter.]

Admiral RICKOVER. No sir, not directly. They consider my age, that is why they are not blaming me directly. If you wish to pursue that—

[Laughter.]

Senator JACKSON. Senator Thurmond.

#### NAVAL REACTORS BUDGET

Senator THURMOND. Thank you very much.

Admiral Rickover, I am glad to have you with us again.

Admiral, throughout the Department of Energy nuclear weapons budget before us I see a program with inadequate funds and general evidence that requests that come from the field have been cut to the bone. Have these budget reductions been in the programs for which you are responsible?

Admiral RICKOVER. No, sir, in fact I have recommended an \$18 million reduction this year in my program, mark that, Mr. Chairman. That may be one of the most unusual statements that has ever been made to a congressional committee.

Senator JACKSON. You mean from you?

Admiral RICKOVER. Well, anyone. I have recommended a reduction in the money I am to get. You don't get that very often, do you sir?

Senator JACKSON. No. That is different.

Admiral RICKOVER. I have been treated very well.

#### ADVANCED CLASSES OF SUBMARINES

Senator THURMOND. I am glad you are not suffering from that situation like some other areas.

Admiral Rickover, what are you trying to achieve in your advanced design nuclear propulsion improvement for future classes of submarines?

Admiral RICKOVER. Including what?

Senator THURMOND. For future classes of submarines?

Admiral RICKOVER. We are not developing future classes of submarines. In fact there is a lot of opinion in the Navy we should go back to older type submarines and not build the fast ones. That is like deliberately trying to breed slower race horses for Churchill Downs.

I hope that Congress helps me in this. They want to go back to slower type submarines because they are supposed to be cheaper.



Senator JACKSON. Who is "they"?

Admiral RICKOVER. People in the U.S. Navy, the civilian element of the Navy and the Defense Department.

#### IMPORTANCE OF R. & D.

Senator THURMOND. Admiral, what do you consider the most important R. & D. program under your reactor plant research responsibilities?

Admiral RICKOVER. I really can't answer that adequately because everything we do meshes into everything else. It is all part of the uniform program. I can't say that any one thing is more important. However, I do think the most important thing is to have safe, reliable reactors, such that people are not subject to unnecessary radiation.

The safety of the people and the safety of the ship and their reliability are very important things. Now that has been borne out. Our submarines are operating more reliably and are more on the line, more available for operation than the conventional ships. That is the most important function I have.

Senator THURMOND. Admiral Rickover, I recently addressed the Atomic Industrial Forum in Atlanta. I found widespread concern over the failure of our country to proceed with nuclear fuel reprocessing at the Barnwell plant. You are familiar with the Barnwell plant?

Admiral RICKOVER. Yes, sir. I know what goes on there. I am not responsible for that project.

Senator THURMOND. I just wondered if you have any comments on that?

Admiral RICKOVER. No, sir. This is not in my area of responsibility, Senator.

Senator THURMOND. I presume you do favor nuclear reprocessing?

Admiral RICKOVER. Yes; I favor nuclear reprocessing for long-term energy utilization but I can't address myself to a specific issue. It is not in my area.

#### VIEWS ON ENERGY IN THE UNITED STATES

Senator THURMOND. Admiral Rickover, I would like your views on what we might expect in the energy area in this country and the civilian sector during the next 10 years?

Admiral RICKOVER. I expect a great shortage of oil, of energy in general. I think you can get a much better answer from the chairman who probably knows as much about this subject as anyone in the United States but I do expect that there are going to be stringencies. I have said now for 20 years that we are going to have to develop a new way of life to deal with reduced energy supplies. We have not yet faced up to the problem. We are not willing to face up to it, because we still have plenty of oil. As far as the vast majority of the public is concerned they see that they have all the oil they need, therefore they don't believe there is an emergency.

There is a very fine example of this attitude. In California not so long ago there was a shortage of water in a large area of California.



When the Government imposed restrictions on the use of water, not only did the people live up to those restrictions but they actually exceeded the goals that were set for them.

I believe that until we start some kind of rationing we are not going to get anywhere. This is my opinion, but I am not privy to all the knowledge on this subject. If you ask me as a person who has been involved in energy for a long time, I would say that until we impose restrictions on the use of oil in one form or another we are not going to get very far.

I think the chairman can give you a better explanation than I can.

Chairman JACKSON. Let's keep the chairman out of it. I am supposed to be the honest judge up here.

#### NEED FOR CONTROLS ON CIVILIAN REACTORS

Senator THURMOND. Admiral Rickover, some people feel there would be fewer problems in the civilian nuclear industry if they followed a single plant design. Do you know whether this has been considered?

Admiral RICKOVER. I don't know whether it has been seriously considered. I have thought for many years that we should have a system which would give to the public greater confidence in civilian nuclear powerplants. I would get the whole atomic industry to organize a group of their own people who are engineers and designers, something like the NELA, which was the National Electric Light Association. They had that some years ago for conventional civilian power plants, and such a group would act for the civilian nuclear power industry as a whole, lay down rules on design, require conformity and standardize on designs. I would also have Government representatives at each nuclear plant.

I do that at the one civilian plant I am responsible for, Shippingport. When that plant is in operation, I have one of my people in the control room at all times sitting there and observing how the plant is operated.

If he sees anything that he thinks might be unsafe he tells the operator. If the operator does not do anything about it he has the authority to order the plant to be shut down.

The Nuclear Regulatory Commission has now stationed one man in some civilian plants. I would go further than that. I would require a man to be on watch in every plant with authority to shut the plant down at all times.

Senator THURMOND. Why don't you think this has been done?

Admiral RICKOVER. Pardon me, sir?

Senator THURMOND. What is your opinion of why this has not been done?

Admiral RICKOVER. I don't know sir, perhaps some believe it is not a good idea. I am not saying every one of my ideas is the only answer but that is the way I would do it if I were in charge.

#### SUBMARINE SERVICE LIFE

Senator THURMOND. Admiral Rickover, I notice in your prepared remarks on page 15 you indicated there would be no life extension program for the Polaris and Poseidon submarines. Why would this be the case?



Admiral RICKOVER. There is no what, sir?

Senator THURMOND. I notice in your prepared remarks on page 15 you indicated that there would be no life extension program for the Polaris and Poseidon submarines. Why would this be the case?

Admiral RICKOVER. The reason is that these ships are old and they are wearing out. We can't extend their lives forever. That is why we need new submarines. They are wearing out, the machinery is getting old. They require a great deal of maintenance. After a while you cannot keep maintaining old equipment efficiently. Therefore, there will come a certain point where we will probably have to put them out of commission.

Senator THURMOND. Carriers can be extended. Why can't submarines be extended?

Admiral RICKOVER. That applies to any submarine, whether it is a Polaris submarine or an attack submarine.

Senator THURMOND. If you can extend a carrier why can you not extend a submarine?

Admiral RICKOVER. You can extend the life of Polaris submarines, just as much as you can an ordinary submarine. What I am saying applies to all of them.

Mr. LEIGHTON. The Senator is saying you can extend the life of an aircraft carrier. If you can do that why can't you do that for submarines?

Admiral RICKOVER. Now I understand the question. You can do that for a carrier like the *Saratoga* class, you can spend \$500 million apiece and rip out all kinds of stuff and put new stuff in there. But it is very difficult to do that with a submarine. The hull in an aircraft carrier is only thick enough to bear up under the pressure of about 30 feet of water, something of that sort. The only purpose of the hull is to keep water out. It does not have to have any inherent strength in it. The real strength of the surface ship is in its girders, it is not in the hull. The only purpose of the hull is to keep salt water out.

Whereas in the submarine the hull is several inches thick. You have to go to a thick hull because the thickness of the hull depends on the depth you want to go.

Senator THURMOND. I am sorry you misunderstood me. I can appreciate my southern accent is hard to understand.

Admiral, I am concerned about the extremely low building rate of the attack submarine under our 5-year plan. Can we maintain our force structure and keep open two building yards at such a low rate of construction?

Admiral RICKOVER. No; we cannot ultimately because there is going to block obsolescence in our submarine force. When we started the nuclear program, mostly by the actions of Congress, we got a considerable number of ships. That has now died down. We are not getting anywhere near enough to replace them.

We get one, or at the most two submarines a year and that will not make up for the coming obsolescence of our submarines. The Russians right today have for years been building five times as many submarines as we have. This is an administration policy and of course the administration has its own reasons but the Members of Congress must face



the unpleasant fact that our submarines are aging and they are not being replaced as they should be.

This is a fact of life. That will require congressional action.

Senator EXON. Will the Senator yield on that point?

Senator THURMOND. I will be glad to yield.

#### SOVIET SUBMARINE THREAT

Senator EXON. What we keep wrestling with is our fleet compared with the Soviet fleet. Are you in a position to give us an evaluation as to whether or not you think that the Soviet nuclear fleet is more efficient or is going to be in the near future in a potential showdown with our fleet?

Admiral RICKOVER. I can give you the facts as to numbers and how it has increased. Now numbers mean something. One cannot postulate that the officers and men of the Russian Navy are not efficient. Look, they serve longer periods of time on those ships. We only keep our people a short time. Our young men, 20, 21 years old or less get into the Navy and the qualification requirements have been lowered to take care of all kinds of people since we have gone to an all-volunteer military.

Why should we believe that the Soviets, with long-term people and while building many more ships than we do, can't beat us? I just want to be logical. I have here the figures and they are very shocking and astounding. I believe most of the Members of the Senate have heard this many times.

Senator EXON. I am a new Member of the Senate, so I have not heard them many times. If it is in the record I won't ask you to look it up. I will find it in there.

Admiral RICKOVER. Yes, sir, it will be in the record. I think that will amply answer your question. On the other hand I am not responsible for running this country, nor am I responsible for congressional action. Other people above me have their own reasons. I can't question those reasons. I may have my own opinions but it is not up to me to question the motives of my superiors.

Senator EXON. I am not asking you to question the motives of your superiors. I am asking you to give us your opinion of the situation. I think generally speaking you have done that.

Admiral RICKOVER. Here are the submarine numbers. The Soviets have about 355. We have 122. These are not all nuclear. They have more nuclear than we do. These are facts.

Senator JACKSON. Admiral, I wonder if it might not help if you could indicate to the committee, following up on Senator Exon's question, how our nuclear submarines stack up against the Russians, sub for sub, (a), the technology, (b), the seamanship, professional seamen, and so on. Clearly they have quantitatively more submarines, both nuclear and conventional. Is that not correct?

Admiral RICKOVER. Yes, sir.

Senator JACKSON. Would you comment on that?

Admiral RICKOVER. You mean the number or just the quality?

Senator JACKSON. If you have the numbers handy there.

Admiral RICKOVER. Yes; I can give you the numbers.



Senator EXON. Nuclear against nuclear?

Admiral RICKOVER. Yes; I will do that.

The Russians have about 71 nuclear ballistic missile submarines. Not all are capable modern launcher platforms. We have 41.

They also have about 20 nonnuclear missile submarines. We have zero.

Senator JACKSON. That is for the cruise missile?

Admiral RICKOVER. No; that is ballistic missile submarines.

The Russians have about 40 nuclear cruise missile ships. We have zero.

Nonnuclear, they have about 25 cruise missile. We have zero.

Attack submarines, they have about 44. We have 73. Nonnuclear they have about 200, we have 8.

They have about 155 nuclear submarines, we have 114.

But they are building nuclear three or four times as fast as we are, so you can see the disparity will become greater. They have a total of about 355 submarines against 122 of ours.

I have seen no reason why their personnel are not as good as ours. It used to be said that 1 Englishman could lick, I think it was, 14 Frenchmen. It was something on that order. No one claims that any more. Now as far as the quality is concerned. I can only guess because we have never been able to find out what precisely goes on inside a Russian submarine. We don't know. We can get certain information from our own activities but we really don't know the details. They certainly are improving and they have improved tremendously in the last 15 years or so. We do know that.

They are getting lots of experience. Then some people say, well, they are not operating as much as we are. They are operating a lot in waters close to their homeland. We understand that they have ballistic missile submarines which can fire their missiles from right off their coast and hit the United States. Therefore, it is not necessary for them to go far out to sea. But they do exercise in home waters all the time.

Generally it is more difficult for a ship to be involved in exercises. The deficiencies in the ship show up much better under exercise conditions than when they are operating in a steady way. So I would not underrate them a bit. You can come to the argument how much is enough and there is something in that, too. I am not saying that we have to match the Russian submarine for submarine. When most ours are getting old and most of theirs are more modern and they are building three or four times as many as we do then it is something for Congress to be concerned about.

Does that sound like a reasonable statement?

Senator EXON. It does. Thank you, Admiral.

#### PROPOSED CARRIER INFERIOR

Senator THURMOND. Admiral, on page 25 of your statement you said the ships, speaking of the carrier, included in the budget this year is substantially inferior in almost every respect to any carrier, nuclear or conventional, authorized in the past 25 years.

Admiral RICKOVER. The carrier which has been recommended by the Department of Defense is in about the same technical status as the one we had 25 years ago.



Senator THURMOND. It is your opinion it would be better to spend more and get the right kind of ship that we need rather than to spend less on such a ship?

Admiral RICKOVER. Of course. Then again Senator, my bosses have problems that I don't have and I don't know what their problems are. From my standpoint it would certainly be better in building any type of ship to build the best kind we can.

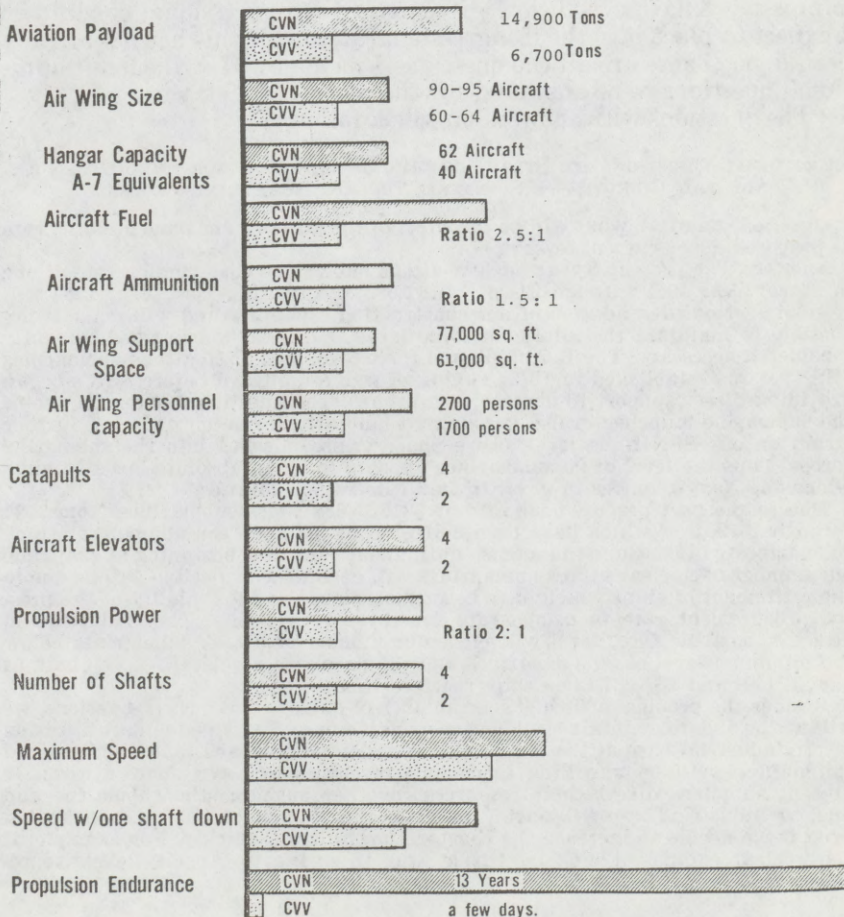
Senator THURMOND. Would you mind putting something in the record on the inferiority of this ship proposed in the bill?

Admiral RICKOVER. I can give you the facts about that, yes, sir. As a matter of fact, I have a chart which I believe was given to the other members. That shows the comparison of the ships. I will put that in the record.

[The information follows:]

### Comparison of CVV and CVN 71 Military Characteristics

1 March 1979





## NEED FOR A STRONG NAVY

Senator THURMOND. Thank you.

There is one paragraph in your statement that is impressive:

Any comparison of the Soviet and U.S. Navies must be viewed in the context that we are a maritime power dependent upon being able to maintain sea lines of communication in order to conduct military operations overseas and to support our allies. The mission assigned to our Navy is a far more difficult task than the Soviet Navy mission of denying us use of the seas.

Admiral RICKOVER. Yes, sir, it is much easier to play a negative role than a positive role. The allies of the Soviets are generally adjacent to their borders. Also they are a land mass. They have a large land mass which extends from Europe to Siberia, to Asia. We don't have that. We are an island nation. The only way we can exert our power as an island nation is through a navy. The Soviets have other means of exerting power.

It is more important for the United States and this has been recognized since the early days of Theodore Roosevelt to have a strong Navy than it is for many other nations.

Senator THURMOND. Admiral, your statement is one of the most impressive I have ever heard presented to a congressional committee. I expect to place it in the Congressional Record if this has not already been done. Those are all the questions I have now. I will submit additional questions to be answered for the record. Thank you.

[The questions with answers supplied, follow:]

ADDITIONAL QUESTIONS BY STROM THURMOND—ANSWERS FOR THE RECORD BY  
ADMIRAL RICKOVER—U.S. NAVAL NUCLEAR SUBMARINE PROGRAM

*Question.* Admiral, what will be the effect of the attack submarine building rate as proposed in the current 5-year plan?

*Answer:* The present 5-year nuclear attack submarine construction rate of one in Fiscal Year 1980 through Fiscal Year 1983 and two in Fiscal Year 1984 will result in serious degradation of our construction capability and will make it impossible to maintain the minimum force level of nuclear submarines currently considered necessary. The U.S. minimum force level goal of 90 attack submarines (SSN's) was established in 1973. This level was established before SSN's began providing direct support to surface task groups. The additional potential use of the submarine launched cruise missile in a land attack role may place a further strain on our SSN-force level as we phase cruise missiles into the submarine forces. Thus the level of 90 submarines appears to be an absolute low minimum which the Navy requires in order to fulfill its responsibilities.

Due to the past procurement rate of 33 SSN688 Class submarines from 1971 through 1979, 9 of which have been delivered to the fleet, the number of attack submarines will continue to increase until about 1983. But beginning at that time our number of nuclear attack submarines will decline. This decline will be due to the retirement of ships which have become obsolete and the inability of the present procurement rate to compensate for these retirements. This reduction in attack submarine force level will place our number of attack submarines below the minimum level of 90 submarines and the drop will accelerate as the bulk of our SSN594 and SSN637 Class ships reach retirement age.

Besides the problem of insufficient number of ships to meet Navy missions, we will not be able to maintain a viable construction base. Sustained underutilization of the industrial base at the low levels proposed today means that suppliers and shipbuilders will be unwilling to commit resources to Navy nuclear work. If present suppliers divert their resources to other business, the submarine and nuclear industrial base will shrink to levels that cannot be quickly reinstituted even if we decide to increase the construction program quickly. For example, if the nuclear equipment industrial base were to shrink to capacity levels repre-



sented by the presently envisioned plan, there would be inadequate component vendor capacity to support the three to six SSN's a year shipbuilding program we had between Fiscal Year 1970 and Fiscal Year 1977. Once lost, rebuilding the industrial base would be costly and time consuming and could adversely affect options for future shipbuilding programs.

In the past, we have had as many as seven shipyards—two naval and five private—build nuclear warships. All seven built nuclear submarines; three built nuclear cruisers; and one, Newport News, has built and continues to build nuclear carriers. At the peak of the nuclear warship building program in the early 1960's, 14 nuclear ships were authorized per year.

However, the decline in the number of nuclear ships authorized each year and the desire to build each one for as little as cost as possible, has caused us to concentrate our present nuclear warship construction in two yards, the Electric Boat Division of General Dynamics in Groton, Conn. and Tenneco's Newport News Shipbuilding and Dry Dock Co. in Newport News, Va. Even with only two construction yards we have enough capacity to build several nuclear attack submarines a year in addition to the TRIDENT and surface ship programs.

The best method of obtaining and maintaining the construction capacity is to develop a consistent construction program and then stick to it. This will also give us an ability to keep a modernized fleet and avoid block obsolescence.

*Question.* Can you provide the committee with your personal views on the so-called high-low mix concept as it applies to submarines?

*Answer.* What you are referring to is the concept some have advocated that we should build a certain number of highly capable submarines for the most demanding of missions and some less capable submarines for less demanding or single purpose missions. The objective is to find a less expensive way to get submarines. On the surface this might appear a reasonable approach. But when you consider the large, capable Soviet submarine force we face, the limited number of submarines the U.S. will ever have, and the sea lines of communication we have to defend world wide, such an approach does not make sense.

The U.S. submarine force is a transoceanic force. It is an offensive force built to carry the fight to the enemy. European navies, with which we are sometimes compared, are by and large designed and built to fight along the coasts of Europe, in the Baltic, and in the Mediterranean Sea. Because of our naval requirements we have historically stressed building multi-purpose ships. We have not banked on a static war in which single mission submarines would be called upon to perform one task only for the war's duration.

In the course of a single deployment an SSN may well be called upon to transit at high speed to reach station, to conduct an area search in advance of a task group or to provide ASW direct support during transit of that task group, and to probe deeply into the home waters of the Soviet fleet on offensive operations.

The Soviet Union is a Eurasian power. To accomplish its mission in a war, it need only to deny us ocean access to our allies and to the Russian homeland. The United States, on the other hand, requires attack submarines capable of seeking out and destroying Soviet submarines and carrying the war to Russian shores. If we do not have nuclear submarines with the necessary capabilities, particularly in light of our growing numerical disadvantage, we will not be able to defend the national interests.

We cannot predict which specific submarine warfare role will be most important in a future war. Unlike other weapons, the attack submarine in the main fights its battles alone, against any adversary which enters its patrol area, and with little external support. Under such circumstances single mission low-mix submarines cannot win and thus are useless to our needs. If we were to have a submarine program of the scope of the Soviets we might be able to build some limited mission submarines since we would have more than enough to take care of the primary naval objective. But we do not and with the current building program of one a year it would be ridiculous to build anything but the best.

Besides we already have to some extent a mix of less capable attack submarines in our inventory now, and will in the future. These are older submarines such as the 8 diesel units and the early nuclear attack submarines. Of course, they were not built that way. Each ship in its day was built as a fully capable unit. When you have a continuous construction program time produces "low-mix" submarines. To build new "low-mix" submarines would result ultimately in a force consisting preponderantly of low-mix ships—some new, some old. Adoption of a high number of low-mix submarines would certainly please the Soviet military. It would make their job a lot easier.



*Question.* Admiral, trace for the record the events which I recall as a bitter battle to get the first SSN688 Class submarines approved within DOD and later in Congress. How did this program evolve?

*Answer.* In 1964 I started working on the propulsion plant for an attack submarine which would have an increased speed capability. At that time we were building the SSN637 Class which used a propulsion plant that when first used in the USS *Skipjack* achieved a speed [deleted]. Because of added weapon and sonar equipment, increased quieting and shock resistance and deeper depth capabilities, subsequent ships had grown in size and thus the maximum speed had dropped [deleted]. It was apparent to me that we needed a new submarine that would regain that loss of speed for two reasons. One, I sensed that the Soviet nuclear submarines were capable of higher speeds [deleted] and two, I felt we needed submarines capable of acting as escorts for our carrier task forces; this meant speeds [deleted] range. In fact, my original title for this project was FES which stood for Fast Escort Submarine.

It took me from 1964 to 1967 to get the Navy to wake up to the fact that higher speed in our submarine was needed. During all that time I was working on the propulsion plant through funds provided by the Atomic Energy Commission.

The aviation and surface ship officers would not accept the concept of using a high speed submarine as an escort for carrier task forces because it might hurt their efforts to get funds. In order to get approval to continue the development I had to change the title of the project and we had to eliminate the escort function from the arguments used within the Navy for gaining approval of the submarine. I ran into a somewhat analogous situation with the *Nautilus*, our first nuclear submarine. The *Nautilus* was designed to make [deleted]. The Submarine Forces were against a ship of this size, and they did not consider the high speed to be necessary. I wanted to improve on the *Nautilus* design and build submarines even faster than the *Nautilus*. The Submarine Forces said they wanted smaller submarines, and did not need high speed so we had to build [deleted]. That was the SKATE class.

When I started on the SSN668 project our intelligence people were estimating that the top speed of Soviet nuclear submarines was [deleted]. I didn't believe it, so I started digging into the whole intelligence picture on Soviet submarines. I found that no one in [deleted] was making a realistic appraisal of Soviet submarine capabilities. I had to become involved to get the intelligence people to face up to the facts that were available to them. At first, people in the Navy tried to keep me and my senior people from getting the necessary intelligence clearance, but I was able to get the Chief of Naval Operations to square that away. By 1967 I was able to get the intelligence community to acknowledge that the new Soviet nuclear submarines under construction would probably have a speed [deleted] and that the older submarines could make at least [deleted]. However, even after that the systems analysts in the Office of the Secretary of Defense continued to use a speed [deleted] in their studies. This was after [deleted].

In late 1967 I was finally successful in getting the CNO and the Secretary of the Navy to recommend long lead funds in the fiscal year 1969 budget for the first ship of this high speed design now referred to as the SSN688 class submarine. However, OSD disapproved it. About that time OSD had performed one of their more memorable studies which tried to predict the outcome of a war with the Soviets following various scenarios. Of course in making such a study your assumptions are all important. Even though there was strong evidence to the contrary the study used old estimates of Soviet submarine speeds and a number of other factors all of which served to benefit U.S. submarines compared to the Soviets. Out of this study came such remarkable things as a conclusion the United States would be able to sink 25 Russian submarines for every 1 of ours lost. I will repeat, the "kill" ratio they derived and on which they based subsequent decision was 25 to 1. They figured on the war lasting 6 months so that at the end of 6 months only [deleted] percent of the Russian submarines would be left. With such results OSD felt it would be foolhardy to spend money on building more submarines because the few Russian submarines left would not pose a serious threat to the United States.

In fact, it was figured on a cost effectiveness basis that if we bought more submarines it would cost us \$11 million to prevent the loss of a \$3 million cargo; that the average value of a cargo to be sunk after 10 percent of Russian submarines were afloat, was only \$3 to \$7 million. Therefore it was not worth it, from a cost effectiveness standpoint, to spend more money on submarines.



I don't believe they gave consideration to whether the cargo consisted of men or whether it consisted of valuable or essential materials.

Nor do I believe that OSD gave consideration to the cost of the ship itself, because I can't imagine a modern ship and its cargo being worth only \$3 million. On this basis of low cargo cost together with the assumed low speed of Russian submarines and the concept that everything about our ships was much better, DOD came to the conclusion that we needed a total of only 69 nuclear attack submarines. Since 65 had already been authorized, that meant that from there on out we needed only four more submarines. I think you would agree the systems analysts in this case achieved a triumph of intellect, but a tragic failure of reason. They appeared to have achieved a new freedom—freedom from fact.

In 1968, the Navy and the Joint Chiefs of Staff had asked for a continuing building rate of from five to six nuclear attack submarines per year. In 1968, the Department of Defense cut this number down to two in fiscal year 1969 and two in fiscal year 1970, and none thereafter. The submarine construction program was to be reduced to zero. Therefore, there was no point in spending more money developing or building submarines, maintaining our submarine design and building capacity, or doing anything else. This was the situation in the Defense Department when the question of proceeding with the high speed submarine was raised. Is it any wonder OSD rejected it?

It was then that the fight went to Congress. Senator Stennis, in his capacity as Chairman of the Preparedness Investigating Subcommittee of the Senate Armed Services Committee, assigned special investigators to the submarine program. They worked for months pulling together all the information available on Soviet and U.S. submarine capabilities. This was followed by special hearings on nuclear submarines by the Senate Armed Services Committee and the Joint Committee on Atomic Energy. The Chief of Naval Operations and I testified at length on the need for building SSN688 Class submarines. Based on these hearings the Congress took a very strong stand for building more nuclear submarines and that these should be of the high speed class.

In July 1968, despite the objections of the Director of Defense Research and Evaluation and the OSD systems analysts, the Secretary of Defense and the Deputy Secretary of Defense decided to go ahead with the high speed submarine. Later that year OSD systems analysts got the Deputy Secretary of Defense to re-raise the issue as to whether we should build the SSN688 instead of continuing to build SSN637 Class submarines. This was thrashed out at length and finally the Deputy Secretary of Defense in December 1968 made the decision that we should stop building the SSN637 Class submarines and go forward with building the SSN688 Class submarines. The idea of building no more nuclear attack submarines after fiscal year 1970 was also dropped.

In the fiscal year 1970 and fiscal year 1971 shipbuilding programs the Congress not only approved the SSN688 Class submarines requested by the DOD but added an extra submarine each year. The committees involved have published many statements on the importance of having high speed in our attack submarines and have insisted that the SSN688 Class proceed with high priority. It is a simple fact that without the strong insistence of the Congress there would today be no SSN688 Class submarines.

In mid 1970 the Navy, after an 18 month fight, got approval of the President to assign the highest industrial priority to the controlling items for the SSN688. In order to gain this approval both the Navy and Deputy Secretary of Defense certified the urgency of getting high speed submarines into the fleet.

Of course even when you have fought through years of delay to get a project moving nothing is ever settled. In 1971 and at various other times questions were raised about stopping production of SSN688 Class submarines and going back to building the SSN637 Class submarines even though there would be little cost savings but considerable loss of capability. The current studies in DOD and Navy are only the latest in a predictable repeat of the issue on what attack submarines if any should be build. The numbers of ships in the shipbuilding program are further evidence of how it is difficult to get the attack submarine program taken seriously for very long with the Defense community. The SSN688 shipbuilding program started in fiscal year 1970 with three units, there were four units in fiscal year 1971, five in fiscal year 1972, six in fiscal year 1973, five in fiscal year 1974, three in fiscal year 1975, two in fiscal year 1976, three in fiscal year 1977, one in fiscal year 1978, one in fiscal year 1979 and it is currently projected to be one each fiscal year through 1985. The loss of momentum is obvious and it will take a corresponding toll in achieving and maintaining an adequate force level. It could lead to an erosion of our submarine shipbuilding capability and loss of



suppliers who have difficulty coping with such an unpredictable shipbuilding program as we are following.

By 1985, the last of the currently authorized SSN688 Class submarines will be in operation. That will give us 33 SSN688 units with high speed capability. If the Soviets continue to build nuclear attack submarines at a rate comparable to what they have done over the past decade, they could have on the order of 60 or 70 high speed nuclear attack submarines by 1985. That does not include other types of nuclear submarines which will also have high speed capability. Just think of the situation we would face in 1985 if the Defense Department had been successful in stopping the construction of the SSN688 Class. Instead of 2 Soviet high speed nuclear attack submarines for every one SSN688 Class, the ratio could have been 60 to 0 by 1985. Can anyone question the wisdom of Congress in requiring that the SSN688 Class program proceed?

It appears we are reaching another critical point in our attack submarine program where pressures are developing to turn back to less capable ships if indeed we will be building any at all. In view of the Soviet submarine threat and our unique requirements for defending the high seas, such a choice would, in my opinion, have the gravest implications for the future well being of our country.

*Question.* Admiral, is there any truth to reports that the Navy has been told to evaluate the option to return to the construction of diesel submarines? What are your views on the subject?

*Answer.* Yes, I am afraid there is. The Navy is again looking at the possibility of building diesel submarines as part of a high-low mix of submarines. The diesel would obviously be the low capability ship in this mix. I have previously discussed the high-low mix concept for submarines and I will not reiterate it. But I cannot help noting that this attempt to go back to diesel submarines is somewhat reminiscent of the difficulty encountered in the conversion from sail to steam.

In 1814, Robert Fulton designed and built for the U.S. Navy the world's first warship propelled by steam. It was named *Demologus*. Over the next 20 years, the merchant marine built some 700 steam merchantmen. However during that period the Navy built only one additional steamship.

In 1869—55 years after the *Demologus*—the Navy Department issued a general order requiring all warships to carry a full set of sails. The concern over cost was so great that very specific instructions were written as to when the steam engines could be run and the general order warned naval commanders that:

"They must not be surprised, if they fail to carry out the spirit of this order, if the coal consumed is charged to their account."

In a later period, there was great reluctance to shift from coal-fired to oil-fired boilers in warships. At the beginning of the 20th Century, it was accepted generally that oil-fired warships offered great military advantages over coal-fired warships, but they were more expensive. It took Sir Winston Churchill's command decision as First Sea Lord to give Britain's Royal Navy the position of world leadership in converting warships from coal to oil. As it later turned out, this was a significant factor in Britain's naval superiority in World War I. The British Admiralty had built oil-burning destroyers as early as 1908, but, as Sir Winston is quoted as saying at the time:

"Shocked at the expense, (the Admiralty had) reverted for 2 years to 27-knot coal-burning flotillas. I was too late to stop the last bevy of these inferior vessels, but I gave directions to design the new flotilla to realize 35-knot speed without giving up anything in gunpower, torpedoes, seaworthiness. I proposed to the board that if money ran short, we should take 16 of these rather than 20 of the others. Building slow destroyers! One might as well breed slow racehorses."

After 25 years, where the superiority of nuclear submarines has been demonstrated again and again, some may wonder about the intelligence of people in government looking at going back to diesel submarines. It does not surprise me as I have constantly encountered people rediscovering the wheel. It is as endemic to the Defense Department as it is for chickens to lay eggs.

The main argument of course is that diesel submarines will be cheaper than nuclear powered ones. Of course they will be. But a diesel submarine is nothing more than a slightly modified surface ship. It is not true submarine and there is little you can do to compensate for its dependence upon rising to the surface to run its engines to get anywhere. As soon as it does it is extremely vulnerable to detection and destruction with the technology available today. Besides, any



diesel submarine built today that has any capability at all will not be a cheap ship. It may be cheaper than a nuclear powered submarine but you will only get what you pay for. It will cost over \$100 million and do little to provide our Navy with the capabilities we need to project our Naval power overseas and counter the Soviet forces.

If cost is the only consideration in building ships then we should build only surface warships that use sails and cannons. We could quickly build up our force levels and help the energy problem at the same time. For the United States to build diesel submarines is worse than breeding slow racehorses. It is more like building a go-cart for the Indianapolis 500. It has wheels and is cheap but it is unlikely that it can even get in the race let alone win.

*Question.* If the decision was made to build three 688 Class submarines a year in addition to the TRIDENT submarines planned, do we have the shipyard capacity to build them?

*Answer.* Yes. Both Electric Boat and Newport News Shipbuilding are currently engaged in SSN688 Class construction. These two private shipyards are geared to a current production rate of a total of almost 5 SSN's per year. Thus, there is no question that the capacity currently exists to build 3 SSN688 Class submarines a year, in addition to the Trident, if such a decision were made.

*Question.* When the Chief of Naval Operations testified earlier this year he indicated that next year he was probably going to recommend building a smaller nuclear submarine than the SSN688 Class design. Are you familiar with this new design and if so what are your personal views as to its value; i.e., should we build it instead of the SSN688 Class?

*Answer.* The details of the design have not been finalized, however, the general approach as I understand it is not to use a new design but [deleted]. Of course that means that the ship will be a [deleted,] and thus not capable [deleted]. As you might expect the submarine will also cost less because that is the reason it is being looked at in the first place. But the cost difference will not be all that great. If it is to have any kind of military capability it will be a relatively expensive ship. In addition, even if you went forward with building this submarine you could not get the first unit until the late 1980's and then the numbers that would be built probably would not differ much from what is proposed now for the SSN688 Class. In my opinion no matter what design is proposed, the Navy is only going to be allowed to put a very few submarines in each fiscal year budget.

I have already commented on the high-low mix concept and the notion of some that we should go back to building diesel submarines. Most of my comments on these ideas also apply to this latest effort to design a cheaper model attack submarine. Given the geographical and geopolitical situation we find ourselves in, the expanding submarine threat posed by the Soviets and the low number of ships we are building, it does not make any sense to build less than the best.

President Carter understands fully this situation as evidenced by a recent press conference statement he made subsequent to the hearing on March 30, 1979. In response to a question as to whether the Navy should spend the available money for smaller, less expensive submarines rather than the current SSN688 Class and Trident submarines, the President stated:

"Well, it costs so much to change designs, as you know, that I am not sure even a slightly smaller or different design would give us in the long run more submarines or more effective submarines.

"As an ex-submariner, one who was in the initial program, I think I am personally biased. But I think that if there ever has been any one single weapon system that has insured our Nation's integrity and security, it has been the nuclear submarine, with a strategic weapon capability.

"It is a great insurer of the peace. And I think the Trident and the 688 combination, as far as their immediate future is concerned, are the best that we have to offer. And, of course, we are exploring new technologies and they will always be available for future designs. But to change from these two designs because there have been cost overruns, based primarily on natural inflation that has occurred, and an improvement in design during the construction phase, I think would be an error.

"So I don't think we will terminate those programs and change the design. I think they are very adequate, and I am very proud of what they have already done and what they will do in the future."



I find it hard to improve on the President's statement. I wish it would result in these studies being stopped so we can get on with our work. But these studies have a life of their own and they will go on and on.

It is important in considering this kind of issue to understand just what is our situation in speed shipquieting compared to that of Soviet submarines.

Until the recent introduction of the LOS ANGELES class into the U.S. fleet, there had been an alarming trend in estimated maximum speed capability of Soviet SSN's compared to that of their U.S. counterparts. The estimated maximum speed of Soviet SSN's [Deleted]. In fact, the Soviets presently have 44 nuclear attack submarines with top speeds [Deleted]. They have 34 *Yankee* Class SSBN's [Deleted]. They have an additional 29 *Delta* Class SSBN's [Deleted]. Certainly there is nothing to indicate any reversal of the Soviet trend toward faster submarines.

With the introduction of the [deleted] SSN688 Class submarine in 1976, the U.S. had finally reversed this trend of reducing the speed of its submarines. For the present at least, the SSN688 and her 32 authorized sister ships will have [deleted]. But the future will belong to the country which continues to improve. It is very apparent that the Soviets desire higher speed. [Deleted.]

One area in which the U.S. has had an advantage over the Soviets is in radiated noise levels. Soviet nuclear submarines are generally noisier than their U.S. counterparts. [Deleted.]

Subsequent to the SSN585 Class, the U.S. embarked on a major submarine silencing program which has resulted in substantial reductions in the radiated noise levels of the SSN595, SSN637, and SSN688 Classes of ships. The U.S. has now made most of those obvious improvements which reduce the radiated noise levels. Further improvement will come, but it will be harder to achieve and less dramatic than previous improvements. The Soviets apparently have yet to incorporate into their nuclear submarines those features which will make major improvements in radiated noise. It should be expected that future generation of Soviet attack submarines will incorporate such improvements and thus narrow the difference in acoustic performance between U.S. and Soviet nuclear submarines.

From this comparison you can see how critical it is that we build the best we can because we certainly are not trying to overwhelm the Soviet submarine fleet with numbers.

There is another aspect of this smaller nuclear submarine design effort that causes me concern. Because of the pressure to have submarines built in quantities sufficient to maintain a specified force level, coupled with the desire to build a less expensive submarine, the Navy is being forced to design and possibly to build a new design submarine in a rush. The result could well be a submarine that satisfies the cost feature but does not prove to be a viable submarine. This becomes particularly important if large numbers of this design are undertaken and at the same time construction of additional SSN688 Class design are stopped. If the problems associated with the new design are typical, they cannot be corrected easily or cheaply. Thus, the Navy ends up with submarines that are not optimally and carefully designed. If this new smaller submarine design is to be built, sufficient time should be allowed to design it properly and then try it out. That way at least the Submarine force would have an opportunity to correct problems. Some people think that designing something which is smaller and cheaper is an easier task than designing a larger version. The opposite is true particularly if the submarine is to work.

*Question.* The SSN688 Class submarines have been operating for several years now. Have they, either in exercises or in actual operations, proved their capability?

*Answer.* The SSN688 Class of ships have been involved in a number of exercises, tactical development programs, and actual operating experiences. These situations again demonstrate the effectiveness of a modern submarine when used against both submarine and surface targets. The particular advantage of high speed available in the SSN688 Class has been a significant advantage for submarines in those exercises which have more closely simulated actual wartime scenarios.

Before discussing the results of these recent SSN688 Class evaluations, I would like to discuss a closely related problem which I have seen many times before. This problem is a currently developing attitude, of certain people in the Defense Department and elsewhere, that there no longer is an Anti-Submarine Warfare



problem. These people seem to feel that there has been some magical change in the present U.S. technology that has made the Soviet submarine threat go away. This attitude has been given a fairly wide dissemination in the press.

I wish to state that I know of no change in technology or any other situation which has made the Soviet submarine threat disappear or decrease in any significant manner. While there have been some improvements in some technology, these advances have not overcome the increasing numbers of advanced nuclear powered submarines the Soviets have in their fleet. [Deleted.] The feeling that the U.S. has somehow been able to nullify or eliminate this threat of Soviet submarines is incorrect. Those people in the Navy who are knowledgeable of the Soviet submarine threat realize the significant problems we continue to face.

This idea of the U.S. having licked the ASW problem may have been brought on by recent stories in the press concerning our underwater listening capability. There is some thought that the underwater listening devices, called SOSUS [deleted].

The thought that the surface ships are now capable of solving the ASW problem because they can detect submarines in wartime is [deleted]. Even with new sonars, the surface ships have [deleted].

The SSN688 Class incorporates significant sonar and fire control system improvements compared to most of the SSN637 Class submarines and has a [deleted] propulsion plant which will drive her at a maximum submerged speed [deleted]. This compares to a maximum speed of [deleted] for the [deleted] SSN637 Class submarines.

The high speed capability provided in the SSN688 Class provides a significant tactical advantage over slower submarines. This advantage can be used to sprint ahead of a target to gain an advantageous tactical position, to increase the amount of time spent listening at slow speed when using the sprint-drift search tactic, to catch a high speed target detected at long range, and to clear the area rapidly after firing a weapon or otherwise revealing its position. High speed is also needed to evade enemy torpedoes, to reduce transit times in responding to urgent requirements anywhere in the world, and to recover from the inevitable human mistakes, errors in judgment, or incorrect choices of tactics which may have placed the ship in danger of enemy attack or caused the ship to lose its tactical advantage.

In the various missions which an attack submarine must perform, the tactical advantages provided by high speed capability can significantly affect the outcome of the mission.

The high speed capability can be used to provide direct support to high speed surface task forces. High speed is essential in this mission in order to search well forward of the task force, to provide early detection and warning to the task force of an enemy submarine threat, to gain an early advantage in prosecuting and attacking the targets, and to regain position ahead of the task force after prosecuting an attack or after a task force course change.

High speed is essential when attempting to intercept enemy submarines or surface ships which have been detected by other surveillance means at long ranges from the U.S. submarine. The high speed capability means that a submarine will be able to overtake a fast target and that the size of the area to be searched upon reaching the reported target position will be smaller.

High speed capability could also be essential [deleted].

In attempting to attack a widely scattered high speed surface task force, high speed capability allows a submarine to obtain the best position for attack, to evade counterattacks, and to reattack the remaining units even if they attempt to escape at high speed.

I would now like to discuss some of the exercises in which the SSN688 Class submarine has been involved. In March 1977 the SSN688 completed the first in a series of exercises designed to determine the tactical capability of the SSN688 Class. This was an 8-day exercise in which the *Los Angeles* and a SSN637 Class submarine, the USS *Sea Devil* (SSN664), were [deleted].

Although it is apparent that her sonar, fire control system, and speed improvements all contributed to the success of *Los Angeles* in this exercise, the exercise results clearly show that the *Los Angeles'* speed capability was a major factor in her superior performance.

Two other exercises have shown direct comparisons of the performance of a SSN637 and a SSN688 Class submarines in various situations. [Deleted.]

In another exercise both a SSN637 Class and a SSN688 Class were assigned



the function of preventing a [deleted] the SSN688 class demonstrated superior ability to conduct a more efficient search and detect more submarines faster and at a longer range. The combination of the higher speed and improved sonar again demonstrated the SSN688 as a superior class of attack submarine.

The last two exercises I would like to discuss involves a SSN688 Class submarine and surface ships. These exercises are the ones I mentioned earlier and they show the advantage which is gained for the SSN688 due to its speed. These exercises are also important in that they show that many of the previous operations between submarines and surface ships had constrained the options of the submarine to such an extent that it could not use and demonstrate its actual abilities.

In an exercise called Passex 1-79 conducted in March 1979, two SSN688 Class nuclear attack submarines were pitted against a non-nuclear aircraft carrier task force which was transiting the Atlantic. This exercise, while still not completely eliminating the constraints on the submarine, is one of the best exercises [deleted].

In the last interaction of Passex 1-79, the SSN688 submarine approached [deleted]. This exercise demonstrates that the SSN688 Class submarine with its high speed is capable of successfully attacking a surface ship task group which is aware of a specific threat and actively trying to find and attack the submarine.

In another exercise titled Trasitex 3-79 a SSN688 Class submarine operated against the aircraft carrier [deleted]. The Commanding Officer of the submarine stated in a letter dated 26 March 1979:

"[Deleted] was highly successful in conducting area transits undetected by carrier based Anti-Submarine Warfare (ASW) aircraft and ASW surface escorts. Simulated attacks were conducted against the surface group without difficulty. The typical [deleted] speed of advance of the surface ships did not tax the speed capability of [deleted].

This report from a Commanding Officer is a case in point which shows that the Defense Department system analysts, who only fight wars on paper, do not realize the true needs of the fleet as far as speed of submarines is concerned.

There has been some other exercises run where the SSN688 Class [deleted].

*Question.* What is the importance of submarines to our defense interests?

*Answer.* As almost everyone is aware, we almost lost World War I and II because of enemy submarines. In 1917-18, the worst years of the submarine war in World War I, the average number of German U-boats at sea was 47. These 47 U-boats sank about 1 million tons of shipping per month in the early months of 1917. In April 1917, 10 to 15 U-boats sank 55 ships that were attempting to supply the British Isles, totaling more than 500,000 tons. Overall in World War I, German submarines sank 5,700 allied ships totaling more than 1 million tons. These German submarines could operate only to a maximum depth of 250 feet, make only 8 knots submerged for 2 hours, and remain at sea only 30 days. When, in 1944, the Germans introduced that snorkel submarine—and all that the snorkel gave the submarines was the ability to remain submerged at 6 knots continuously—that one feature changed the whole nature of the submarine war. It required far more anti-submarine effort than we had been using. In fact 20 percent of the entire Allied World War II effort was employed in anti-submarine warfare.

During World War II, German submarines sank 2,759 ships and 66 allied warships of destroyer size or larger for a total of more than 14 million tons. The United States lost over 130 tankers in the World War II Atlantic Campaign, mostly due to German submarines. By mid-1942 the situation had become desperate. So many tankers had been and were being sunk that supply of military fuel to Europe and the Pacific was threatened.

The 130 tankers lost is very significant. During World War II we had a large number of small tankers. Most tankers were of 10,000 to 15,000 tons full load with the largest about 25,000 tons. Therefore sinking a tanker at that time did not have anywhere near the impact that would be the case if one of the large tankers we have today were to be sunk. Presently, many tankers are over 100,000 tons and plans are being made to build tankers of 500,000 tons and larger. One such tanker carries many times the oil of the World War II tankers; also they offer a much larger target and so can be sunk more easily.

The vulnerability of our overseas logistic supply lines is greater today than at any time in the past and is continuing to increase for several reasons. We



face an increased threat of submarine attack because of the improvements in submarines including the advent of nuclear power. There is an increased threat of air attack because of the increased range of aircraft and missiles and their improved means of detection. The amount of fuel which the U.S. and its allies must transport has increased because of the higher fuel consumption rate of post-World War II military units. Each tanker lost has a greater impact because of the substitution of a smaller fleet of larger tankers for the large fleet of smaller tankers used in World War II. As the number of nuclear submarines and air striking capabilities of our potential enemies has increased, the difficulty of providing logistic support when our supply lines to our combat forces are under attack has increased.

The advent of nuclear power has completely revolutionized submarine warfare. Today's nuclear submarines can operate at [deleted] depths, for months at a time submerged, at speeds which, for ships like the new SSN688 class, exceed [deleted]. They are equipped with sophisticated sonars, navigational equipment and weapons. The latest U.S. reactor cores enable our submarines to operate for over 10 years without refueling. Nuclear power has made possible the development of our Polaris and Trident strategic missile submarines which are the most invulnerable element of our strategic deterrent. The nuclear submarine now represents one of the most potent elements of the major navies of the world and its importance continues to grow.

Being essentially an island nation we are dependent on our sea lines of communication with our allies. Not only are we vulnerable to attack from the oceans that wash our shores, but those same oceans carry commodities which are vital to our national livelihood. Today we import 41 percent of our oil from overseas and this will likely increase in the future. This supply and many other strategic materials can be denied us by simply destroying the shipping which carries it. There is nothing our tankers and freighters are more vulnerable to than modern nuclear submarines.

The importance of submarines today also relates very directly to the threat we face from our potential adversary, the Soviet Union.

The Russians have established as a matter of national priority, the design, construction, and operation of a submarine fleet second to none. They have given it priority status in their military establishment. There is no doubt that the Soviets have decided that their Navy is to occupy a predominant role in their military strategy. It is also clear that their submarine force is the major element of their Navy. High ranking Soviet officials have openly stated this.

In their government, basic decisions can be made and implemented quickly. Once these decisions are made, they are effected rapidly and without the huge overhead administrative effort imposed on us in the United States by a bureaucracy which delays all projects and greatly increases our lead time and costs.

During the past several years, the Soviets have expanded and modernized their nuclear submarine construction and overhaul yards. They now have the largest and most modern submarine yards in the world. They are using production line methods under very large sheds so they can continue work regardless of weather.

One of their five submarine construction yards has an area of more than [deleted].

The logical question one must ask is: Why have they increased their submarine building capability when they already possess so tremendous a capacity, a capacity greater than all the rest of the world together? As you may recall from history, the Soviets were able to build 80 conventional submarines in just one post World War II year. The answer to this question should be a sobering one. If they already possessed facilities to construct 80 submarines in a single year, why have they spent their manpower and money to greatly expand this capacity? The most we have ever been able to build since World War II is 12 nuclear submarines in one year. Nine of these 12 were of the Polaris type which had the highest national priority and unlimited funding.

Even though the Soviets experienced technical problems with their early nuclear submarines, it is obvious they have overcome these problems and are building at a rate of three to four times greater than we are. Today they have about 355 submarines compared to our 122 with about 155 nuclear powered compared to our 114. In the last 5 years the Soviets have built over 40 nuclear submarines to our 14 and our long-held lead in this critical area has vanished. It is estimated they have a capability to build more than 20 nuclear submarines on a



one shift basis and ? on a three shift basis. They have a submarine program of much greater scope than we have, producing over nine new submarine designs or modifications in design in the last ten years.

In the course of the last two decades I have repeatedly faced intense opposition in the Defense Department to building nuclear submarines. This opposition comes from people who don't realize the value of these ships or who have vested interests in pursuing some other course at the expense of submarines. They have often argued we can wait for some new development not realizing that in any major conflict with Russia we will fight the war with the ships and submarines we have on hand. In fiscal year 1979 the submarine force of the United States accounts for approximately 17½ percent of the Navy's budget. That percentage remains about the same for the fiscal year 1980 budget before Congress and the one being developed for fiscal year 1981. Discounting the strategic submarine force, the general purpose submarine force now accounts for only 8 percent of the Navy's budget in fiscal year 1979 and that drops to 7 percent in fiscal year 1980 and below 7 percent in fiscal year 1981. By way of comparison it is estimated the Soviet spent 40-45 percent of their Navy budget on submarines. This is just another indication of the relatively low importance placed on the submarine program in this country.

In those instances—such as in the case of nuclear submarines—where the U.S. has willingly and knowingly conceded to the Soviet Union a substantial numerical superiority in a particular weapon system, it has been both the policy of, and a matter of practical necessity for, the United States to compensate in quality for what we lack in quantity.

The qualitative-quantitative comparison of relative effectiveness can constitute a fairly valid approach only so long as the quantitative advantage of the opposing force remains within reasonable bounds or parameters. Obviously, there is point at which massive quantities will certainly overwhelming minimal quantities irrespective of the quality of the latter. Moreover, there is a dangerous risk of self-delusion relying on the qualitative-quantitative comparison in that, once having made a determination of the qualitative supremacy of our own force, there is a tendency to ignore the qualitative improvements which will upgrade the capabilities and effectiveness of the opposing force as time wears on.

I mentioned earlier there have been some newspaper accounts which claim that the U.S. has solved the Anti-Submarine Warfare problem. Our capabilities, while they are improving all the time, are now being portrayed as if there is some breakthrough that has neutralized Soviet submarines. This is simply not the case and anyone that is familiar with the evolution of warfare would immediately look at such statements with a jaundiced eye. I hope no one any longer suffers from the dangerous self-delusion that we have across-the-board qualitative supremacy in our submarine program. Although we have deliberately chosen not to match the Soviets submarine for submarine, it is essential that we build sufficient numbers of our best submarines to meet our national requirements.

I believe there are very few in our military or government who have a genuine appreciation for what nuclear submarines will be capable of doing in an unrestrained all-out war. The exercises which are done during peacetime invariably introduce so many constraints as to not be a true test at all. I am convinced that in a real war nuclear submarines will be able to devastate the seas. We had better be prepared with our best nuclear attack submarines because there is no better way to cope with enemy nuclear submarines than to fight them in their own domain with the best ships we can build.

*Question.* In last year's Senate Armed Services Report on the FY 1979 Defense Budget, the Defense Department was asked to submit with the FY 1980 budget, an integral plan for the development of a new attack submarine which would reverse the trend in cost growth. Can you tell the committee where this stands and your personal views on this plan?

*Answer.* In the Senate Armed Services Report where this request is contained, the discussion centers around a future attack submarine that would follow the SSN688 Class. The report highlights six research and development programs currently underway and questions how these fit into an integrated plan. The report also expresses concern that the price of new submarines continue to grow. I will address each of these subjects.

I previously reviewed for you the history of the SSN688 Class high speed attack submarine. By the time this issue was clearly before the Congress in 1968



and it was understood that we were playing a catch-up game with the Soviets [deleted] the matter became one of urgency. I was asked by members of the Senate Armed Services Committee, how quickly could I put a submarine to sea which would [deleted]. In addition the same philosophy was used throughout the ship—only known, proven technology was used. That is what is now the SSN688 Class design. We accomplished what we set out to do.

At the same hearings I was asked what I was doing to produce a reactor plant for the future that would provide for an even greater speed capability considering the then understood advantage of speed. That was the beginning of the advanced High Performance Nuclear Attack Submarine reactor project.

It should also be recalled that at that time, in 1968, there was growing concern over the U.S. lack of a cruise-missile firing submarine similar to that possessed by the Soviets. There had been an earlier attempt at such a capability—namely the Regulus missile installed in the nuclear submarine *Halibut*. The Regulus program was terminated at the time the Polaris program got underway in order to concentrate all available resources on that highly important effort. However, this still left the U.S. with no submarine-launched cruiser missile capability. By then, the Soviets had over 50 cruiser missile firing submarines in operation and they were developing a new class, the Charlie.

As a result, the Chief of Naval Operations in September 1970 appointed an Ad Hoc Panel to study in Advanced High Performance Nuclear Attack Submarine. This submarine was to use the higher powered reactor plant design and would be capable of firing long range cruise missiles from a submerged position against surface targets. This panel reported out its findings on November 28, 1970.

During this same time the SALT-I talks were underway and the decision was made by the Administration to terminate all development work associated with a cruise missile. I am not in a position to comment as to why this was done or if such a decision was wise. In any event, the decision was made and without a cruise missile development program, the impetus to proceed with the High Performance Nuclear Attack Submarine was slowed to almost a standstill. Reactor plant development continued because at that time the early stages of the ULMS or Trident program were underway and there existed a possibility that the high performance reactor might have application in that ship. It was later decided to install a [deleted] plant into the Trident rather than the [deleted] design envisioned for the High Performance Nuclear Attack Submarine. Since a great deal of research and development had already gone into the [deleted] plant it was decided to continue its development to a point where this effort would not be wasted. We are currently winding down that effort and will have a design which could be used if such a requirement for higher submarine speed is established in the future.

In 1975 the Navy reopened the question of what attack submarine should the Navy be working on as a follow-on to the SSN688 Class. This effort was given the title of SSNX. The Deputy Chief of Naval Operations for Submarines was tasked to review all aspects associated with this question and to recommend a course of action leading to a new design submarine that would go to sea sometime in the 1990 time frame. Force level studies, threat analyses, research and development programs were all renewed. However, at about this time two new elements came on the scene which had a significant effect on any future submarine design efforts. One was the growing concern over the rising cost of weapon systems, including submarines, and the other was the contractual, management problems which developed with the two submarine building shipyards, Newport News and Electric Boat. The latter of these two problems manifested itself in raising the question of whether or not the Navy could build more submarines even if they were authorized.

However, the cost issue became and still is, the predominant influence in slowing down almost all effort on the SSNX. Not that costs are not important, but Congress should be aware of how this pressure affects decisions. Let me give you an example.

In the late 1960's and early 1970's [deleted] the need for our submarines to go deeper. The SSN 637 Class has a depth capability [deleted]. Because of size constraints and the previously discussed urgency to increase speed, the SSN688 Class was designed [deleted]. The Navy still decided to have a submarine which could go deeper. But to increase submarine depth capability using the submarine hull steel that was qualified leads to an increased ship size and lower top speed unless propulsion power is increased. Thus a major effort was



started by the Navy to qualify a stronger hull steel, referred to as HY-130, which would allow increasing submarine operation depth without having to increase ship size or propulsion power. But when the criticism started coming in on the current SSN688 Class costs, it became obvious that a more expensive hull would probably not be approved due to the increased cost. Thus this program has also been essentially stopped even though it would give the operating fleet a more effective submarine.

Thus, at present, all U.S. efforts to design and develop a submarine which has improved capability and will be capable of overtaking future Soviet submarine designs have been halted because of the concern that in order to build a better submarine, it will cost more money and Congress will not approve any more money for submarine construction.

Thus, of the six submarine-related research and development programs highlighted in last year's Senate Armed Services Report, four have, for all practical purposes, been stopped or slowed down. These are: (1) the development of a new nuclear reactor, (2) the building of a nuclear hull test vehicle to test a new high tensile strength steel, (3) the development of components for a deep diving submarine; and (4) the conceptual studies and preliminary design for the SSNX. To me, this is unfortunate if not foolhardy. We should be expanding our efforts in submarine research and development—not slowing them down. It takes 10 to 20 years in many of these areas to develop the concepts so that they can be used. There is ample evidence that the Soviets are continuing to devote great effort in their submarine research and development programs. [Deleted]. We see new Soviet submarine designs every year or so. [Deleted].

I share the Committee's concern over the state of submarine Research and Development program. However, you should try to find out why submarine Research and Development is in such a mess. Try to find out who is really running it; or who has the responsibility for running it. I can assure you that you will not get a clear, simple answer. Too many people have little pieces of it; there is no coordination. As a result, the Research and Development programs do not interrelate to the submarine, nobody pushes the important ones, so that at budget time, the needed programs are not supported to the extent necessary.

Because of fiscal constraints the Navy has had to limit the number of submarines we presently build and also reduce the future designs of ships. The U.S. has willingly and knowingly conceded to the Soviet Union a substantial numerical superiority in submarines. Although I believe our new submarines have some superior capabilities, such as lower noise, compared to Soviet designs, letting cost concerns effectively stop our designing submarines that will maintain our qualitative lead is tantamount to giving the Soviets a future ability to control the seas.

*Question.* In last year's Senate Armed Service Report on the fiscal year 1979 Defense budget, the Defense Department was asked to conduct a comprehensive study of all options and alternatives for maintaining an attack submarine force level of not less than 90 submarines. Can you provide the committee a status of this study and your personal views on that study?

*Question.* How was this study conducted and what are the conclusions?

*Answer.* I am aware of such a study. As a matter of fact to my knowledge, at least six studies are being conducted by various groups, agencies, etc., on how the Navy should design and build cheaper submarines so as to maintain the current force level of 90.

There are several issues involved in this area that need to be discussed and understood. I would like to address each of them.

Partially, as a result of the request contained in the Senate Armed Services report, the Secretary of the Navy on May 22, 1978 asked the Assistant Secretary of the Navy (Research, Engineering and Systems) to conduct a study not only of the nuclear attack submarines (SSN's) but also of the ballistic missile submarines (SSBN's). Its objective was to "define and analyze alternative nuclear submarine forms to satisfy the Navy's near-term objectives". The Secretary directed that "attention should be directed to options which offer the prospect of significantly reducing costs while retaining operational adequacy".

The Secretary also requested the Chief of Naval Operations (CNO) to participate in the study by providing his concepts and to render all possible assistance. This point is particularly significant because at the outset the study was scheduled



to be conducted by people almost entirely outside the Navy, which would have ensured no "interference" by persons supposedly biased towards current submarine philosophy. Apparently the Secretary understood the implication of this and wisely insisted on CNO's involvement.

Mr. Fred A. Payne, a former Pentagon research executive and aerospace consultant was named the fulltime director of the study. He reported directly to the Assistant Secretary of the Navy (R,E & S). There was established a Steering Group, an Advisory Committee and a number of working groups. Some of the members selected to serve on these committees, etc., were people who had previously been active participants opposing the building of the SSN688 Class submarine back in the 1964-68 time frame.

Based on how this study was first programmed, it was inevitable that the results, if there ever were any, would not represent a proper, well reasoned approach. As a result I directed my people to cooperate to the fullest extent by providing whatever technical information was requested, but not to become a member of the study group or get involved with the group's findings. This has proven to be a wise decision.

The results of this study were to have been presented to the Congress by February 1, 1979. To my knowledge, they have yet to be transmitted. As best as I can tell, the reason is that there have been basic disagreements between those who conducted the study and the Navy. It is also my understanding that the Study Director, Mr. Payne was disassociated from the study last December.

As far as the study itself, I can not comment on its validity. As I said earlier, I supplied technical information on nuclear propulsion plants as requested. The final findings and recommendations which may be contained in this study I have not seen. However, even without seeing them I can comment in general terms, if for no other reason than I have watched many similar studies conducted over the past 25 years involving nuclear submarines, nuclear aircraft carriers and nuclear cruisers. They all have certain elements in common and they are the trade mark of the systems analysts. First you find out what answer is desired and then you set about to prove it. In this case the end point was to prove that you could design and build a nuclear or non-nuclear submarine that would be considerably cheaper than the 688 class but one which would be just as effective in "selected essential" roles. I am sure that had it not been for the Secretary insisting on Navy involvement in the final product, Congress would have in its hands today a study "proving" just that. Since the study results have not been published, I can only conclude that the results did not support the pre-conceived answer and must be re-evaluated.

As I am sure you know, the Navy is perfectly capable of designing and building a cheaper submarine. It doesn't need any help. It is just as easy for them to do that as it is for Detroit to design and build cheaper automobiles; for the aerospace industry to design and build cheaper commercial passenger aircraft; or for the Army to build cheaper tanks. The question which must be answered is, will these cheaper versions serve the purpose for which they are intended? If Detroit builds a cheap automobile and nobody buys it, then the effort was a failure. However, in the automobile business you are dealing with a product that is produced by the millions and if a mistake is made on a given model, the company changes or drops that particular model and comes up with a new one the next year. With submarines we are dealing with a small number of inherently expensive items that must last for 20 to 30 years. So the question boils down to, what do you want the submarine to do? This is a question the Congress must be in a position to answer, because it is not certain that you will receive a clear, well-reasoned recommendation from the Department of Defense.

You should recall that it is Congress that can take the credit for the existence of the SSN688 Class high speed submarine we now have and we are continuing to build. The DOD fought the SSN688 Class design all the way for years. Yet today it represents probably the most capable attack submarine in the world. Operational results prove it has capabilities no other submarine has in carrying out many of the missions required of a modern attack submarine.

To make a submarine cheaper all you need to do is tell the designer to remove certain capabilities. Each capability that is deleted or reduced, make the submarine smaller, lighter, and thus cheaper. If you decided you don't want a certain speed capability, a certain quietness capability, a certain shock capability, a certain weapon capability or a certain depth capability, you can reduce them



and the submarine will get cheaper. Where all of these so-called "studies" fall flat, is when they try to prove that by reducing one or all of these capabilities, you can end up with a submarine that is just as effective for a cheaper price. By doing this, the study becomes a fraud. You do not get something for nothing.

In my opinion this entire issue could be settled in a relatively short period of time and without a lot of useless studies. Again, the burden will fall on the Congress, as it always has.

I have said many times before, in peacetime we should build the best and most capable weapon systems we can. In a real wartime situation we will not have the time to build these complex ships such as was possible in past wars. The judgement as to what and how many we should build in peacetime is obviously a question involving many elements, not the least being, how much money the Administration and Congress is willing to provide in competition with other national programs. But to build less capable submarines in peacetime, in my opinion, would be a grievous error.

Another factor which I do not believe is given serious enough attention is a realization of just what the threat will be in say 10, 20, or 30 years. Remember, a new submarine designed today will take at least 8 years before it goes to sea and will have to last well into the 21st century. No one knows what the enemy will have in 10 or 20 years. How can you even guess? How can you guess what missions will be demanded of our attack submarines? We have not fought a war at sea since 1945 and, if and when we do, a responsible official must assume that there will be many changes in strategies and tactics of naval warfare. We have never faced an enemy at war using nuclear submarines nor have we ever used our nuclear submarines in a real war situation. Knowing this, how can anyone, regardless of how smart he may be, come up with calculations that prove, in a theoretical and mathematical sense, just what our submarines should be capable of? Yet this is what is going on. Soon you may be getting the 12-inch-thick "study" on what kind of submarine we should be building. At this time I do not know what that study will recommend. It is quite possible they will arrive at the absurdity that a diesel submarine is just as effective as a nuclear powered one. Using the same logic I guess they could just as easily conclude that we decommission all of our nuclear powered submarines. You may recall that several years ago the DOD system analysts recommended that we sink 10 of our Polaris submarines because they "proved" it would be cost effective.

Let me emphasize, if the Congress and the Administration want the Navy to build cheaper submarines, diesels included, all they have to say is "do it". But the Navy should not be asked to prove that they are just as effective as the SSN688 Class nor should they make the Navy say that is what the Navy wants instead of the SSN688 Class.

There is another important factor that affects the cost of submarines which the Congress should consider if you really want to reduce the shipbuilding cost and that is the constantly changing submarine construction program.

A few years ago the SSN688 Class program was planned to include five submarines per year. The Trident submarine program was planned to include three submarines per year. Both these programs are now down to about one per year after several changes in Defense Department planning. The lack of firm programs discourages potential suppliers and results in increased costs.

I am not in a position to evaluate how many submarines we should ultimately build. However, every time there is a stretchout in building ships, costs go up. The Congress can help avoid this waste by insisting on firm planning from the Department of Defense.

Insofar as submarines are concerned let me give you my recommendation, and I can assure you it is not based on systems analysis, computer studies, or war game scenarios. It is based on intuition, knowledge of ships and history, and just plain common sense. I am sure that, for this reason alone, the DOD "studiers" would reject it.

First let me address the attack submarines. I would continue building the SSN688 Class. Today, it represents the best we know how to do. In addition, I would continue reviewing the design of the SSN688 Class to see what improvements can be made. Such a reengineered SSN688 might come out smaller but then again, it might not. Remember, the SSN688 was designed over 10 years ago and since that time we have learned more about its operation. These lessons need to be incorporated into later designs. To go back to the SSN637 Class with its reduced speed capability would be sheer nonsense. Recall, it was Congress that



forced the Navy to build the 688 in the first place because of our continuing loss of speed capability in comparison to what was seen in the Soviet nuclear submarines. The idea of intentionally building a slow submarine just to save money strikes at the core of absurdity.

Insofar as Trident submarines are concerned, I will continue building them to their present design. You should recognize that at the time this ship was under consideration, over 3 years of studies had been conducted by practically every group who could be assembled. Detailed consideration was given to its speed, depth, quietness, number and size of missiles, mode of operations, etc. . . . What was finally agreed upon was the culmination of all these factors, including debates between the Navy, DOD, the National Security Council, the White House, and the Congress. Finally a decision was made and the design features were settled. It has taken us 8 years to get where we are and, as you know, the first Trident has yet to be completed. To change the design at this point would not only take years to accomplish but would be extremely costly. As far as I know, the only objection to the presently designed Trident is its cost. I have not heard anyone say that there is anything wrong with its design in that it can not perform the mission needed.

One element of the Trident design which was the subject of extensive discussion was the number of missile tubes. Twenty-four tubes were selected. If, for reasons unrelated to mission capability, it were decided to change the number of tubes to say 20 or 16, that change could be made on Tridents further down the line and it could be done without massive change in the ship's design features. However, the number of tubes is not within my area of expertise.

Senator JACKSON. Thank you, Senator Thurmond.

I have one question, Dr. Deutch. From the standpoint of the research and development, how are we doing on the nuclear waste problem as a whole? We have a number of approaches to include solidification in various forms. There has been substantial progress made to contain the waste. As you know, I think the problem of how we manage nuclear waste, both civilian and military, is a matter of utmost importance as pertains to our own national security and support of defense programs as well as the civilian power program. Can you take a minute on that and then we will quit for the day?

We will hear the three laboratory directors briefly.

Mr. DEUTCH. Let me make a few remarks about my own view, my personal technical view of the progress that we are making on understanding the proper way to solidify waste and then dispose of it.

We have had this year in operation I believe at Battelle and Hanford the successful vitrification and operation in terms of engineering, actually chopping up commercial spent fuel assemblies, reprocessing them and vitrifying the resultant waste to form glass cylinders. More broadly, the scientific knowledge associated with the solidification medium itself, whether it is glass or some other type of medium, is rapidly increasing.

The work at Savannah River laboratory where we are about to undertake a major evaluation of various kinds of solidification technology leads me to be quite confident that we can contain these radionuclides in high level waste extremely safely and subsequently dispose of them in a geological environment.

Senator JACKSON. Thank you very much, gentlemen.

Senator THURMOND. Mr. Chairman, I have a few questions of Dr. Deutch.

Senator JACKSON. How long will that run? We may have to go over? We have the laboratory people here, too. Could you submit them?

Senator THURMOND. Dr. Deutch, I have some questions here. To save time I will just ask that you answer them for the record.



Mr. DEUTCH. I will be happy to do that, Senator.

[Questions with answers supplied can be found following testimony of witnesses; see p. 245.]

Senator JACKSON. Thank you, gentlemen.

We want to express our appreciation for your fine presentation.

The Chair will state that those of you who have other commitments we don't want to tie you up here. We are going to hear from Dr. Morgan Sparks of Sandia, Dr. Roger Batzel, Lawrence Livermore Laboratory, and Dr. Robert Thorn, Los Alamos Scientific Laboratory. If you gentlemen will come up.

Admiral RICKOVER. Mr. Chairman, may I visit with Senator Cohen for a moment?

Senator JACKSON. Yes, we will grant you dispensation for that purpose.

We will recess for a few minutes.

[A brief recess was taken.]

Senator JACKSON. Gentlemen, we are sorry that the hearings have run so long today. It was unavoidable. We would like to have some brief comments from all three of you. Dr. Batzel will you begin first.

## STATEMENT OF DR. ROGER BATZEL, LAWRENCE LIVERMORE LABORATORY

### WEAPON DEVELOPMENT

Dr. BATZEL. If I can have the first vugraph, my comments will just be in the framework of my view of the existing status of our nuclear weapons development technology.

### BACKGROUND

1. A decade of declining resources :
  - (a) Advanced development; and
  - (b) Number of nuclear tests.
2. Weaponization requirements increasing.
3. Limitations on testing—TTBT.
4. Emphasis on providing weapons options.
5. New DOD requirements appearing.
6. Stockpile assurance for a CTB.

It has to be viewed in the background of a decade of declining resources which means we are limited in advanced development through nuclear tests. We have continuing weaponization requirements, in fact they are increasing. We live with the limitations on testing, the Threshold Test Ban Treaty.

Emphasis has been on providing weapons options. There is no sign that DOD requirements are going to cease. We are also concerned about the stockpile assurance for a CTB.

The consequence is that within the framework of resources available to us I have significant worries about the laboratory's ability to execute its responsibilities to the country in nuclear weapons development.



## SIGNIFICANT ADVANCES IN NUCLEAR WEAPON TECHNOLOGY ARE STILL POSSIBLE

1. Even in the last decade—examples :

- (a) ER [deleted].
- (b) Insensitive high explosives.

2. For the future—examples :

- (a) Safety and security.
- (b) High yield-to-weight.
- (c) [Deleted].

We have made some contributions : We have introduced the enhanced radiation warhead, at least we hope to introduce it; we have introduced insensitive high explosives; and we are working hard on increasing safety and security of nuclear weapons systems.

We have significantly more work we can do in a number of areas for the future. We can't just work those areas today.

## TESTING

[Chart deleted.] We have discussed earlier the issue of tests. This vugraph shows the Soviet tests as we have detected them as compared with the U.S. test rate in the past and our projections for 1979 and 1980. I view this as the most serious area as far as the laboratories are concerned—that is, the opportunity for experimentation we cannot do without.

I have no reason to believe that the Soviet nuclear weapons technology is far behind, if behind at all. Given the relative efforts which I see there it gives me cause for worry about what is potentially possible in nuclear weapons technology. At the rate we are going we are not going to know.

I think with that I can stop. I could elaborate on any one of these particular issues.

Senator JACKSON. There are a few basic things on my mind. What is the impact of CTB on your ability to do the job, to have ongoing test programs to insure the reliability of the stockpile, the morale of the laboratories. I would like those questions to be addressed to all three of you gentlemen as you make your comments.

## STATEMENT OF DR. ROBERT THORN, LOS ALAMOS SCIENTIFIC LABORATORY

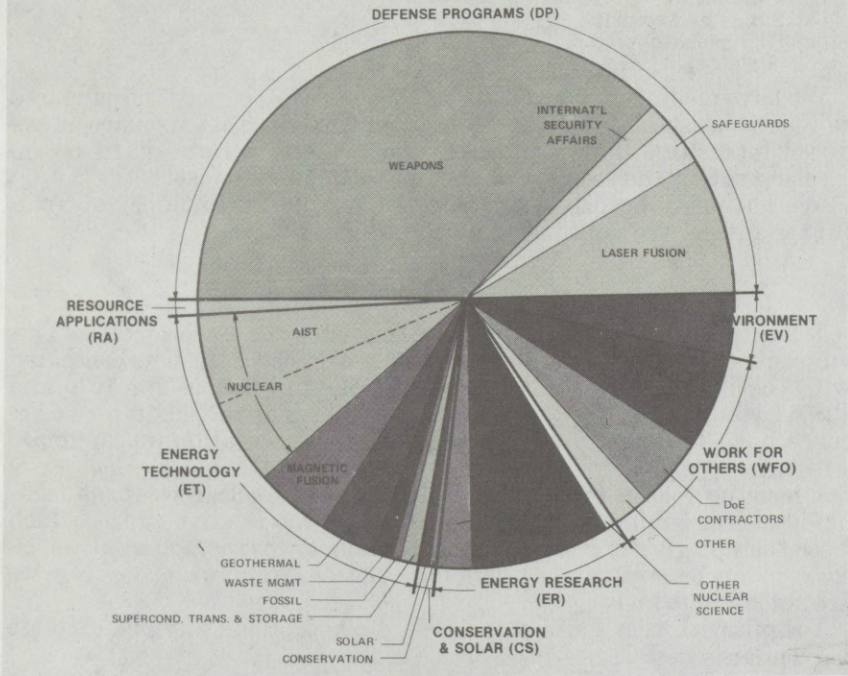
Dr. THORN. Mr. Chairman and members of the subcommittee, it is a pleasure to speak to you from the Los Alamos Scientific Laboratory.

Los Alamos is a multidisciplinary laboratory with an operating budget of \$310 million for fiscal year 1979. Most of the lab programs support the Department of Energy with only 10 to 15 percent supporting other Government agencies. More than half of the total is supporting the Assistant Secretary for Defense programs with about three-quarters of that amount devoted to nuclear weapon research and development.

The fraction of the total of the program devoted to nuclear weapons continues to decrease from year to year.



LASL FY-79 OPERATING COSTS  
(TOTAL \$310 MILLION)  
NOVEMBER 1978



PHASE 3 AND POST-PHASE 3 PROGRAMS

| PROGRAM    | STATUS<br>(PHASE)                   | PHASE 3 DATE<br>(FY) | ESTIMATED<br>IOC DATE<br>(FY)       |
|------------|-------------------------------------|----------------------|-------------------------------------|
| B61-3      | [ D<br>E<br>L<br>E<br>T<br>E<br>D ] | 1976                 | [ D<br>E<br>L<br>E<br>T<br>E<br>D ] |
| B61-4      |                                     | 1976                 |                                     |
| B61-5      |                                     | 1977                 |                                     |
| W76/Mk 4   |                                     | 1973                 |                                     |
| W78/Mk 12A |                                     | 1974                 |                                     |
| W80/ALCM   |                                     | 1976                 |                                     |
| W81/SM-2   |                                     | 1978                 |                                     |



## WEAPON DEVELOPMENT

I now want to discuss our current nuclear warheads, our hardware development program. The laboratory has a leading role in providing U.S. nuclear deterrence in the 1980's.

The first three weapons listed are modifications to the B-61 bomb, the Mod 3 to Mod 5. All three have full fuzing options.

In addition, the Mod 3 and 4 have insensitive high explosives. We believe that insensitive high explosives greatly enhance the safety and security of the system. The LASL B-61 will be the first weapon in the inventory to have insensitive high explosive. Other warheads we are developing are the Trident warhead [deleted], the W-78 warhead which goes in the Mark-12A reentry vehicle on Minuteman III; and the W-80 warhead, which is being developed as a common warhead for the Air Force air launched cruise missile, and the Navy Tomahawk cruise missile.

The last item listed is the W-81 warhead for the Navy standard missile II intended for defense against antiship cruise missiles. We are also working on a Pershing II weapons system. It has been assigned to Los Alamos in anticipation of a formal phase 3 authorization.

We understand the Army phase 3 request has now been signed by the Under Secretary of Defense Research and Engineering. It is a request for the development of two warheads for Pershing II—air burst/surface burst and [deleted] Earth penetrator warheads. Both warheads will have insensitive high explosive.

[Chart deleted.]

I would like to briefly mention two new programs.

[Deleted.]

Senator JACKSON. Does that complete your statement?

Dr. THORN. That completes my statement.

Senator JACKSON. We have a rollcall coming up. I would like to hear Dr. Sparks to get your feel about CTB in all of this. I don't mean for or against it, but its impact.

## STATEMENT OF DR. MORGAN SPARKS, SANDIA LABORATORIES

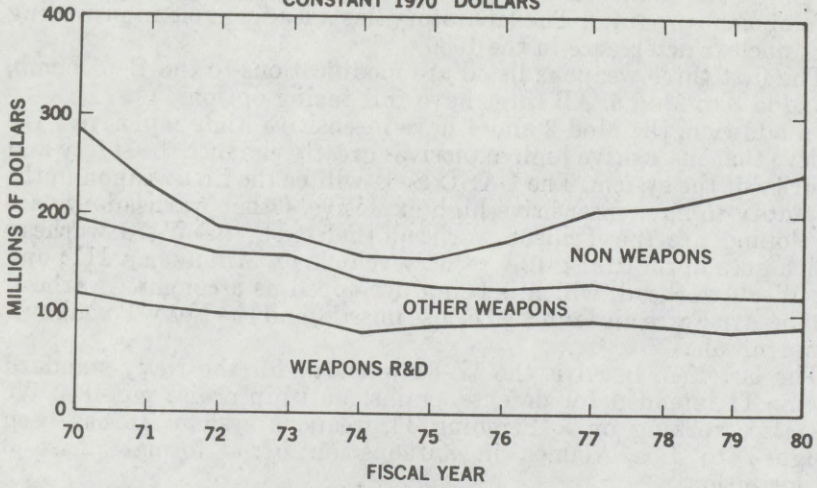
Dr. SPARKS. I will remind you that the Sandia responsibilities are for the nonnuclear parts of nuclear weapons. We have had many accomplishments in the last 10 years. I think many of the principal advances in nuclear weapons have come from our contributions. In particular they have enabled these miniaturizations in size and power and so forth to lead to new nuclear capabilities.

The first vugraph that I have presents the Sandia funding situation. It is in terms of constant 1970 dollars and shows the weapons R. & D. at the bottom line, R. & D. being a very important part of our budget. For a half dozen years our funding level has remained constant. The nonweapons growth of energy has enabled the laboratory to be on a reasonably healthy basis.

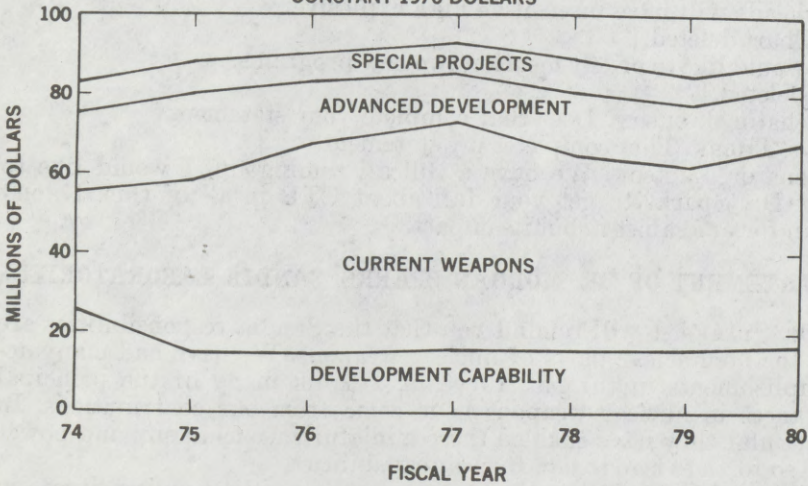
The part in the lower right-hand corner, R. & D., is broken into several parts in the next vugraph. The only point I want to make is that the current weapons, that is, those for which we have had a



**SANDIA LABORATORIES  
FUNDING LEVELS  
CONSTANT 1970 DOLLARS**



**SANDIA LABORATORIES  
WEAPONS R&D  
CONSTANT 1970 DOLLARS**





formal request from the Defense Department and therefore are our highest priorities, have increased—we now have nine as opposed to five in 1975. The result has been a squeeze in advanced development. That's the area where new ideas come from.

I will just take a couple of minutes to tell you about one of those ideas. It is based on microelectronics. It is not really a new idea. People for a long time thought that we might be able to get some kind of electronic technology into nuclear weapons.

In recent years, the improvement in microelectronics, like this little commercial calculator that sells for about \$30 and has the computation equivalent of a half a room full of the computers of a decade or so ago, has given us some great opportunities. Here is a version of an RCA microprocessor. It is less than a quarter of an inch on the side. This was made in our facility.

Here is something from Texas Instruments that has ability to store 100,000 words, the equivalent of a fair size handbook. By using this kind of technology we hope to get some new ideas.

#### CONTINUOUS MONITOR AND CONTROL SYSTEM

Security:

(a) Identification of authorized personnel.

(b) [Deleted.]

State-of-health: Continuous monitor of critical weapon components.

Command and control.

[Deleted.]

This last vugraph shows the kind of things we can do. In the area of security we could make it possible to have the identification of any personnel who have any operational interface with the weapons. [Deleted.] One of the things we do constantly is quality assurance, monitoring the state of health of weapons. [Deleted.]

Then, finally, in command and control there are increased opportunities. There is a new mathematical phenomenon that is usually called [deleted]. Also, as indicated, detonating in certain unauthorized targets and extending this in the future to identification of targets.

Thank you.

Senator JACKSON. Thank you, Dr. Sparks. Thank you, gentlemen. We are going to have another vote after this. What we will do, if it is agreeable, we will submit some questions to you for the record.

I want to express my appreciation for the work the laboratories are doing. Some of us are greatly concerned about the morale, keeping up the interest and to maintain the good people that you need at the lab. I think one of our biggest problems, should a comprehensive test ban come into being, is how are you going to get your job done?

I would like your comment on that. Those questions will be asked. There is a need for an ongoing investment in basic research, I think you will all agree.

I am very pleased in the aggregate the President has turned that around in his budget for the first time in several years, speaking not just about the labs, but in general for basic research.

I think appropriations requests are up. The three labs here are of critical importance, not just in terms of national security, but in the area concerned directly with energy as well as other disciplines involved.



Senator COHEN. I was going to inquire of General Bratton, I notice, on page 8 of your statement, you indicate there is no likelihood of a comprehensive test ban in fiscal 1980. I was wondering why you are so optimistic about that and whether the White House shares that view. Those are the kinds of questions we unfortunately won't have a chance to ask.

We will submit those for the record.

Senator JACKSON. The National Laser Users Facility, University of Rochester, in Rochester, N.Y., has submitted a statement for the hearing record. Without objection, the statement will be entered in the record at this point.

[The prepared statement of Dr. Robert L. Sproull and Prof. Moshe J. Lubin, University of Rochester, follows:]

PREPARED STATEMENT OF ROBERT L. SPROULL, PRESIDENT, UNIVERSITY OF ROCHESTER, AND PROF. MOSHE J. LUBIN, DIRECTOR, NATIONAL LASER USERS FACILITY, LABORATORY FOR LASER ENERGETICS, UNIVERSITY OF ROCHESTER

Dr. SPROULL. Mr. Chairman and distinguished members of the subcommittee, I appreciate the opportunity to appear before you this morning.

I am here to ask this Committee to authorize funds to support capital equipment, research and operations at the National Laser Users Facility (NLUF), which is located at the University of Rochester's Laboratory for Laser Energetics. Our request is for considerably more than the relatively small amount contained in the Department of Energy's budget request to Congress for a prior obligation for the Rochester facility, because the realization of the need came too late for the Administration's budget.

The National Laser Users Facility, (NLUF) in addition to its key role in the energy program in inertial confinement fusion, lends important support to the military program and to military facilities in this field.

Mr. Chairman, let me review for this Subcommittee the highlights and distinctions of the NLUF. The NLUF was conceived and specifically developed to meet fundamental and applied research needs related to an alternative source of clean, safe, and economical energy—in particular the development of laser fusion, or inertial confinement fusion.

1. The NLUF has designed the OMEGA laser system—the highest powered multibeam system existing outside of the national laboratories in inertial confinement research. It has constructed, and has operated since October, 1978, the first six beam stage of this symmetrical irradiation laser system.

2. Experiments conducted at high repetition rates on NLUF's OMEGA laser system will create the wide data base that the Department of Energy needs if it is to optimize its investment in the design and construction of the NOVA laser at Lawrence Livermore Laboratory and other high-powered drivers at national laboratories for inertial confinement fusion research.

3. The NLUF provides critical and direct support for military applications being pursued at the national weapons laboratories. For example, the NLUF laboratory developed the x-ray instrumentation to measure events on a time scale of a trillionth of a second, and is carrying out multi-shell implosion experiments to demonstrate thermonuclear burn and intense x-ray bursts. Both of these programs have direct weapons relevance.

4. The NLUF experimental laser can be fired every 30 minutes for at least 16 hours a day—by far the highest repetition rate of any high power glass laser facility in the world. Associated with OMEGA is some of the most sophisticated diagnostic instrumentation in the nation. All this makes NLUF capable of producing more essential data on inertial confinement research than any other facility in existence.

5. The NLUF, because it is the only university-based laser fusion research facility has an educational as well as a research mission. Graduate and post-doctoral students and technicians are trained at Rochester in the skills needed for the future science, application, and management of inertial confinement technology.



6. The NLUF is also the site of the Laser Fusion Feasibility Project (LFFP), the only fusion research facility that is managed by a consortium of industry, federal and state governments, and a university. They contribute funds and scientific workers, thus sharing the risks of development and creating a coalition of approaches that represents the best of fundamental university and applied industrial research. To date, over \$27 million has been committed in support of the laser fusion program by industrial sponsors, including General Electric and Exxon, Northeast Utilities, a consortium of New York State utilities, and the University.

7. The NLUF was established because of the foresight of the Department of Energy and the University during the negotiation of the original contract for construction of the laser. It is the only available high-powered laser facility in the nation where unclassified research can be done by qualified scientists from universities, industries and national laboratories. Data derived from this research significantly contributes to efforts at the national laboratories.

To fully understand the importance of the NLUF you must understand the contribution made by the facility's gifted staff to critical scientific advances.

I am pleased to introduce to the Subcommittee the well known Director of the NLUF, Dr. Moshe Lubin. He will discuss the Laboratory's scientific program.

Dr. LUBIN. The prime motivation for establishing the NLUF was the rapidly developing field of inertial confinement fusion. Thermonuclear fusion is a potentially inexhaustible source of energy. Estimates differ as to when its impact on our energy economy will be felt. However, most scientists working in the field concur that at least ten years of intense research and development is required before we can accurately project when we can begin to realize a substantial contribution to our energy economy from this inexhaustible energy source.

The rewards from fusion energy will be large—using a fuel available in seawater in essentially infinite quantity, and causing far less environmental hazards than large fossil-fuel power plants now being planned.

There are two main approaches to harnessing this energy source for civilian applications. The first, called "magnetic confinement", involves heating a large volume of relatively dilute fuel to the extreme temperatures required for significant energy release while confining it in large scale magnetic fields. The Princeton Plasma Physics Laboratory is the leading program for this approach in the U.S. The second, called "inertial confinement", involves compressing and heating a small dense fuel pellet to ignition conditions with a concentrated energy driver such as focused laser beams, as shown in Figure 1.<sup>1</sup> In this very simple concept the fuel burns before the heated target disassembles—needing no confinement other than its own inertia—hence the term "inertial confinement". (See Figure 2)<sup>1</sup>

This inertial confinement approach to significant energy release from thermonuclear fusion is relatively new, having been conceived in the middle 1960's and developed into a program in the late 1960's. Researchers at the University of Rochester have been leaders in this field of research from the start.

Inertial confinement fusion requires the development and integration of three components: a) an ignition source or "driver", b) a target suitably configured for significant energy release and c) a method of capturing the energy and harnessing it for use. Results of work in all three areas during the last few years have increased our confidence in the feasibility of the process.

I want to share some of these developments and prospects with you at this time to underscore the need for support of the National Laser Users Facility, which will allow us to proceed productively with the scientific talent we have assembled at NLUF for this promising mission-oriented research.

#### THE IGNITION SOURCE OR "DRIVER"

For successful thermonuclear ignition, the driver must be able to deliver—on a time scale of a few billionths of a second ( $10^{-9}$ ) or less—tens of kilojoules of energy to a fuel pellet ranging in size from a fraction of a millimeter to a centimeter in diameter. We have identified large scale glass lasers as the leading candidates for the initial demonstration of successful inertial confinement fusion as shown in Figure 3.<sup>1</sup> The two highest power glass laser facilities in the world are the SHIVA system at Livermore and the OMEGA system at the

<sup>1</sup> Retained in committee files.



University of Rochester. Figure 4<sup>1</sup> shows the configuration of the OMEGA system, figures 5,<sup>1</sup> 6,<sup>1</sup> and 7<sup>1</sup> are photos of the first stage of OMEGA, which is now in operation. Engineering features of the SHIVA and OMEGA "drivers" reflect different and changing technologies designed for different missions. SHIVA is designed for non-symmetrical laser beam interaction with or irradiation of classified target geometries at a low repetition rate. In contrast, OMEGA is designed and operated to acquire a large research data base by the symmetrical irradiation of unclassified target geometries at high repetition rates. DOE's participation in this project has led to the establishment of the National Laser Users Facility whose laser development timetable is shown in Figure 8.<sup>1</sup>

A variety of drivers including new kinds of lasers and charged and neutral particle beams are being developed at different laboratories. These are at an earlier stage of development, however, and may become important later in the inertial confinement program.

#### TARGET DEVELOPMENT

During the last two years, developments in target design (as indicated by the simple targets in Figure 9<sup>1</sup> and the complex structures of Figure 10)<sup>1</sup> and experimental verification of previously predicted patterns of energy release have led to a family of unclassified target configurations (those of Figure 10\*) that are projected to scale favorably through the breakeven point—that is the point where the process becomes a net energy producer. (This is shown in Figure 11)<sup>1</sup>. This in turn has allowed us to fabricate new materials, which can play an important role in the fuel pellet manufacturing process. When inertial confinement fusion energy power plants or fuel breeding plants are successfully implemented, pellet manufacturing will be a big business amounting to many billions of dollars per year. Large scale computer capability is required in order to optimize target designs. Here, too, the University's researchers have developed the only major target design computer codes for unclassified target configurations outside of the classified computer codes being used for inertial confinement by the national laboratories.

I will address the issue of classification later in my statement.

#### ENERGY APPLICATIONS

Because the results of ongoing research at NLUF and the national laboratories continue to be encouraging, harnessing the energy released from inertial confinement fusion and applying it to power generation in a useful and environmentally sound manner is an area which has received increasing attention over the past few years. (Probable applications are shown in Figure 12).<sup>1</sup> In 1971 the laser fusion research group at the University, working closely with industrial scientists from major energy industries, published for the first time the concept of using neutrons produced by inertial confinement of target material to rejuvenate spent fission fuel for use in light water reactors. This concept—called the hybrid fusion-fission system—has become the most promising near-term civilian application of this technology. The main features are shown in Figure 13.<sup>1</sup>

What impact might this "near term" application have on the energy economy? Econometric studies carried out in cooperation with NLUF's industrial participants indicate that the availability of this type of fuel producer could have a major impact on nuclear energy production. We believe this technology would at least double the energy available from nuclear plants. This technology would also greatly simplify the waste problem and dramatically reduce the possibility of nuclear weapons proliferation resulting from fuel reprocessing. (Figure 14 and 15).<sup>1</sup>

Thus, inertial confinement fusion technology has two pay-offs for our country. First, it makes possible the relatively short-term application of the hybrid rejuvenation process for fission fuel. Second, it promises the long-term development of an "inexhaustible" supply of power from pure fusion. Both, in stages, will reduce America's dependence on and vulnerability to unreliable energy resources abroad.

<sup>1</sup> Retained in committee files.



Since 1972 the University of Rochester has developed and expanded this research in inertial confinement fusion through a unique consortium of university-industry-government participants combining and focusing their financial and scientific resources. The strengths of this partnership and the rationale for its formation are shown in Figures 16 and 17.

I said that the university/industry/government consortium at the NLUF is unique. Because it is unique, the formation of this partnership required us to pioneer working agreements in several complex areas. Not the least of these was the question of patent rights. Our solution to the patents problem is reflected not only in written agreements with Government and our industrial sponsors, but also in the management style of the NLUF. While the management of all functions and scientific groups is totally integrated, the organization is set up into ten interdependent but separable operational research and engineering groups.

These are: theory and computation, experimental, x-ray, target fabrication, plasma physics, applications, fusion laser, active mirror, operations, and laser engineering.

This organizational structure also enables us to determine patent right entitlements. For example, all equipment purchased or developed with federal funds is guaranteed to be publicly available under the terms of our contract with the Department of Energy. Individual industrial participants may help to fund and/or staff one or more of nine group functions, and their settlement to patent rights is defined by the separability of the privately funded research activity from the DOE funded laser construction activity. In other words, the patent rights flow according to the funding source.

Thus, while the entire NLUF program benefits from the integration of the activities of all ten groups and from the interface and cross fertilization which occurs on a day to day basis, questions such as patent rights which are critical to the consortium are solved via the management concepts.

In 1975, the University of Rochester laser facility was first approved by the Joint Committee on Atomic Energy. This approval came with the full realization that inertial confinement fusion was and is a very sensitive technology from the standpoint of its national security applications. The JCAE was willing to approve the Department of Energy's participation in an unclassified inertial confinement fusion facility at the University of Rochester in part because the Committee was impressed with University of Rochester's long standing track record in fields involving or touching on national security sensitivities. It is worth mentioning in this context that even during the turbulent college years of the 1960's, the University of Rochester operated and continues to operate today, the Center for Naval Analysis as a contractor for the United States Navy. The University maintains its reserve officer training program throughout the 60's and to the present day. Further, the President of the University of Rochester is a former director of the Advanced Research Project Agency (ARPA) of the Department of Defense.

As a part of our contract with the federal government to carry out the laser fusion program an understanding exists between the government and the university on classification matters. That understanding recognizes that only unclassified research is performed in the Laboratory. However, the University is prepared to deal with our research which unintentionally develops information judged to be classified. There is a security classification officer who monitors all work. If there is any question regarding a publication, the material is sent to the DOE classification office for approval prior to release. As soon as an information is identified as being sensitive, the University will immediately assume security protection and if necessary, move it to a classified laboratory.

The University and particularly the staff the NLUF are well experienced and equipped to monitor closely the necessary delineation between work on unclassified target design at Rochester and classified target work at the national laboratories. At least six of the top scientists at NLUF serve as consultants with proper clearances and are, therefore, in a position to carefully avoid intrusions into classified areas by experimental work that is done at Rochester.

Unfortunately, the University's superb track record in handling major government programs and the pioneering management concept at NLUF are not in and of themselves sufficient to solve the facility's financial problems.

Dr. SPROULL. The University's initial plan was to fund operations and research for LFFP through 1981 as a joint endeavor with industrial sponsors. We planned to finance the development, and construction of the laser with DOE



funds, and to finance operations and research by other users with federal funds. We believed that federal funds could be obtained once NLUF was opened and the nature and level of demand for user experiments was established.

NLUF was opened and dedicated in the fall of 1978. It was launched by the University's original 1976 agreement with ERDA (now the Department of Energy), specifying that experimental time on the high-powered laser be shared between the Laser Fusion Feasibility Project (LFFP) and scientists from industries and universities throughout the nation. These researchers will use the laser for their own experiments in fusion and related high energy and high density physics technologies.

While we have not met our goals for obtaining the amounts of non-federal funds necessary to implement fully our initial funding plan for the Users Facility, we have obtained commitments of more than \$27 million—more than 50 percent of the goal—from industry, the University of Rochester and the State of New York for the NLUF building, for research and operations of the LFFP, and for some equipment.

However, several events occurred since September, 1978, which give us no choice but to abandon our initial funding plan for the full amount of industry support and to turn to the Congress and the federal government for additional support.

First, in the same month, we reached an impasse in our year-long efforts to obtain between \$9 and 12 million from two major additional industrial sponsors. Decisions of these potential sponsors were controlled by their own internal problems and priorities, not by the quality or the progress of NLUF. Technical reviews of our program by industrial sponsors are uniformly outstanding. Nevertheless, this development seriously jeopardizes our chances of meeting the goals for non-federal funds. Even so, our effort to attract non-federal dollars continues on an urgent basis. But we are concerned that we will not attract major new private funding soon enough, if at all, to enable us to keep the NLUF open and operating.

Second, the facility opened and began operating in October, ahead of our original construction schedule. Thus, NLUF was ready to serve users before DOE or the University had expected it to be.

Third, almost as soon as NLUF opened, the heavy demand for time on the lasers by users other than the LFFP became clear. In only 4 months, 14 complex, pioneering experiments have already been proposed from national laboratories, universities, and industries. These experiments alone would consume 50 percent of the operating time of the laser for the next 18 to 24 months. Originally we planned to allocate only a third of the laser time to non-LFFP users; we are now revising that plan to allocate more of the time to other users.

These developments forced us to seek federal funding for user operations and research support earlier than we had anticipated and caused us to miss the normal FY 80 budget request cycle in DOE. Because all research at the NLUF is in pursuit of national energy, military and other goals, we are forced to ask the federal government to assume a greater share of its cost.

Let me briefly give you a financial overview of the entire project before detailing our budget request for FY 80. The entire cost of the project from 1975 through 1981, a period of six years, is \$92.3 million. This includes research operations, the cost of operating the facility for users, and the upgrade of the OMEGA laser system to a power level of 20 to 30 terawatts or more (see chart above). I will discuss the technological reason for the upgrade later. We have already raised \$48.0 million, or over half the total, \$27.8 million of which has come from non-federal sources. (See chart below.) (In addition, our industry participants have contributed another \$2.5 million in the time of scientific staff assigned to the NLUF. This amount is not included in the overall \$92.3 million cost.)

To complete the six-year program, we need \$42.8 million in new federal funds. There is a strong possibility that \$9.1 million of this amount will come from the Japanese Government, an option which I will discuss shortly. If so, we need \$33.7 million in new federal funds, with \$16.5 million in FY 80. Without Japanese participation we will need the full \$42.8 million, with \$19.0 million of this amount in FY 80.



**NATIONAL LASER USERS FACILITY  
PROGRAM COSTS  
1975—1981 (PROJECTED)  
(in Millions of Dollars)**

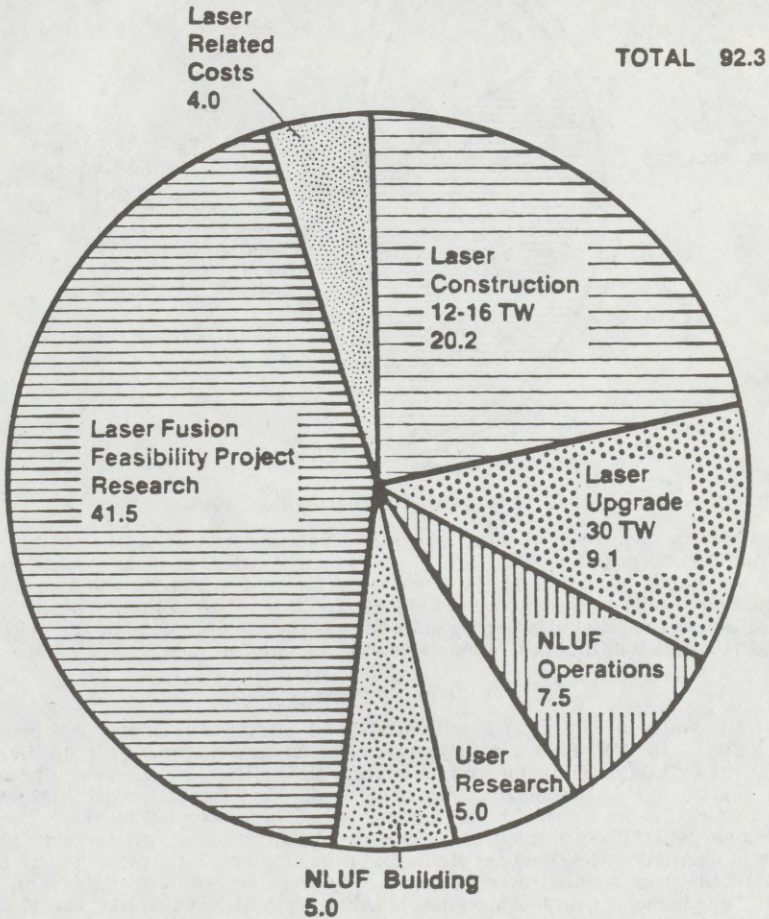
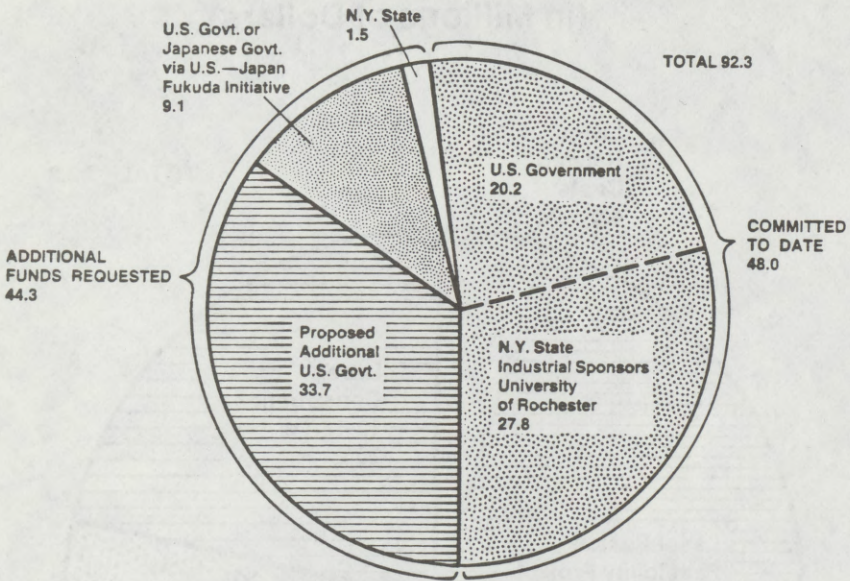


Chart I breaks down the cost elements of the program at the NLUF.



**NATIONAL LASER USERS FACILITY  
PROPOSED PROGRAM FUNDING 1975—1981  
(in Millions of Dollars)**



**FISCAL YEAR 1980 AUTHORIZATION REQUEST**

In order to operate at the full program level, we need an authorization for \$19.0 million from Congress in FY 80. As an alternative, if Congress and DOE agree to support us in seeking Japanese Government funding for the upgrade of the laser, the authorization we need FY 80 would be \$16.5 million. This amount in addition to the \$2.5 million in Japanese funds for the first stage of the upgrade would yield \$19.0 million, the amount needed for our full program in FY 80.

**CAPITAL EQUIPMENT**

For the full program, NLUF will need \$11.3 million for capital equipment: \$4.0 million in FY 1980 for laser-related equipment costs, \$4.8 million in diagnostic and data collection equipment, and \$2.5 million for the laser upgrade. (See chart below.) Diagnostic equipment is the very sophisticated equipment used to measure and record what happens when high-powered laser beams hit the target pellet. They measure temperature, densities, x-ray production, intensity and characteristics, neutron yields and other factors. I am proud to say that much of the most sophisticated diagnostic and data recording equipment in the inertial confinement field has been developed at the NLUF. Of course, the government obtains title and rights to all capital equipment it purchases or develops.

You will note that we have included in the budget request to Congress \$2.5 million in FY 80 for a start in the equipment funds needed to upgrade the power level of the OMEGA laser system to 20 to 30 terrawatts or more. Predictions of neutron yield scaling and other studies in inertial confinement done by our facility and others indicate that we must go beyond 20 terawatts to carry out the kind of experiments that will determine whether fusion can be the alternative power source which will extricate the United States from its dependence on petroleum imports. The present research sponsors, including the University, who are responsible for \$27.8 million of the funds committed, agreed to their



# NATIONAL LASER USERS FACILITY

## REQUESTED U.S. GOVERNMENT FUNDING (in millions of dollars)

|                                          | FISCAL YEAR   |               |
|------------------------------------------|---------------|---------------|
|                                          | 80            | 81            |
| <b>CAPITAL EQUIPMENT FUNDS</b>           |               |               |
| Laser Upgrade                            | \$ 2.5*       | \$ 6.6*       |
| Laser Related Equipment Costs            | 4.0           | -             |
| Diagnostic and Data Collection Equipment | 4.8           | 7.9           |
| <b>Total Capital Equipment</b>           | <b>\$11.3</b> | <b>\$14.5</b> |
| <b>OPERATING FUNDS</b>                   |               |               |
| LFFP Research Program                    | \$2.2         | \$ 2.3        |
| NLUF Operations                          | 3.5           | 4.0           |
| NLUF User Research                       | 2.0           | 3.0           |
| <b>Total Operating Funds</b>             | <b>\$7.7</b>  | <b>\$ 9.3</b> |
| <b>TOTAL REQUEST</b>                     | <b>\$19.0</b> | <b>\$23.8</b> |

### \*U.S. Government or Japanese Government via U.S.—Japan Fukuda Initiative

association with NLUF expecting to participate in experiments at 20 terawatts and above. Under the full funding program described in the attached charts and in the budget request booklet, we plan to complete the laser upgrade over a two year funding period. The total cost of the laser upgrade will be \$9.1 million. This, possibly, may be absorbed entirely by the Japanese Government.

As you know, Mr. Chairman, with the well-known Fukuda Initiative, the Japanese Government expressed its eagerness to participate in the development of various advanced energy technologies with the U.S. Government. One of Japan's primary desires is to participate meaningfully in inertial confinement fusion research. Because all other major facilities in this field are classified, the NLUF at Rochester was identified as the best possible candidate for Japanese Government investment. Of course, DOE must grant permission for a foreign government to participate in the funding and operation of a sophisticated, high-powered laser. We have had extensive discussions with DOE and the Japanese Government concerning this option.

### RESEARCH AND OPERATIONS

For the full program, NLUF will need \$7.7 million for research and operations including \$2.2 million for LFFP research, \$3.5 million for NLUF operations and \$2.0 million to support non-LFFP users' research and experiments.

This completes the breakdown of our total \$19.0 million request, Mr. Chairman. I said at the outset that NLUF has a major role in the energy program in inertial confinement fusion and related technologies. I also cited its strong relevance to the military program.



The NLUF can also be the key to alleviation of the budget pressure which DOE and the Congress are under in the inertial confinement fusion field. Earlier this year DOE officials told a congressional committee that there is a growing demand for investments in laser fusion facilities on the part of the federal government and that it is DOE's intention to consolidate the program rather than to proliferate it. Of all the major facilities now established for inertial confinement research, only the NLUF is designed to accommodate research by scientists from universities, industrial, national laboratories and other institutions. That is the purpose of a users facility. And that, Mr. Chairman, may be a key solution to the present budget pressure. If NLUF is functioning at its maximum capabilities, DOE need not invest more than it already has in other inertial confinement fusion equipment and facilities outside the national laboratories.

Mr. Chairman, our primary interest is in continuing the development and operation of the NLUF. We believe we have demonstrated that it serves a national need as the only unclassified research facility in inertial fusion and in high density and high energy physics. We have demonstrated that it can and should serve users across the nation in such a way as to enhance the achievement of national scientific goals while avoiding unnecessary proliferation of equipment and facilities costs to the government. We believe we have also demonstrated that this facility has earned a place at the head of its class in the scientific sense, and in the sense that it is the only facility training leaders and technicians for this new technology. (Many NLUF graduates and former employees now work at national laboratories). It is also the only facility to have attracted tens of millions of non-federal dollars.

Mr. Chairman, except that its funding is not yet assured, the NLUF is already playing a role in inertial confinement fusion analogous to the role played by the Princeton Plasma Physics Laboratory in magnetic confinement fusion. Both facilities are unclassified, and both are academically-oriented and operated. Both lie at the cutting edge of their fields. The NLUF at the University of Rochester has the added virtues of its substantial industrial participation and funding, and its availability to users, and its support of the military inertial fusion program.

The NLUF at the University of Rochester fulfills the recommendations of the Foster Committee Report, which, like other evaluations of the inertial confinement program, urged greater unclassified work in inertial confinement fusion and greater university and industry participation. You probably recall, Mr. Chairman, that the Foster Committee Report stressed that the potential rewards of fusion are so great in terms of fuel supply, cost, and reduced environmental problems, that the Department of Energy's funding for fusion should be exempted from the President's requested cuts in the national budget.

These facts, we feel, warrant your funding the NLUF at the full level it needs in order to continue its contributions to science and to energy research.

Only positive action by this Committee and by Congress as a whole can assure the continued availability and operation of the NLUF at the University of Rochester. We are very hopeful that the Armed Services Committee will support our request, and that you will help us to win the support of your colleagues in the Senate.

Senator JACKSON. We appreciate very much your patience. I am sorry about the protracted nature of the hearing today. We will submit additional questions to be answered for the record. Thank you.

[The questions, with answers supplied, follow:]

QUESTIONS SUBMITTED BY SENATOR HENRY M. JACKSON, ANSWERS SUPPLIED BY CHARLES GILBERT

#### NUCLEAR MATERIALS PRODUCTION

*Question.* Explain the decisions to place the Richland standby reactors in retired status and PUREX processing plant in standby. What are the costs involved, what costs are saved, and are these decisions driven by budget constraints or operational considerations?

*Answer.* The decision to place the PUREX fuel processing plant at Richland in a lower level of standby condition in fiscal year 1980 was due to operational considerations regarding the reduction in near-term fuel-grade plutonium requirements associated with rescheduling and delay of the Liquid Metal Fast



Breeder Reactor R&D program. The earliest possible startup date for the Clinch River Breeder Reactor was rescheduled to December 1986. The fiscal year 1980 cost savings are estimated to be about \$9.1 million compared to maintaining the PUREX plant in the ready availability status of the standby condition. The decision to place the PUREX plant in a lower level of standby condition results in extending from two to about two and one-half years the time required for restart.

During 1978, we reassessed the cost and schedule for restarting the KE and KW reactors based on meeting current criteria for environmental protection, public and occupational health and safety, safeguards and security as well as useful life expectancy because of their age, 24 years. KE and KW reactors were placed in standby in 1970. The order of magnitude cost to meet the above criteria at startup is about \$1 billion and restart was estimated to require about five to six years. In our judgment, undertaking the restart of these reactors would not provide an effective use of resources. Also we feel that continued reliance on these standby reactors to provide near-term contingent nuclear materials production capability may be an unrealistic policy.

The B and C reactors were constructed in 1944 and 1952, respectively, and placed in standby in 1968 and 1969, respectively. As these reactors are considerably older than the K reactors and have been in standby longer and based on a recent field assessment of their conditions, our judgment on attempting to restart B and C reactors is that such action could be as or more costly than for the K reactors and could take longer. For these reasons and those stated above, all four reactors are planned to be placed in retired status.

The costs saved from the retirement of these four reactors are about \$1 million and our fiscal year 1980 budget request was reduced by that amount.

With respect to a reduction of capabilities, the three operating Savannah River reactors are sufficient to produce current and forecast nuclear materials [deleted]. In addition, N-reactor operation can be changed in one year to weapons-grade plutonium production to provide an additional 750 kg per year. [Deleted.] As a [deleted] result, we do not feel that the apparent loss of the production capacity for the four reactors being retired at Richland will affect our ability to meet forecast nuclear materials requirements.

*Question.* Your PE&D request (\$3.4 million) appears low. How much did you request to OMB? Justify an optimized number.

*Answer.* The initial request to OMB was \$7.0 million. This was reduced to \$3.4 million and resulted in the elimination of funding for multi-site upgrading projects (\$2.8 million) and reductions for two other projects. Savannah River project, Steam Generation Additions and Boiler Control Improvements, was reduced from \$1.3 million to \$1.1 million; and Idaho project, Plant Analytical Chemistry Building, was reduced from \$1.6 million to \$1.0 million. A funding level of \$7.0 million would provide for restoration of funding (\$0.8 million) for the Savannah River and Idaho projects and provide for initiating design for multi-site facility upgrading projects (\$2.8 million) which will be identified in the Facility Upgrading Study to be provided to the Congress later this spring. Congressional review of the extent of deterioration and/or obsolescence of the 25-year old production facilities led to the requirement (DOE fiscal year 1979 Authorization Act, Public Law 95-509) for a new upgrading initiative in the fiscal year 1981 budget.

*Question.* 80-AE-3. Design and contingency percentages seem unrealistically high. This is not an unduly sophisticated construction project. Why is your cost estimate so imprecise?

*Answer.* The percentage indicated in the Schedule 44 for item 10.a. (Engineering, Design, and Inspection) should be 24 percent, not 30 percent. The reason is that the cost for the boilers should have been included under the construction cost item (10.b.) rather than being shown as a separate entry (10.c.).

With respect to the \$3.55 million indicated for item 10.a., about \$1 million is included for project management costs. The remaining \$2.55 million (17 percent of construction costs) is needed to perform the project engineering, design, and inspection. This includes developing design options to use newly developed, more cost effective, pollution control equipment such as a fluidized bed combustion system and dry versus wet scrubbers. The 29 percent contingency indicated for the project is required if it is decided to use this newly developed equipment. Their cost estimates are less certain than equipment currently available on the shelf.



The \$24 million project cost estimate, we believe, is a good one at this time recognizing, as mentioned previously, that there are pollution control equipment options and associated cost uncertainties. These options and cost uncertainties will be resolved as part of the Title I effort, and an updated and improved cost estimate will be prepared at that time. It will be used as a basis for proceeding with the Title II design activities.

*Question.* 78-18-e. You are well along in the execution of this project. Can't your cost estimate be refined? Why are you still carrying a 29 percent contingency?

*Answer.* RL Project 78-18-e is a multifaceted project which impacts production and waste management operations in both the Richland 200-E and 200-W areas. It covers process upgrading/modification, criticality alarm systems, physical security and fire protection. Scope of the project was increased in fiscal year 1979 to include ventilation and fire protection improvements to the Plutonium Processing Plant. Design for the overall project is currently under 50 percent complete. The status of design and the uncertainties associated with the renovation of the ventilation system makes it desirable to maintain the assigned contingency at this time.

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QUESTIONS SUBMITTED BY SENATOR HENRY M. JACKSON, ANSWERS SUPPLIED BY  
JAMES R. SCHLESINGER

GENERAL OPINION OF DEFENSE PROGRAMS

*Question.* Mr. Secretary, you have been either directly or indirectly involved with the nuclear weapons program for many years—in your previous positions with AEC, CIA, OMB, and as Secretary of Defense. Would you characterize the nuclear weapons program today versus what it has been in the past?

*Answer.* The nuclear weapons program has since its inception been dynamic—constantly opening new frontiers of technology in order to maintain the strength of our strategic and theater nuclear forces in response to changing threats and environments. This program has been a central element in assuring the viability of U.S. forces as a deterrent to hostile action. Our problem, of course, has been to allocate constrained resources so as to meet competing requirements. Insofar as the nuclear weapons program is concerned, we have to date been successful. My basic observation, however, is that we have reduced that program about as far as we should. If we are to maintain a credible deterrent, our laboratory manpower levels should not go lower; we must have a viable underground testing program (so long as CTB negotiations permit); and the production complex should have available the resources necessary to meet DOD requirements.

*Question.* Secretary Schlesinger, there is a concern that the nuclear weapons program now has to compete for dollars and manpower with the rest of the DOE programs. In fact, I am worried that the bill we are considering is up only 4 percent in new obligational authority—not enough to keep up with inflation. How do you prioritize your programs—how can you be sure that the nuclear weapons program does not suffer irreparable harm under artificial budget constraints?

*Answer.* Prior to submission of the Department's fiscal year 1980 Defense Programs budget to the Congress, I personally reviewed that request with the Assistant Secretary for Defense Programs to assure that the request, while austere, was adequate for meeting our commitments in the area of national defense and that no further long-term degradation would occur in the weapons complex.

Although there are many competing priorities within DOE, maintenance of a viable and responsive weapons complex is one of the highest priorities of DOE even when faced with very restrictive budget ceilings. Requirements to maintain the safety, security, and reliability of our nuclear deterrent, protect the viability of our unique nuclear weapon laboratories, restore the effectiveness and efficiency of the weapons complex, and meet Presidentially-approved weapon system deliveries resulted in deferrals to or reductions in other fiscal year 1980 Department programs, i.e., those related to energy. In this sense, the national security programs in DOE have not been adversely impacted by energy programs and may, in fact, face less competition than if they were in DOD.



## COMPREHENSIVE TEST BAN

*Question.* In putting together this budget, what have you assumed regarding a CTB (schedule for implementation and threshold) ?

*Answer.* The budget request assumes for planning purposes that a CTB does not take effect during fiscal year 1980. Nevertheless, the Department of Energy is managing its operations so as to be in the best position at all times to accept a cessation of testing, if that should occur.

*Question.* Are there specific inclusions or omissions in this request that are premised on your CTB assumptions? (Details for the record.)

*Answer.* The Department of Energy budget for fiscal year 1980 includes a request for \$201 million for underground nuclear testing. This reflects the assumption for planning purposes that a CTB does not take effect during fiscal year 1980. Should a CTB occur before or during fiscal year 1980, there would be program changes. However, substantial funds would still be required in order to retain the capability to resume testing.

Also, the Department has the responsibility for the development, production, and deployment of National Seismic Stations in support of the CTB currently under negotiation. In this connection, we have an ongoing program in the Office of International Security Affairs to undertake the necessary activities so that the National Seismic Stations can be deployed. Our budget request includes support for these activities.

*Question.* I am concerned because your nuclear testing budget is down—especially in view of the recent Soviet flurry of testing activity. Is there a connection between your CTB assumptions and the level of testing proposed for fiscal year 1980?

*Answer.* The number of nuclear tests planned is a function primarily of balancing the weapons program within available resources. Comprehensive Test Ban considerations have not been a factor in establishing the overall level of testing although we are acutely aware that a CTB could be implemented at most any time. The potential of a CTB has been factored into the fiscal year 1980 test program by assigning priority to support current DOD weaponization requirements. This, of course, does adversely affect a strong exploration and advanced development effort.

*Question.* What are your views on the verifiability of a CTB—can we go to a zero yield test ban—what will this do to our nuclear stockpile reliability?

*Answer.* Speaking technically, verification of nuclear testing is closely related to the yield range of the testing. The threshold below which tests can be performed with good confidence that they will not be identified varies with the medium and the quality and characteristics of the monitoring equipment assumed. Underground, it ranges from about [deleted]. Note, however, that these yields assume that the tests are conducted in hard rock in a seismic area and that no attempt is made to decouple the tests. If they were conducted in soft materials or in cavities, the yields could be higher by factors of from 10 to about 100. Other evasion techniques, such as testing immediately after an earthquake, also raise the possible undetected and/or unidentified yield thresholds.

These thresholds do not apply to tests in other environments. For tests under water or in the atmosphere, especially near the poles, yields could be in the [deleted]. In deep space, they could be in the [deleted] with little risk of detection.

The probability of a problem arising in the nuclear stockpile that would require a test to correct during a [deleted] period is low, but not zero. Any problems that might arise would require competent and experienced nuclear weapon designers and engineers to recognize them, to evaluate them, and to devise remedies. In cases for which there were sufficient relevant data, the judgment of these experts might be that the design could be modified slightly without nuclear tests to confirm the fix, or that suitable materials and processes were available for rebuilding to original specifications. However, it is possible that a problem might arise for which it would be infeasible either to make a fix without testing or to rebuild. In such a case, our options would include: (a) invoking the treaty's supreme national interest provision to withdraw and resume testing, (b) waiting until the treaty's scheduled expiration date to resume testing, and (c) replacing the affected warheads with those of a different but proven design, probably with some loss of military effectiveness.



*Question.* Have the Soviets violated the 150 kt threshold test ban agreements?  
*Answer.* [Deleted.]

*Question.* In the recent past, according to the press, you called on the President with the lab directors to discuss the evolving CTB. Would you advise the Committee on the essence of the concerns that may have been expressed at that session regarding the evolving CTB?

Do those concerns still exist? Has anything happened to allay some or all of these concerns?

*Answer.* The meeting was general in nature and covered various issues with national security implications. Many of the topics and concerns discussed have been addressed in the Department's report on "Reliability of Nuclear Weapons" which will be forwarded to you in the near future.

#### SALT

*Question.* Does the fiscal year 1980 budget request reflect any SALT assumptions?

*Answer.* No. The nuclear weapons program budget was formulated on the basis of stated DOD requirements, together with those anticipated for the future. This process is carried out in coordination with the DOD and reflects SALT considerations only insofar as they would affect the DOD input and concurrence.

*Question.* What have you assumed regarding a SALT schedule and what are the specific budget impacts (inclusions and omissions)? (Details for the record).

*Answer.* No assumptions have been made with respect to SALT other than those incorporated into DOD planning assumptions and guidance.

*Question.* There is a commonly-held perception that the United States holds a significant technological lead over the Soviet Union in strategic weapons systems; therefore, we can afford not to have the massive throw weight that the Soviets have. What is your general sense of the comparative technology of United States versus the Soviet strategic systems? Do we have a significant technological advantage?

*Answer.* We, of course, do not know positively what the status of Soviet technology may be. There seems to be sufficient evidence, however, to warn us against a feeling of complacency regarding comparative capabilities. The Soviet Union does indeed have an advantage with respect to throw weight, while the United States has certainly led in the past with respect to sophistication of technology. We cannot be sure that this lead continues to exist today. I would recommend that the Committee be provided with a special intelligence briefing in this area.

*Question.* Can you address the same question in terms of nuclear weapons? Do we have a "significant technological" lead?

*Answer.* With reference to design capabilities, the U.S.S.R. probably does not design their weapons the same way as the United States. Our designs are highly optimized to fit size and shape constraints on the reentry vehicles. Soviet reentry bodies are much larger than U.S. RV's, so that their designers are not limited to the same extent as [deleted].

Estimates of Soviet weapons design capabilities are limited because the data base (derived from above ground testing) necessary for accurate assessments was eliminated with the implementation of the Limited Test Ban Treaty in 1963. Only the numbers and approximate yields of Soviet underground tests have been available since then.

Some specific comparisons are these: [Deleted.]

Some implications of these differences are that the Soviet nuclear weapon stockpile may be less affected by a Comprehensive Test Ban if it prohibits all testing. [Deleted.]

Based on the overall history of nuclear testing of the two countries, the relative expertise in weapons design is believed to be that the [deleted].

#### ENHANCED RADIATION DECISION

*Question.* Is the ER decision a significant factor in any ongoing negotiations? (MBFR)

*Answer.* The Soviets have brought up ER weapons in several arms control forms in order to gain propaganda advantages, but they have not yet succeeded in getting them on formal agendas as new weapons of mass destruction.



The U.S. position has been that as far as arms control is concerned, ER weapons should not be treated any differently from other nuclear weapons. Thus, they are not a factor in any current negotiations.

*Question.* [Deleted.]

*Answer.* [Deleted.]

*Question.* Is there a specific prohibition against making the ER components fully ready? If so, please provide a copy of the source document for the record.

*Answer.* Yes, there is a specific prohibition. [Deleted.]

#### RESEARCH LABORATORIES

*Question.* One of the "rumblings" I mentioned has to do with the contractual arrangement that exists between the University of California and Livermore and Los Alamos. What is the situation here and what are you doing about it?

*Answer.* The two weapons laboratories, the Lawrence Livermore Laboratory (LLL) and the Los Alamos Scientific Laboratory (LASL), have been operated by the University of California (UC) under essentially the same contractual arrangement for more than 25 years. Over this period, the nature of the laboratories' work, their operating environment, and the agencies for which they have been operated have all changed to varying degrees. With the contracts scheduled to expire in 1982, it is appropriate at this time to determine whether the present contractual and management arrangements between the UC and the laboratories continue to perform the essential functions entrusted to them by the Federal Government.

In December 1978, I asked the Energy Research Advisory Board (ERAB) chaired by Dr. Solomon Buchsbaum, to form a study group to examine the nature of the relationship between the UC and the weapons research laboratories. This study group is also free to explore any alternative management arrangements it feels may contribute to the effective execution of programs at the laboratories.

The study group has held a number of meetings: in Washington on February 2, 1979; in California (Livermore and Berkeley) on March 1-3, 1979; and in Los Alamos, New Mexico, on March 20, 1979. The ERAB to which the study group reports is scheduled to present its recommendations to me in mid-May 1979.

*Question.* I am also concerned with what some have termed as the "proliferation" of nondefense work at the labs. To a degree, I think this is healthy, but we are now at the position where the workload at Livermore and Los Alamos is 50 percent nondefense—at Sandia 25 percent of the workload is nondefense. I do not want these labs to lose their defense focus. Would you discuss this situation—what are you doing to ensure that these labs retain their emphasis on defense programs?

*Answer.* This has been an area of concern in recent years and procedures have been established for the review of nondefense program activities at the weapons laboratories with a view to ensuring that requirements of these programs will not adversely impact accomplishment of the weapons program mission. Long-range plans have been developed for each program at the weapons laboratories with emphasis on manpower and facility requirements. These long-range plans are analyzed and coordinated with the directors of the nondefense programs to assist them in planning for the accomplishment of their missions and to identify and resolve problem areas which may develop in the future.

In no case, however, do we permit non-defense work to detract from the laboratories' fulfilling their continuing commitment to meet DOD and national security requirements.

*Question.* Many years ago when the labs were founded, someone had what I consider to be excellent foresight in establishing two laboratories to do basic nuclear research. The only competent critics of weapons scientists are their peers in the "other lab." But again, I hear "rumblings" that times have changed and maybe one of the two labs should be phased out—it would probably save money. Are we at a point where we should consider phasing out either Livermore or Los Alamos?

*Answer.* The issue of the need for two distinct laboratories has been reviewed on numerous occasions and, in each study, the gains from the competitive environment created and sustained by the two laboratory concept more than offset any projected cost reduction that a postulated consolidation might achieve. Consolidation would have little or no effect on the total weapons-related work-



load, would eliminate the competitive environment, and would severely damage the corporate memory pertaining to these systems developed by the R&D groups dissolved in the consolidation. Assuming that the one laboratory that would lose the weapons activities would become an "energy laboratory," the synergistic benefits of the joint weapons and energy endeavors would be lost to both laboratories.

*Question.* Are we doing enough basic nuclear weapons research to stay abreast of technology. I ask this question because of other "rumblings" and in view of the fact that manpower at the research labs dedicated to this pursuit has gone down appreciably in recent years.

*Answer.* The manpower devoted to nuclear weapons research and development has been reduced about 25 percent since fiscal year 1970. Much of this reduction has taken place in the advanced development and development capability areas. Development capability provides the science and engineering technology base from which new concepts evolve and improved capabilities are generated to ensure that we can continue to develop and provide nuclear weapons to meet national security requirements. There is a threshold level of weapons research support activity below which would result in a compromise in fundamental capabilities which, in turn, would result in a loss of credibility in specific technical areas and a degraded ability for advancing certain technologies. We believe that current levels of funding are just sustaining this threshold level in many areas of weapons research.

*Question.* Discuss the Soviet nuclear weapons research effort. Do they have labs similar to ours? How good is the quality of their weapons? How much effort are they expending in this effort?

*Answer.* [Deleted.]

#### DEFENSE WASTE MANAGEMENT

*Question.* Realizing that you have total responsibility for the management of nuclear waste I want to concentrate for a moment on the defense nuclear waste problem. Would you give some indication of the scope of the defense nuclear waste problem as opposed to the total waste management effort?

*Answer.* We have on hand—mainly at the three DOE production sites—about 74 million gallons of high level waste which have over the past 30-odd years been generated from processing highly specialized fuels using techniques especially developed for these fuels under operating conditions of the past. These processes were designed to produce fissile material for military purposes as quickly and efficiently as possible, and the neutralized wastes from these processes were stored in tanks whose only purpose was to safely isolate the radioactivity from man's environment until more permanent management methods could be developed. The record in managing high-level radioactive waste at DOE's sites included both favorable experiences and instances where problems have occurred. But there have been no discernible health or safety effects on the public from these activities. There are fundamental differences in the form and composition of these high level wastes and the spent fuel or solidified high level waste from the nuclear industry, should reprocessing be later authorized.

*Question.* How long can the defense facilities continue to operate at their current level before the defense waste problem becomes unmanageable?

*Answer.* I foresee no problem in maintaining the defense high level waste in interim storage until we identify suitable long term isolation options. That waste is currently handled and protected to ensure no risk to the public. We are, however, implementing and expect to complete by 1986 a comprehensive program to upgrade their interim management through storing the liquid high-level wastes in new double shell tanks that are now under construction, improved monitoring and surveillance, and solidification. Development programs are proceeding to define long-term disposal options which will provide protection of the environment, with less dependence on human surveillance. We will propose to Congress, as part of the budget process, long-term disposal options which will provide necessary protection to the public and the environment as these options are identified.

*Question.* As you know the Waste Isolation Pilot Plant was an issue last year. You are back in the budget for \$55 million this year to continue that project. As far as I can tell, none of the issues from last year have been resolved—

Is this project for defense waste—or all waste?



Is the facility to be licensed or not?

Is it a research facility or a "production" model to be built in other regions of the United States?

Answer. The WIPP as proposed by the Department of Energy would provide for final disposal of defense transuranic nuclear wastes (TRU), experimental research and development with high-level waste forms (both for defense and non-defense programs) and the potential disposal of up to a thousand spent fuel assemblies from commercial nuclear power plants in an intermediate scale facility (ISF).

The Department of Energy proposes that the facility be licensed, whether or not the project as authorized provides for disposal of spent fuel assemblies.

The WIPP as proposed includes facilities for three distinct activities. First, it would provide facilities for the geologic disposal of TRU waste. It has the potential capacity for ultimate disposal of all defense TRU waste, and thus is a "production" model.

Secondly, it would provide a facility in which to perform R&D with high-level waste materials in salt. All experiments with high-level waste will be removed, so that these facilities are for research. Facilities will be designed so as not to prevent or preclude a future decision to establish a high-level defense repository at the site.

Third, it would provide a facility capability for a possible option to demonstrate the emplacement of up to one thousand encapsulated spent fuel assemblies. This feature has development and demonstration functions.

Since the WIPP could meet the needs for ultimate disposal of all defense TRU waste, that aspect would not be expected to be extended to other sites. The experience gained in the R&D facility for high-level waste and in the spent fuel facility would be applicable design and operation of future facilities, particularly those which might be located in bedded or dome salt.

*Question.* There is discussion in the House of deauthorizing WIPP as a defense project and requiring that defense waste be processed and temporarily stored until the question of long term storage of all nuclear waste is resolved. Are you aware of this proposal; what is your reaction?

Answer. I am aware of that proposal. Currently, the WIPP project is, as you know, included in the defense authorization. On the basis of discussions between the Chairman, we hope to work out an arrangement to construct this facility outside the defense appropriation with the mission described above. We hope that this procedure will have strong support of other concerned committees in the House and Senate.

[Deleted.]

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QUESTIONS SUBMITTED BY SENATOR HENRY M. JACKSON, ANSWERS SUPPLIED BY  
RAY E. CHAPMAN

VERIFICATION AND CONTROL TECHNOLOGY

*Question.* Your justification data indicates a cost of \$1.1 million each for five seismic stations—a total of \$5.5 million.

(a) Does this represent the total cost—equipment, drilling, installation, etc.—to completely install the stations? (Provide a first order breakout.)

(b) [Deleted.]

(c) If there were no CTB, would these stations be needed?

*Answer (a)* The five stations referred to are not National Seismic Stations in the real sense. These are seismic instruments to be used in our regional seismic research program. The downhole package is the same as the downhole package of an NSS but there are some differences in the uphole equipment. [Deleted.] The first order costs are:

|                                                               | Millions  |
|---------------------------------------------------------------|-----------|
| Seismometers and electronics.....                             | \$2.5     |
| Communications .....                                          | 1.4       |
| Tape recorders.....                                           | 0.45      |
| Surface structures and deployments (including drilling) ..... | 0.8       |
| Acceptance test and calibration facility.....                 | 0.35      |
|                                                               | <hr/> 5.5 |



(b) The deployment costs [deleted] are not included.

(c) These stations are needed for our regional seismic research programs. [Deleted.]

*Question.* When will the so-called National Seismic Stations be available? Who will design and who will build them? Will they have any value except that expected under a CTB?

*Answer.* Assuming approval of the required funding and procurement priorities [deleted]. The implementation of these plans is clearly contingent on the progress of CTB negotiations, e.g., no site can be deployed until after entry into force. The development, production, deployment and operation of the NSS equipment and associated Seismic Data Management Analysis Center (SDMAC) is a joint DOE-DOD program in accordance with a December 12, 1978 DOE/DOE Memorandum of Understanding. The DOE has the responsibility for the NSS, data communications and a system control and receiving station. The DOD is responsible for the SDMAC facility to be located in Washington, D.C. The Sandia Laboratories, Albuquerque, New Mexico, with the assistance of Lawrence Livermore Laboratory, Livermore, California, and that of pertinent contractors, will be responsible for designing and building the NSS system. [Deleted.] The first group of NSS downhole packages, totaling five, will be produced for the purpose of conducting research on Regional Seismic Data Collection. The broadband digital data from these stations will be valuable as an input to the USGS programs in seismicity and earthquake prediction, for developing modern data processing and handling techniques for the reduction of the raw seismic records to useful information, and in some cases for monitoring the possibility of clandestine testing by potential nuclear proliferators.

*Question.* What is meant by a regional seismic detection system? Is it equivalent to the large aperture seismic arrays developed over the past decade by the Defense Advanced Research Projects Agency or the Atomic Energy Detection Systems operated by the Air Force Technical Applications Center?

*Answer.* A regional seismic detection system is, by definition, one which records seismic events at less than 2,000 kilometers from the source. The large aperture seismic arrays and other systems developed and operated by Department of Defense agencies, record seismic events at distances greater than 2000 kilometers from the source; these are, by definition, teleseismic detection systems.

Of course, regional seismic systems also record signals from events at distances greater than 2000 kilometers; however, they are primarily designed to obtain certain seismic wave phases which propagate to distances of less than 2000 km.

The regional seismic systems will serve two purposes by recording these wave phases: (1) it will allow us to detect events which would not be detected by the teleseismic systems, and (2) it will allow us to better discriminate between earthquakes and explosions by the application of sophisticated signal processing techniques to those wave phases which propagate only to regional distances.

*Question.* How does the DOE expect to demonstrate the technical feasibility of a regional detection system?

*Answer.* In fiscal years 1978 and 1979 DOE Sandia has built and is field testing a first model of a complete National Seismic Station [deleted]. An improved version of the NSS will be built and installed in Alaska in fiscal year 1980. Analysis of information from these field experiments will demonstrate the feasibility of the system.

*Question.* What is the status of the existing Vela satellite systems? Is your program funded and capable of restoring the Vela programs to its original degree of competence? Are there any plans for such a significant upgrading?

*Answer.* [Deleted.]

The funds we have requested for fiscal year 1980 [deleted] are consistent with known Department of Defense requirements. [Deleted.]

[Deleted.] We are working with the Air Force in establishing a detailed satellite design which will incorporate the necessary detection components.

*Question.* Are you aware of the very recent Defense Intelligence Agency report which illustrates [deleted] in U.S. national technical means of verification regarding a CTB? Would you submit for the record DOE comments on that DIA report?

*Answer.* We believe the DIA report is a well balanced and thorough discussion of a number of CTB-related topics of importance, i.e., weapon design, requirements for testing, alternatives to testing to ensure reliability, and verification issues. With regard to verification, we would point out that the DIA paper cov-



ered the technical monitoring capabilities of current and projected detection systems rather than the political aspects of verification. Verification is a process which reviews the technical data from the monitoring network as the basis for a political decision regarding the national security implications of confronting or not confronting the U.S.S.R. with the technical basis of an alleged violation. In general, the report is an initial step to address the very comprehensive terms of reference as drafted for the panel by DIA.

[Deleted.]

It should be noted that monitoring requirements, both for the Soviet Union and other nuclear powers, will be determined and implemented by the [deleted] interagency intelligence group which is currently studying the various questions and most likely avenues of monitoring a CTB. [Deleted.]

DOE, DP/ISA, is responsible for the development and procurement of the National Seismic Stations (NSS) [deleted]. However, under current practices at known underground weapon test sites (aseismic) the current seismic network can detect and locate (monitor) signals equivalent to [deleted]. Basically, any change from standard practices would increase the equivalent yields to the [deleted] kiloton range, and dedicated evasion attempts could result in undetected or at least unidentified, underground tests as large as [deleted]. Deep space tests can be carried out at [deleted].

*Question.* Will it be realistic to "mock-up" regions in the United States to simulate Soviet areas for the purpose of "reading" seismic signals?

*Answer.* Our present work is to develop a regional seismic model of the U.S.S.R. based on a number of geologic provinces described by structural characteristics such as faults, rift zones, magma bodies, and seismic propagation characteristics. From these studies we will be able to estimate performance of the NSS in the U.S.S.R. Similarly, the United States will be studied on a regional basis and these studies used in conjunction with field experiments to estimate NSS performance in U.S. regions geologically comparable to the U.S.S.R. The estimate of NSS performance in the United States will clearly be more accurate than that for the U.S.S.R. by virtue of the more complete data from the U.S. studies. This work will help to refine the predictions of NSS performance in the U.S.S.R. At this time there is insufficient data on U.S.S.R. geology to know if it will be possible to make a true analog in the United States for regions in the U.S.S.R.

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QUESTIONS SUBMITTED BY SENATOR HENRY M. JACKSON, ANSWERS SUPPLIED BY  
RICHARD L. SCHRIEVER

INERTIAL CONFINEMENT FUSION—COMPARISON WITH MAGNETIC FUSION PROGRAMS

*Question.* Explain the differences between the inertial confinement fusion program and the magnetic confinement fusion program.

*Answer.* The key differences are in the physics of the two approaches. Magnetic fusion plasmas are rather large, require continuous heating, and are confined on the order of thousandths of a second. Some magnetic confinement concepts would be near steady-state, though fusion fuel burn on the order of seconds will be sufficient for net energy production. Inertial fusion plasmas are created instantaneously in very small fuel masses, and the key problem is to cause a substantial part of the fuel to burn before the fuel mass disassembles, in the period of a few billionths of a second. The inertia of the fuel mass alone confines it, though a suitably shaped energy pulse (from a laser or particle beam source) and target configuration can help ensure that fusion burn gets under way while the fuel mass is still being compressed. A rapidly pulsed system will be required to produce useful amounts of energy. The fundamental physical problems are thus very different for the two approaches to controlled fusion, and very different solutions are being sought. However, we expect that many of the engineering problems of cavity wall materials, tritium (fuel) breeding and handling, and energy conversion will, to a degree, lead to common solutions for the two approaches. Systems studies suggest the economics of the two approaches will be similar. Thus there are great differences in the physics stage, but still substantial differences in the engineering stage, and if it is possible to solve the engineering and physics problems in each, there probably would be little difference between the two approaches in the commercialization stage.

*Question.* Compare the funding (fiscal year 1975 to fiscal year 1980) of the two programs.

*Answer.* I will insert for the record the requested comparison. Insert follows:



BA

[In millions]

|                      | 1975   | 1976   | 1977   | 1977    | 1978    | 1979    | 1980    |
|----------------------|--------|--------|--------|---------|---------|---------|---------|
| Inertial fusion..... | \$65.1 | \$83.6 | \$23.2 | \$111.9 | \$129.6 | \$143.2 | \$144.8 |
| Magnetic fusion..... | 118.2  | 166.3  | 52.9   | 316.3   | 332.4   | 355.9   | 364.1   |

*Question.* Aren't the two programs directed toward the same goal? Why shouldn't they be combined?

*Answer.* The two fusion program offices are now operating under unified DOE policy guidance. Since the inertial fusion program has goals in the area of nuclear weapons technology development that the magnetic fusion program does not have, inertial fusion is placed organizationally under the Assistant Secretary for Defense Programs, while the magnetic fusion office is placed organizationally under the Assistant Secretary for Energy Technology. These two officials, along with the Director, Office of Energy Research, as chairman, form the Fusion Review Committee of DOE. A single strategy paper for fusion was developed last year on the basis of the fusion policy statement, and is now under revision consistent with budget planning guidance for Fiscal Year 1981. This degree of coordination of the two fusion energy programs is, we believe, consistent with the common purposes of the programs, recognizing that the inertial fusion program has unique additional goals and unique aspects involving the use and protection of classified information. Combined management at the Assistant Secretary level and below would not be consistent with the distinct missions of the R. & D. programs in DOE, which comprise both nuclear weapon development and civilian energy development activities. As we have seen with comparable dual significance programs—i.e., naval reactors and nuclear materials production—there are no uniquely successful long-term solutions to overlapping organizational interests. At the present time, the Fusion Review Committee structure appears to be adequate to ensure that a common energy strategy is pursued by the two fusion programs.

#### ICF PROGRAM COSTS

*Question.* This ICF program has turned out to be an expensive effort. What are the program costs through fiscal year 1980 and what are your estimates for the next 5 years?

*Answer.* The total cost for the ICF program for the 1963 to 1980 period is \$831 million. Costs for the next five years, based on commitment projections, total \$950 million.

#### ICF PROGRAM DECISIONS

*Question.* It appears to me that you are approaching a key milestone in the "breakeven event." Discuss "breakeven", what does it mean, where do you go from there?

*Answer.* For inertial fusion, breakeven (pellet gain of 1) is defined as energy released from pellet fusion burn equal to or greater than the energy measured in the laser or particle beam used to heat and compress the fuel to fusion conditions.

This definition usefully expresses the importance of the interaction of energetic beams with the fuel pellets. Once breakeven is achieved, the thrust of the program will be toward pellet gains greater than 1 in order to realize maximum fusion energy gains that can be optimized with the most promising driver and then tailored to either the energy or weapons application.

*Question.* Each of the three labs has its own ICF effort: each lab has invested heavily in facilities—very expensive facilities—to support their approach. Livermore has SHIVA, NOVA, at a cost of \$200 million, and is using the glass laser as a driver. Los Alamos has ANTARES, at a cost of \$65 million, and is using a gas laser as a driver. Sandia has their e-beam facility (EBFA I) at a cost of \$15 million, and is considering expansion of that facility (EBFA II). Won't costs force you to concentrate your efforts on the most promising approach(es)? When will you reach a decision point on how to proceed with this program—which driver to use, which target approach, etc.?

*Answer.* We have already concentrated efforts to a considerable extent. A number of target concepts that once appeared promising have been evaluated and de-



emphasized. Several laboratories formerly had more than one experimental driver program (e.g., both CO<sub>2</sub> and Nd:glass lasers at both LASL and LLL, a Nd:glass laser at Sandia, etc.) have been forced to use a single driver approach for experimental verification of the target physics. This has cost the program flexibility and possibly delayed the time when we could have narrowed options with some confidence. The problem is that "the most promising approaches" raises the question "most promising for what?". We have insufficient resources to pursue simultaneously the development of high average power (i.e., pulsed) drivers and high peak power drivers (for experiments). The reactor requirements are expected to involve complex tradeoffs among the following: driver energy/driver power, target complexity; cavity environment (which may be the main determinant of the type of beam that is acceptable); and pulse rate. Promising concepts vary from slow pulse/high yield/complex blanket and wall to rapid pulse/low yield/gas background concepts. We also face the possibility of multiple applications—fusion-fission hybrids, electrical energy, process heat, possibly hydrogen production, for which systems would have to be optimized as well. The energy demand by type for the period when fusion could be available is by no means clear at this time. Unless we propose to cut off future opportunities, it would now be premature to cut off present lines of approach for which no serious obstacles to feasibility have yet appeared.

#### NATIONAL USER FACILITY

*Question.* We have received written testimony from the University of Rochester regarding their laser facility. Would you discuss their funding problems from a DOE perspective and tell us what you think should be done?

*Answer.* The University of Rochester (UR) has attempted to secure industrial participation to help support its laser fusion program (called Laser Fusion Feasibility Project or LFFP). The present phase of LFFP started in 1975 and is due to run through the fall of 1981. This phase was planned on the basis that industrial sponsors would contribute an approximate total of \$41M toward the operations and research activities centered around the use of the DOE supplied Omega laser. (DOE has a contract with UR for about \$20M to construct the 24-beam Omega laser system. The laser will be completed on or ahead of schedule in the second or third quarter of fiscal year 1980.) Unfortunately, UR has only been able to identify \$17M of the total, while spending at a rate that assumes availability of the full \$41M. The short fall is presently being absorbed by UR but it is unwilling and/or unable to incur the debt indefinitely.

DOE has, at no time, attempted to influence the UR research program. Further, the DOE obligation to UR will be complete at the end of the laser build (at which time the contract calls for UR to make the laser available, at no cost to the government, 32 percent of the time for three years for outside users as part of a National User's Facility (NUF) concept).

However, it is recognized by DOE that considerable investments have been made by both the private and federal sectors in the UR program. Hence, DOE is exploring methods by which it can help UR over its present financial difficulties so that the considerable benefits anticipated from the program can be realized.

The present course of action being explored by DOE attempts to retain the initial character of the UR initiative to secure support from other industrial sponsors while making the NUF available to qualified researchers.

#### NOVA

*Question.* Although the NOVA Project is completely authorized and, therefore, not a matter of direct concern to this Committee in the fiscal year 1980 authorization request, I understand that funding for the project has been severely cut back. Would you discuss this situation to include what efforts you are making to regain an optimum funding schedule and the impact on your program if funding cuts are not resolved?

*Answer.* The \$15M requested for NOVA in fiscal year 1980 is sufficient to continue building construction but delays laser hardware procurements. This action resulted from the recommendation in the Ad hoc Fusion Experts' Review Committee Report of April 1978 that major commitments for NOVA hardware not be made until target interaction experiments on SHIVA had been reviewed. To this end, the Ad Hoc Committee, headed by Dr. John Foster has been reconvened to review the complete ICF program and the position of NOVA within the program.



In anticipation of favorable comments from the Foster Committee, we are proceeding with a request for an additional \$41M (through a budget request amendment) to bring NOVA funding to \$56M in fiscal year 1980. However, building construction starts in fiscal year 1970 and hardware procurements will be delayed until the completion of the Foster Review and a subsequent review by DOE Under Secretary Myers. The approval of Under Secretary Myers is required as part of DOE's implementation of the Major System Acquisition process.

*Question.* Your justification for NOVA indicates that the TEC is under review. What does that mean?

*Answer.* The \$195M TEC of NOVA is based on the availability of \$56M in fiscal year 1980; the budget request was for \$15M. The NOVA TEC, for the lower level of funding in fiscal year 1980, would have to be increased to approximately \$220M.

#### DESIGN

*Question.* You are requesting \$1.5 million in design funds to continue design of EBFA II at Sandia. Is this your total requirement for design funds? Aren't you considering a new target facility at Los Alamos—what would the design costs be?

*Answer. First part.* The \$1.5 million referred to for fiscal year 1980 is to complete the two-year planning, estimating and design (PE&D) effort for the EBFA II facility at Sandia.

*Second part.* Yes, we are considering a new target fabrication facility at Los Alamos. Its TEC is \$14 million. We are also considering a new target facility at Lawrence Livermore Laboratory, with a TEC of \$7 million.

*Question.* Are there other ICF construction projects that you are planning in the next 5 years that will require design funds? (Provide list of projects, TEC and schedule for the record.)

*Answer.* We have not finalized plans for additional construction projects, as opposed to possible departures in the present program depending on funding levels and experimental results. The uncertainties surround the advanced short wavelength laser, for which the optimum medium and design have not yet been selected, and a heavy ion accelerator, for which we expect to produce one or more conceptual designs by fiscal year 1981. We may be able to select the short wavelength laser for scaling up by the end of fiscal year 1981. These are highly promising alternatives to further development of Nd: glass and CO<sub>2</sub> lasers, provided that target experiments verify current predictions that very short wavelength lasers or heavy ions have decisive energy coupling advantages. Should additional resources become available, over and above those needed to keep the experimental program leading to feasibility demonstration on track, we would propose for the fiscal year 1981 or fiscal year 1982 budgets scaling experiments in both a short wavelength laser and a heavy ion accelerator that would involve some construction. We are also considering the possibility of target fabrication facilities at LASL and LLL. Given these uncertainties, we cannot furnish for the record at this time a listing of projects for the next five years along with estimates of required funding for design and total construction costs with schedules.

#### ANTARES

*Question.* ANTARES has previously been authorized in the amount of \$54.5 million. You are requesting an increase in authorization of \$8 million. Your justification indicates that this increase is the result of funding stretchouts. Provide the comparable funding schedules and show how the \$8 million increase was calculated.

*Answer.* A TEC of \$54.5 million was requested and authorized for the ANTARES project in fiscal year 1977. At that time the construction was scheduled to be completed in fiscal year 1980. The current plans call for a TEC of \$62.5 million and construction to be completed in fiscal year 1983 based on the following funding schedule:

| Fiscal year: | Millions |
|--------------|----------|
| 1980         | \$12.0   |
| 1981         | 10.0     |
| 1982         | 10.0     |
| 1983         | 3.8      |



The increase of \$8.0 million in the TEC is accounted for as follows:

|                                                                                                                                                                 | <i>Millions</i> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Escalation of costs due to delayed schedule.....                                                                                                                | \$2.1           |
| Added costs (personnel, etc.) due to extend schedule.....                                                                                                       | 2.4             |
| Restoration of spares to project and an increased energy storage margin<br>which had been earlier dropped in an effort to stay within the original<br>TEC ..... | 2.2             |
| Contingency on laser hardware to be provided.....                                                                                                               | 2.4             |
| Net savings on facility construction contracts.....                                                                                                             | (1.1)           |
| <br>Total .....                                                                                                                                                 | <br>8.0         |

*Question.* How confident are you in the revised TEC? (Your justification shows you are still carrying a 16 percent contingency which seems excessive in view of the advanced state of design and construction.)

*Answer.* Our confidence in the TEC of \$62.5 million is reasonably high in light of project progress made to date and on the basis of receiving funding as scheduled.

The amount identified as contingency is a composite number, 8 percent for building construction and 20 percent for laser hardware procurement. These figures are based on building construction which is well under way, and on hardware procurement which is just getting started.

*Question.* Why do you need additional authorization? Why can't you proceed within the 25 percent cost variation authorized by the General Provisions?

*Answer.* The requested \$8.0 million authorization increase for Project 75-3-b High Energy Laser Facility (ANTARES) brings the total estimated cost to \$62.5 million. This increase is caused by inflationary factors over a longer construction period than had been originally planned. Although technically under the general provision, we could proceed without additional authorization by the Congress, we feel it is best to try and keep Congress informed of all facets of the inertial confinement fusion program.

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QUESTIONS SUBMITTED BY SENATOR HENRY M. JACKSON—ANSWERS SUPPLIED BY  
GEN. JOSEPH BRATTON

WEAPONS ACTIVITIES—R. & D.

*Question.* There is concern over whether there is enough weapons R. & D. being done. Manpower devoted to this effort has gone down 25 percent since 1970, the proportion of effort being applied to basic research is declining. Is there any way to arrive at a quantitative judgment on "how much is enough?"

*Answer.* To ensure new ideas and concepts and the necessary technological advancements during development engineering, the level of effort in the advanced concepts and technology base areas must be adequate to meet the requirements of current and future weapons systems. The necessity of devoting larger portions of available manpower to meeting the current weaponization requirements has tended toward an imbalanced weapons R. & D. program. We believe that current levels of funding are required to sustain the fundamental capabilities of our nuclear weapons laboratories.

*Question.* Are the labs sufficiently funded to maintain all ongoing R. & D. programs at the fiscal year 1979 level? Will any programs be seriously curtailed or stretched out?

*Answer.* The level of effort in the advanced development and development capability areas has been reduced significantly over recent years and many long-term advanced concepts cannot be adequately supported at the present funding levels. Many applied efforts in development capability to improve our technology base have been delayed or extended into future years.

*Question.* Explain the contractual arrangements between each of the labs' prime contractors and the Government. (Include type of contract, fees, duration, options to renew, termination provisions, etc.).

*Answer.* All three weapon laboratories are government-owned, contractor-operated facilities. The nuclear research and development laboratories, Los Alamos Scientific Laboratory (LASL) and Lawrence Livermore Laboratory (LLL) have been operated for the government under separate contracts with the



Regents of the University of California since 1943 and 1952, respectively. (The LLL contract also includes the operation of Lawrence Berkeley Laboratory.) Sandia Laboratories have been operated since 1950 by the Sandia Corporation, a wholly owned subsidiary of the Western Electric Corporation. Work conducted by all the laboratories is performed on a cost reimbursable basis, i.e., the contractors are reimbursed for all allowable costs, as defined by their contracts.

The terms of all three original contracts and subsequent extensions have generally been for five years. The present terms of the University of California contracts are from October 1, 1977, through September 30, 1982. DOE can terminate either contract in part or in whole upon 120 days notice. The University of California can terminate the contract upon two years notice. The present term of the Sandia contract is from October 1, 1978, to September 30, 1983. It can be terminated by DOE upon 90 days notice or by Western Electric upon 120 days notice.

Decisions regarding extension of these contracts are governed by the Agency's Procurement Regulations. Briefly summarized this process is as follows: Approximately 18 months before the expiration of each contract, the agency conducts a comprehensive review to determine whether the contract should be open to competition or extended without competition. Three of the prime factors that enter into such a determination are the contractors' past performance, both in program and support areas; whether or not there is a likelihood that qualified industrial firms or other organizations will compete for the contract; and the potential impact of a change of contractors on programmatic activities.

Each year the University of California receives a "management allowance" rather than a fee for its operation of LLL, LBL, and LASL. This payment is intended to defray administrative and other expenses incurred by the University of California in its management of LLL, LASL, and other activities. For fiscal year 1979, the management allowance is approximately \$4 million. Western Electric receives no payment or fee of any kind for its operation of Sandia Laboratories.

#### CURRENT WEAPONS DEVELOPMENT

*Question.* Is the W80 ALCM warhead identical to the W80 SLCM warhead? Is additional development and testing needed for the W80 SLCM?

*Answer.* The only differences between the W80-0 (warhead for the SLCM) and the W80-1 (warhead for the ALCM) are:

The use of the low ngs (neutron/gram/second) plutonium to produce low intrinsic radiation for the W80-0 (SLCM); and

Warhead mounting peculiarities for the ALCM and SLCM. [Deleted.]

*Question.* [Deleted.]

*Answer.* [Deleted.]

*Question.* What is the status of DOD requests for Phase 3 engineering development for other candidate warheads?

*Answer.* On March 19, 1979, the DOD requested the DOE to join in a Phase 3 program to provide nuclear warheads for the PERSHING II missile. [Deleted.] The DOD further requested that the DOD-DOE development program support an IOC [deleted] for the airburst/surface burst warhead and [deleted] for the earth penetrator [deleted]. The only other Phase 3 request expected during fiscal year 1979 or fiscal year 1980 is one on the warhead for the M-X missile. We expect that request in fiscal year 1980 [deleted].

#### SPECIAL PROJECTS

*Question.* Briefly describe the NEST team concept and include a summary of your role in the search for the Soviet satellite that came to earth in Canada.

*Answer.* The concept of the Nuclear Emergency Search Team (NEST) is one of providing a command, control, and logistical support structure to direct, administer, and support those scientific and technical resources that might be applied to the neutralization of any nuclear or radiological incident that threatens public health and safety.

The scientific and technical missions are classified as technical analysis of the "threat," search for and detection of the radiological material involved, diagnosis of the material and its source, render safe or neutralization, and cleanup or decontamination assistance. A NEST deployment for whatever purpose envisions the tailoring of a response force with three major elements—a command and control (management) element, a support element, and a scientific and technical element.



The Manager of the Nevada Operations Office is charged with the missions of assuring the readiness and proficiency of the command, control, and support elements and for coordinating the preparedness and application of the scientific and technical element. In order to accomplish these missions, he directs and manages research and development conducted by Defense Program contractors; equipment acquisition, maintenance, and readiness similarly conducted by contractors; and planning, training, exercises, and interagency coordination conducted by all NEST elements. The Manager, Nevada Operations Office, receives guidance and direction from the Director of Military Application for the Assistant Secretary for Defense Programs.

NEST is the tailored application to certain types of nuclear problems of trained personnel and special equipment, appropriately supported, under the command and control of a trained management team.

The role of the Department in the Cosmos 954 incident, "Operation Morning Light," was two phased—planning and response.

Departmental representatives joined representatives of other Federal agencies in planning for contingencies that would be occasioned by satellite reentry. This was done under direction of the National Security Council. The DOE was assigned the lead planning role and designated lead agency for Federal response to domestic reentry. Department of State was designated lead agency for response in the event of extraterritorial reentry.

#### RESTORATION PROJECT

*Question.* Provide an executive summary of the restoration study for the record.

*Answer.* The "Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1979" requires the Secretary of Energy to conduct a study of the status of all government-owned, contractor-operated plant, capital equipment, facilities, and utilities which support the United States nuclear weapons program. The results of such a study were submitted to the Congress with the DOE authorization request for fiscal year 1980.

During the past few years, there has been considerable concern within DOE that the nuclear weapons production, development, and testing facilities were deteriorating to such a condition that planned workloads and schedules for the 1980's might not be met. As a result, major studies were completed in 1977 and 1978 to appraise the physical conditions and technological status of equipment and utilities at the nuclear weapons production sites, laboratories, and the Nevada Test Site. These studies concluded that serious deterioration of equipment and utilities had occurred over the past several years which could seriously impair our ability to meet the nuclear weapons forecast for the 1980's. The data developed in these studies formed the basis for estimating that about \$595 million of accumulated degradation existed at the various locations.

As part of the review in 1978, the DOE Under Secretary requested that the Controller conduct an independent assessment of the earlier studies and the appraisal techniques used. This assessment concluded that the degradation was serious, appraisal methods were sound, and certain improvements were needed in the appraisal techniques. The revised estimate based on this assessment was that accumulated degradation totaled about \$451 million.

The DOE will undertake to correct these deficiencies with a multifaceted program over the next several years. This will include (a) annual appraisals of the technical and physical status of the U.S. nuclear weapons capability and the progress being made to correct the existing deficiencies, (b) improving the precision of the appraisal techniques, and (c) developing annual funding requirements through the normal budgetary procedures as part of a multiyear restoration program. The latter should include specific consideration of increases needed in future-year funding for basic capital equipment and general plant projects to prevent further degradation.

The fiscal year 1980 budget includes \$80.7 million in budget authority against a total estimated cost of \$115.3 million to initiate this program. Of these amounts, \$28.0 million authorization and appropriation has been included for the research, development, and testing complex for restoration of capital equipment; \$69.3 million authorization and associated \$39.4 million appropriation has been included for Project 80-AE-6, Utilities and Equipment Restoration, Replacement, and Upgrade at various production locations; and an additional \$15.8 million authorization and associated \$13.3 million appropriation has been included for



Project 79-7-n, Utility System Restoration, Y-12 Plant, Oak Ridge, Tennessee. For this latter project, \$2.2 million was authorized and appropriated in fiscal year 1979.

*Question.* It appears from your budget request when compared against the fiscal year 1979 authorization that cuts are being made in some areas to accommodate the restoration project. For instance, LLL and LASL were cut from \$24.6 million to \$17.4 million in the capital equipment account, etc. Are you "robbing Peter to pay Paul"; are you really increasing your capital investment program to get well?

*Answer.* Overall, the allocation of resources between operating expenses and plant and capital equipment represents a balanced but austere program. There is a decrease in basic capital equipment funding from fiscal year 1979 to fiscal year 1980. However, this is offset in part by the utilities and equipment restoration program which includes an authorization request of \$113.1 million and related fiscal year 1980 appropriations of \$80.7 million. This program represents a significant portion of our overall appropriation request of \$270.7 million for plant and capital equipment in fiscal year 1980. Specific consideration is being given to increases needed in future year funding for plant and basic capital equipment to prevent further degradation in the nuclear weapons complex.

#### TESTING

*Question.* Your statement advises of a testing supplemental for \$12.8 million. Where does that supplemental request stand? Do you need new authorization?

*Answer.* The supplemental budget request was transmitted by the President to the Congress on March 27, 1979. To date, no formal Congressional action has taken place on that request.

It is essential that additional authorization be provided [deleted].

*Question.* If no action is taken on the supplemental, would you need this testing authority added to the fiscal year 1980 bill?

*Answer.* Assuming that the Congress concurs in the need to accomplish this testing and that such testing is not precluded by an early Comprehensive Test Ban, additional funding would be required in fiscal year 1980 to preclude the deferral or cancellation of other high priority testing.

#### PRODUCTION

*Question.* Your justification data indicates that "a program is being developed to improve selectively the existing stockpile. . . ." Expand on this statement—just what do you have in mind, how are you proceeding?

*Answer.* Although no production funding is specifically provided in the fiscal year 1980 budget request for stockpile modernization actions, the stockpile is being examined jointly by the DOE and DOD for the purpose of initiating an effort to modernize selected weapons with long-term retainability. What we have in mind is selectively incorporating improved safety, security, and command and control features that have evolved since these weapons were first produced. Under consideration are the incorporation of command disable capability for in-theater nuclear weapons, incorporation of multiple code coded switches and improved permissive action links to enhance command and control features, and incorporation of enhanced electrical safety features and insensitive high explosives to improve safety under normal and abnormal environments. The DOE and DOD are jointly accomplishing the planning necessary to support a fiscal year 1981 budget request for such a program.

*Question.* For the table at the bottom of page 249 in your justification data, show the figures for fiscal year 1978. Are your estimates for fiscal year 1979 going to be accurate based on production to date?

*Answer.* [Deleted.]

#### CONSTRUCTION

*Question.* General plant projects are limited to projects costing not more than \$750,000. How long has the \$750,000 ceiling been in effect? Should this ceiling be raised?

*Answer.* In the fiscal year 1976 authorization act, Public Law 94-187, Section 102, the limit on general plant projects was increased from \$300,000 to \$750,000 and the cost of any building was increased from \$100,000 to \$300,000. However, this section of the act states that "the building cost limitations may be exceeded



if the Administration determines that it is necessary in the interest of efficiency and economy."

In fiscal year 1978, field office requests to exceed the building cost limitation of \$300,000 have increased. It has become increasingly difficult to design and construct small projects and stay within the current funding limitations.

The Department's Civilian fiscal year 1980 Authorization Bill proposes that the limit on general plant projects be increased from \$750,000 to \$1,000,000 and any separate building limitation be removed. I believe the defense programs would benefit programmatically and there would be an economic benefit by the more effective use of these funds if the current limitations were increased.

**Question.** Your PE&D estimate appears extremely low. \$3.6 million (at 8 percent of TEC) will support a construction program of only \$45 million. Isn't your estimate low? What should it be?

**Answer.** Yes. This amount would permit design of about \$45 million to \$50 million in construction projects. In order to state a more precise number, it would be necessary to know what will be included in the fiscal year 1982 budget, excluding general plant projects, construction related to production requirements, and line items for restoring and upgrading existing facilities. The weapons program has a list of potential candidates having a total estimated cost of about \$190 million that are under active consideration for future year funding. The PE&D associated with this group of projects is estimated to be \$16.7 million.

**Question.** Referring to your list of potential projects on page 119 of your justification, for each project, what is the TEC and the estimated PE&D cost?

**Answer.** The potential projects shown on page 119 are listed below with the TEC and the estimated PE&D cost.

#### POTENTIAL P.E. & D. PROJECTS

[In millions]

| Title and location of project                                              | P.E. & D. title I<br>and title II | Title III and<br>construction | TEC    |
|----------------------------------------------------------------------------|-----------------------------------|-------------------------------|--------|
| New detonator facility, LASL, New Mexico.....                              | \$0.8                             | \$17.0                        | \$17.8 |
| Laboratory building, SLL, California.....                                  | .7                                | 13.9                          | 14.6   |
| Engineering office building, NTS, Nevada.....                              | .08                               | 1.0                           | 1.08   |
| Plant support facilities, LLL, California.....                             | .4                                | 4.1                           | 4.5    |
| Dynamic facility testing upgrade, LASL, New Mexico.....                    | 1.4                               | 13.0                          | 14.4   |
| Security and emergency headquarters building, SLA, New Mexico.....         | .22                               | 2.5                           | 2.72   |
| Production and assembly bays, Pantex plant, Amarillo, Tex.....             | .7                                | 7.3                           | 8.0    |
| Soils decontamination plant, Rocky Flats plant, Golden, Colo.....          | .55                               | 5.0                           | 5.55   |
| Tritium waste recovery system, Mound facility, Miamisburg, Ohio.....       | .12                               | 1.9                           | 2.02   |
| High flux neutron radiography facility, Pantex plant, Amarillo, Tex.....   | .2                                | 2.0                           | 2.2    |
| General shops environmental upgrading, Y-12 plant, Oak Ridge, Tenn.....    | .25                               | 2.35                          | 2.6    |
| Electrical shops upgrading and expansion, Y-12 plant, Oak Ridge, Tenn..... | .2                                | 2.0                           | 2.2    |
| Tritium production support facility, Mound facility, Miamisburg, Ohio..... | 1.6                               | 11.0                          | 12.6   |
| Total.....                                                                 | 7.22                              | 83.05                         | 90.27  |

**Question.** Why haven't you started design of Project 80-AE-4 with available PE&D funds?

**Answer.** Project 80-AE-4, Addition to Computer Facility, Sandia Laboratories, Livermore, California, is scheduled to start construction in the fourth quarter of fiscal year 1980. PE&D funding was not available in fiscal year 1978. The fiscal year 1979 plant engineering and design funds were not available to the Department of Energy until October 1978 which did not allow sufficient time for engineering and design to develop an adequate cost estimate for inclusion in the fiscal year 1980 budget. Therefore, the DOE intends to use fiscal year 1979 plant engineering and design funds for potential fiscal year 1981 construction projects.

**Question.** In previous years, you have had projects (e.g., 78-16-e) to accommodate unforeseen new production starts. You have no such project for fiscal year 1980. Do you need such a contingency project?

**Answer.** A contingency project of this nature would allow DOE the flexibility to support unforeseen DOD requirements. However, budgetary constraints have precluded such a request in fiscal year 1980.

**Question.** Regarding 80-AE-5, Ground Launched Cruise Missile (GLCM) Warhead Production Facilities, your cost estimate on page 258 of the justification data appears ultraconservative. Half of the cost is for "contingencies" and "uncertainties." Have you refined the cost estimate? How did you derive the "uncertainties" cost?



Answer. The cost estimates for the weapons system production facilities are constantly under revision as additional design information becomes available from the laboratories and the production planners continuously appraise the availability of existing plant capacities and capabilities. A review of the GLCM production facilities has been completed and preliminary results show that the uncertainties in the amount of \$2,300,000 have become requirements, leaving the "uncertainties" category now at \$800,000 as opposed to \$3,080,000 shown on page 258.

The initial estimate is made by the weapons production plants based upon preliminary weapons design details, production schedule, and on guidance provided on generic processes to represent production of weapon parts that have not been fully designed. The initial estimate from each site includes firm requirements for additional capacity and/or new capability and includes "uncertainties" covering areas where weapon design details have not been resolved. As the weapon design progresses, the cost estimate is revised and uncertainties are eliminated.

PROJECT NO. 80-AE-6, UTILITY AND EQUIPMENT RESTORATION, REPLACEMENT, AND UPGRADE, VARIOUS LOCATIONS

*Question.* Why are you requesting authorization in excess of appropriations? Since this will be a "level of effort" project, which will be reevaluated each year, why shouldn't authorizations and appropriations be the same each year?

Answer. Full authorization is being requested for each of the subprojects and funding requirements for fiscal year 1980 have been established based on schedules for each subproject and the availability of manpower to accomplish engineering and procurement activities. Requesting full authorization and only the appropriation required for each year allows works to be initiated on all identified requirements and provides for engineering, procurement, installation, and checkout activities to be more adequately coordinated and the funds more effectively used. This approach facilitates equipment purchases and installation and minimizes construction delays. DOE's fiscal year 1980 funding approach (vice full appropriation) is essentially consistent with the findings of the DOE Controlled task group which reviewed the weapons program's proposed fiscal 1980 capital restoration projects.

*Question.* Again your cost estimates appear conservative—17 percent for design and 25 percent for contingencies. Justify.

Answer. This project consists of the replacement and restoration of deteriorated and overage equipment and individual components and portions of utility systems. Access to much of the work is restricted and, in the case of utility systems, many of these are underground. This will require that in addition to normal office type design activities, much of the design effort will have to be performed at the work site as the construction effort proceeds and utility runs are exposed. This will increase the cost of the design effort and is the reason that an approximately 17 percent engineering, design, and inspection allowance was used.

Similarly, because of the nature of this project, the actual condition of some utility systems and the tie-ins required for some equipment cannot be specifically identified in advance. We anticipate construction changes as the work progresses. Accordingly, a higher than normal contingency has been included to provide for these uncertainties.

*Question.* Provide a first order cost estimate for each site involved in terms of costs involved for fiscal year 1980 (not authorization).

Answer. The following table summarizes the cost estimate and associated fiscal year 1980 appropriations for each site included in this project.

[In millions]

| Site                                  | TEC    | Fiscal year<br>1980 B/A |
|---------------------------------------|--------|-------------------------|
| Y-12 plant, Oak Ridge, Tenn.....      | \$21.3 | \$18.0                  |
| Rocky Flats plant, Golden, Colo.....  | 24.7   | 7.5                     |
| Mound facility, Miamisburg, Ohio..... | 10.1   | 9.3                     |
| Bendix plant, Kansas City, Mo.....    | 11.0   | 2.4                     |
| Savannah River plant, Aiken, S.C..... | 2.2    | 2.2                     |
| Total.....                            | 69.3   | 39.4                    |



*Question.* Regarding Project 80-AE-8, Advanced Size Reduction Facility, Rocky Flats, why hasn't design started on this facility using available PE&D funds? How can you start design in the first quarter of fiscal year 1980 and start construction three months later? Is the start of this project affected by the date that you will bring the new plutonium processing facility on line? Discuss this relationship.

*Answer.* The only PE&D funding available to the weapons program is that available under Project 79-8. The authorization of Project 79-8 is based on using these funds for fiscal year 1981 project candidates in accordance with the purpose stated in the project request. In order to meet the scheduled completion date, it is necessary to start construction activities in the second quarter fiscal year 1980. Unless this project is authorized in fiscal year 1980, construction will be delayed at least one year.

By definition, the start of construction occurs with the award of a contract for procurement of material or equipment if such an award precedes the award of construction contracts or beginning physical construction. For this project, procurement of equipment will begin in the second quarter fiscal year 1980.

The Advanced Size Reduction Facility, Rocky Flats, will process and decontaminate scrap metal, plastics, tools, plutonium processing equipment, and machinery. Beginning in fiscal year 1982, a much larger than normal volume of contaminated equipment and materials will require disposal when decontamination and decommissioning starts in the old plutonium handling facilities located in the process area. Decontamination and decommissioning of the process area of the old plutonium recovery building (Building 771) is scheduled to start during the third quarter fiscal year 1982. Decontamination and decommissioning of the old waste treatment building (Building 777) and the manufacturing building (Building 776) is scheduled to follow. The completion schedule for the Advanced Size Reduction Facility shown in the fiscal year 1980 budget submittal will bring the facility into operation to meet this decontamination and decommissioning schedule.

*Question.* Regarding Project 80-AE-10, Additional Loading Facilities, Savannah River Plant, since this project will not begin until fiscal year 1981, couldn't authorization for construction be deferred one year? Design funds would have to be provided in PE&D and the cost estimate should be much more accurate.

*Answer.* It is essential that this construction project begin promptly in fiscal year 1981 in order to provide increased plant capacity by the second quarter fiscal year 1983. We need full authorization in fiscal year 1980 in order to solicit competitive bids for long lead equipment procurements in fiscal year 1980. Procurement awards are planned in the first month of fiscal year 1981. Physical construction is scheduled to begin in the first quarter 1981.

*Question.* Explain the TEC increase for Project 79-7-c, Proton Storage Ring, Los Alamos Scientific Laboratory, New Mexico, since your budget request for fiscal year 1979.

*Answer.* Subsequent to Congressional action on this project in fiscal year 1979, an option has been identified which, if exercised, would ultimately expand the capability of this facility to provide a unique and powerful tool for pulsed neutron research for the weapons program and other research programs within the Department of Energy. The latter would include research programs of the Office of Energy Research and would be possible by establishing this expanded facility as a National Users Research Facility. Operation of this expanded facility for other programs would not affect the ability of the weapons program to carry out all experiments for which the Proton Storage Ring was originally intended. A complex with this potential capability does not currently exist. The expanded facility would be powered by the Proton beam from the Clinton P. Anderson Meson Physics Facility (LAMPF) coupled with the Weapons Neutron Research Facility.

The steps necessary to maintain this option would require an upgrade of the Proton Storage Ring facility to include a larger tunnel enclosure and equipment building, additional shielding, a larger beam tube and vacuum system, and larger aperture magnets. These facilities are estimated to cost an additional \$4.4 million and result in a new total estimated cost for the Proton Storage Ring of \$21.1 million. These facilities, which could not be added at a later date, are necessary to preserve the option to provide the future capability should the DOE decide to develop an expanded pulsed neutron research facility at the Los Alamos Scientific Laboratory. They would, however, provide increased utility of the Proton Storage Ring to the weapons program even if the options to expand were never exercised. The additional research and office facilities to provide a national users research capability are currently estimated to cost approximately \$20



million. Should these additional facilities be submitted in the future by the DOE, it would be as a separate request under the cognizance of the Office of Energy Research and not as part of the weapons program.

While the option to maintain the neutron research capability requires an increase in the total estimated cost of the Proton Storage Ring, it is anticipated that significant cost savings could be realized by using existing facilities at LASL versus building new facilities elsewhere for a National Users Research Facility of comparable capability.

*Question.* Project 79-7-n, Utility System Restoration, Y-12 Plant, Oak Ridge, Tennessee. Design and contingency costs appear unrealistically high. Justify.

*Answer.* This project consists of the replacement of individual components and portions of utility systems, many of which are underground or where access is otherwise restricted. This will require that in addition to normal office type design activities, much of the design effort will have to be performed at the work site as the construction effort proceeds. This will significantly increase the cost of the design effort and that is the reason that an approximately 24 percent engineering, design, and inspection allowance was used.

Similarly, because of the nature of this project, the actual condition of some utility system components cannot be fully evaluated in advance and we anticipate a large number of construction changes as the work progresses. Accordingly, a higher than normal contingency has been included to provide for these uncertainties.

*Question.* Design and contingency costs for Project 79-7-o, Universal Pilot Plant, appear excessive. Justify.

*Answer.* This project was authorized in the weapons program fiscal year 1979 budget for a total estimated cost of \$3,500,000. Concurrent with the preparation of the weapons program budget, the DOE developed and issued new interim safety criteria for high explosives processing facilities as a result of the DOE investigations into the accident that occurred at the Pantex Plant, Amarillo, Texas, in 1977.

Following the issuance of the DOE interim safety criteria, a detailed review was conducted of the design criteria used for the original conceptual design of this project for developing the total estimated cost of \$3,500,000. Significant changes were required to meet the new criteria, and a new conceptual design was completed just prior to our submittal of the weapons program fiscal year 1980 budget. The current data sheet reflects the results of the revised conceptual design effort, and the total estimated cost of this project was increased to \$7,400,000.

However, in haste to meet our budget submittal deadline after the completion of the conceptual design, certain equipment was incorrectly categorized within the cost estimate provided on page 180. In that estimate, Item c, Standard Equipment, includes \$1,020,000 which is actually part of the construction costs and should have been included under Item b.(3), Special Facilities. Equipment is included under the construction category only when it requires significant design, engineering specifications, drawings, or related effort associated with special fabrication to meet project requirements. The more appropriate estimate for construction costs is \$5,000,000 versus the \$3,980,000 shown. Thus, the cost of design is actually 12 percent of construction costs rather than 15 percent.

The 27 percent contingency for this project is appropriate to the type of facility to be provided, particularly since this will be our first design using the new interim safety criteria. Areas of uncertainty that have increased the contingency are (1) the extensive instrumentation for remote operations that will be required, and (2) potential modifications to or replacement of existing equipment that may be required to achieve performance necessary for effective remote operations.

*Question.* For Project 78-16-d, Weapons Safeguards, Various Locations, \$26 million has been authorized and \$26 million will also be obligated through fiscal year 1979. Your original cost estimate of \$28,000,000 includes a contingency of \$3,250,000. You are now requesting \$2,000,000 in authorization. What will the remaining \$2,000,000 buy?

*Answer.* When this project was first submitted, it was planned to proceed with all work at all six sites simultaneously. However, partial authorization in fiscal year 1978 of \$17 million (versus the \$28 million requested) required that work at some sites be deferred. In fiscal year 1979, \$11 million in authorization was requested but only \$9 million was authorized. Approximately \$2,000,000 in construction was again deferred until the remaining funds to complete this project are authorized.



During the progress of the work, a substantial amount of the contingency was allocated for increased costs related to delays in funding authorization, engineering requirements, unexpected construction problems, and modifications necessary to ensure adequate performance of some electronic detection systems. Experience has shown that substantial unanticipated effort has been required to adjust and modify sensitive alarm and monitoring systems following the initial installation in order to obtain the necessary sensitivity and reliability needed. In addition, escalation associated with deferral of some work has consumed a significant part of the contingency.

The \$2,000,000 authorization and appropriation requested for fiscal year 1980 will be used to complete the security system upgrade and building alarm and monitoring systems at the Los Alamos Scientific Laboratory. More specifically, the \$2,000,000 will fund the following items of work: hookup the central alarm system to three technical areas where sensitive nuclear materials are present; install hardened guard stations at eight technical areas; provide a backup computer for the central alarm system; provide hardwire duress alarm to all guard stations, and correct fencing and lighting problems in some areas.

*Question.* For Project 78-16-g, Radioactive Liquid Waste improvements, Los Alamos Scientific Laboratory, New Mexico, how did you get in a situation where appropriations exceed authorization (through fiscal year 1979)?

*Answer.* The President's budget for fiscal year 1978 included a request for \$12,500,000 in authorization and \$6,800,000 appropriations for this project. Subsequent action by the Congress resulted in an appropriation of \$2,800,000 for fiscal year 1978. Authorizations for this project, however, were limited to architect-engineer activities only, not to exceed \$600,000.

In fiscal year 1979, the Department of Energy requested that authorization be increased by \$11,900,000 and appropriations by \$9,700,000. This would have provided full authorization and appropriation at \$12,500,000. Congressional action on this request resulted in \$5,700,000 of additional authorization and appropriation being added to the project. This action again had the effect of appropriations exceeding authorizations.

In fiscal year 1980, the Department of Energy is requesting additional authorizations of \$6,200,000 and additional appropriations of \$4,000,000 which, if granted, will resolve this problem as the project will be fully authorized and funded at \$12,500,000.

*Question.* Regarding Project 77-11-c, 8-Inch Artillery Fired Atomic Projectile (AFAP) Production facilities Various Locations, an additional \$4,600,000 in authorization and appropriation is requested in fiscal year 1980. Why don't you use the 25 percent cost variation provision rather than requesting new authorization for the increased cost?

*Answer.* The legal authority which permits us to exceed the authorized amount for this project provides no funds. In requesting additional appropriations in the fiscal year 1980 budget, we included a request for new authorization as a means of keeping the authorizing committees informed of developments on this project. We do not anticipate any further cost increases on this project. However, in the unlikely event that an additional cost increase exceeding \$1,060,000 should develop, it would be necessary to stop work on the project until additional funds could be authorized by law. The new authorization requested in the fiscal year 1980 budget would ensure that a relatively nominal cost increase would not result in a serious delay in the project completion schedule and possibly delay the weapon production schedule.

*Question.* Project 71-9, Fire, Safety, and Adequacy of Operating Conditions Projects, Various Locations. Why are you asking for \$7,000,000 in authorization? Isn't the total within the allowable increase? Just precisely what will the \$7,000,000 buy?

*Answer.* In the fiscal year 1978 weapons program budget, we had requested an additional \$47,000,000 in authorization and identified an increase in the total estimated cost for this project from \$240,000,000 to \$287,000,000. The cause for the increase was subproject 71-9(1), New Plutonium Recovery and Waste Treatment Facility, Rocky Flats; the total estimated cost had increased from \$140,000,000 to \$187,000,000. Approximately \$7,000,000 of the new total estimated cost of \$187,000,000 was for strip-out and removal of the potentially unsafe old Plutonium Recovery Facility equipment and glove boxes after completion of the new facility.

Since the removal of equipment from the existing building would not be initiated until after completion of the new construction, only \$280,000,000 was au-



thorized for the total project in fiscal year 1978, or \$180,000,000 for subproject 71-9(1), with the understanding that the additional \$7,000,000 in authorization would be requested in future years. Since the completion of the new facilities is currently scheduled for March 1980, the additional \$7,000,000 in authorization for this project has been included in the weapons program fiscal year 1980 budget request even though it is within the allowable increase.

The additional \$7,000,000 will be used for strip-out and removal of the potentially unsafe old Plutonium Recovery Facility equipment and glove boxes after completion of the new facility.

#### R&D LEVEL

*Question.* As the "first line supervisor" of the R&D labs, are you satisfied that they are adequately funded and are doing the necessary R&D to keep us technologically competitive with the Soviet Union? I realize this requires a somewhat subjective judgment, but it is a judgment with the national security of the United States at stake.

*Answer.* The level of weapons R&D funding over the past several years has resulted in the higher priority weaponization work being done at the expense of not pursuing either the advanced development area or the basic science and engineering areas. The current funding level limits the numbers of new weapons concepts which the R&D laboratories are able to pursue. Thus, the options for the future may be reduced, and we may not be able to respond to long-term defense requirements.

*Question.* Are you concerned with the amount of nondefense work that the laboratories are now doing? Have we reached the point where defense R&D is taking a "back seat" to more "glamorous" energy R&D projects? Should the Congress legislate some controls in this area?

*Answer.* We are concerned only to the extent necessary to preclude adverse impact upon accomplishment of the weapons program mission at the weapons laboratories. We do not believe that defense research and development efforts are taking a "back seat" to other nondefense R&D activities. Nor do we believe that Congress should legislate control in this area. There are long-term benefits to the weapons program from the pursuit of nonweapons activities at the laboratories.

In no case, however, does laboratory or DOE management permit nondefense work to detract from the laboratories fulfilling their continuing commitment to meet DOD and national security requirements.

#### TESTING

*Question.* Your proposed level of nuclear testing also concerns me. Trace the history of U.S. nuclear testing for the past decade or so.

*Answer.* At the beginning of the decade, there were a great number of tests being conducted. The United States was preparing to produce new MIRV warheads for the Minuteman system and the Poseidon submarines [deleted]. The yearly number of tests conducted since then has declined steadily as system requirements were satisfied. The attached chart portrays the U.S. test summary by year from 1970. It indicates the number of tests by category.

FISCAL YEAR 1980 WEAPONS BUDGET—TEST SUMMARY (U.S. TEST DEVICE)

|                             | Fiscal year— |      |      |      |      |      |      |      |      |      |      |
|-----------------------------|--------------|------|------|------|------|------|------|------|------|------|------|
|                             | 1970         | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
| Current weapons.....        | [Deleted.]   |      |      |      |      |      |      |      |      |      |      |
| Advanced development.....   |              |      |      |      |      |      |      |      |      |      |      |
| Development capability..... |              |      |      |      |      |      |      |      |      |      |      |
| Total.....                  |              |      |      |      |      |      |      |      |      |      |      |

*Question.* Compare the U.S. testing programs over time with the Soviet program.

*Answer.* For several years prior to the past fiscal year, each country has conducted [deleted] nuclear tests per year. This rate has usually varied only by a few tests each. However, last year there was a marked change, and [deleted] Soviet tests were detected as compared to [deleted] by the United States. [Deleted.]



Since the Limited Test Ban Treaty of 1963, radioactive debris has not been readily available for analyses to provide estimates of Soviet weapon designs or technologies and apparent intentions. The current Soviet underground test program probably is planned to meet their needs for testing new and improved weapon designs. [Deleted.]

In recent years, emphasis in the U.S. test program has centered on executing necessary events to support weaponization for DOD systems. This emphasis on weaponization has resulted in a deferral of some proposed tests supporting advanced development and development capability.

Based on a mix of intelligence inputs, including the overall history of nuclear testing, the relative U.S.S.R.-United States expertise in weapons design is believed to be that the [deleted].

*Question.* How do you explain the surge in testing by the Soviet Union in this past year?

*Answer.* In reviewing recent tests by the Soviet Union, our estimates of yields show a number of tests toward the high end of the current 150 kt yield limit. Although we have no firm data on Soviet intentions, one speculation is that this could indicate their anticipation of a Comprehensive Test Ban and a desire to complete their testing of a number of high-yield weapons.

*Question.* If you could set aside funding constraints, how many nuclear tests would you like to perform in fiscal year 1980? (For the record compare this optimum testing program with your budgeted testing program in terms of numbers of tests, types of tests, and costs.)

*Answer.* I think the lowest number is what is provided for in the budget and, furthermore, we should not go below a level of [deleted]. Sustained over a long period of time [deleted] is not enough for a viable program; rather, an appropriate level is something between [deleted] per year. For such a program, the estimated cost in fiscal year 1980 would be approximately \$300 million.

*Question.* What happens to stockpile reliability if we cease all testing?

*Answer:* We define reliability for a particular weapon as the probability that, when the warhead is used, detonation will occur and produce the desired nuclear yield. We expect no significant degradation in our assessed stockpile reliability during the now-contemplated finite duration ban on nuclear testing. This judgment is based upon several important factors: first, all warheads now in the stockpile are assessed to be highly reliable; secondly, our assessment of weapon reliability is based upon an extensive base of data and experience involving exhaustive testing and analysis of nonnuclear components and nuclear tests to confirm performance of nuclear components; third, continued assessment of warhead reliability can be supported by nonnuclear Quality Assurance/Reliability Testing which would continue under a ban on nuclear testing; and fourth, the DOE laboratories expect to maintain the cadre of highly skilled scientists and engineers necessary to provide continuing technical judgments for reliability assessments.

It must be noted that our extensive stockpile experience has shown us that the change in a particular warhead's reliability with time is not necessarily a known smooth, predictable decline dependent upon the aging of certain components. The change in reliability could be quite abrupt and adverse. We believe, however, that we can assess confidently stockpile reliability during the expected period of a finite duration test ban. This confidence stems from our comprehensive past programs, our currently ongoing efforts, and our expectations to retain the necessary skilled and experienced people to interpret past, current, and future information and to provide judgments on reliability.

*Question.* [Deleted.]

*Answer.* Yes. [Deleted.] Stockpiled weapons are periodically sampled for signs of aging. These sampling activities are part of the Quality Assurance and Reliability Testing (QA/RT) program for each warhead, the nonnuclear portion of the total process for reliability assessment.

[Deleted.] Therefore, while we would have discovered the problem without nuclear testing, assuring a workable solution depended upon the results of past underground nuclear testing. [Deleted.]

#### DOD COORDINATION

*Question.* I understand you now sit with the Defense Systems Acquisition Review Committee (DSARC) on nuclear weapons systems. Explain how this new coordination process works and what benefits you see.



Answer. Your understanding is correct. At the invitation of Dr. Perry, Under Secretary of Defense for Research and Engineering, the Director of Military Application represents the Department of Energy in the Defense Systems Acquisitions Review Council (DSARC) process for those programs involving nuclear weapons systems. Generally, this involves participation in the individual Military Service Review Council meetings and in DSARC prebriefings as well as in the formal DSARC meetings. Since last fall, I have attended meetings on the M-X and Pershing II systems.

Direct involvement of the DOE in the DSARC proceedings will provide DOD with appropriate and timely information at crucial program milestone decision points. The DOE will benefit as well since the candid exchange of views between DOE and DOD will be beneficial in proceeding with the nuclear weapon development process.

#### M-X

*Question.* The M-X warhead is of key concern to me. Dr. Perry recently testified that for all of the options on the M-X missile, they were considering [deleted.] as the probable M-X warhead. What options for an M-X warhead do we have that are compatible with the desired IOC and that are not test constrained?

Answer. A joint DOD-DOE study on warhead options for the M-X system has concluded that a wide choice of warhead candidates can be available for the M-X to meet the expected operational capability date. [Deleted.] Nuclear designs of the offered candidates have been verified through nuclear tests, and a number could be fully certified at this time. [Deleted.]

*Question.* What M-X warhead options are being foreclosed because of testing constraints (large yield, insensitive high explosives, etc.)?

Answer. We expect fully to satisfy current warhead requirements for the M-X. [Deleted.]

*Question.* As you know, the M-X basing mode is still up in the air. Can you use the same warhead regardless of the basing decision? Or will the basing decision affect your warhead options?

Answer. [Deleted.]

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#### QUESTIONS SUBMITTED BY SENATOR HENRY M. JACKSON, ANSWERS SUPPLIED BY DUANE SEWELL

##### INSENSITIVE HIGH EXPLOSIVES (IHE)

*Question.* Last year in the Committee report, we endorsed the use of insensitive high explosives in all future nuclear weapons. We asked that you review the impact of incorporating IHE into all new weapons and of retrofitting existing weapons with IHE. You have recently furnished your report to the Committee. Would you briefly summarize the review and provide a more detailed summary to be included with the hearing record?

Answer. A summary of the review follows: "A Summary of the Review of the Impact of Incorporating Insensitive High Explosives into the U.S. Nuclear Weapon Stockpile."

The review is the response by the Departments of Energy and Defense to a request contained in the Senate Armed Services Committee section of Report No. 95-961 accompanying Senate Bill No. 2693, the "Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1979."

The review states that the use of insensitive high explosives (IHE) in nuclear weapons, when compared to the other types of high explosives used in these weapons, can provide a significant enhancement in the explosive safety of nuclear weapons and can reduce the potential dispersal of special nuclear material (SNM), particularly plutonium and enriched uranium. Its use also enhances security by simplifying the incorporation of nonviolent disablement systems. Due to these benefits, IHE is being incorporated into several new weapons. However, IHE is not a panacea for all safety and security problems. IHE is not suitable for all weapons, nor would it be advisable at this time to have the whole stockpile built with this relatively new material for which there is no in-stockpile experience.



IHE is only one technological approach to increased safety and security. There are several other approaches available which can provide similar benefits. [Deleted.] Additionally, there are a number of companion technological approaches available which can enhance safety and security. These include enhanced electrical system safety features, modern permissive action links (PALs), and nonviolent disablement systems. The approaches mentioned and others which exist are in various stages of development, and each has its own advantages and disadvantages.

The review indicates that, while it is technically feasible to incorporate IHE into most, but not all, of the existing and projected weapons not already IHE designs, the overall impact of such a course of action would be significant in a number of ways. [Deleted.] Thus, the incorporation of IHE and the appropriate companion approaches to enhance safety and security would cause design impacts on many of the weapon systems. [Deleted.]

Implementation of a mostly IHE stockpile would require that much of the existing stockpile be retrofitted or replaced. To accomplish this and accommodate existing near-term force modernization requirements, a vigorous, virtually unprecedented ten-year DOE production program would be required which could start only after an extended period of intensive design efforts and nuclear testing by the DOE laboratories and preparation by the DOE production complex. Consequently, acquisition of a mostly IHE stockpile, even if fully funded, could not be achieved until the early nineties.

In implementing a mostly IHE stockpile, a large workload would be imposed on the DOE design laboratories and the associated DOD system development activities. Continued nuclear testing for development and yield certification purposes would be required, as a complete nuclear weapon development program including nuclear tests would be needed to incorporate IHE in many of the weapon systems. Existing tested IHE warhead candidates that might be suitable and which could be adapted to new or existing weapons systems would be given special consideration in order to reduce the overall workload. The large number of retrofits, new builds, and retirements required would likewise place a very large and complicated workload on the DOE production complex and on DOD planning and logistics activities.

An important consideration would be the cost. It is estimated that the implementation of a mostly IHE stockpile, maintaining about the current numbers of warheads for most systems, would require [deleted] for DOE over the life of the program, in addition to the funding required in the current planning for new systems. This does not include the associated DOD costs for activities such as testing, system modification, and logistic movements. The actual DOE funding required and the establishment of DOD costs would have to be determined in a much more comprehensive study should such a course of action be adopted.

None of the above factors alone preclude implementation; but, as many of the new IHE warheads would require nuclear testing, an intervening Comprehensive Test Ban (CTB) could prevent implementation. Incorporating IHE into warheads with stockpile yields greater than the existing Threshold Test Ban (TTB) limit of 150 kt would introduce yield certification problems. This is because only partial yield nuclear tests could be conducted using modified warhead designs so that each test yield is within the TTB constraint. In such cases, certification of the stockpile yield could not be provided with the normal uncertainty limits. [Deleted.]

A selective but limited application of IHE could be made for those systems in the stockpile which have a higher probability of exposure to abnormal environments. This could be accommodated with a small increase in funding. In general, the types of systems with greater degrees of exposure are those in the aircraft-carried, theater missile, and deck-stored fleet missile categories, which are more visible by the nature of their deployment and/or are handled and transported frequently. The IHE warheads now being developed are for systems in these categories.

The review highlights a number of systems where the complete value of IHE is unknown and additional study is necessary. The issues involved will be addressed in existing and future study and development activities. As these issues are examined, the findings will permit better assessments of the value of incorporating IHE into all nuclear weapons. The studies will also consider the other approaches to enhance safety and security so the most appropriate approaches



could be incorporated into any new or modernized weapons. Realistically, the application of IHE or any of the other approaches must strike a balance among military effectiveness, reliability, safety, security, and available resources.

*Question.* What is your view on the desirability of incorporating IHE in the new M-X and Trident II warheads?

*Answer.* The incorporation of IHE into the warheads for the M-X and Trident II systems would be desirable from a safety and security standpoint. [Deleted] the behavior of IHE warheads on missiles containing large amounts of high energy propellants in abnormal environments (crash and fire) is not yet well understood. In the past the ballistic missile systems have been deployed in relatively protected environments and the exposure to abnormal environments has been small. The air and ground mobile deployment options being considered for the M-X system will lead to an increase in the exposure to abnormal environments. This is not the case for the Trident II systems which will be deployed like its predecessors. Considerable attention is being given to all of these issues by both the DOE and DOD in ongoing studies. The results of these studies will be factored in at appropriate decision points as the systems proceed through the development process.

#### WEAPONS RELIABILITY

*Question.* Weapons reliability, especially in view of a possible Comprehensive Test Ban, is of concern to this Committee. In our report last year, we asked you, in coordination with the Defense Department, to do a major review of the weapons reliability question. Where does that effort stand?

*Answer.* The Secretaries of Energy and Defense have approved what I consider a very thorough review of weapons reliability. The report has been forwarded to the National Security Council for review.

#### FISCAL YEAR 1980 BUDGET

*Question.* How would you characterize the budget request for the nuclear weapons program for fiscal year 1980?

*Answer.* I believe that the fiscal year 1980 budget request for the nuclear weapons program is austere but adequate for meeting our near-term national security commitments while maintaining the longer term viability of the weapons complex.

*Question.* If you had more money for the nuclear weapons program, where would you use it, or put another way, which portions of the program are underfunded or only marginally funded?

*Answer.* As I stated previously, I believe that our fiscal year 1980 request is austere but adequate for meeting our program commitments as defined at the time our budget request was formulated. Obviously, as we developed our request, many activities were reduced, deferred, or eliminated on a priority basis in order to remain within available resource levels. If additional funding was made available in fiscal year 1980, we would endeavor to allocate this funding to the highest priority candidate activities as determined at the time that funding became available. In my opinion these priorities would result in any additional funding being used for the testing program.

#### BACKGROUND

*Question.* How many weapons do we now have in our nuclear stockpile and is that number going up or down? (For the record, provide chart showing numbers of weapons in the stockpile since 1970, extrapolated through the forecast in the stockpile paper, broken down in some fashion to differentiate between strategic and theater weapons.)

*Answer.* [Chart deleted.]

*Question.* What is the total yield in the current weapons stockpile and how has that varied over time? (For the record, provide a chart showing total stockpile yield from 1970 through the period of the stockpile paper, broken down in some fashion to differentiate between strategic and theater weapons.)

*Answer.* [Chart deleted.]

#### M-X

*Question.* I am interested in your plans for an M-X warhead. What are you prepared to do? (Discuss the options as a function of missile weight.)

*Answer.* In a formal joint feasibility study with the DOD, we are pursuing a number of warhead options for M-X. These candidate warhead designs cover a



range of yields of interest to the DOD. They also involve use of a variety of suitable reentry vehicles (RVs) [deleted] optimized specifically for a particular warhead design. The warhead options under consideration [deleted] offer a warhead selection for either M-X missile under consideration, the 92-inch diameter or the 83-inch diameter. In general, the specifics for each of these candidates are not determined directly by the weight of a potential missile design for M-X. Rather the missile weight (and size) directly would influence the number of RVs which could be carried on each missile.

*Question.* Assuming your CTB schedule is accurate (completed in early 1980), what possible M-X warhead options are foreclosed because you can't do the testing (larger yield, insensitive high explosive, etc.)?

Answer. [Deleted.]

#### COMPREHENSIVE TEST BAN

*Question.* Review again your assumptions regarding the schedule for a CTB.

Answer. Based upon the most optimistic assessments by the agencies concerned, and the projected progress of the CTB negotiations, the following key scheduling assumptions have been agreed to for planning: [Deleted.]

*Question.* In your fiscal year 1980 request, what items are included as a result of these assumptions? (5 monitoring stations)

Answer. The fiscal year 1980 budget request includes funds to begin production of five seismic station units of the type envisaged [deleted]. The seismic detection and recording portion of these units will be available [deleted].

*Question.* Would you need these monitoring stations if there were no CTB?

Answer. These units are currently planned for deployment in the United States as soon as they are available for use in the DOE/LLL regional seismic research program for the Nevada Test Site. [Deleted.]

[Deleted.] Regional seismic networks could also be used in bilateral or multilateral agreements related to nuclear proliferation.

*Question.* How did you arrive at the number 5 for seismic research stations [deleted]?

Answer. The number 5 for seismic research stations to be produced in our initial program proposal [deleted] was arrived at on the basis of achieving two objectives. The first was to achieve a workable DOE seismic research program incorporating these stations, whether or not a Comprehensive Test Ban Treaty was successfully negotiated. The second was to begin the procedure for design, development, test and long lead time procurement for stations which would be required [deleted]. If our long lead time procurement and production planning could be based on 5 stations for either the DOE research program or [deleted] we could then build upon this capability [deleted].

*Question.* Can a CTB be truly comprehensive? Isn't there some threshold below which we could not hope to verify? What is that threshold? Is that threshold meaningful as far as being able to develop nuclear weapons?

Answer. The term "comprehensive" has been used in international discussions for years, but has never been authoritatively defined. It is generally used to distinguish a ban on all nuclear tests in all environments from a ban on nuclear tests in some environments, such as the Limited Test Ban Treaty, which prohibits tests in the atmosphere, underwater, and in outer space, while permitting nuclear testing underground.

The threshold below which tests can be performed with good confidence that they will not be identified varies with the medium and the quality and characteristics of the monitoring equipment assumed. Underground, it ranges from about [deleted].

[Deleted.] Note, however, that these yields assume that the tests are conducted in hard rock in aseismic areas. If they were conducted in soft materials or in cavities, the yields could be higher by factors of from 10 to about 100. Other evasion techniques, such as testing immediately after an earthquake, also raise the possible yield.

These thresholds do not apply to tests in other environments. For tests underwater or in the atmosphere, especially near the Poles, yields could be in the [deleted]. In deep space, they could be in the [deleted] range with little risk of detection.

[Deleted] tests underground or in the atmosphere could be useful in developing low yield weapons and in maintaining [deleted] weapons. The higher yields possible in space would allow development of new strategic weapons. Any testing



activity would help to maintain the expertise of personnel in a nuclear weapon program.

*Question.* Discuss our capability to detect and monitor nuclear tests in deep space. Could deep space testing provide meaningful data and if the Soviets were to employ that techniques, could we monitor the testing?

*Answer.* [Deleted.]

In the longer term, given the right platforms with orbits similar to Vela, current technology could extend our detection capability [deleted].

No instrumentation can completely preclude useful nuclear weapon tests in deep space. The proposed systems would, however, make such tests more difficult.

#### INERTIAL CONFINEMENT FUSION

*Question.* The Committee has been contacted by the University of Rochester regarding funding problems for their fusion facility. Briefly explain the situation and give us your views on what should be done.

*Answer.* The University of Rochester (UR) financial difficulties appear to stem from over anticipation of industrial funding. As background, in 1972 the University of Rochester expanded its laser fusion research program on the basis of funding from private industry. By 1975, it had been reasonably successful in establishing this support and turned to the Federal Government to supply funds to build a larger laser. The goal was to have the University of Rochester and industry operate the laser for their own experiments and outside users (as a National User Facility), if DOE would fund the laser. It was anticipated that the industrial contribution for the six year period from 1975 to 1981 would total about \$41 M; the University of Rochester has identified, to date, only \$17 M. The problem is, therefore, that the University of Rochester has been spending at a rate that assumes full industrial commitment (\$41 M). The difference is being absorbed, temporarily, by the University.

DOE is funding the construction of the laser and its commitment will end late this year or early 1980. Further, the contract with the University states that UR will operate the laser, at no cost to the government, and will make the laser available to outside users for about a third of the time.

Thus, the University of Rochester is in the position, because of its financial difficulties, that it cannot meet its contractual obligations. However, it is felt that the goals of the University of Rochester program are sound and that both industry and government have a considerable investment. Hence, DOE is attempting to develop plans that can help the University of Rochester over its present problems without interfering with the character of its program.

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#### QUESTIONS SUBMITTED BY SENATOR HENRY M. JACKSON, ANSWERS SUPPLIED BY ROBERT BATZEL

##### *Lawrence Livermore Laboratory*

#### COMPREHENSIVE TEST BAN

*Question.* Some months ago, according to the press, some of you gentlemen met with the President to discuss concerns over the emerging CTB. Would you share those concerns with us and tell us if anything has occurred to alleviate those concerns?

*Answer.* My views on the effects of a Comprehensive Test Ban Treaty on the maintenance of the nuclear weapon stockpile are described in the attached letter dated November 10, 1978, to Dr. Schlesinger. I expressed similar views in my meeting with the President earlier in the year.

The problems I identify depend on the time involved. I would not expect severe stockpile problems to occur in a few years. If a guaranteed resumption of testing were to occur after a CTBT of a few years, most good people would stay on, detection of stockpile problems could be made with reasonable certainty, and tests of newly built, rebuilt, or worrisome stockpile weapons could be made on resumption of testing.

A CTBT of limited duration without a guarantee of resumption of testing would not encourage our scientists and engineers to remain in weapons work and could only offer false promise of detecting and fixing stockpile problems.



LAWRENCE LIVERMORE LABORATORY,  
November 10, 1978.

Reference: Department of Energy National Security and Military Applications  
of Nuclear Energy Authorization Act of 1979.

Hon. JAMES R. SCHLESINGER,  
*Secretary, Department of Energy, Forrestal Building*  
*Washington, D.C.*

DEAR JIM: The referenced Act calls for statements from the Directors of the weapons laboratories on the importance of conducting nuclear detonations for establishing and maintaining confidence in the reliability and performance of nuclear weapons in the U.S. arsenal.

If the United States does not conduct nuclear explosions, our national technology base in the nuclear explosions area will decay within a few years, both because skilled people will leave the program and because the ones who are left will not be able to keep learning by experiment what they can and cannot do in nuclear explosives. It has been the universal experience, so far as I know, that practitioners in any technical field who are not regularly faced with experimental results are unable to maintain a level of competence.

In the longer term, without testing it would be impossible to maintain confidence that existing nuclear weapons would operate properly if circumstances required their employment. In theory, of course, as deterioration is observed in a deployed weapon (and in the course of a time, deterioration of key components inevitably occurs) the weapon could be rebuilt exactly as it was built in the first place. One of the major difficulties is the judgment as to when a level of deterioration is sufficient to adversely affect performance. Another major problem is the fact that in practice, changes are made. These changes are dictated by, for example, unavailability of the old materials, more stringent requirements for safety, major economies to be effected in the systems by apparently minor modifications, and generally speaking, the pressure associated with maintaining a large scale nuclear weapon deployment under budget restrictions and in an environment where the technologies that affect the performance of the system as a whole are constantly changing.

At present, changes are made in nuclear weapon systems sometimes with the help of nuclear testing, sometimes without. When they are made without a nuclear test, they are evaluated by groups of scientists and engineers who are constantly immersed in an on-going nuclear test program involving items closely related to the one being changed. The judgment that a test is not required in order to effect the change can, therefore, be made with considerable confidence. Without tests, in my view, there would be no basis for such confidence. In support of this, during the 1958-1961 moratorium, a number of new weapons were put into stockpile, owing to new system requirements such as Minuteman and Polaris. There were some design errors which were subsequently discovered, some by nuclear testing, some by non-nuclear testing. Some of these errors required nuclear tests for correction.

In several other cases not related to the moratorium, a nuclear test was needed to verify a fix of a stockpile problem. More cases could have occurred were it not for the fact that we have normally replaced existing nuclear weapon systems with new ones well before the nuclear warhead reached the age when it would begin to undergo significant deterioration.

Non-nuclear testing is, of course, very helpful. However, it is limited in its scope. Many of the changes which are made in nuclear warheads cannot be evaluated on the basis of non-nuclear testing.

It is important to bear in mind that we cannot assume that stockpile degradation will be symmetrical in respect to United States and Soviet weapons. We do not know how Soviet weapons are made, by what means they can maintain the quality of their weapon scientists, or what their remanufacturing problems are. Nor do we have any reason to believe that our weapon technology is currently superior to theirs.

It is for these reasons that I believe the continued credibility of the U.S. nuclear weapon deterrent cannot be assured for long without nuclear testing.

Sincerely,

ROGER E. BATZEL,  
*Director.*

*Question.* The nuclear testing proposal in the fiscal year 1980 budget is down significantly. Are you comfortable with the proposed level of testing? If not, what do you feel it should be and why?



Answer. The nuclear testing level proposed in the fiscal year 1980 budget is not adequate to fulfill our program responsibilities. Our rate of testing should be increasing, not decreasing, for a number of reasons:

Our weaponization workload is significantly larger than in the past. Several designs are in the process of preliminary weaponization to be available after the Comprehensive Test Ban.

Many issues regarding safety and security need to be solved.

Conservation of nuclear materials is an added constraint.

We should be pursuing the basic physics and science involved in nuclear explosions to be better prepared for a cessation of testing.

I believe funds should be added to provide for [deleted] tests in fiscal year 1980. The details of this program have been prepared and can be made available to the Committee if desired.

#### R&D LEVEL

*Question.* Do you feel that enough resources are being applied to nuclear weapons R&D—especially basic research? Put another way, are you able to devote adequate resources to all key areas of technology to permit us to stay competitive with the Soviet Union?

Answer. I do not believe that adequate resources are being applied to nuclear weapons R&D and it appears that we may have fallen behind the Soviets in several areas of technology. Examples obtained from unclassified publications would be high explosive detonation physics and flash x-ray capabilities. The enclosed letter expresses my view on this matter. [Letter to D. C. Sewell dated March 23, 1979.]

LAWRENCE LIVERMORE LABORATORY,  
March 23, 1979.

MR. DUANE C. SEWELL,  
U.S. Department of Energy,  
Assistant Secretary for Defense Programs,  
Washington, D.C.

DEAR DUANE: The following statement was prepared in response to the request from the House Committee on Appropriations on March 19, 1979.

I have been asked to comment on the impact of personnel reductions in the weapons program at the Lawrence Livermore Laboratory between 1969 and the current fiscal year. At this Laboratory the decrease in weapons research and development has been a little over 40 percent.

The effect of the decrease in effort available has been compounded by an increased weaponization load, limitations on weapons test yields and numbers, and additional safety and security requirements. Because of this combination of circumstances I have serious reservations as to the Laboratory's ability to meet its commitments to the country.

In the process of trying to cope with this difficult situation we are taking more risks in the weaponization effort. We are doing only minimal advanced development and long range research and we have closed down important facilities and equipment. The frustrations created by seeing support for research projects disappear is causing morale problems. These problems are exacerbated by the continuing threat and uncertainty of a Comprehensive Test Ban.

I believe the following actions should be taken in fiscal year 1980 to reverse the erosion of the Laboratory's nuclear weapon capability:

(1) The Laboratory should be provided with the resources to increase its weapon personnel by about 15 percent (an increase of ~27M\$).

(2) Funds should be added to allow [deleted] for the Laboratory (a 25M\$ increase in funding for the Nevada Test Site).

These actions would be a major step in improving the situation.

The attached paper gives examples of science and technology areas affected and facilities which have been or are being shut down.

Sincerely,

ROGER E. BATZEL,  
Director.

Attachment.

Several examples of science and technology which have been adversely affected because of lack of resources are:

Studies on higher energy safer high explosives has been stopped.



Studies to better understand high explosive detonation physics so that safer weapons can be designed have declined to a level which is marginally productive.

Work on specific weapons designs to provide a complete solution to the plutonium dispersal safety problem has stagnated.

Numerous ideas for new weapon designs which will be needed to meet new military requirements a decade from now are not being pursued.

Studies to better our understanding of the basic physics and technology involved in nuclear explosions and phenomenology are moving at a snail's pace. This information would be extremely valuable in trying to address stockpile problems in case of a test ban.

Materials studies to provide information needed to guarantee long life for weapons entering the stockpile are inadequate. [Deleted.]

[Deleted.]

Facilities that have or are being shut down are:

The Super Kukla burst neutron facility used to study weapon vulnerability is being disassembled;

The facility which allows us to study solid lithium hydride fuels is being decommissioned;

The electroforming facility which allows fabrication of precision weapon components has been closed;

Numerous analytical chemistry instruments have been shut down.

*Question.* It is often said that the United States has a significant technological lead over the Soviets in the nuclear weapons area. What is your assessment of the relative technological sophistication of Soviet versus U.S. nuclear weapons?

*Answer.* We do not have detailed information on the technological sophistication of deployed Soviet nuclear warheads. Size and throw weight capability could allow less sophisticated designs to be used in Soviet systems compared to the tightly constrained U.S. payloads. At the same time, based on information from past atmospheric testing and from published Soviet technical literature, we know that the Soviets have a very advanced technological capability. I cannot say with confidence that the United States has a significant technological lead over the Soviets in the nuclear weapons area.

*Question.* Do the Soviets have counterparts to your labs?

*Answer.* The Soviets do have large and active nuclear weapon development laboratories and an active underground test program which is significantly larger than the current U.S. program.

*Question.* How important is the U.S. lead in computer technology?

*Answer.* Large scale computers are very important to the U.S. nuclear weapon design program. The computers allow us to progress with fewer laboratory and underground experiments. However, weapon designers can work around a lack of computers with more analytical work, more experimentation, more special nuclear materials, less restrictive payload structures and requirements, and perhaps more uniformity of design. This approach would be less cost effective for both the nuclear design and the delivery system.

#### LAB CONTRACT WITH UNIVERSITY OF CALIFORNIA

*Question.* I have heard "mumblings" that the contractual arrangement with the University of California is deteriorating. I don't know if it can be salvaged or not. What is your assessment of the situation and what do you recommend should be done?

*Answer.* In the past, the University relationship has contributed to the continuing effectiveness of the Laboratory, and I believe it can continue to do so. Every few years the University reexamines its management role with regard to LLL and LASL, and at those times that role becomes a focus of attention and controversy within the University. We have successfully worked through these periods in the past, and it appears to me that we will be able to do so this time, too. A DOE study group, chaired by Dr. Solomon Buchsbaum, is also examining the relationship.

The commitment of The Regents and the President of the University is of central importance to continuation of a good relationship. We have recently been told quite directly by the Chairman of the Regents' Special Research Projects Committee, which handles Laboratory matters, and by the President, that the University wants to continue and strengthen the relationship. While changing conditions within the University require continuing attention, with this commitment we should be able to preserve the effectiveness of the relationship.



## NON-DEFENSE WORK

*Question.* How much of your lab effort is in non-defense R&D?

*Answer.* Including DOE-funded nuclear weapons R&D, some part of the Inertial Confinement Fusion work, and work directly for DOD on non-nuclear weapons R&D, just about half the Laboratory's effort is in defense related R&D. The non-defense R&D includes a large fusion energy research program, non-nuclear energy R&D, work for the Nuclear Regulatory Commission, and a biomedical and environmental program. Many of our programs are emphasized because of their synergism with the nuclear weapons program.

*Question.* Do you perceive that your defense R&D may be taking a "back seat" to the other more glamorous, unclassified work?

*Answer.* Because we recognize that defense R&D is vitally important, and because it consists of work which is as technically challenging as any that we do, we do not regard it as being less "glamorous" than non-defense work. We also recognize that, with Los Alamos, we have a unique role in nuclear weapons R&D which makes that work our central reason for being here. The non-defense programs are important in their own right, and the newness of some of them provides an interest which strengthens the Laboratory as a whole and all of our programs. As we have increased the proportion of non-defense programs, we have paid close attention to their relationship to the defense programs, choosing those which, through similar technology and in other ways, will strengthen the weapons R&D. We are increasingly seeing direct benefits flowing to the weapons program from the non-defense work. I can provide you with examples if you wish.

*Question.* How much of your own time is devoted to defense versus non-defense work?

*Answer.* One aspect of my job as Director is to manage the Laboratory as a whole in such a way that the various programs mutually benefit one another. Because of this, it is impossible for me to accurately determine how much of my time is devoted to particular parts of the Laboratory's work. However, I can assure you that I do not spend disproportionate time on the non-defense work.

*Los Alamos Scientific Laboratory*

## COMPREHENSIVE TEST BAN

*Question.* Some months ago, according to the press, some of you gentlemen met with the President to discuss concerns over the emerging CTB. Would you share those concerns with us and tell us if anything has occurred to alleviate those concerns?

*Answer.* While it was Dr. Harold Agnew who met with the President, I will try to convey my views, which I think are consistent with Dr. Agnew's. My concerns are the following:

A. In order to maintain our nuclear weapons capability, we must attract and retain nuclear weapons stockpile experts, and we must maintain the war reserve stockpile. [Deleted.]

B. A CTBT is not verifiable below [deleted]. This is particularly significant, of course, because it would be possible to test clandestinely below the verifiable limit and accomplish the goals listed in item one above.

Nothing has been accomplished to alleviate my concerns regarding a CTBT. Indeed, I see nothing on the horizon that can lower the verification threshold significantly. It is clear that a reasonable number of seismic stations on foreign territory would not be able to reduce the number of ambiguous seismic events to an acceptable level. I am also concerned that the military significance of even a few nuclear tests is not appreciated in many quarters.

Briefly then I see no way for the United States to maintain a nuclear weapon capability indefinitely under a CTBT.

The United States could probably weather a three-year CTBT if we could be absolutely assured by Congress and the President that we would resume testing after three years and if the resources were made available to retain the Nevada Test Site and all weapons RD&T facilities and personnel. [Deleted.]

*Question.* The nuclear testing proposal in the fiscal year 1980 budget is down significantly. Are you comfortable with the proposed level of testing? If not, what do you feel it should be and why?

*Answer.* The appropriate long-term nuclear testing level can be determined using the following rationale.



There are approximately 25 separate nuclear warheads in the U.S. nuclear stockpile. On the average, each is replaced after [deleted.] Using knowledge accumulated over the past 35 years, the nuclear design laboratories now feel that some weapon systems can be certified [deleted] before component aging might mandate replacement. Development of new weapon-delivery systems might reduce the time to replacement. However, if each nuclear weapon has a life [deleted] the total stockpile will have to be replaced in approximately [deleted.] This establishes a minimum level of effort. To carry out this replacement there must be [deleted] engineering development programs, with new programs appearing at the rate of [deleted]. The nuclear testing level required is [deleted] per year, including a modest number of advanced development tests to make new weapon design concepts available for the future. Research and development funding at no less than the fiscal year 1979 level, together with [deleted] per year (with appropriate Test funding), makes a reasonably balanced program, provided that the Department of Defense occasionally can use an older warhead for another purpose than originally intended or will accept some weapon-system penalties in order to reduce development effort. If these compromises are unacceptable, then more advanced development effort will be required and both R&D and Test funding should be increased.

#### R&D LEVEL

*Question.* Do you feel that enough resources are being applied to nuclear weapons R&D—especially basic research? Put another way, are you able to devote adequate resources to all key areas of technology to permit us to stay competitive with the Soviet Union?

*Answer.* LASL has been able to support about 1,100 direct FTEs (the 1,100 direct FTEs equates to about 1,715 total FTEs) in the nuclear weapons R&D (but not test) area for the period of fiscal year 1972 through fiscal year 1979. The President's budget for fiscal year 1980 will support a similar number of people.

During this period (fiscal years 1972–1979), we have been able to satisfy the DOD's requirements for new weapon systems. However, to accomplish this work, it has been necessary for us to defer work on some of our new advanced development concept. In addition, we have initiated some new research activities that we believe to be essential in view of a possible CTB. These new activities involve approximately 100 direct FTEs. Therefore, we feel that the LASL weapons R&D manning level should be increased from 1,100 to approximately 1,200 direct FTE level. The increased manning will allow us to accomplish some of the deferred advanced development activities, continue the new research work, and to maintain a proper level of effort in the other nuclear R&D areas.

The increase in FTEs will allow LASL to be more responsive to future DOD requests as well as increase our competitive capability in respect to the Soviet Union nuclear weapon technology.

*Question.* It is often said that the United States has a significant technological lead over the Soviets in the nuclear weapons area. What is your assessment of the relative technological sophistication of Soviet versus U.S. nuclear weapons?

*Answer.* We do not have adequate data on Soviet nuclear weapons technology to confidently address this question. There is a widespread belief that we are ahead of the Soviets, but this cannot be confirmed. We do believe, however, that from the size and weight of Soviet weapon systems, their need for high technology is less important than it is for us.

*Question.* Do the Soviets have counterparts to your labs?

*Answer.* Yes, the Soviets have a very active program with considerably larger laboratories than we do. The intelligence community can elaborate on this if you wish.

*Question.* How important is the U.S. lead in computer technology?

*Answer.* I suspect that it is very important.

#### LAB CONTRACT WITH UNIVERSITY OF CALIFORNIA

*Question.* I have heard "mumblings" that the contractual arrangement with the University of California is deteriorating. I don't know if it can be salvaged or not. What is your assessment of the situation and what do you recommend should be done?



Answer. The Buchsbaum Committee is now examining the relationship between the University of California and the nuclear weapons laboratories. I would prefer to wait on their report, which should be available in a few months, and provide my comments after I have had an opportunity to review their findings. There are no immediate problems that need be addressed regarding the contractual arrangements.

#### NON-DEFENSE WORK

*Question.* How much of your lab effort is in non-defense R&D?

Answer. About 55 percent of the laboratory effort is in non-defense R. & D. Nuclear weapons RD&T comprises about 35 percent of the total laboratory effort.

*Question.* Do you perceive that your defense R&D may be taking a "back seat" to the other more glamorous, unclassified work?

Answer. In the view of laboratory management, defense R&D does not take a "back seat" to any other programs. We do, however, have a relatively minor problem with more glamorous programs attracting some of our top R&D talent away from the weapons area. While this is not yet a major problem, continued discussion of a CTBT does tend to decrease morale and to increase the feelings of insecurity in our employees.

*Question.* How much of your own time is devoted to defense versus non-defense work?

Answer. Seventy-five percent.

#### *Sandia Laboratories*

#### COMPREHENSIVE TEST BAN

*Question.* Some months ago, according to the press, some of you gentleman met with the President to discuss concerns over the emerging CTB. Would you share those concerns with us and tell us if anything has occurred to alleviate those concerns?

Answer. I did not attend the meeting with the President concerning a CTB. The testing of nuclear weapon components for which Sandia is directly responsible would not be precluded by a CTB. Of course, the entire weapons complex is interdependent and the longer term effects of a CTB would impact us all.

I am concerned about our ability to verify compliance with a CTB. Sandia is developing National Seismic Stations (NSS) for possible emplacement in Russia to operate unattended. Deployment of an adequate number of these stations should detect any cheating [deleted] but over a long period testing below this level could make a difference between having an active nuclear weapons development program and not having one.

*Question.* The nuclear testing proposal in the fiscal year 1980 budget is down significantly. Are you comfortable with the proposed level of testing? If not, what do you feel it should be and why?

Answer. The proposed level of testing will not affect our work in the near term (a few years). We do participate in underground tests carried out to determine the effects of a nuclear explosive environment on our materials and components. Our current requirements are adequately covered.

#### R. & D. LEVEL

*Question.* Do you feel that enough resources are being applied to nuclear weapons R&D—especially basic research? Put another way, are you able to devote adequate resources to all key areas of technology to permit us to stay competitive with the Soviet Union?

Answer. As I indicated in my earlier (oral) remarks, our advanced development activities are being squeezed, and they are being squeezed more than our applied research. Since the advanced development is largely directed toward designing safer and more secure weapons, it is not so much a question of whether we are staying competitive with the Russians but of whether we will have weapons which are adequate for our own needs, for our own social and political environment. We have essentially no information on the Russian equivalence of Sandia technology.

*Question.* It is often said that the United States has a significant technological lead over the Soviets in the nuclear weapons area. What is your assessment of



the relative technological sophistication of Soviet versus United States nuclear weapons?

Answer. We know very little about the relative sophistication of Russian and U.S. weapons. We do know, of course, that they have a big advantage in the throw weight of their strategic systems, and thus can tolerate less refined technology.

*Question.* Do the Soviets have counterparts to your labs?

Answer. The Russians have the equivalence of our weapons R&D laboratories. They don't publish or discuss design assignments and there are no visits allowed to their weapon development areas (nor of their citizens to our weapons areas). Also, we don't know how they divide the weapon design assignments among institutions, if indeed they do.

*Question.* How important is the U.S. lead in computer technology?

Answer. I believe that the U.S. technological lead in computers and in micro-electronics has been an important factor in our favor in the continuing development of nuclear weapons. This is not a result of secrecy; it is the vitality and competence of our technical industries which make the best equipment and instrumentation available to us. In Russia much of such vital support must be designed and built by the user.

#### LAB CONTRACT WITH UNIVERSITY OF CALIFORNIA

*Question.* Dr. Sparks, why doesn't Bell Labs take over these contracts?

Answer. The Bell System has not been asked if they would take over the contract to manage Los Alamos and Lawrence Livermore Laboratories. The management of Sandia is done on a no-fee basis and there is only a relatively small overlap of the technology with that of the Bell System. I'm sure that an expansion of Bell System management of DOE labs would require careful consideration by top level Bell executives.

#### NON-DEFENSE WORK

*Question.* How much of your lab effort is in non-defense R&D?

Answer. Approximately 25 percent of Sandia's work is non-defense (energy) R&D.

*Question.* Do you perceive that your defense R&D may be taking a "back seat" to the other more glamorous, unclassified work?

Answer. No, this possibility has not become a problem. We worried about it when we began to diversify into non-defense work about five years ago. Accordingly, we have carefully monitored such indicators as trends in our post-and-bid system which permits employees to seek different jobs. Actually, the technical challenge in our weapons work is generally greater than in our energy programs. It is our intention to remain primarily a weapons laboratory. Our energy programs are chosen when possible to augment our strength in areas that are also useful for weapons work.

*Question.* How much of your own time is devoted to defense versus non-defense work?

Answer. My own time is divided approximately according to our program involvement: 75 percent defense; 25 percent energy.

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#### QUESTIONS SUBMITTED BY SENATOR HENRY M. JACKSON, ANSWERS SUPPLIED BY JOHN M. DEUTCH

*Question.* Mr. Secretary, one of the toughest dilemmas facing this country is the handling of nuclear wastes. You have just made public your Interagency Review Group (IRG) study on this question. Would you give us a few words on that report? What are the significant recommendations?

Answer. On the basis of their findings, the IRG developed specific policy recommendations in the following areas: Objectives, regional siting of repositories, consultation and concurrence, Federal/State partnership, public input, interim strategic planning basis for HLW, alternative approach to the first HLW repository, licensing, regulatory consolidation in standards development, interim strategic planning basis for TRU, special issues of defense waste, planning and management responsibilities, NEPA implementation plans, low level waste, and



other policy and program elements. These recommendations will accompany the IRG's Report to the President.

**Question.** Characterize the waste disposal problem. How much are we talking about; how much is from the defense program versus the civilian nuclear reactor system?

**Answer.** Large quantities of radioactive waste exist today as a byproduct of our nuclear weapons activities. Additional wastes and spent nuclear fuel are produced by commercial users of radioactive materials and the nuclear power industry. The growth in volume of waste and spent fuel has been accompanied by a growth in public concern over the problems associated with nuclear waste management. This is the essence of the problem. The requested data are provided in the following tables.

*Existing commercial transuranic (TRU) waste (as of Jan. 1, 1977)*

| Site:                   | Buried<br>transuranic<br>quantities<br>(kilograms) <sup>1</sup> |
|-------------------------|-----------------------------------------------------------------|
| Barnwell, S.C. ....     | 0                                                               |
| Beatty, Nev. ....       | 14. 3                                                           |
| Hanford, Wash. ....     | 22. 7                                                           |
| Maxey Flats, Ky. ....   | 69. 1                                                           |
| Sheffield, Ill. ....    | 13. 4                                                           |
| West Valley, N. Y. .... | 3. 6                                                            |
| <b>Total</b> .....      | <b>123. 1</b>                                                   |

<sup>1</sup> The associated volumes of TRU waste are not known. The only site presently receiving commercial TRU waste for burial is Hanford.

EXISTING DOE TRU WASTE

[Millions of cubic feet as of Jan. 1, 1977]

|                                       | Buried <sup>1</sup> | Retrievably<br>stored <sup>2</sup> | Total         |
|---------------------------------------|---------------------|------------------------------------|---------------|
| Hanford, Wash. ....                   | 5. 40               | 0. 27                              | 5. 67         |
| Idaho Falls, Idaho. ....              | 2. 30               | 1. 28                              | 3. 58         |
| Los Alamos, N. Mex. ....              | 4. 10               | . 06                               | 4. 16         |
| ORNL, Tenn. ....                      | . 20                | . 05                               | . 25          |
| Savannah River, S.C. ....             | 1. 00               | . 06                               | 1. 06         |
| Nevada test site. ....                | <. 01               | <. 01                              | <. 01         |
| <b>Total</b> .....                    | <b>13. 00</b>       | <b>1. 72</b>                       | <b>14. 72</b> |
| Transuranic content (kilograms) ..... | (>700)              | (374)                              | (>1,100)      |

<sup>1</sup> These are approximate volumes of TRU waste included in the buried LLW. Burial of DOE TRU waste ceased in 1974 (most sites in 1970).

<sup>2</sup> Do not reflect any potential volume reduction.

EXISTING HIGH LEVEL WASTE (HLW)<sup>1</sup>

[Thousands of cubic feet as of Oct. 1, 1977]

| DOE                              | Total           | Liquid          | Salt<br>cake | Sludge       | Calcine   | Cs;Sr<br>capsules |
|----------------------------------|-----------------|-----------------|--------------|--------------|-----------|-------------------|
| Savannah River. ....             | 2,900. 0        | 1,700. 0        | 900          | 300          | 0         | 0                 |
| Idaho. ....                      | 404. 0          | 350. 0          | 0            | 0            | 54        | 0                 |
| Hanford. ....                    | 6,102. 5        | 1,600. 0        | 2,800        | 1,700        | 0         | 2. 5              |
| <b>Subtotal</b> .....            | <b>9,406. 5</b> | <b>3,650. 0</b> | <b>3,700</b> | <b>2,000</b> | <b>54</b> | <b>2. 5</b>       |
| West Valley (NFS): <sup>2</sup>  |                 |                 |              |              |           |                   |
| Neutralized (600,000 gal.) ..... | 80. 2           | 80. 2           | 0            | 0            | 0         | 0                 |
| Acidic (12,000 bal.) .....       | 1. 6            | 1. 6            | 0            | 0            | 0         | 0                 |
| <b>Subtotal</b> .....            | <b>81. 8</b>    | <b>81. 8</b>    | <b>0</b>     | <b>0</b>     | <b>0</b>  | <b>0</b>          |
| <b>Total</b> .....               | <b>9,488. 3</b> | <b>3,731. 8</b> | <b>3,700</b> | <b>2,000</b> | <b>54</b> | <b>2. 5</b>       |

<sup>1</sup> This reflects the present form of the existing waste, not necessarily the form that would be placed in permanent disposal.

<sup>2</sup> The neutralized waste is stored in a 750,000-gal carbon steel tank while the acidic waste is in a 15,000-gal stainless steel tank. There is a spare tank for each in case of leaks.



*Existing DOE low level waste (LLW) (as of Jan. 1, 1977)*

| Site:                              | Millions of<br>cubic feet<br>buried <sup>1</sup> |
|------------------------------------|--------------------------------------------------|
| Hanford, Wash.....                 | 6.40                                             |
| Idaho Falls, Idaho.....            | 5.27                                             |
| Los Alamos, N. Mex.....            | 8.55                                             |
| Oak Ridge National Lab., Tenn..... | 6.42                                             |
| Savannah River, S.C.....           | 9.27                                             |
| Nevada test site.....              | .27                                              |
| Sandia Lab., N. Mex.....           | .04                                              |
| Other <sup>2</sup> .....           | 14.59                                            |
| <b>Total.....</b>                  | <b>50.81</b>                                     |

<sup>1</sup> Includes previously buried TRU waste.

<sup>2</sup> These are wastes contaminated with uranium only which are buried onsite at Pantex (Texas), FMPC (Ohio), National Lead (New York), ORGDP and Y-12 (Tennessee), Paducah (Kentucky), Portsmouth (Ohio), and Weldon Springs (Missouri).

**EXISTING COMMERCIAL LOW LEVEL WASTE (LLW) (AS OF JAN. 1, 1977)**

| Site                  | Status      | Millions of<br>cubic feet<br>buried <sup>1</sup> |
|-----------------------|-------------|--------------------------------------------------|
| Barnwell, S.C.....    | Open.....   | 3.52                                             |
| Beatty, Nev.....      | do.....     | 1.97                                             |
| Hanford, Wash.....    | do.....     | .51                                              |
| Maxey Flats, Ky.....  | Closed..... | 4.95                                             |
| Sheffield, Ill.....   | Open.....   | 2.40                                             |
| West Valley, N.Y..... | Closed..... | 2.46                                             |
| <b>Total.....</b>     |             | <b>15.81</b>                                     |

<sup>1</sup> Includes commercial TRU waste buried.

*Question.* I am very concerned with the licensing of waste repositories—especially those which will handle defense wastes. I want to get on the record, the Administration's position with regard to the licensing (by NRC) of all defense nuclear facilities. On February 13, 1979, in his letter transmitting the fiscal year 1980 legislative proposal, Secretary Schlesinger said:

"Consistent with Congressional guidance and consultation, the project (WIPP) as proposed does not provide for other than defense waste disposal, nor does it provide for licensing by the NRC."

The Secretary went on to qualify this statement because of the pending review by your IRG.

Now more recently in the IRG Study (page 73) you are recommending to the President that repository for defense wastes be licensed by the NRC.

Is it your position that the WIPP project, or a similar defense waste repository, should be licensed by the NRC?

Is this the Department's position? The Administration's position?

*Answer.* We believe that the WIPP project should be licensed by the NRC. Yes, this is the position of the Department and the Administration.

*Question.* How long do you estimate the licensing process would take?

*Answer.* Our schedule for the WIPP contemplates a construction authorization approximately two years after submission of an application to NRC, and a license to receive waste approximately five years later. Since this would be the first waste repository licensing activity for both DOE and NRC, it would be realistic to characterize that estimate as achievable but optimistic.

*Question.* What is your position (and the Department's and the Administration's) with regard to licensing other defense facilities—particularly facilities where there is interim storage of defense wastes?

*Answer.* Our position is that there should be no independent regulatory oversight of Defense activities under the responsibility of the Department of Energy that have any potential for interfering with those Defense activities. It is that rule that will govern our positions and does govern our positions on all matters with regard to independent regulatory oversight.

We do not believe—I know I speak for the Secretary on this as well as for other members of the Department—that independent regulatory oversight can be permitted to interfere in our Defense activities.



Other Department of Energy activities such as research and development activities not associated with Defense programs are another matter. These are special purpose activities. We are not sure in what way reasonable regulatory participation might occur. However, in our judgment the provision of the present law as expressed by Congress calls for licensing of ultimate disposal sites for high level waste.

We believe this is the correct position as expressed by Congressional law, the correct position for NRC licensing oversight, namely, that high level waste disposal, not storage, not treatment, not handling, not facilities at existing sites, but NRC licensing for ultimate disposal in new facilities for high level waste as the present law requires is indeed a satisfactory situation.

We do believe that ultimate disposal facilities (for which at the time the present law was enacted, was not classified as a separate type of waste) should also be licensed by the Nuclear Regulatory Commission.

With regard to low level wastes, we would argue that new non-Defense low burial sites sponsored by the Department of Energy should such occasion arise, should be licensed. However, new Defense low burial sites, that is, burial sites for primarily Defense wastes, should not be licensed by the NRC.

That in summary form is the position of our Department. I am pleased to inform you that I believe that the overwhelming Administration view takes the same position.

*Question.* Let's discuss the WIPP project for a moment, since your budget includes \$55 million to continue that effort. Just where does the project stand?

*Answer.* The project has been organized with decentralized management by a DOE project office in Albuquerque, New Mexico. The project office has been established and staffed with approximately 12 DOE employees. Conceptual design and a geologic characterization study, performed by Sandia Laboratories, are complete Preliminary (Title I) design, being performed by Bechtel Corporation, is approximately 75 percent complete and is scheduled to be completed in May 1979. The draft Environmental Impact Statement (DOE/EIS-0026-D) was issued in early April 1979. A support contractor, Westinghouse Electric Corporation, has been retained. The Preliminary Safety Analysis Report (PSAR) is scheduled for completion in August 1979, which would be necessary whether or not the facility is licensed by NRC.

Coupled with our WIPP related base technology development and facility design efforts is the requirement for acquisition of the land presently comprising the proposed WIPP site and the corresponding mineral leases. Of the approximately 19,000 acres making up the WIPP site, about 17,000 acres is currently held by the Department of Interior and 2,000 acres owned by the States of New Mexico. The DOE has two actions underway regarding the land and lease acquisitions. Legislation is presently being prepared to transfer titleship of the Federally held land to DOE with the expectation that the legislation will be forwarded to Congress later this year. This will provide the land in perpetuity to DOE. Negotiations are underway to acquire the leases and State lands in order to protect the site from drilling and intrusion.

Any decision to establish a waste disposal site in the Carlsbad area would be contingent upon full compliance with the National Environmental Policy Act (NEPA) and other applicable laws. Development would also be contingent upon approval and funding by Congress.

*Question.* Have you given the State of New Mexico the right to veto this project if they choose?

*Answer.* We have indicated, as a matter of pragmatism, that we are not going to go ahead in a particular area without the concurrence of the people in the area. We have indicated that as a matter of administrative policy that we are going to seek such concurrence from the state authorities. That has gotten tangled up with the issue of whether the veto is a legal right of the state. Under the current law it is not a legal right of the state because the Federal Government has preempted all issues in this area.

*Question.* The House Armed Services Committee has under consideration the complete deauthorization of the WIPP project as a defense project. The rationale being suggested is that since the longterm nuclear waste management problem is not solely a defense problem, that issue must be resolved for the entire spectrum of nuclear wastes. Only then would defense nuclear wastes, after appropriate processing, be turned over to a national repository for long term storage. Under this rationale, defense programs would be treated as a customer of



the national repository and pay their share of the cost. Also under this rationale, licensing would be appropriate. Would you comment on this proposal?

Answer. The WIPP project is, as you know, included in the defense authorization. In this regard, I wish to emphasize that the Department is complying with the Congressional direction to expend no funds for storage of spent fuel at WIPP or for licensing that facility. On the basis of discussions between the Chairman of the House Armed Services Committee and Secretary Schlesinger, we would hope to work out an arrangement to construct this facility outside the defense appropriation with the mission described in the answer to question 6 above.

We recognize, of course, that to proceed with the DOE proposed mission for WIPP it is essential that we reach an accommodation with the House Armed Services Committee and other concerned committees in the House and Senate.

*Question.* It's something of a mystery to me that the management of defense nuclear wastes resides under your jurisdiction as Assistant Secretary for Energy Technology and not under Mr. Sewell's jurisdiction as Assistant Secretary for Defense Programs. It appears to me that the management of the defense waste is a part of the process of producing nuclear materials and weapons. How do you explain your jurisdiction arrangements?

Answer. While there is a difference in the origin of the wastes, whether they are from defense activities or from Department of Energy research and development activities, or from our commercial sector, the handling of the technology for dealing with these wastes is indeed quite common. A common management approach involving common technology in my judgment is essential for effective and economical treatment and handling of our waste issues. Let me give you two examples.

In the transportation of radioactive wastes the Federal Government is responsible for the transportation of defense waste but it is not responsible for the transportation of commercial waste between different sites. The technology that we learn in our defense transportation activities is of value to our commercial enterprise. Furthermore, as is well known, commercial reprocessing has been indefinitely deferred. However, our understanding of how to deal with reprocessed military waste will be of value in subsequent years if and when commercial reprocessing is once again permitted in the Nation. Then, we will have the technology on hand, as much as it is possible, to transfer that technology by joint management of our commercial and defense programs.

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QUESTIONS SUBMITTED BY SENATOR HENRY M. JACKSON, ANSWERS SUPPLIED BY  
JIM WADE

PLUTONIUM STRATEGIC RESERVE

*Question.* Some time ago, the JCS developed a requirement for a strategic reserve of plutonium. Give us the background on this issue.

Answer. In 1974, as a result of placing certain plutonium production reactors on standby, the DOD requested the AEC to maintain a working reserve of [deleted] reactor products (plutonium and tritium). In 1975, in response to JCS-expressed concerns about the levels of stockpiled weapons, a plan to establish a reserve was approved. This continuing reserve [deleted] of reactor products (which is reviewed in the annual stockpile submission) provides a hedge to support possible increased weapons production. The reserve would be used in the interval between providing funds for the restart of a reactor and the actual availability of plutonium from that reactor [deleted].

*Question.* Has the JCS changed its position on the necessity for this strategic reserve?

Answer. The JCS continues to support a need for increased plutonium production capability and reserves to support current and future contingency stockpile projections to meet force objectives.

The DOE, DOD, and OMB have been tasked by the President to provide a report which addresses the issue of special nuclear materials availability and requirements, prior to the fiscal year 1981 budget submission. The above subject will be covered in the report.

M-X

*Question.* Are you satisfied with the options available to the Defense Department as far as candidate warheads for the M-X are concerned?



Answer. Yes, we are preparing to support the M-X warhead requirement. We have available and under development warhead candidates [deleted]. We will be adequately covered if the associated test programs are completed.

I believe we should seriously consider, however, the requirement to [deleted]. [Deleted] if a CTB treaty were to be extended beyond a few years.

#### COMPREHENSIVE TEST BAN

*Question.* The JCS has expressed some reservations in the past about a CTB. What are those reservations and what is the DOD position?

Answer. Although I do not speak for the JCS, let me give you my impressions of their concerns or reservations. In relation to a CTB, the JCS have indicated the need for:

Continued high confidence in the reliability we have today in our nuclear weapons stockpile.

Maintenance of our national asset of high quality scientists at our nuclear weapon design laboratories.

Maintenance of a continuing and viable effort aimed at assuring the capacity of our weapon systems to function in a nuclear environment.

Capacity to adequately verify a CTB—to minimize the risk that the U.S.S.R. could gain a significant military advantage should they attempt evasive testing during a CTB.

The DOD shares these concerns:

High confidence in the reliability we have today in our nuclear weapon stockpile is a must. A short-term CTB, in all probability, should [deleted].

With high level attention from the Executive Branch, and I would add the Congress, we believe that we should be able to keep at our nuclear weapon laboratories the high quality scientists needed to maintain our nuclear weapon design capability, and be on scene once testing is resumed.

Similarly, the DOD must maintain its expertise in nuclear weapon effects to assure the operational effectiveness of our weapon systems in a nuclear environment.

It remains to be seen as to whether an adequately verifiable agreement can be negotiated with the U.S.S.R. Such negotiations are proceeding today.

If a short-term CTB were to be successfully negotiated with the U.S.S.R., there would be the need for a Safeguard program which adequately addresses the concerns cited above.

#### ER STUDY

*Question.* Last year this Committee in its report on the fiscal year 1979 Nuclear Weapons Authorization Bill asked the Defense Department for a report on the enhanced radiation situation. Specifically, we asked:

"In addition, the committee requests the Secretary of Defense to provide a report to the Congress before the end of calendar year 1978, which—

"(1) Specifies in detail the nature, scope, and types of reciprocal armaments, restraints, or any other military conditions that could be agreed to by the Soviet Union which would warrant a definitive U.S. decision to cancel or delay beyond fiscal year 1978 production of ER weapons;

"(2) Evaluates the prospects for agreement by the Soviet Union on restraints of the kind delineated in (1);

"(3) indicates the date by which the Administration intends to proceed with production of ER weapons in the absence of specific agreements by the Soviet Union to undertake such reciprocal restraints; and

"(4) indicates the position of our NATO allies as to the deployment of ER weapons in NATO."

Would you insert a copy of your response at this point in the record and discuss it briefly?

Answer. As you requested, I have inserted a copy of the Department's response which provides the Administration's current position on ER weapons and addresses the questions posed above. As mentioned, the President has approved modernization of the LANCE missile and the 8-inch artillery nuclear weapons, retaining the option to install the ER components later, if so decided. We are proceeding accordingly.



THE SECRETARY OF DEFENSE,  
Washington, D.C., December 30, 1978.

HON. JOHN C. STENNIS,  
Chairman, Committee on Armed Services,  
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: In your committee's report accompanying S. 2693, we were requested to provide a report before the end of this calendar year on several aspects of policy on enhanced radiation (ER) weapons.

The Administration's position on ER weapons remains as enunciated by the President on April 7th of this year. "The ultimate decision regarding the incorporation of enhanced radiation features into our modernized battlefield weapons will be made later and will be influenced by the degree to which the Soviet Union shows restraint in its arms programs and force deployments affecting the security of the United States and Western Europe." In the meantime, the President has taken steps to modernize the Lance missile and 8-inch artillery nuclear weapons while keeping open the option to install ER components later. In particular, the President has directed the production and stockpiling in the US of certain critical enhanced radiation components simultaneous with the production of modernized warheads.

The Administration has not yet reached a judgment regarding Soviet restraint, nor is there a specific timetable for doing so. We continue to monitor and assess Soviet weapons programs and force deployments affecting NATO security for indications of restraint. The Soviets have proposed mutual renunciation of ER weapons, which we have rejected on the grounds that it would be an unbalanced exchange since ER weapons are defensive weapons designed to stop armored attacks—a mission the Soviets have no need to be concerned with. President Brezhnev's recent statement that the Soviets long ago decided not to produce ER weapons bears out this analysis.

The position of our NATO Allies remains as on April 7, 1978, when the Allies expressed understanding for the President's decision to defer production of ER weapons. In general, our Allies have also called upon the USSR to show restraint.

I welcome the Committee's interest and concern on this issue, as well as the committee's action in support of theater nuclear modernization. I am prepared to discuss this with you further if you wish.

Sincerely,

C. W. DUNCAN,  
Deputy.

*Question.* Quoting from the President's ER position of last April 7:

"The ultimate decision regarding the incorporation of enhanced radiation features into our modernized battlefield weapons will be made later and will be influenced by the degree to which the Soviet Union shows restraint in its arms programs and force deployments affecting the security of the United States and Western Europe."

The purpose of the report requested by this Committee last year was to try and pin down when the ultimate decision would be made and what would constitute adequate "restraint" on the part of the Soviet Union. I think you would have to agree that your response is not much help. Let me ask you specifically, when will the "ultimate decision" be made; is the decision under active consideration in the Administration now?

Answer. It would be difficult for me to estimate when the ultimate decision will be made. As stated by the President, it will be influenced by the degree to which the Soviet Union shows restraint in its arms programs and force deployments. In the meantime, we are proceeding with modernizing the LANCE and 8-inch nuclear warheads, retaining the option to install ER components later.

*Question.* What would constitute adequate "restraint" on the part of the Soviet Union that would result in a U.S. decision not to produce ER weapons?

Answer. To my knowledge, we have not yet reached a judgment based on specific set criteria as to what would constitute adequate restraint by the Soviets. I do not believe the thrust of the President's remarks was aimed at comparable restraint in ER weapon technology. His comment was broader in nature.

*Question.* Has the U.S. sought (or obtained unsolicited) a response from the Soviet Union in return for the President's unilateral decision not to produce ER weapons?



**Answer.** The Soviets have proposed mutual renunciation of ER weapons, which we have rejected on grounds that it would be an unbalanced exchange. ER weapons are principally defensive weapons designed to stop massed armored attacks. The Soviets have little need for this capability. I am not aware of any further response in this regard.

**Question.** Have our allies agreed to the deployment in NATO of ER capable warheads (the Lance and the 8" artillery round)?

**Answer.** When the President announced his decision to defer production of ER weapons, our allies generally expressed understanding and also called upon the Soviets to show restraint. It is my understanding that our allies still hold to that position, and further discussion has not taken place.

QUESTIONS SUBMITTED BY SENATOR HENRY M. JACKSON, ANSWERS SUPPLIED BY  
CHARLES GILBERT

FISCAL YEAR 1980 BUDGET

**Question.** Dr. Gilbert, I'm quite concerned about your part of the budget. In the area of operating money you took a cut of more than 10 percent in constant dollar terms (\$342 million in fiscal year 1979 to \$326 million in fiscal year 1980). One way to unilaterally disarm is to quit making plutonium and tritium and dismantle the reactors. As I understand it, your budget would require Savannah River to go on  $\frac{2}{3}$  operation and Richland would retire 4 reactors that are now held in standby. Is my assessment of the budget impact accurate?

**Answer.** Your assessment of the budget impacts is correct for the items you mentioned. However, weapon requirements can be met [deleted]. We have judged that it is no longer advisable to retain the four reactors at Richland in standby since their restart is not practical for both economic and environmental reasons.

**Question.** How confident are you that we will have the necessary special nuclear materials in the out years—1985–1995?

**Answer.** The three operating Savannah River reactors, when upgraded, will be sufficient to produce current and forecast nuclear materials [deleted]. In addition, N-reactor operation can be changed in one year to weapons-grade plutonium production. [Deleted.] As a result, we do not feel that the apparent loss of the production capacity for the four reactors being retired at Richland will affect our ability to meet forecast nuclear materials requirements.

**Question.** How much more money would it cost to maintain your operations in fiscal year 1980 at the fiscal year 1979 level? (Details for the record.)

**Answer.** The Nuclear Materials Production operating budget for fiscal year 1979 was \$343.3 million in authorization with \$321.3 million in appropriations. Allowing for 7 percent inflation over the fiscal year 1979 appropriation level would require \$343.8 million in authorization and appropriation in fiscal year 1980. Since our fiscal year 1980 request is \$326.0 million for both authorization and appropriation, we would need \$17.8 million more to maintain operations at the fiscal year 1979 level.

This would permit full operation of the three Savannah River reactors in fiscal year 1980 or the conversion of the Richland N-reactor to weapons grade plutonium with one Savannah River reactor in warm standby. It would also permit better maintenance of the Richland Purex facility in standby condition. The net result of these actions would be a 50 percent increase in nuclear material production in fiscal year 1980.

**Question.** How much of a cut in this area did you take from OMB? What reason was given?

**Answer.** The reductions in the fiscal year 1980 Nuclear Materials Production budget made by the OMB are shown in the following table:



[In millions of dollars]

|                                                                                                  | OMB submittal                         |        | Reduction                             |        | Congressional report                  |        |
|--------------------------------------------------------------------------------------------------|---------------------------------------|--------|---------------------------------------|--------|---------------------------------------|--------|
|                                                                                                  | Authoriza-<br>tion/ap-<br>propriation | B/O    | Authoriza-<br>tion/ap-<br>propriation | B/O    | Authoriza-<br>tion/ap-<br>propriation | B/O    |
| Operating:                                                                                       |                                       |        |                                       |        |                                       |        |
| Production reactor operations.....                                                               | 179.6                                 | 174.95 | -8.8                                  | -8.8   | 170.8                                 | 166.15 |
| Processing of nuclear materials.....                                                             | 107.77                                | 100.92 | -12.57                                | -12.57 | 95.2                                  | 88.35  |
| Supporting services.....                                                                         | 67.43                                 | 66.13  | -8.33                                 | -12.63 | 59.1                                  | 53.5   |
| Total.....                                                                                       | 354.8                                 | 342.0  | -29.7                                 | -34.0  | 325.1                                 | 308.0  |
| Equipment:                                                                                       |                                       |        |                                       |        |                                       |        |
| Production reactor operations.....                                                               | 12.9                                  | 10.9   | -2.4                                  | -1.4   | 10.4                                  | 9.5    |
| Processing of nuclear materials.....                                                             | 14.3                                  | 12.3   | 0                                     | 0      | 14.3                                  | 12.3   |
| Supporting services.....                                                                         | 12.8                                  | 9.6    | -2.5                                  | -1.4   | 10.3                                  | 8.2    |
| Total.....                                                                                       | 40.0                                  | 32.8   | -5.0                                  | -2.8   | 35.0                                  | 30.0   |
| Construction:                                                                                    |                                       |        |                                       |        |                                       |        |
| General plant projects.....                                                                      | 17.8                                  | 17.8   | -2.8                                  | -2.8   | 15.0                                  | 15.0   |
| Plant engineering and design.....                                                                | 7.0                                   | 7.0    | -3.6                                  | -3.6   | 3.4                                   | 3.4    |
| 80-AE-3 steam generation facilities,<br>Idaho chemical processing<br>plant, Idaho.....           | 22.5                                  | 22.5   | +1.0                                  | -12.5  | 23.5                                  | 10.0   |
| 79-7-h, utilities replacement and<br>expansion, Idaho chemical pro-<br>cessing plant, Idaho..... | 15.5                                  | 15.5   | 0                                     | -2.3   | 15.5                                  | 3.2    |

<sup>1</sup> Full authorization for this project at the TEC of \$10,500,000 was provided in fiscal year 1979. This additional request or \$5,500,000 was incorrect, and the fiscal year 1980 budget request should be modified.

In developing a fiscal year 1980 mark for the Nuclear Materials Production program, the OMB assumed that the production reactors at Richland and Savannah River would operate at the fiscal year 1978 level; plutonium separations at Savannah River would be reduced below the fiscal year 1979 level; Richland processing of plutonium feed for the Fast Flux Test Facility (FFTF) would be funded by the Office of Nuclear Energy Programs, ET; the Savannah River heavy water plant extraction unit would terminate operations in fiscal year 1980; four Richland production reactors now in standby would be retired (no restart capability); process development activities at Richland, Savannah River and Idaho would be reduced 15 percent below the fiscal year 1979 level; and upgrading of NMP program facilities through accelerated replacement of capital equipment, increased General Plant Project activities and increased Plant Engineering and Design efforts would be deferred.

*Question.* In planning for future special nuclear material requirements, what is your current thinking? Are you considering reactivating a Richland reactor to produce weapons grade material?

*Answer.* Our most recent analysis of the supply and demand for nuclear materials in the DOE Materials Management Plan (MMP) indicates that requirements projected for the twelve-year planning period (fiscal year 1979-1990) will require [deleted]. However, we are also studying ways of efficiently implementing the soon-to-be proposed production and waste management facilities upgrading program during fiscal year 1981-1985. One option is to shut down a Savannah River reactor for a predetermined time period, perform the necessary upgrading, restart that reactor, and repeat the process on the remaining two reactors. To upgrade all three reactors serially might take from three to four years. To make up the production shortfall which would accrue during the upgrading activity, we could change the mode of operation of N-reactor from fuel-grade plutonium production to weapons-grade production or, if necessary, to a coproduction mode where both tritium and plutonium would be produced at the same time. These and other potential options, [deleted] are cur-



rently being evaluated. A DOE decision is planned as a part of the fiscal year 1981 budget formulation process.

We are not considering reactivating a Richland reactor to produce weapons grade material as all Richland reactors will have been retired, except N-reactor. As I mentioned, we are considering changing N-reactor operations to produce weapons-grade plutonium if material requirements support that change.

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QUESTIONS SUBMITTED BY SENATOR CARL LEVIN, ANSWERS SUPPLIED BY  
JAMES R. SCHLESINGER

WORLD ENERGY IMPLICATIONS FOR NATIONAL DEFENSE

*Question.* Mr. Secretary, your recent statements and those of Secretary of Defense Brown about the possibilities of armed U.S. intervention to protect Middle East/Persian Gulf oil assets deemed important to U.S. national security reportedly have been tempered recently.

Have you received guidance from the White House to moderate your statements?

*Answer.* My statement and that of Secretary Brown stressed the possibility of and requirement for a U.S. presence in the Persian Gulf area, rather than armed intervention. The perception of United States will and strength, particularly generated by a presence in the area, is a key element in deterring events [deleted]. [Deleted.] If our possible opponents perceive, and if our allies perceive, that we are prepared to defend our vital interests, and oil from the Persian Gulf is indeed a vital interest, then we would hope that these perceptions would prevent such threats to these interests.

*Question.* If not, what other contingency plans have we developed to supply our energy needs in a future energy crisis? (Do you have a rationing plan, for example, how long would it take to implement it in a crisis?)

*Answer.* The President transmitted three standby energy conservation plans and a standby gasoline rationing plan to Congress on March 1, 1979. These plans were developed under the Energy Policy and Conservation Act of 1975. Congress has 60 days to approve or disapprove these plans.

The President has announced his intent to implement the standby conservation plan which would require that thermostats in non-residential buildings be set no higher than 65° in winter, no lower than 80° in summer, just as soon as Congress approves it. He has asked that Congress approve this particular plan expeditiously.

The conservation plans and the gasoline rationing plans are specific in nature. They are designed to reduce demand for particular petroleum products or distribute available supplies of a particular product equitably. These plans would be incorporated along with other conservation, fuels switching and allocating measures in a broader plan developed to respond to a particular oil shortage situation.

The DOE has developed a plan to respond to the current world oil supply situation and expects to release this plan within the next several days. We will provide you with a copy of the overall plan at that time.

*Question.* The Egypt-Israel peace treaty rests in part on a U.S. assurance to Israel that we will supply that nation's energy needs if it is cut off from Arab oil sources.

Mr. Secretary, this nation has enough troubles just meeting its own energy needs without a crisis. In a crisis, we presumably would have even more problems. Why do we think we can meet this extra burden? Do we have the energy resources to meet this additional requirement?

During a crisis, will the requirement to meet Israeli energy needs cause or increase energy shortages in the United States? Have we calculated the extent of such an increase, and have we calculated these effects on the average American consumer?

*Answer.* Corollary to the new peace treaty between Egypt and Israel, the United States is obligated to make oil available for purchase by Israel to meet Israel's domestic oil requirements. This obligation can be met either by assist-



ing Israel to locate oil in the world market or by providing Israel with oil produced in the United States. Israel would purchase U.S. oil at the world market price. Volumes required by Israel would be less than 1 percent of current U.S. oil consumption. To date, Israel has not found need to call upon the U.S. for any assistance (an earlier, similar obligation has been in existence since the 1975 Sinai II accords).

*Question.* Mr. Secretary, how likely is another Arab oil embargo in response to the Egypt-Israeli peace agreement?

*Answer.* We believe that an Arab oil embargo in response to the Egypt-Israeli peace agreement is unlikely.

*Question.* The Soviet Union relied heavily on Iranian natural gas to help meet its energy needs. It also purchased some Iranian oil. What has happened to this source of supply to the Soviets since the revolution in Iran? Have the flows of natural gas and oil stopped? Have they resumed?

*Answer.* The USSR does not purchase oil from Iran. Iranian natural gas exports to the USSR resumed in early April 1979 but on a reduced scale. Iranian gas deliveries to the USSR were virtually ceased since mid-November 1978. Deliveries to the USSR had been running nearly 1 billion cubic feet per day (170,000 b/d oil equivalent) before the strikes began in late October. Although Iranian gas amounts to less than three percent of overall Soviet gas consumption, the Transcaucasus region—Georgia, Azerbaydzhan and Armenia—is heavily dependent on Iranian deliveries. Moscow has decided to make do with less at home. The greatest burden of conservation appears to have fallen on Armenia.

*Question.* What effects are the disruptions of oil and natural gas to the Soviets having on the USSR economy and on its industrial production?

*Answer.* Local officials in Armenia have instituted emergency measures to find alternative fuel supplies. Despite these measures, Armenia is forced to make do with 5 to 10 percent less energy. Industrial production in the Transcaucasus region is reportedly being hurt by the fuel crisis. The effect on the overall Soviet economy industrial production is believed to be minimal.

*Question.* Have these disruptions forced the Soviets to curtail their supplying energy to their East European clients? What have been the effects of this on the economies and industrial production, if any, of these nations?

*Answer.* The Iranian cutoff does not appear to have resulted in a noticeable reduction in gas deliveries to either Eastern or Western Europe. Due to severe weather conditions, there were some temporary shortfalls in deliveries. Such disruptions are not unusual during the winter months, and the weather last winter was exceptionally severe.

*Question.* Has the USSR, or its East European clients, turned to the open world energy market to replace direct or indirect energy shortfalls because of the revolution in Iran?

*Answer.* There is no evidence of the USSR turning to the world oil market as a result of the Iranian situation. Several East European countries such as Romania and Poland were purchasing small amounts of oil from Iran. These countries have been seeking replacement oil in the world oil market, but with little success in the current tight oil market.

*Question.* What have been the effects of this on the price and supplies of world energy?

*Answer.* Although the East European demand for oil to replace Iranian oil is quite small (less than 100,000 b/d or 0.3 percent of world oil exports) any additional demand in a tight oil market put further upward pressure on prices.

#### COMPREHENSIVE TEST BAN CONCERNS

*Question.* DOE's budget for nuclear weapons testing has decreased from last year. What are the reasons for this decrease? How much of the decrease is related to Comprehensive Test Ban considerations, and how much is related to the fact that many of your weapons development programs accomplished necessary testing in the past and are now beyond the phase where testing is required?

*Answer.* The number of nuclear tests planned is a function primarily of balancing the weapons program within available resources. Comprehensive Test Ban (CTB) considerations have not been a factor in establishing the overall level of testing although we are acutely aware that a CTB could be implemented almost any time. The CTB potential has been factored into the fiscal year 1980



test program by assigning priority to support current DOD weaponization requirements.

*Question.* The major concerns about whether a Comprehensive Test Ban would reduce our confidence in the reliability of our nuclear weapons stockpile have been expressed by DOE. Could you briefly summarize for the Committee your Department's concerns?

*Answer.* We believe the current reliability of our nuclear stockpile is very high because of the extensive information provided by nonnuclear and nuclear testing programs and because of the skilled scientists and engineers able to use these data accurately to assess that reliability. We further believe that under the limited duration CTB now envisioned, the stockpile reliability would remain high, principally because of the extensive activities under nonnuclear Quality Assurance/Reliability Testing, and also because of the skilled people who incorporate this data and post-nuclear testing experience into timely, updated reliability assessments.

Should a CTB become protracted, we would be concerned that the potential for aging problems would be greatly increased. In addition, a decline in weapon reliability might not be smooth and predictable, but rather very abrupt and severe. An extended CTB would increase the chances of encountering sudden and serious changes. Lastly, a long-term CTB, with its attendant lessening of overall weapons activities would lead to the loss of the skilled scientists and engineers who foster the reliability of the stockpile. Loss of these people could greatly impact our ability to respond to stockpile problems identified over the long term.

*Question.* It is my understanding that there have been stockpile reliability problems in the past. Could you please elaborate upon them briefly for the Committee now and provide full details of them for the record as to causes, solutions, etc.?

How have these stockpile problems been discovered? Is it necessary to test to discover these problems, or is it only useful to test in efforts to arrive at solutions to them? Please be specific for each past instance of stockpile problem.

*Answer.* There have been occasions in the past when problems were discovered in which warhead reliability would have been reduced. Some of the most noted examples, how they were discovered, and their solutions are as follows:

[Deleted.]

[Deleted.]

*Question.* What other methods does this nation have to detect and solve nuclear weapon stockpile reliability problems? Please elaborate on the strengths and weaknesses of each.

What are the non-testing capabilities we have to determine stockpile reliability as well as to carry out nuclear weapons design work?

*Answers.* We will discuss the elements of the activities which permit assessment of stockpile reliability. First, we will emphasize the overall methods employed in our assessment of stockpile reliability.

The U.S. nuclear warhead stockpile reliability is assessed as the result of several programs in the DOE and DOD. Because of existing nuclear testing treaties, environmental constraints, and the cost of performing operational system tests, it is neither permissible nor practical to test the function of complete nuclear weapons in the STS. These programs are designed to provide the necessary information to assess reliability. The QA/RT program and nuclear test results provide the data base for this assessment.

The QA/RT program includes the major stockpile surveillance activities. Since the introduction of stockpile sampling in 1958, more than [deleted]. [Deleted] were tested as part of QA/RT. This testing includes nonnuclear flight testing, nonnuclear system testing in the laboratory, a variety of component tests and visual and nonfunctional tests, and inspections of nuclear and nonnuclear components. For all nonnuclear components; i.e., electronic, electromechanical, and mechanical components [deleted] these testing programs, along with other applicable data, result in a quantitative assessment of the reliability of the nonnuclear components for each warhead type in stockpile.

For the nuclear components, the technology base provided by all nuclear tests and the specific nuclear tests carried out during the warhead development process provide assurance that the warhead design is correct. Additional tests using the same or similar components give further and repeated assurance that the nuclear



components will function properly. Through the nuclear testing results and that part of the QA/RT program that inspects the nuclear components, the DOE laboratories continually monitor the nuclear components and are able to provide the technical judgment for the reliability assessment. This monitoring and judgment by the laboratories, and the assessments of warhead reliability which result, require scientists and engineers experienced in warhead design, computer modeling, nuclear and nonnuclear testing, production techniques, and quality surveillance activities. These people are an essential element in the experimentation, manufacturing, and assessment processes which enable agreed nuclear weapon certifications to be made.

Now, we will concentrate upon details of the nonnuclear activities of reliability assessment.

The QA/RT program is designed to ensure that all nuclear weapons and weapon components are manufactured in accordance with the plans and specifications provided by the design laboratories; that all weapons in the stockpile continue to meet their original performance specifications safely and reliably throughout their stockpile life; and that any age-related or other defects are promptly identified so that appropriate action can be taken.

The QA/RT program is divided into four major elements: Product acceptance, laboratory testing, joint flight testing, and surveillance.

1. Product acceptance encompasses performance of necessary independent verification inspections and surveys by DOE inspectors to ensure that nuclear weapons and components are manufactured and tested in accordance with plans and specifications of the design laboratories.

2. The laboratory testing program is intended to verify the capability of weapon systems to function in their intended mode and to determine their degree of conformance with design intent. The laboratory program encompasses tests of both newly produced and stockpiled weapon systems and components.

- (a) The New Material Laboratory Test (NMLT) program consists of laboratory tests conducted at the system level on weapons selected at random from new production before those weapons are delivered to the DOD. The NMLT program provides data for assessing the reliability of weapons and components entering the stockpile and baseline performance data which can be compared with results of future stockpile laboratory tests to identify possible degradation. [Deleted.]

- (b) The Stockpile Laboratory Test (SLT) program consists of the annual laboratory testing at the system level of pre-determined numbers of weapons selected at random by DOE from the DOD stockpile population. The SLT program is structured to provide an annual appraisal of the quality of weapons and components in stockpile and to provide data that will reflect any degradation of performance resulting from stockpile storage, handling, or aging. [Deleted.]

- (c) A small number of the weapons selected for NMLT and SLT are disassembled for component testing rather than system testing. General laboratory component testing allows a closer examination of component performance than could otherwise be obtained from system tests. Some components are obtained from new production for long-term or accelerated aging studies to identify any degradation trends or peculiar characteristics, while other components are destructively tested or subjected to specialized tests designed to obtain specific data or to monitor peculiar environments. Results of these evaluations assist in predicting the useful life of individual components, materials, and assemblies. Insofar as possible, the same series of system and component tests are performed each year to detect trends or areas of specification nonconformance when systems and components are exposed to the expected STS environments. Design margins may be explored through credible overtests. Safety tests, where appropriate, are included.

3. The Joint Flight Test (JTF) program is a combined DOE-DOD flight test program conducted on an annual basis for most weapon types. Flight test units include an instrumented denuclearized warhead utilizing randomly selected DOE war reserve components mated to the fuzing system and to the DOD delivery system. The program is structured to verify each weapon system's capability to function in a variety of actual STS environments that cannot be duplicated exactly during laboratory testing and to demonstrate continuing compatibility between DOE and DOD subsystems. This form of testing also provides confirmation of the reliability assessment methodology. As in the systems laboratory test program, this program includes both new material and stockpile flight (drop) tests. [Deleted.]



4. Surveillance consists of supplementary design agency testing requirements in addition to those normally associated with the laboratory and flight testing activities. Specifically, surveillance includes shelf-life studies of products removed from the production line for storage, monitoring, and future testing; testing of selected components from retired weapons; and special, in-depth testing of suspect problem components or assemblies.

These complementary elements of the QA/RT program have provided the necessary data to assess the reliability of the nonnuclear components and to identify potential problem areas in both the nuclear and nonnuclear components. Potential nuclear component problems discovered in QA/RT are analyzed by design personnel and may require interaction with the nuclear testing program.

*Question.* If laboratory simulations are used, how much useful information for stockpile reliability and weapons design purposes do they yield?

*Answer.* The U.S. has performed [deleted] nuclear tests since the first one, Trinity, on July 16, 1945. These tests are complex experiments that are not single entities standing alone with no relation to either tests; rather they are pieces in a large matrix of test information with feedback to many other parts of the weapons program. A very important feedback is to the computer models used to calculate weapon performance. These computer models can then be used to better, but not fully, predict weapon performance under a variety of conditions relating to weapon reliability.

Nuclear tests have been essential for determining with confidence the proper functioning of new or modified nuclear components and for assurance that such tested components have continued to function properly over time. Calculations alone have not sufficed, and there is no known way to simulate experimentally or calculationaly the performance of a nuclear weapon.

*Question.* What information regarding stockpile reliability and weapons design can only be obtained through testing, and what is the significance of such information to the reliability process and to the nuclear weapons design process?

*Answer.* The only real long-term assurance of the reliability of the stockpile is in the full understanding of the operation and performance of the devices by competent, experienced designers. There are still a number of areas of nuclear explosive physics which still rest to a substantial degree on empirical science. [Deleted.]

[Deleted.]

*Question.* I have been informed, Mr. Secretary, that none of the problems which have arisen during the 30 years our nuclear weapons stockpile has existed have required testing to solve. Is this true? Why or why not?

*Answer.* This is not true. Although our nonnuclear Quality Assurance/Reliability Testing program, combined with the data, experience, and knowledge base from previous nuclear tests has discovered and helped solve many stockpile problems, testing has been essential to solve or verify the solution to problems in several important designs. Two examples illustrate this.

[Deleted.]

*Question.* I have been told that regarding the specific problem of corrosion of special nuclear materials, it is not required to test to solve this problem. I have been informed that if we rebuild a nuclear weapon to the original specifications established by the original testing program which yielded certified weapons, then we have reestablished the reliability of the weapon in question. Do you agree with these statements. Why, or why not?

*Answer.* Our nuclear weapons contain a complex combination of materials, including somewhat unstable organic compounds. Consequently, our designers have worked hard to effect compatibility between materials. Most difficulties with corrosion are seen in nonnuclear components of a weapon, such as the first appearance of oxidation on a switch contact. These items, because of extensive stockpile monitoring, are quickly found, the cause identified, and the problem rectified.

[Deleted.]

As a general consideration, rebuilding to the original specification with attention to correcting the cause of corrosion would permit the production of a reliable weapon. However, it has occurred that the original materials used in the construction of the weapons build are no longer available or suitable. This has happened due to recognizing safety and health problems with certain adhesives, to manufacturers going out of business or discontinuing production of a particular material, or to recognizing that particular material will continue to cause prob-



lems. Correction of a particular problem has been our approach, rather than complete rebuilding.

*Question.* If an acceptable fix to the stockpile is to rebuild it, other factors which might influence such a solution are time, cost, and the availability of special nuclear materials. For those weapons which experienced problems in the past, what would it have cost in terms of these factors to rebuild them, rather than test and solve the problems?

*Answer.* Nuclear and/or nonnuclear testing, combined with field or factory retrofit, has been the method of rectifying past stockpile problems. Nuclear testing for evaluation and certification has been required only for a portion of these experiences, but every one of the cases of problem correction by retrofit relied upon the data base from previous nuclear testing in verifying the approach to solving the particular stockpile problem.

If the rebuild approach were selected for solving a specific problem, we would define the term "rebuild" to mean the weapon is completely remanufactured with all new components. In this circumstance, the cost of rebuilding the warhead would be [deleted] dollars per unit. If rebuilding is defined to mean modifying the weapon with just the faulty components replaced, then the costs would normally be [deleted] dollars per unit. Retrofitting to the original specifications would take less time and money than retrofitting with a newly designed component because extensive research, development, and testing would not be needed; however, the original problem would be expected to reoccur. Special nuclear material availability would probably not be a problem because the material is recycled for future use, although temporary shortages could be encountered in production scheduling.

#### COMPREHENSIVE TEST BAN CONCERNS

*Question.* Another concern voiced about CTB is that the Soviets might cheat and that we would not be able to detect such cheating. I understand that our detection/verification technology is years ahead of that possessed by the Soviets. Is this true? If so, in which areas, and why? Please describe our detection/verification capabilities for CTB compliance.

*Answer.* The Soviets maintain such secrecy around much of their technology that it is difficult to compare theirs with ours. Certainly, they often do things differently than we do, but, as we learned with the MIG-25, that does not necessarily mean they do not do them well. We do know that they have a very large geophysical program, including a well-known effort to understand and predict earthquakes, which is relevant to verification of a CTB.

Soviet verification capabilities are considerably enhanced by their opportunity to check their data against that available in official and unofficial open literature.

Detection and verification capabilities for underground nuclear testing are described in the chart titled "Seismic Network Capabilities." For tests in the atmosphere especially near the Poles, and for tests under water, yields could be in the [deleted.] In deep space, they could be in the [deleted] with little risk of detection.

*Question.* [Deleted.]

*Answer.* [Deleted.]

[Deleted.]

[Deleted.] It should also be noted that testing away from known test areas would make detection much more difficult [deleted].

It must be recalled that these tests were not conducted under a CTB. [Deleted.]

We cannot be sure that we have not missed others, even some at known test sites, [deleted].

*Question.* What is the smallest nuclear weapon we believe the Soviets would find it necessary and useful to test for weapons purposes? Would we be able to detect this? Why, or why not?

*Answer.* We would need far more insight into the Soviet military establishment than we have to anticipate their nuclear weapon requirements. We have only sketchy, usually circumstantial, evidence on their current weapons and certainly weapons decision details. We know that there has been discussion in Soviet military literature of the utility of very low yield weapons [deleted] for killing tank crews with neutrons rather than blast, much as an enhanced radiation weapon would. This understanding of the military utility of very low



yield weapons could have led the Soviets to develop [deleted] ER weapons [deleted].

As noted earlier, our detection systems cannot provide complete assurance that evasive tests cannot be carried out. Tests in the [deleted] range can be carried out underground and [deleted] tests can be carried out in deep space. Our monitoring systems can, however, provide substantial deterrence by making evasive testing more risky and more expensive.

#### INERTIAL CONFINEMENT FUSION

*Question.* The fiscal year 1980 Arms Control Impact Statement on ICF states: ICF research will not provide a viable source of energy or fissile material for civil purposes in this century—indeed, it may never do so—but the possibility of such a long-term payoff is sufficient inducement to many countries to proceed with this research.

If this potential payoff exists for other countries, doesn't it exist for us as well? Can we afford to forego the tremendous potential benefits of ICF in civilian applications?

*Answer.* The Arms Control Impact Statement (ACIS) is an analysis performed by the Arms Control and Disarmament Agency. The ACIS is not a statement of U.S. Government policy on ICF. DOE now has under consideration, by a panel of experts, in the question of ICF and proliferation. As often happens, this particular analysis has preceded in-depth study. It is our view that the potential of ICF is great, but the costs will be high and the attainment of the goal of feasibility demonstration is still uncertain. In that sense it is unlikely that the ICF research efforts in a large number of countries will materially affect the timing or certainty of feasibility demonstration. [Deleted.]

*Question.* Although the Department of Energy states that ICF will not be a viable energy source for civil purposes for at least forty years, are you prepared to assure this Committee that that timetable could not be expedited given aggressive government support?

*Answer.* We are not in a position at this time to state that an aggressive government program even of the "crash program" kind would significantly advance the time when fusion energy could be commercialized. Before turning on a generation of scientists and technicians to discover and solve the problems of fusion engineering, it would be prudent to demonstrate conclusively that controlled fusion is feasible. Greater support in the near term could, in our view, ensure that we could determine in the next decade whether or not inertial fusion is feasible. Conversely, we can give no assurance that the timetable cannot be expedited given aggressive government support, in part because the timetable itself is intuitive.

*Question.* Isn't it true that an R&D program for civil application of ICF would have a significantly different orientation than a military applications program (e.g., towards commercialization, transportability in different modes, etc.), and hence that a program that relies on civilian spin-off from weapons-related research will inevitably take longer to achieve a pay-off?

*Answer.* Fusion research, both magnetic and inertial confinement was originally a "spin-off" from the nuclear weapons program. However, at this point in the inertial confinement fusion research and development program, I do not characterize the potential civilian applications as spin-off from military applications. Rather, inertial confinement fusion technology is one with potential applications to both weapons technology and civilian energy production. The present near-term goal of the program is to demonstrate scientific break-even—the point at which the energy released by the fusion reaction is equal to driver input energy. Demonstration of scientific feasibility is equally important to both potential military and civilian applications. Thus, the thrust of the program over the next several years is to develop the common technology base necessary for both applications. ICF contributions to military applications will come sooner than any significant impact on energy technology because of differing requirements in the two areas. There are contributions in the weapons area already. The weapons requirement is for easily diagnosed, reproducible experiments. For civilian energy applications there are the additional requirements for rapid pulsing, and of course, the engineering development effort that would be required for a power plant.

*Question.* Even if the commercialization of ICF technology is years away, doesn't it make sense to identify and begin working to overcome the commercialization hurdles now?



Answer.—As indicated above, the near-term goal of the ICF program is to demonstrate feasibility. However, it is appropriate to begin examining future commercialization requirements. To address this issue the FY 1980 budget includes \$5,100,000 specifically for systems studies and technology development efforts to evaluate energy system performance, define required engineering development, and establish a technology base within industry for commercial applications. The FY 1980 funding in this category will allow the following:

(1) Completion of preliminary conceptual design studies of a fusion power plant using a lithium fall reactor cavity.

(2) Completion of an economic data base for fusion fission hybrids and synthetic fuel production plants.

(3) Continuation of particle beam electric power plant conceptual designs and associated economic analyses.

(4) Completion of the systems studies begun in FY 1979 by industrial contractors given access to classified inertial confinement fusion data.

(5) Initiation of scoping studies for the earliest inertial confinement fusion engineering development test facilities.

(6) Beginning initial activities to develop inertial confinement fusion technology capability within industry in the areas of:

High average power drivers.

Pulsed power.

Pellet production.

Pellet tracking and targeting.

Liquid lithium materials compatibility.

*Question.* Could you describe to us the evaluation DOE currently has underway of the appropriate role of ICF in our overall fusion research program? Will we have that information available to us before we act on this year's authorization bill?

Answer. You may recall that last year a committee under Dr. Foster reviewed DOE's fusion programs, both magnetic and inertial confinement. The results of that study led to the development of an overall strategy for DOE's fusion efforts. The ICF program is being conducted in accordance with the DOE's fusion strategy. The follow-on experts panel was to examine the specific ICF program balance between near-term experimental, and longer term fusion engineering efforts.

I expect that the panel of experts now being chaired by Dr. John S. Foster will make its report to the DOE Fusion Committee by May 15. We expect the panel to make recommendations on the appropriate program balance between near-term experimental and longer term fusion engineering efforts; on its evaluation of the alternative driver and target systems, as they are now understood, that could be pursued as the mainline program activity leading to an Experimental Test Facility operating in the 1990's; and on the level of resources that are likely to be required to meet the program goals as set out in the DOE fusion policy. We expect that the results of the review and DOE's consideration of it will be complete before the end of the third quarter of FY 1979.

*Question.* If not now, at what point in the future would you foresee developing a distinct civilian application program, separate from weapons-related research?

Answer. As soon as we can determine with confidence target and driver requirements for ICF and whether civilian applications are distinct from those for weapons applications, it will probably be expedient to separate the two programs. We cannot now do that, nor does it appear likely that we will be able to do so before the early to mid-1980's.

We cannot now foresee a time when an ICF program will be separate from weapons-related research. It is likely that following feasibility determination only a very small part of a program directed toward civilian applications would continue to be concerned with fusion theory and target design problems of a fundamental nature. However, this latter effort will continue to be weapons-related unless our present perception [deleted] of ICF were to change radically. [Deleted.] Conceivably some of the sensitivity surrounding these relationships could decline over the next decade or two, and in any case the spinoffs back into the weapons program are not likely to require common engineering solutions with the commercial applications.

*Question.* What portion, if any, of the ICF program do you plan to declassify? [Deleted.]

Answer. DOE has no plans to this time to declassify any information relating to ICF that is now classified. [Deleted] this question is under continuous review.



QUESTIONS SUBMITTED BY SENATOR CARL LEVIN, ANSWERS SUPPLIED BY  
DUANE SEWELL

*Question.* What are the defense "spin-offs" of nondefense work at the nuclear weapons laboratories? If there are such spin-offs, is it accurate to state that the workload at Los Alamos Scientific Laboratory is 50 percent nondefense and that at Sandia is 25 percent nondefense? Would these "nondefense" workload statistics be lower if one considered and factored in defense spin-offs of such activity?

*Answer.* The major "spin-off" to defense programs from nondefense work at the nuclear laboratories is the attraction of high quality people to the laboratories who might not otherwise come to work there if only defense programs work were being done. Once there, many of these people, having been exposed to the defense program personnel and the challenges presented by the program, shift over to defense work. However, it is accurate to say that 50 percent of the work at Los Alamos and 25 percent of the work at Sandia is nonweapons. Nearly all of the scientific and engineering "spin-offs" are from defense programs, and the non-defense workload would not be affected by the contributions proceeding in the other direction.

*Question.* Mr. Sewell, it generally is considered that this nation is significantly ahead of the USSR in nuclear weapons technology. Do you agree with this assessment? In which areas of nuclear weapons technology do we maintain the advantage? In which areas do the Soviets have the advantage? In both cases, why?

*Answer.* In judging nuclear weapon capability, the entire nuclear weapon system must be considered. For example, given the size of Soviet strategic missiles, the number of large warheads they carry, and their accuracies, statements that U.S. nuclear weapons are superior are unconvincing.

If one focuses only on certain approaches to nuclear warhead design that the U.S. has adopted, largely because of decisions on the characteristics of the Minuteman missile, then U.S. weapons seem better because they generally have, we believe, [deleted]. However, it is not clear that they are better suited to their missions than are Soviet warheads to theirs.

It is also possible that the Soviets use some very clever techniques in their warheads that we do not even suspect [Deleted.]

The USSR probably does not design their weapons the same way as the U.S. Our designs are highly optimized to fit space constraints on the reentry vehicles. Soviet reentry bodies are much larger than U.S. RV's, so that their designs are not limited to the same extent as are U.S. designs. [Deleted.]

Estimates of Soviet weapons design capabilities are limited because the data base necessary for accurate assessments was eliminated with the implementation of the Limited Test Ban Treaty in 1963. Only the numbers and approximate yields of Soviet underground tests have been available since then.

[Deleted.]

*Question.* How far behind the U.S. is Soviet nuclear weapons technology? How long is it expected to take them to catch up with the U.S.?

*Answer.* We have learned over the years that it is a mistake to think of the Soviets as always lagging a few years behind us. In their civilian economy, they may, but they have put immense resources into their military research and development, often surprising us with the results. Their efforts in nuclear weapon development seem to be [deleted] they have probably developed some technologies that we have not. We cannot know what these are, because we have had very little insight into their nuclear weapon designs since 1963. Even then, much of what we thought we knew was from inference.

*Question.* How does our stockpile reliability compare with what we know about Soviet stockpile reliability? What problems do we know the Soviets have experience with their stockpile since they began building nuclear weapons?

*Answer.* We know that the reliability of our stockpile is high when we can test to confirm changes or to replace faulty weapons. We know that we had some problems during the 1958-1961 moratorium on testing. We do not know the Soviet experience under either of these circumstances, and we can predict neither their experience nor our own under a CTB. We judge, though, that our approach to nuclear weapon design is more likely to lead to problems in the absence of testing, because we have fine tuned our designs to the maximum using state-of-the-art practices, an approach that Soviet designers need not have taken, given their larger missiles.



*Questions.* Why are the Soviets willing to agree to a Comprehensive Test Ban (CTB)? Have they completed all the testing they need [deleted] for new nuclear weapons we expect them to be developing?

Have they completed all the testing they would need for new weapons if the CTB is extended indefinitely [deleted].

*Answers.* We have little detailed information on the Soviet nuclear weapons program. Hence, we cannot say whether the Soviets have completed all the testing they will need for weapons being developed [deleted]. In addition, the date of entry of the CTB into force is uncertain.

[Deleted.]

[Deleted.] We have no reason to doubt that the Soviet test program is designed to provide reliable weapons for strategic missile systems as well as those tactical systems with a nuclear capability and that the Soviets will not agree to a CTBT until they feel they have conducted the required tests.

[Deleted.]

*Question.* On page 20 of your statement, Dr. Sewell, you say your office is responsible for assessing foreign nuclear weapons capabilities, technologies and design philosophies. One focus you mention is foreign nuclear weapons requirements both from current and projected design technologies. Please describe Soviet nuclear weapons design philosophies, compare/contrast them with those of the U.S., and project future directions, scope and composition of Soviet nuclear weapons design efforts. Please explain why you believe the Soviets will move in these directions.

*Answer.* We have such slender information on the Soviet nuclear weapon program that any comparison must be very sketchy and limited in its usefulness, particularly when applied to anticipating future Soviet decisions. [Deleted.] By comparison, our warheads incorporate state-of-the-art technology and are designed so specifically for their weapon systems that [deleted] a change in RV characteristics can influence the nuclear performance of the warhead. [Deleted.]

[Deleted] because the large throw weight of Soviet missiles allows very large RVs, which give Soviet nuclear-weapon designers considerable latitude within which to work.

[Deleted.]

Compared to the years before 1963, when the Limited Test Ban Treaty was signed, we get very little information on Soviet nuclear weapon tests. In most cases, we learn only yields, and we can only infer the weapon systems for which the devices tested are intended.

One point we have learned regarding Soviet military equipment in general: [Deleted.]

*Question.* Are the Soviets more confident in their nuclear weapons stockpile reliability and in the design of their nuclear weapons, than we are? Should they be this confident, based on your knowledge of their programs, design, etc?

*Answer.* While we do not know what confidence the Soviet leadership has in its nuclear weapons, it would be prudent to assume that Soviet nuclear weapons are designed to be reliable. The latitude for design conferred by large RVs certainly allows them to design and build reliable and durable warheads. It may also allow them to adopt existing warheads to future systems or to replace troublesome warheads, if such should occur.

*Question.* What are DOE's major activities to assist other nuclear nations in protecting their nuclear materials and facilities?

*Answer.* DOE is cooperating directly with other nations in helping them to protect their nuclear materials and facilities from attacks by sub-national groups including saboteurs and terrorists. In the period from November 1975 through February 1978, bilateral discussions have been held with 22 groups of visitors to the United States. In the period from December 1974 through 1978 physical security review teams have visited nuclear installations in 40 countries for the purpose of assessing the effectiveness of their physical protection measures and advising the countries on how weaknesses might be eliminated. DOE has established emergency communications links with the United Kingdom and France. DOE is also cooperating with the United Kingdom and France in their establishment of nuclear emergency search capabilities and cooperating bilaterally with the Federal Republic of Germany in research and development studies related to the physical protection of nuclear materials. In accordance with Section 202 of the NNPA of 1978, DOE, in consultation with the Nuclear Regulatory



Commission and in cooperation with the IAEA, offers training in the physical protection, material control and accountability of SNM to individuals from other countries with responsibilities in this area. This training program includes the most advanced safeguards and physical security techniques and technology consistent with the National Security interests of the United States.

*Question.* Please provide for the record a breakdown and chart of DOE activities referred to above to support U.S. non-proliferation goals. Also provide this information regarding DOE activities to participate in U.S. efforts to identify and provide non-proliferatory nuclear fuel cycles and to support IAEA safeguard objectives.

*Answer.* The Office of Safeguards and Security coordinates all safeguards input to the International Nuclear Fuel Cycle Evaluation (INFCE) and the U.S. Nonproliferation Alternative Systems Assessment Program (NASAP) through a coordinating group with members from DOE, ACDA, State, and NRC. OSS chairs this group and provides an effort equivalent to seven full time OSS staff and contractor professional personnel to prepare the U.S. safeguards positions and papers on facilities such as enrichment plants, spent fuel and waste storage and alternate fuel cycles. All foreign papers (about 200) contributed to INFCE are reviewed for accuracy and completeness of the safeguards content, keeping in mind the U.S. policy and goals. DOE safeguards material is provided to the U.S. representatives to INFCE.

#### 1. SAFEGUARDS FOR ENRICHMENT PLANTS

We are developing conceptual designs and testing measurement, containment and surveillance instrumentation at DOE facilities, and using results to assist the IAEA in approaches to international safeguards.

#### 2. SPENT FUEL STORAGE/TRANSPORTATION SAFEGUARDS

To satisfy international non-proliferation goals, and the proposed DOE away-from-reactor spent fuel storage facility, we are developing and testing advanced safeguards systems that provide timely detection of national diversion attempts and verification of stored spent fuel status, and that deter and prevent dangerous actions and diversion attempts by terrorist groups.

#### 3. SAFEGUARDS SYSTEMS FOR CRITICAL FACILITIES

We are developing and evaluating in an operational environment, safeguards subsystem elements for U.S. facilities that will not disrupt operations, and coordinating a possible demonstration to the IAEA at the ZPPR.

#### 4. SAFEGUARDS SYSTEM CONCEPT DESIGN AND DEVELOPMENT FOR NUCLEAR FUEL CYCLE ALTERNATIVES

We are developing physical protection, containment and surveillance system concepts which can be integrated with materials measurement and accounting so that selection of a fuel cycle will not be restricted due to lack of safeguards technology.

#### 5. INTERNATIONAL TRAINING

Courses meet the intent of the Nuclear Non-Proliferation Act of 1978 (Section 202). OSS carries out this task with the aid of contractors providing safeguards curricula, syllabi and related educational materials. In July 1979 a course will be presented on a national system for the accounting and control of nuclear material, with special reference to bulk fuel facilities. This course is being given in response to an IAEA request for training of personnel from member states and is funded by the Department of State. OSS-funded training includes programs tailored for managers and policy decision-makers from foreign countries. A course will be offered in the first quarter of FY 1980 in cooperation with NRC, State, ACDA and IAEA on "International Training in Materials Control and Accounting" for domestic and international safeguards. The "International Training Course on Physical Protection of Nuclear Facilities and Materials" will be repeated. Courses on non-destructive assay for nuclear materials measurement and accounting systems for domestic and international safeguards are currently underway at Los Alamos Scientific Laboratory.



## 6. CONSULTING ON IAEA SAFEGUARDS

OSS provides funding and management for participation by DOE staff and contractors in the IAEA Standing Advisory Group on Safeguards Implementation and other IAEA ad hoc consultant and advisory group meetings.

In addition to OSS-funded and directed safeguards work, OSS also manages the following support programs funded by the Department of State to insure the effectiveness of IAEA safeguards.

## 7. U.S. PROGRAM OF TECHNICAL ASSISTANCE TO IAEA SAFEGUARDS (POTAS)

In response to IAEA requests for safeguards assistance, DOE implemented POTAS and established an International Safeguards Project Office (ISPO) at Brookhaven National Laboratory. Forms of assistance include cost-free experts as well as equipment, training and technical studies. Functional areas of IAEA activity which benefit from this assistance include nuclear material measurement, containment surveillance, accounting, auditing, information processing, operational planning, and assessment and reporting of IAEA safeguards operations.

## 8. TOKAI ADVANCED SAFEGUARDS TECHNOLOGY EXERCISE (TASTEX)

The U.S. and Japan initiated and France and the IAEA joined in a program to develop and test specific advanced safeguards techniques for spent fuel reprocessing plants. U.S. funding is by the Department of State, and management is by DOE and ISPO. This U.S.-funded portion of the effort, called TASTEX, provides for studies of advanced techniques as well as U.S. development of advanced safeguards equipment to be tested at Japan's Tokai Mura reprocessing facility.

*Question.* Your statement refers to your programs in fiscal year 1980 to understand the character and intentions of possible adversaries. Some \$600,000 has been allocated to place particular emphasis on gaining a more complete characterization of possible "insider adversaries (e.g., an employee or employees, with authorized access attempting to divert SNM for some unauthorized purpose or to sabotage a facility), completing effectiveness studies of security clearances in this regard, and identifying design features which may deter possible adversaries".

What "insider" threats are you referring to, and what insider threats have you had in the past at government and non-government facilities?

*Answer.* Our threat research program includes the development and application of appropriate behavioral analysis techniques for assessing the credibility of nuclear extortion threats; the study of the full spectrum of potential adversaries to U.S. nuclear programs from both outside the system (e.g., terrorists) and inside the system (e.g., cleared employees) to determine their possible motivations, resources, knowledge, intent and other characteristics. We will also examine the historical performance of our clearance system and determine whether additional measures may be desirable and effectively applied with respect to the threat from inside the system.

"Insider" threats refer to potential malevolent acts by people who are authorized access and include those with responsibilities for operations, safeguards, security and up through plant management. To date no serious threats have materialized although there have been low level thefts and sabotage. The recent incident involving theft of low enriched uranium from an NRC licensed plant in Wilmington, N.C., could be regarded as an example. In this case, however, the individual was a former, not an active, employee.

*Question.* What problems have there been in the past regarding security clearance procedures and "design features" for deterring adversaries?

*Answer.* The security clearance criteria are currently being applied in two different aspects: (1) to determine an individual's eligibility for access to classified information; and (2) to determine an individual's eligibility for access to significant quantities of special nuclear material. As the personnel security program criteria apply to determining an individual's eligibility for access to classified information, there have been no problems—and the criteria generally follow those used by other Government agencies in making the same or similar determinations. Similar criteria are also used throughout the Executive Branch for determining an individual's suitability for Government employment.



While there have been no problems in applying these criteria for determining an individual's eligibility for access to significant quantities of special nuclear material, one of the outcomes of the studies referred to in the Answer to Question No. 49 will be to determine if these criteria should be modified or changed—or additional criteria (or techniques) developed to address the specific motivations/characteristics of individuals who comprise the insider threat.

"Design features" to maximize deterrence have received little attention to date. Deterring an adversary from even attempting an act is the best possible outcome, but we can never be sure if we're succeeding since nothing happens if our attempts at deterrence are successful. We don't know how many, if any, acts we've deterred to date. Certain areas show promise for providing significant additional deterrence for little or no cost. Those are what we will investigate. [Deleted.]

**Question.** In the \$1.8 million "concept development" part of your safeguards/security program, you will study, among other areas, "deficiencies in existing sub-systems". What deficiencies are these, and for how long have they existed? What are their significance for the safeguarding and security of our facilities and of our special nuclear materials?

**Answer.** Safeguard system deficiencies identified at existing facilities include perimeter alarm systems, entry control systems, and measurement technology. Perimeter alarm systems suffer from high false alarm rates and the requirement to utilize multiple sensors in various combinations in order to achieve a high safeguards system effectiveness. Also, no single sensor system exists that provides high reliability and low false alarm rates, and low maintenance for the full range of site specific applications and varying climatic conditions. Fiscal Year 1980 activities will be directed at developing and testing new and/or modified sensor systems that offer improved operating characteristics, and implementing these systems at operating facilities.

In the area of entry controls, improvement is needed in contraband detection and personnel identification techniques. Metal detectors utilized to detect weapons being brought into a facility exhibit high false alarm rates [deleted]. Also, many manual entry control systems (guard intensive) currently in use at existing facilities do not provide for rapid identification of personnel that use the normal access routes without extensive use of guards. In addition, it is difficult to detect the possible diversion from facilities of small quantities of shielded SNM with high reliability and confidence.

In Fiscal Year 1980, improved contraband detection capabilities will be developed, tested, and implemented at selected facilities. Explosive detection systems will be developed and tested utilizing olfactory, mass spectrograph, and plasma chromatograph techniques. These systems should be able to detect a more complete range of explosives, [deleted].

Finally, current measurement technology is not sufficiently accurate, fast, or available for the wide variety and large quantities of strategically important nuclear material forms and compositions encountered in the DOE facilities, and comparable processes in both domestic and international nuclear fuel cycle facilities.

Prototype technology that holds promise of accurate, timely and cost-effective operation will be demonstrated in Fiscal Year 1980 by installing the instrumentation in operating DOE facilities under rigorous and comprehensive test and evaluation programs. Where practical, modifications will be provided to adapt instrumentation for international safeguards use where a need for such a capability has been identified.

In addition, an automated entry control system incorporating a positive personnel identity verifier, an explosives detector, a metal detector, and an SNM detector in an unattended portal will be developed and evaluated to determine achievable performance characteristics in an operational environment for system design modeling purposes and possible application at DOE and commercial facilities.

The significance of the deficiencies listed above does not mean that safeguards systems at existing facilities are ineffective; however, it does mean that many of these systems are highly "people intensive" and are not, in many cases, optimized for cost of safeguards effectiveness. This situation has existed for a number of years and will be remedied through the continued testing, evaluation, and modification of commercially available equipment, development of improved technology, design, development and testing of advanced safeguards systems, and the implementation of these systems at operating DOE facilities.



It should be mentioned, however, that the major purpose of the \$1.8 million for "concept development" is to develop conceptual safeguards system design approaches for generic types of nuclear facilities and to identify new techniques and procedures to evaluate the effectiveness of safeguards systems and possible system tradeoff alternatives. These conceptual safeguards system designs can then be utilized in the design of new facilities, thereby reducing the possible need for costly safeguards backfitting after a facility is constructed. The development of safeguards system effectiveness evaluation techniques provides a valuable tool in developing possible cost-effective safeguards system options for existing facilities.

*Question.* Some \$13.6 million of your request is for "safeguards technology development to produce and test prototype systems. This is a \$1 million increase from FY '79 and your statement indicates there is increased emphasis on development and test of advanced instruments to better measure special nuclear materials. You discuss developing more advanced, reliable contraband detectors, etc.

Why is there increased emphasis in these areas since last year? Is this increased emphasis in response to new problems, or have older problems become more urgent?

*Answer.* The increased emphasis in these areas since last year is in response to both older, more urgent problems at DOE facilities and increased emphasis on proliferation-resistant nuclear fuel cycle alternatives. Major emphasis is being placed on developing safeguards technology to meet performance specifications resulting from vulnerability and conceptual design studies for DOE production facilities, uranium enrichment plants, spent fuel, critical facilities, and automated materials measurement and accounting systems for alternative fuel cycles. For example, prototype instrumentation will be designed and tested for detection of contraband (including explosive); in-line Pu measurement to establish material balances around liquid processing operations and material held up in process equipment at DOE facilities; to monitor production activities at enrichment plants while protecting sensitive and classified enrichment technology; spent fuel assay for long-term storage; and to measure coprocessed U/Pu and U/Th.

*Question.* Has the amount of contraband special nuclear material increased during the past year? Five (5) years? Are detectors for this material unreliable now? What problems now exist for measuring special nuclear materials?

*Answer.* The Department of Energy is not aware of any contraband special nuclear materials incidents other than the well-publicized incident of January 30, 1979, at the Wilmington, North Carolina, General Electric facility. Detectors used by the Nuclear Emergency Search Team (NEST) are considered to be reliable now for detecting special nuclear materials that may be lost or stolen.

Regarding measurement of special nuclear materials in DOE facilities and in both domestic and international nuclear fuel cycle facilities, current measurement technology is being improved to provide accurate and fast techniques for the wide variety and large quantities of the different nuclear material forms and compositions encountered. Needs for measurement capability are identified through the DOE and NRC assessment programs, Diversion Path Analysis, and the OSS program for integrated safeguards conceptual designs.

In Fiscal Year 1980, prototype technology that holds promise of accurate, timely and cost-effective operation will be demonstrated by installing instrumentation in operating DOE facilities under rigorous and comprehensive test and evaluation programs. Where practical, modifications will be provided to adapt instrumentation for international safeguards use.

*Question.* How much special nuclear material is lost or unaccounted for annually in government and non-government facilities in the United States and in foreign nations where U.S. technology and special nuclear materials have been sent? Why have these losses occurred, and from where? Have most of the losses been from government or DOE-contractor facilities? Why?

*Answer.* Inventory Differences (ID) for government facilities from startup through March 31, 1978, are contained within "Report on Strategic Special Nuclear Material Inventory Differences, ERDA 77-68" and in subsequent Semi-Annual Reports DOE DP-0001-1, 0001-2, and 001-3, copies attached. ID's for non-government facilities in the U.S. during the period 1954 through 1967 are included in publication ERDA 77-68, pages 226 through 229. For periods after 1967, Inventory Differences for these facilities are published by the Nuclear Regulatory Commission. Inventory Difference records for special nuclear material supplied to foreign nations for peaceful purposes by the U.S. are maintained by the IAEA pursuant to tri-lateral agreements between the U.S./IAEA and the host country.



Inventory differences are the differences between the quantity of materials held in inventory according to the accounting records and the quantity measured by physical inventory. These differences are generally due to errors in estimating material in unmeasurable form at the time of an inventory, unmeasurable holdup in equipment, measurement imprecisions, inaccuracies in initial determinations of special nuclear material produced or used in nuclear reactors, and inventory or bookkeeping errors. However, since it is possible that even a small ID may be caused by theft of nuclear material, both DOE and contractors operating DOE facilities carefully maintain, analyze, and investigate ID data. Differences between book and physical inventory values are expected in nuclear material processing and are not in and of themselves, evidence of lost or stolen material.

Inventory Differences information on U.S. material supplied to foreign countries is not being maintained by the U.S. This type of information is maintained by the IAEA pursuant to safeguards agreements of the U.S., IAEA, the recipient countries, and EURATOM.

With respect to the last question regarding Government or DOE contractor facilities, all of DOE's nuclear material processing facilities in which Inventory Differences occur are contractor-operated. On the assumption, however, that the question applies to ID's in licensed (by NRC) and Government license-exempt facilities (DOE) contractor-operated), most of the ID's have occurred in the latter license-exempt facilities due to the much higher quantities of material processed and much longer history of operation.

*Question.* Please provide a chart of the losses of special nuclear materials from all government and non-government facilities with which DOE is concerned—since our government first began to monitor such materials. Please supply this information by location of loss, by year, type of material, suspected cause of loss, and where any of the material ever was recovered.

*Answer.* A tabulation of Inventory Differences (ID) for Special Nuclear Material (SNM) by location, year, and type of material, together with an explanation of the ID's, are contained within the "Report on Strategic Special Nuclear Material Inventory Differences, ERDA 77-68", and subsequent Semi-Annual Reports DOE DP-0001-1, 0001-2, and 001-3. These four reports are attached. Inventory Difference data from the Oak Ridge Y-12 and Rocky Flats weapons facilities is not included since it is classified Secret/Restricted Data. For periods after 1967, Inventory Differences for non-government facilities are published by the Nuclear Regulatory Commission.

A number of incidents have occurred involving extremely small quantities of SNM in which no evidence of theft or willful diversion was found. In most cases, accountability records or procedures were found at fault, and the material was later determined not to have been missing at all. In some cases material has been determined to have been mistakenly buried as scrap or waste.

In addition, there have been ten recorded instances of the theft or suspected theft of small quantities of nuclear-material from U.S. government facilities or contractor activities over the history of the AEC, ERDA and DOE nuclear weapons and materials production programs. Each of these incidents were reported to the FBI for investigative purposes in accordance with Section 221 of the Atomic Energy Act of 1954, as amended. (A listing of these incidents is enclosed.) (Tab A)

Additionally, there have been a number of incidents wherein nuclear sources and/or quantities of special nuclear materials have been reported to be missing in the private (non-government) sector and wherein theft was alleged but not proven. These incidents have been catalogued in Section III of a Nuclear Regulatory Commission draft document entitled "Safeguards Summary Event List", dated December 31, 1978, a copy of which is enclosed for your information. (Tab B)

In a single incident of record wherein nuclear material was known to have been stolen and used as the basis for an extortion threat, an individual employed as a subcontractor at a commercial nuclear facility (General Electric Company) in Wilmington, North Carolina, stole 66 Kilograms of low enriched uranium in January 1979 and threatened to use it to contaminate a municipality unless a sizable amount of money were paid by General Electric for the return of the material. The FBI investigated the matter, the perpetrator was apprehended, and with DOE and NRC assistance the nuclear materials were recovered.



ACTUAL AND SUSPECTED THEFTS OF SNM<sup>1</sup>

| Date and place of occurrence                             | SNM involved, amount and identity                                                                             | Circumstances of loss or theft                                                                                                                                                                                                                                         | Reported to                                                    |                                           | Disposition of case                                                                                                                                                       |
|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                          |                                                                                                               |                                                                                                                                                                                                                                                                        | AEC/ERDA                                                       | FBI                                       |                                                                                                                                                                           |
| May 9, 1975, Argonne National Lab.                       | 0.50996 gm Pu-239 of high purity-calibrations standard.                                                       | Discovered missing by custodian. Investigation conducted by CH and FBI.                                                                                                                                                                                                | ERDA-HQS, May 11, 1975                                         | Local FBI office, May 11, 1975.           | CH and FBI investigated. Standard concluded to have been stolen; no suspects identified.                                                                                  |
| Nov. 5, 1974, Kerr McGee                                 | 0.0003 gm plutonium (Pu-239).                                                                                 | Plutonium detected on Karen Silkwood's (employee) skin. Subsequent investigation by AEC and NRC.                                                                                                                                                                       | AEC-HQS, Nov. 6, 1974                                          | Nov. 6, 1974 (local FBI office).          | NRC investigation resulted in no positive conclusions. FBI investigation of circumstances of case also resulted in no positive conclusions as to plutonium theft.         |
| Sept. 26, 1969, in transit                               | 2 calibration sets each containing 818.1 micrograms of Pu-239.                                                | Discovered missing from shipment between Naval Rad. Defense Lab. and Atomchem (a licensee).                                                                                                                                                                            | AEC region I compliance office Sept. 26, 1969.                 | FBI local office Oct. 1, 1969.            | FBI and RCMP conducted inquiries. Materials believed stolen from shipment at J. F. Kennedy Airport. No suspects identified. Material not recovered.                       |
| Aug. 5, 1950, Los Alamos Scientific Lab.                 | 1,032 gm plutonium disc.                                                                                      | Former military employee of LASL reported to have plutonium disc in his possession, and including four pieces of normal uranium.                                                                                                                                       | AEC, Aug. 15, 1950                                             | Aug. 15, 1950                             | FBI investigated; interviewed former employee who turned SNM over to FBI. Prosecuted and imprisoned.                                                                      |
| November 1951, Hanford complex.                          | Classified unirradiated normal uranium                                                                        | Former employee of the Hanford complex stole a normal uranium slug for a souvenir.                                                                                                                                                                                     | November 1951 AEC was advised.                                 | November 1951 FBI was advised.            | FBI investigated; recovered uranium slug; former employee was convicted and fined \$100.                                                                                  |
| Aug. 4, 1976, Oak Ridge associated Universities, Museum. | 3 radio-active sources, including one 1/2-inch cube of uranium-238 and microcurie quantities of strontium-90. | Sources were stolen from Atomic Museum.                                                                                                                                                                                                                                | Aug. 3, 1976, to ERDA local office.                            | Aug. 4, 1976, local FBI                   | FBI investigated and determined that emotionally disturbed youth had stolen the museum sources. Material was recovered; youth was referred to local juvenile authorities. |
| July 11, 1969, in transit                                | 0.23 gm. of Pu-238 in sealed Pu-BE neutron source.                                                            | Vehicle containing source was hijacked in transit. No indication theft of vehicle was related to presence of a Pu-238 source. Shipment made from Monsanto Research, Ohio to Schlumberger Wells Service, Texas.                                                         | July 11, 1969, AEC-HQS.                                        | July 11 1969, local Ohio Office, FBI.     | FBI investigated hijacking; vehicle recovered with Pu-238 source intact.                                                                                                  |
| Feb. 16, 1971, NUMEC, Apollo, Pa.                        | 35 lb depleted uranium, metal and scrap.                                                                      | NUMEC employee removed box of scrap materials from plant to his home. Home of employee found to be contaminated.                                                                                                                                                       | Feb. 16, 1971, AEC Safeguards Office, district office.         | Feb. 16, 1971, local office (Pittsburgh). | Investigation by AEC and FBI. Justice Department declined prosecution. Materials returned to NUMEC.                                                                       |
| Sept. 11, 1970, Western Nuclear Corp., Jeffrey, Wyo.     | 2,400 lb of U.O <sub>2</sub> , 98 percent pure, (Yellowcake).                                                 | 2 55-gal drums stolen from plant (AEC licensee).                                                                                                                                                                                                                       | Sept 11, 1970, AEC Grand Junction Office and region IV office. | Sept 11, 1970, local office (Denver).     | FBI investigated; arrested 3 individuals, who were convicted and confined to prison. Material was recovered.                                                              |
| July 2, 1969, MIT, Cambridge, Mass.                      | 20 gm of enriched uranium and 4 depleted uranium plates weighing 2.45 Kg.                                     | The material was found on the desk of an MIT professor subsequent to the questioning of a suspect by the MIT campus police. The material could have been accessed by gaining undetected entry during a time a painting operation was taking place in the storage area. | July 12, 1969 AEC                                              | July 7, 1969, local office (Boston).      | FBI investigated the missing material. The material was recovered. Insufficient evidence precluded prosecution.                                                           |

<sup>1</sup> Plutonium, H.E. uranium, significant cases of L.E. uranium.



*Question.* Have DOE contractors improved their monitoring/measurement procedures for special nuclear materials? How?

*Answer.* Yes, DOE contractors have improved their monitoring/measurement procedures for special nuclear material by selectively performing Diversion Path Analysis and the application of state-of-the-art instrumentation to strengthen detection capabilities. Through the utilization of electronic isotopic identification instruments linked to computers for data analysis, some formerly unmeasurable materials can now be measured and evaluated with repeatable accuracy in certain operations.

*Question.* On page 16 of your statement, Dr. Sewell, you say your office has been given responsibilities to protect nonnuclear energy resources, such as the "Electric Power Distribution System" and our "Strategic Petroleum Reserve".

Why was your office, as opposed to another part of the Department of Energy or the Federal Government, tasked with these responsibilities?

*Answer.* For two principal reasons—first, many mechanisms used to provide physical protection to assets of this type are identical to those used to provide physical protection to other assets for which we have traditionally been responsible and for which we have a substantial history of experience. Second, some of these non-nuclear assets are also essential to the preservation of the public health, safety and security and, consequently, are similar in that respect as well to other responsibilities which have traditionally been ours.

*Question.* Do these new responsibilities strain your financial and manpower resources to protect our nuclear energy resources, facilities, materials, etc? Will you perform these added tasks on a reimbursable basis for other parts of the Department of Energy?

*Answer.* We will insure in carrying out these new responsibilities that our financial and manpower resources necessary to protect nuclear energy resources remain adequate.

Within the Office of the Assistant Secretary for Defense Programs, the Office of Safeguards and Security began to provide technical assistance to nonnuclear programs in the Department of Energy in fiscal year 1978. This is an ongoing effort and will continue to evaluate security system needs, establish security guidelines and system concepts and provide technical support for Department of Energy non-nuclear facilities. The DOE Strategic Petroleum Reserve Office is currently being supported in this area, and assistance is planned for other DOE emergency facilities such as you mention (e.g., electric power distribution systems). Analyses are planned for all these non-nuclear energy resources to determine those having national security significance.

The principal task of our office with respect to these nonnuclear energy resources is to insure the provision of adequate technical support and advice. We will budget for the cost of this technical support and advice within our own program. Implementation of systems as a result of this advice and mutual understanding of what is necessary between ourselves and the responsible program offices will be the responsibility of those program offices as will budgeting for the associated operational and equipment costs.

*Question.* Your statement regarding the seismic monitoring stations which could be part of our onsite (in the USSR) monitoring resources for CTB raises the question of how you can propose specific dollar amounts of these facilities if, as Dr. Schlesinger testified earlier, the details of what these stations are to contain in the way of equipment, etc., has yet to be agreed to by the Soviets?

*Answer.* It has been possible to describe a program involving seismic stations for use in DOE seismic research which would have technical characteristics identical to the stations proposed for use in verifying the CTB. The U.S. Delegation has tabled technical characteristics which must be achieved if we are to obtain reliable and authenticated regional seismic data from within the Soviet Union. It is correct, as indicated in Dr. Schlesinger's testimony, that certain details of the stations are subject to negotiation. However, there are basic technical characteristics specified in the proposed CTB Separate Verification Agreement which allow us to design, develop, and test a seismic station which will have application in a DOE seismic research program as well as the CTB verification. We wish to make it clear that the money and effort expended to design, test, and produce these stations would not be wasted if a CTB was not achieved. In addition to a DOE seismic research program, it will be possible to utilize these stations in many other types of seismic research, such as earthquake monitoring and prediction.



*Question.* If the timing of the CTB treaty is after SALT, why is this part of your request not premature? How do you know what types of sophisticated equipment you will need for this CTB verification task before the Soviets agree to what these stations may contain?

*Answer.* The timing of the request for seismic station equipment is not premature, because the U.S. Government is taking a position in negotiating a Comprehensive Test Ban which requires that there be seismic stations in the Soviet Union which are designed to provide regional seismic data which is not otherwise available from existing teleseismic stations. This U.S. requirement also involves the incorporation of authentication equipment, the application of which is unique for the station which is being designed and developed. In order to have these stations available for deployment to the Soviet Union after ratification of the treaty and upon its entry-into-force, it is essential that we take the steps described in our program to design, develop, and test the stations. We cannot wait for completion of the SALT treaty to initiate the design, development, and test program. It is our current negotiating position to have [deleted] stations installed and operating in the Soviet Union in the first [deleted] of the CTBT. In response to your question, as to how we know what types of verification equipment we will need for this task, we have, as indicated above, designed seismic equipment which will acquire regional seismic data and transmit it in an authenticated form to U.S. data analysis centers. Certain minimum technical characteristics concerning the data, its transmission, authentication, and reliability have been established as a U.S. position in the Comprehensive Test Ban negotiations. There are minimum technical characteristics which must be achieved in order to assure the effectiveness of these stations. Our requirements are based on these minimum standards. If the Soviets refuse to accept our minimum technical characteristics, we will not achieve required CTB verification levels. However, it is our belief that the seismic stations currently under development and test may be used in many other valuable seismic applications related to our own National Technical Means of verification, in addition to earthquake monitoring and other types of seismic research.

*Question.* On page 21, Dr. Sewell, you discuss a "significant need to update existing (testing) equipment" for verification technology work. Why is there this "significant" need? Have we postponed needed modernization in the past? Are we not as capable in verification as some parts of our government contend because of this significant need?

*Answer.* There is a "significant" need to accomplish this updating in the case of seismic equipment because it will be possible, in the case of CTB, to gain unique benefits from the collection of regional seismic data, that is, data which is available from within shorter distances from an explosion compared to existing equipment which is used in teleseismic monitoring by National Technical Means. We have not postponed needed modernization of seismic equipment in the past. We are modifying seismometers which are used to collect data at teleseismic distances to facilitate the collection of data at the shorter regional distances. In addition, we must modify the data processing equipment to provide a means of authenticating the data as it is transmitted from the Soviet Union to assure that we have valid seismic data to verify a CTB. In response to the last portion of this question, the CTB case is unique in its requirements for seismic stations inside the Soviet Union. This additional or unique capability is being added to provide adequate verification of a CTB. It was not required in the past because national technical means alone were considered adequate to monitor other test ban treaties.

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QUESTIONS SUBMITTED BY SENATOR WILLIAM S. COHEN, ANSWERS SUPPLIED  
BY JAMES R. SCHLESINGER

#### NATIONAL SEISMIC STATIONS

*Question.* Under the Comprehensive Test Ban (CTB) Treaty being negotiated now by the U.S., Great Britain, and the Soviet Union, "National Seismic Stations" would be permitted on the territory of the signatories. [Deleted] Great Britain has not yet agreed on the number of stations. Final locations have not been agreed to.

If, when a Comprehensive Test Ban is concluded, each nation—the U.S., Great Britain, and the USSR—will have [deleted] "National Seismic Stations," [de-



leted] stations will be required. Will the U.S. be required to supply all [deleted] stations?

Under a CTB, who will produce National Seismic Stations, who will pay for them, who will own them, and who will control them?

Under the CTB being negotiated, is it anticipated that National Seismic Stations will include seismic arrays, or will they simply be single stations?

If we will need between [deleted] National Seismic Stations under a CTB, [deleted] Isn't it likely we will have a CTB Treaty in FY 1980?

If we signed a CTB in January 1980, how long would it take us [deleted].

Answer. The present DOE planning for National Seismic Stations (NSS) includes only a program to provide [deleted] operating stations in the Soviet Union. The U.S. and Great Britain stations are not included. It is anticipated that the Soviet Union and Great Britain will pay for the [deleted] stations for their country.

Under the present DOE plan, the U.S. will produce the stations for use in the Soviet Union. We expect the Soviet Union will produce and pay for the equipment for use in the U.S. The NSS are considered to be national resources of each host country, hence those in the Soviet Union would be under the operational control of the USSR. However, arrangements would be made as part of the separate Verification Agreement of the CTB and the Joint Consultative Committee (JCC) to insure that US monitoring needs are met.

For the [deleted] CTBT now being negotiated, the proposed NSS will be single stations. There are no plans for arrays during this period, however the U.S. has officially indicated to the USSR that in the event of [deleted].

The U.S. negotiating position is for [deleted] stations in the USSR. The 5 seismometer systems proposed in the Fiscal Year 1980 budget are for the regional seismic research program, are not complete stations, and are not directly related to the treaty position. They are, however, of similar design and could be pre-empted for deployment in the Soviet Union, should that become necessary. Additional equipment would have to be added to complete each station. The earliest we expect to deploy them would be [deleted].

We have prepared an accelerated schedule, not yet approved, which indicates that about [deleted] would be required from authorization to the first production unit. If the program were authorized in April 1979, we would expect the first production unit in [deleted].

A production schedule for [deleted] stations has not been prepared. The production line to be established should be able to reach a rate of [deleted] after a reasonable time. Thus, the worst case would be [deleted] stations, plus spares, and could be done [deleted] given necessary funding.

#### SCHLESINGER'S VERIFICATION CHART

*Question.* Secretary Schlesinger, you provided this committee with a chart showing the capabilities of present and possible seismic networks to attempt verification of a Comprehensive Test Ban Treaty. This chart is very useful, but is lacking in several regards:

(1) It does not distinguish the Identification Threshold for tests conducted in hard rock from those conducted in soft soils (alluvium) or in cavities such as salt domes. For example, the Schlesinger Chart gives an identification threshold for Improved AEDS as [deleted]. If I am not mistaken, that is in hard or intermediate rock. In alluvium, that threshold might be [deleted] and in cavities such as salt domes it might even be as high as [deleted].

(2) Schlesinger's chart shows several options using arrays and individual stations inside the Soviet Union. [Deleted]

(3) It would be useful if we could know how long it would take to develop and deploy [deleted] stations or arrays of these different seismic networks, including one with only [deleted] stations.

For the record, could you annotate the Chart provided to include a seismic network of [deleted] individual stations and then:

(a) Provide the same information for alluvium (soft) and also for tests in cavities such as salt domes; and

(b) Provide the cost and development and deployment for each type of system.

Answer. [Deleted].



| Following are average cost estimates for single stations: | Millions |
|-----------------------------------------------------------|----------|
| R.D.T. & E. plus production preparation-----              | \$11.0   |
| Fabrication per station-----                              | 2.0      |
| Deployment per station-----                               | 1.2      |

| The following are first order average cost estimates for arrays: | Millions |
|------------------------------------------------------------------|----------|
| R.D.T. & E. plus production preparation-----                     | \$15.0   |
| Fabrication per array-----                                       | 8.0      |
| Deployment per array-----                                        | 3.5      |

Note. Arrays are no longer being negotiated and are not being developed at this time, hence, the cost estimates are less accurate than those for single stations.

[Deleted.]

#### ONSITE INSPECTION

*Question.* Would onsite inspection of the sort being considered in the Comprehensive Test Ban negotiations completely resolve the difficulties associated with verification of such an agreement?

*Answer.* Onsite inspection cannot completely resolve the difficulties associated with verification of a CTBT. If we had reason to suspect a clandestine nuclear test from [deleted].

[Deleted.]

#### SAFEGUARDS

*Question.* What kind of safeguards would you like to see in conjunction with a CTB?

*Answer.* We are currently working with other agencies to develop a safeguards program and have recommended that it include measures in six areas to:

(a) Reduce the rate of decline in stockpile reliability by instituting among other things, a more extensive program to find and assess potential flaws in weapons and by preserving sources and methods to rebuild or replace any weapons found to be defective;

(b) Maintain modern nuclear weapon design laboratories to retain the best possible level of technical competence;

(c) Maintain modern nuclear weapon effects facilities and programs;

(d) Maintain the capability to resume testing on short notice and prepare a full-scale program for resumption of testing at the end of the treaty period;

(e) Maintain modern nuclear weapon production expertise and facilities essential to the continuing production of reliable weapons for the nuclear stockpile;

(f) Improve the capability to monitor treaty adherence in all environments.

#### CTB EXTENSION

*Question.* At the present time, the U.S., Great Britain, and the Soviet Union are negotiating a Comprehensive Test Ban Treaty [deleted].

To your knowledge, has an agreement been reached concerning the possible [deleted]. What is the U.S. position? What is the Soviet position?

Is it your understanding that the U.S. will [deleted].

Could you, at the present time, support a "zero yield" Comprehensive Test Ban Treaty [deleted].

What kind of testing would you expect to conduct at the end of a [deleted] comprehensive test ban? How much testing would you expect to conduct?

[Deleted.]

*Answer.* [Deleted.]

The probability of a problem arising in the nuclear stockpile that would require a test to correct during [deleted] period is low, but it cannot be ruled out entirely. Any problems that might arise would require competent and experienced nuclear weapon designers and engineers to recognize them, to evaluate them, and to devise remedies. In cases for which there were sufficient relevant data, the judgement of these experts might be that the design could be modified slightly without nuclear tests to confirm the fix, or that suitable materials and processes were available for rebuilding to original specifications. However, it is possible that a problem might arise for which it would be infeasible either to make a fix without testing or to rebuild. In such a case, our options would include: (a) invoking the treaty's supreme national interest provision to withdraw and resume



testing, (b) waiting until the treaty's scheduled expiration date to resume testing, and (c) replacing the affected warheads with those of a different but proven design, probably with some loss of military effectiveness.

[Deleted.]

#### CTB DURATION

*Question.* The U.S., Great Britain, and the USSR are presently negotiating a Comprehensive Test Ban Treaty (CTBT) expected to be [deleted].

Why is it that we are not now negotiating for a Comprehensive Test Ban Treaty [deleted]?

At the present time, do you think it would be wise to attempt to negotiate a "zero yield" test ban treaty [deleted]?

If a reduced threshold test ban treaty were negotiated with a test limit of 10 kilotons and a duration of five years, could you support it? What if the threshold were 5 kilotons? What if the threshold were one kiloton? At the present time, how long do you believe the U.S. could safely adhere to a 5 kiloton threshold test ban treaty?

Answer. It is our belief that, in the long run, without testing, we could not maintain the same confidence in our nuclear weapons stockpile that we have today as a result of test experience. Nor do we believe that we could rebuild the stockpile without designers and engineers who have had experimental proof of their design judgment. The effect of reduced confidence in U.S. nuclear weapons under a CTBT cannot be assessed in isolation from other political and military factors. An assessment of a decision to stop testing must be made in the broad context of national security, including SALT, our relations with our allies, and nonproliferation. [Deleted.] [Deleted.] Higher threshold test bans clearly would have less impact on U.S. nuclear weapons, but their political benefits would undoubtedly also be greatly reduced. [Deleted] in the long run, [deleted] confidence in higher yield systems will inevitably decrease.

I can best answer the question in this context. The minimum effective yield for recertifying a weapon if a design error has been found once it has entered the stockpile is [deleted]. The laboratories have told us that for most problems they could foresee in the future, or the kinds of problems that have existed in the past, that they could recertify the majority of stockpile systems we have today if testing at [deleted] were permitted.

However, testing at this yield or at any of the yields you have mentioned is not adequate if there are to be future improvements to the U.S. stockpile because tested warheads may or may not meet future requirements. This depends on how requirements evolve and, if the past is any guide to the future, this evolution is not wholly predictable. For example, an air-mobile ICBM could well require a quite different warhead from any now existing—possibly for safety reasons alone. Still further, stockpile vulnerability will change as a result of adversary actions and deployments, and such changes may force the development of new warheads. [Deleted.]

#### PERMITTED EXPERIMENTS IN A CTB

*Question.* It is assumed that there will be certain "permitted experiments" under the Comprehensive Test Ban Treaty now being negotiated. That is, the "Comprehensive" test ban will not be absolute.

How could one define "permitted experiments" in the text of a Comprehensive Test Ban Treaty?

What kind of "permitted experiments" would permit the United States to guarantee the reliability of its nuclear weapons stockpile without the resumption of weapons testing?

If a CTB required that "permitted experiments" be "laboratory" experiments, what types of experiments do you believe would be permitted?

How valuable would laboratory experiments be to maintaining the reliability of the stockpile? Could they do the job without full scale nuclear weapons testing?

Answer. [Deleted.]

Permitted experiments [deleted] reliability of the stockpile. [Deleted.] Of course, the longer the duration of a test ban, the less certain we would be about the maintenance of stockpile reliability. Other warhead problems [deleted] could develop which would require testing at higher yields.

[Deleted.]



Laboratory experiments, [deleted] would be of no direct value in maintaining the reliability of the U.S. stockpile [deleted]. They would be indirectly valuable to stockpile maintenance in that they would help somewhat in retaining for some period of time, technically competitive, experienced scientists and engineers upon who the assessment of stockpile problems depends. However, should stockpile problems develop which require testing to confirm the adequacy of the corrective action, laboratory experiments could not do the job. [Deleted.]

#### RELIABILITY AND TESTING

*Question.* How certain are you that you could detect problems in our nuclear weapons stockpile and make workable corrections in all cases without nuclear testing?

*Answer.* We are confident that we would retain the ability to assess weapon reliability throughout the duration of the currently envisioned Comprehensive Test Ban (CTB). Our assessment capability is built upon the input from the ongoing Quality Assurance/Reliability Testing program for nonnuclear components and the long-established data base from our nuclear testing experience. Even without nuclear testing, the rigorous quality assurance program would provide the ability to detect problems of weapon aging and, combined with data and judgments from prior nuclear testing, would permit confident assessments of weapon reliability. We would expect that this combination of past and updated data melded with the extensive nuclear testing experience of the skilled weapon designers will allow us to overcome difficulties revealed during the finite duration CTB. We cannot assure that any change in reliability during that period would be a predictable smooth and gradual decline; it might be very abrupt and possibly very serious. We would bring to bear upon such a problem; however, an arsenal of talent and a wealth of experience that to date has sustained very high reliability in our nuclear stockpile.

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#### QUESTIONS SUBMITTED BY SENATOR WILLIAM S. COHEN, ANSWERS SUPPLIED BY DUANE SEWELL

##### THEORETICAL PREDICTION OF THE BEHAVIOR OF NUCLEAR WEAPONS

*Question.* Theoretical nuclear physics has advanced greatly since 1954, when the 15 megaton "BRAVO" test produced twice the yield expected. Nevertheless, I understand that you still get unexpected results from tests.

Have your mathematical nuclear weapon design "codes" advanced to the point where you can dispense with nuclear weapons tests in designing or modifying nuclear weapons?

Have you had any surprise results from any recent nuclear weapons tests?

[Deleted.]

*Answer.* No, the mathematical nuclear weapon design codes have advanced but not to the point where we can dispense with nuclear weapon tests to confirm the design or modification of nuclear weapons. There are still a number of areas of nuclear explosive physics which rest to a substantial degree on empirical science. [Deleted.] The understanding of these and other related areas can only come about through a long-term multifaceted program which involves both theoretical work and experimental nuclear testing.

We do continue to experience testing results which do not agree with predictions. [Deleted.]

##### DEFINING NUCLEAR WEAPONS TESTING

*Question.* One of the problems associated with nuclear weapons test bans has been defining weapons-related testing. Many weapons-related technologies are also important to such efforts and developing new energy sources. At very low yields, isn't there a problem in defining what is a nuclear weapons test and what is not? For example, how would one define and detect laser fusion tests and other efforts at pure fusion reactions which are very small?

*Answer.* A combination of both yield and intent contribute toward what constitutes a nuclear weapons test and there is a problem in arriving at a universally acceptable definition. Yield alone will not, however, satisfactorily define what constitutes a nuclear weapons test. For example, the level of output from



a reactor can overlap with the level of output from a laser fusion experiment. Any of the fusion concepts which could eventually prove useful in civilian energy production also has potential value to nuclear weapons programs. Since energy would be released variously in the form of x-rays, fast neutrons, and charged particles, these techniques could be useful in studying nuclear effects. [Deleted.]

*Question.* Could you provide for the record a list of those ongoing nonweapons projects which involve nuclear experiments which either have weapons implications or involve experiments which could conceivably be restricted by a ban on nuclear weapons testing?

*Answer.* In general, there are no DOE nonweapons projects involving nuclear experiments which we believe would be restricted by a comprehensive test ban. In the past, however, we have conducted experiments to expand our knowledge of [deleted] seismic phenomena using nuclear explosive devices as energy sources. Under a comprehensive test ban, these type experiments would not be possible.

*Question.* What kind of testing would you expect to conduct at the end of a three year "zero yield" comprehensive test ban? How much testing would you expect to conduct?

*Answer.* The highest priority would be assigned to nuclear testing required to evaluate or resolve nuclear weapon stockpile problems identified during the period of test cessation. The next highest priority would be tests required for new non-stockpiled warhead designs which had not been previously tested to verify fabrication techniques and production material compatibility and to verify safety provisions such as one-point detonation. The final category of testing expected would be that related to expanding and verifying our understanding of basic physical laws and principles related to nuclear weapon design.

The extent of the resumed testing would be dependent on the number and nature of the problems or questionable problems identified by the stockpile surveillance program; the number and nature of new warhead designs necessary for national security; and the number of tests required to verify our understanding of basic principles critical to future weapon designs.

#### VERIFICATION TECHNOLOGY AND RESPONSIBILITIES

*Question.* The Department of Energy and the Defense Advanced Research Projects Agency (DARPA) both have test ban verification technology responsibilities. How do the responsibilities of the Department of Energy and the Defense Advanced Research Projects Agency (DARPA) differ with respect to the development of test ban verification technologies?

*Answer.* The DARPA is responsible for nuclear monitoring research. Seismic research is a significant part of their program. For several years, the DOE has jointly participated with DARPA in this program. According to a Memorandum of Understanding between the DOD and the DOE it has been agreed that together they will conduct a coordinated program of research, development, testing, and evaluation of seismic stations suitable for [deleted]. The DOE has responsibility for development [deleted] of the stations, and data acquisition. DARPA has responsibility for advanced research on sensors, signal handling and processing techniques which could later be incorporated into the system. In addition, DARPA is responsible for the design and construction of the Seismic Data Management and Analysis Center (SDMAC) where the data are interpreted.

#### INTERNATIONAL SAFEGUARDS

The Department of Energy is responsible for assisting the International Atomic Energy Agency with technologies and procedures designed to safeguard nuclear materials and prevent the proliferation of nuclear weapons.

*Question.* How confident are you that the present international safeguards can prevent the development of nuclear weapons by other nations?

*Answer.* International safeguards are not designed to prevent nuclear weapon development but, rather, to effectively deter diversion of nuclear material for such development. The United States and other sovereign states rely on the safeguards system of the International Atomic Energy Agency (IAEA) (i.e., international safeguards) to detect the diversion of nuclear material from nuclear power and research programs involving the use of materials subject to safeguards agreements with the IAEA. The threat of detection serves to deter diversion of these materials to the development of nuclear weapons by states having possession of the materials. IAEA safeguards are considered to be sufficiently effective that a nation possessing these materials and choosing to undertake a



nuclear weapons program would be less likely to use materials subject to IAEA safeguards.

While IAEA safeguards serve as the technical means to deter the measure of nuclear energy for peaceful purposes, the United States relies upon the Nuclear Non-Proliferation Treaty (NPT) as the fundamental political safeguard against the development of nuclear weapons by other nations. The NPT provides that each non-nuclear weapon state party to the treaty forswear production of nuclear explosives and accept nuclear fuel cycle safeguards implemented by the IAEA. Most other countries have joined the NPT and do support IAEA safeguards activities. The United States has also encouraged other nations multilaterally and bilaterally in actions intended to oppose and discourage the proliferation of nuclear weapons among non-nuclear weapon states. In addition, the United States is consistently taking unilateral action on occasions as appropriate to oppose and discourage specific acts which threaten proliferation of nuclear weapons. These actions by the United States and others provide widespread and effective resistance to the development of nuclear weapons by other nations.

*Question.* Has the International Nuclear Fuel Cycle Evaluation reached any agreements on what would be the least proliferation prone nuclear fuel cycle?

*Answer.* No. The INFCE Technical Coordinating Committee which reports to the Plenary has addressed the question of relative preference of one fuel cycle over another, and has decided that fuel cycles would not be ranked in the INFCE reports. Instead, technical information on the proliferation resistance of each fuel cycle would be included in the reports in sufficient detail for each participating nation to make its own assessment and ranking of the various fuel cycles from a total national perspective of proliferation resistance, contribution to energy availability, economics, technical viability, public health and safety, environment and safeguards. Participants of the International Nuclear Fuel Cycle Evaluation (INFCE) have agreed to restrict, for Government use only, any conclusions or assessments by individual countries until the evaluation is presented to the full INFCE Plenary of 53 nations and 3 international organizations, in February 1980.

*Question.* Have any nations associated with the International Nuclear Fuel Cycle Evaluation (INFCE) indicated that they would adapt their nuclear programs to conform to a proliferation resistant fuel cycle?

*Answer.* No. The INFCE is a technical evaluation, the purpose of which is to provide governmental decision makers with fuel cycle information necessary for the natural decision-making process.

Many nations have written papers on alternate technologies aimed at increasing the proliferation resistance of nuclear fuel cycles. Although at this stage of INFCE no major shifts in the development of technology are apparent, INFCE has resulted in a greater awareness of the need to include proliferation concerns in assessing and proceeding with future fuel cycle development. Most developing as well as industrialized nations generally support the U.S. policy of preventing proliferation as evidenced by their active participation in INFCE.

It is hoped that, after the INFCE studies are completed, nations will modify their nuclear programs to emphasize the development of proliferation resistant fuel cycles and technologies and cooperate in institutional arrangements designed to reduce the risk of proliferation associated with such technologies.

*Question.* Is there any truth to the charge that the International Nuclear Fuel Cycle Evaluation (INFCE) has resulted in little more than the transfer of American nuclear technology to other nations? What significant changes do you expect from the International Nuclear Fuel Cycle Evaluation?

*Answer.* As we pointed out in the answer to Question #3, the INFCE is a technical evaluation—an examination and characterization of fuel cycle alternatives from the standpoint of proliferation and economic concerns by technical peers from the nations involved.

The U.S. is mindful of the sensitivity of certain technologies (e.g., enrichment) and has, as a matter of policy, avoided any transfer of such technologies either within or outside INFCE. Other technically advanced nations have been equally careful in this regard. On the other hand, most nations recognize the U.S. has made an extensive contribution to provide information to INFCE that is pertinent.

It should be noted that the collective contribution of other INFCE participants is significant. Of the more than 250 INFCE papers tabled for discussion, about 50 papers were submitted from the U.S. and about 200 papers were submitted by other nations.



It is already apparent that many nations have a heightened or new awareness of the importance of proliferation resistance in the selection of fuel cycles for development or deployment. It is clear that INFCE is laying an important foundation for future international discussions and negotiations beyond INFCE relating to national, multi-national, and international programs for the reactors and fuel to meet growing worldwide energy needs.

#### SAFEGUARDING NUCLEAR MATERIALS

The Department of Energy is responsible for developing means to prevent nuclear materials from being stolen or diverted for illegal use.

*Question.* At the present time how much safeguarded nuclear material is unaccounted for?

Answer. Inventory Differences for non-government facilities in the U.S. during the period 1954 through 1967 are included in the publication ERDA 77-68, pages 226 through 229. For periods after 1967, Inventory Differences for these facilities are published by the Nuclear Regulatory Commission.

*Question.* Is any weapons grade nuclear material unaccounted for?

Answer. Yes. "Weapons grade" material is regarded to be uranium enriched in the isotope  $U^{235}$  to a level of 93 percent  $^{235}Pu$ . In the case of uranium, Inventory Difference records do not differentiate this material on a basis other than "uranium enriched to greater than 20 percent  $U^{235}$ ". ID data on Strategic Special Nuclear Material (Pu, and uranium enriched to greater than 20 percent  $U^{235}$ ) is contained in the four attached reports, ERDA 77-68, DOE DP-0001-1, 0001-2, and 001-3. Data from the Oak Ridge Y-12 and Rocky Flats weapons facilities is not included since it is Secret/Restricted Data. Note: The referenced reports are the same as those referenced in Senator Levin's question p. 235.

*Question.* How secure are our present nuclear safeguards procedures?

Answer. Safeguard systems and procedures are conceived, designed, developed, and applied to protect the public and the national security against willful actions involving the possession of nuclear materials or the sabotage of nuclear facilities. In practice, general principles can be and are applied in conceiving and developing the safeguards systems for any nuclear material process. Until specific system features are incorporated into a system design based on the unique operational requirements of the facility in which it will be applied, no information is present that would tend to reveal vulnerabilities which could be exploited by a potential adversary. Once such specific information is included, the DOE system design becomes classified to protect it from compromise.

*Question.* What is being done to upgrade our nuclear safeguards program, and how important are those steps?

Answer. We are examining, systematically, our systems performance goals with the aim of insuring that, insofar as systematic design procedures can insure, the systems will be reliable and designed to counter a broad spectrum of threats forcing an adversary to his breaking point in many areas and thereby deterring many. In addition, specific requirements are being imposed as follows:

1. DOE Order "Physical Protection of SNM" is a significant upgrade of the requirements for the physical protection of SNM.

2. We have established a graded program for the protection of SNM consistent with its strategic value, and susceptibility for use in fabricating a clandestine nuclear explosive device.

3. We have extended levels of prescribed physical protection requirements during use, storage, and transportation to include quantities below strategic significance.

4. We have upgraded medical and training qualification standards for protective personnel.

5. We have upgraded emergency response capabilities of protective personnel through provision of semi-automatic weapons and armored cars at selected nuclear facilities.

6. Exterior and interior intrusion detection alarm systems in use and the requirements therefore have been upgraded.

7. Fixed guardposts are being hardened for better defense against attack.

8. Material Access Areas are being redefined and tighter controls established over personnel with access to such areas.

9. We are developing and installing SNM portal monitors at exits to SNM process areas.

10. DOE Order "Control and Accountability of Nuclear Materials, Basic Principles" (not yet issued) requires: (a) more frequent inventories of strategic



quantities of highly attractive special nuclear materials (while using more sophisticated inventory-taking procedures, techniques and equipment), and (b) expanded use of tamper-indicating devices, nondestructive assay equipment and the use of real-time accountability.

QUESTIONS SUBMITTED BY SENATOR STROM THURMOND, ANSWERS SUPPLIED BY  
JOHN DEUTCH

Senator THURMOND. Dr. Deutch, the approach in technology development in the waste program as laid out in your statement makes a great deal of sense. I note the DuPont Company at Savannah River has the responsibility for both high level and spent fuel wastes. Why was this particular assignment made to Savannah River?

Dr. DEUTCH. Lead assignments to DOE Field Offices are part of our overall decentralization strategy to give the lead to the organizations that seem to us most qualified to manage a national program. The Savannah River Operations Office has demonstrated ability and leadership in high level waste and spent fuel management. Savannah River has a large portion of the high level waste inventory and is one of only two sites that produce high level wastes today. Savannah River also has experience with the storage of government-owned spent fuel and is located in the vicinity of the Barnwell facility, a candidate for an early AFR.

Senator THURMOND. Dr. Deutch, you state the disposal of high level wastes is being given top priority. How is that support backed up by your present spending request?

Dr. DEUTCH. The fiscal year 1980 budget request does, in my opinion, reflect an aggressive and balanced program to manage both high level wastes and spent fuel. In particular, the fiscal year 1980 budget contains funds for a significant start on the long term management of defense high level wastes: the program to remove these wastes from the near-surface tanks and to place them in a suitable immobile form for permanent isolation.

Senator THURMOND. Dr. Deutch, your statement indicates you are transferring the currently stored wastes at Richland and Savannah River to more secure tanks. How long have we had the technology for such transfers and briefly what is involved?

Dr. DEUTCH. Transferring currently stored liquid waste at Savannah River and at Richland involves pumping this waste from the older tanks to new improved tanks. At Savannah River, wastes converted to salt cake in the past are to be redissolved and the insoluble solids resuspended prior to pumping. At Richland, the insoluble solid waste remains in the older tanks. Technology to accomplish this transfer was first used to remove waste from tanks at Richland in 1952; however, improvements have been made over the years. Many of the newer double-shell tanks which provide the more secure storage are still under construction. All will be completed by the end of 1981.

Senator THURMOND. On page 7, you mention the long-term program for the defense waste processing facility at Savannah River. What money is in this bill for that facility and what levels of funding will you request over the next 5 years?

Dr. DEUTCH. Our fiscal year 1980 budget includes \$13.1 million operating and \$2.5 million plant engineering and design in direct support of the DWPF. Also, the fiscal year 1980 budget includes \$25.5 million for R&D directly related to the DWPF. Pending resolution of a major strategy paper to define our alternatives further, we are currently planning the following budgetary guidance for the DWPF over the next five years:

[In millions of dollars and fiscal years]

|                              | 1981 | 1982  | 1983  | 1984  | 1985  |
|------------------------------|------|-------|-------|-------|-------|
| Operating.....               | 4.3  | 5.1   | 6.0   | 10.0  | 21.6  |
| Design and construction..... | 42.5 | 600.0 | 700.0 | 900.0 | 600.0 |
| Related R. & D. ....         | 20.9 | 13.0  | 13.0  | 13.0  | 7.0   |

The above table anticipates a \$42.5 million design-only authorization in fiscal year 1981 and an approximately \$2950 million construction project authorization in fiscal year 1982.

Senator THURMOND. Briefly describe the type and function of facility we plan to build at the SRP for the waste processing program.



Dr. DEUTCH. The Defense Waste Processing Facility that is planned for construction at the SR site is a large concrete structure, over 1000 feet long, 150 feet wide and 100 feet high. Inside it will be two large sealed "canyons" running the length of the facility in which equipment to separate, treat and process the waste can be done in a completely remote manner. Such a facility is similar to existing structures at SR and RL and is sufficiently flexible to house just about any waste processing approach known.

Senator THURMOND. Is it anticipated this plant will be used for any purpose other than the defense program waste disposal?

Dr. DEUTCH. Not at this time.

Senator THURMOND. Is there any chance the Government would want to handle waste from foreign nations at this facility?

Dr. DEUTCH. No.

Senator THURMOND. I understand the House Armed Services Committee has released some of the design money for the Savannah River Waste Processing Facility. Do you plan to expedite the design of this facility?

Dr. DEUTCH. Design activities are planned to be conducted as the money becomes available to support a line item request for the facility as early as 1982.

Senator THURMOND. When will a decision be made on the concept work on this facility?

Dr. DEUTCH. The selection of the process equipment to separate, treat, and process the waste is planned for no earlier than 1981. The general conceptual waste form and waste immobilization process, which could be selected at a later design of the facility has been done and found to be reasonably insensitive to the waste form and waste immobilization process, which could be selected at a later time (i.e., after the selection of the facility to separate, treat, and process the waste). Vitrification has been used as the reference process for conceptual design purposes.

Senator THURMOND. Is DOE now fully committed to this project provided the design concept proves out from a technical standpoint?

Dr. DEUTCH. DOE is fully committed to proceed with the preliminary design of this facility.

Senator THURMOND. When would this plant begin operations and what do you expect will be its total cost?

Dr. DEUTCH. Operation of this plant may begin as early as 1989. The facility may cost as much as \$3 billion.

Senator THURMOND. On page 9, you discuss the problems of licensing defense facilities. What do you see as the greatest danger from the push within the Administration to attempt to license defense nuclear facilities as opposed to civilian facilities?

Dr. DEUTCH. Federal licensing of civilian facilities makes good sense to assure the protection of public health and safety in facilities that are operated as a commercial venture. Federal licensing of Federal activities does not have the same benefit but adds to costs and causes delays. It can jeopardize national security when the volume composition, geometry, or physical state of the waste permits conclusions to be drawn about the activities that gave rise to the waste.

Senator THURMOND. Dr. Deutch, briefly explain why it has taken us so long to deal with the waste problem when these high level materials have been piling up for nearly three decades?

Dr. DEUTCH. Standards and criteria for the management of high level wastes have been changing over these three decades, and have, in fact, still not been finalized by the EPA. Storage into new double-shell tanks would be safe as well as there would be continued monitoring and surveillance and construction of new tanks when needed. We believe that waste management should not be deferred to the indefinite future in this way and are aggressively pursuing immobilization of these wastes. We are, therefore, exploring opportunities to do the job better, safe, and at less cost. The immobilization will begin before a suitable Federal repository is expected to be available.

Senator JACKSON. Thank you, and good luck.

The hearing is adjourned.

[Whereupon, at 5:35 p.m. the hearing was adjourned.]



