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THE SOCIOECONOMIC EFFECTS OF A NUCLEAR WASTE STORAGE SITE ON RURAL AREAS AND SMALL COMMUNITIES

GOVERNMENT

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HEARING

BEFORE THE

SUBCOMMITTEE ON RURAL DEVELOPMENT

OF THE

COMMITTEE ON AGRICULTURE,

NUTRITION, AND FORESTRY

UNITED STATES SENATE

NINETY-SIXTH CONGRESS

SECOND SESSION

AUGUST 26, 1980

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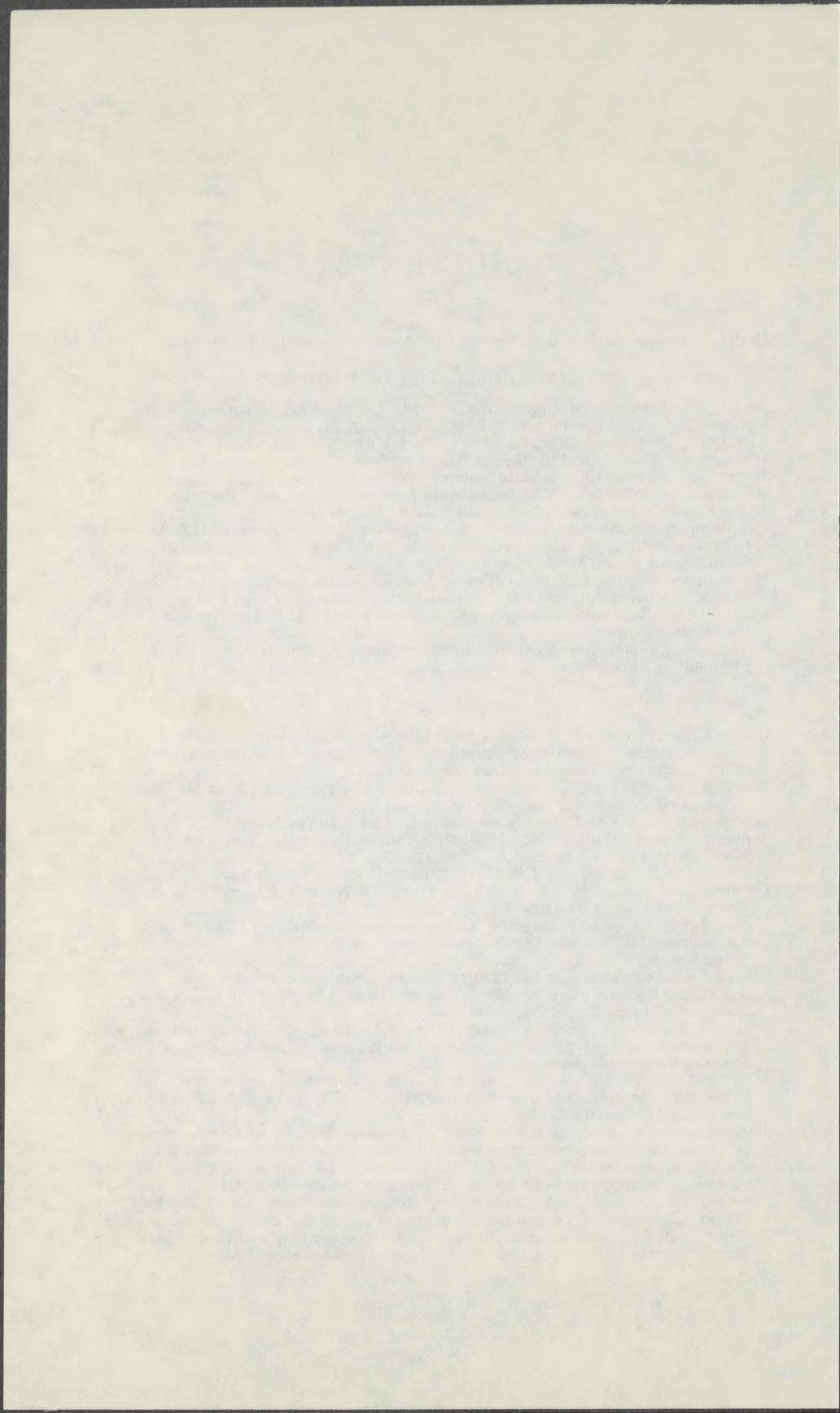
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THE SOCIOECONOMIC EFFECTS OF A NUCLEAR WASTE STORAGE SITE ON RURAL AREAS AND SMALL COMMUNITIES

TUESDAY, AUGUST 26, 1980

U.S. SENATE,
SUBCOMMITTEE ON RURAL DEVELOPMENT,
COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY,
Washington, D.C.

The subcommittee met, pursuant to notice, at 8 a.m., in room 457, Russell Senate Office Building, Hon. Patrick J. Leahy (chairman of the subcommittee) presiding.

Present: Senator Leahy.

STATEMENT OF HON. PATRICK J. LEAHY, A U.S. SENATOR FROM VERMONT

Senator LEAHY. Good morning. The Senate Committee on Agriculture, Nutrition, and Forestry Subcommittee on Rural Development, will be in order. Today's business will be an oversight hearing on the Socioeconomic Effects of Nuclear Waste Storage Sites in Rural Areas and Small Communities.

We appreciate your being here at what was not necessarily a traditional hour for committee hearings, although it is for the Agriculture Committee. This chairman once said that he assumed, as we were on the Agriculture Committee, we all had farmer's habits. I did not want to tell him that some of us are not farmers, but were practicing attorneys and try to confine our practice to courts that normally did not start until noon. But that never seemed to get all the way through.

There is another problem, however, in the reason for this morning's start. I am serving on another panel which has been meeting a great deal lately, and will again meet today. It met until quite late last night. And I did not want to have to cut into the time of this panel, or this hearing, to go to that other committee.

And while other Senators have offered to come in and fill in the chair for part of it, I really wanted to be here for the whole testimony and the whole hearing, myself.

I think that it is an extremely important matter. Over the past 2 years we have held a series of hearings in the Rural Development Subcommittee on matters important to the lives of 60 million rural Americans. In my opinion, the issue before us today, the issue of safe storage of nuclear wastes and guarding the interests of small towns and rural people living near a storage site, is the most crucial question this subcommittee has addressed, certainly in the time since I have been on it.

It is important to remind members of the committee and today's witnesses and the public that the hearing has not been called to weigh the merits of nuclear energy. I have my own personal views on that important matter, and I am certain everybody here does, also.

The question of should we build more nuclear powerplants or should we shut them down will not be considered today. There are far more appropriate forums within the Senate for that discussion. This hearing will investigate the serious problem of nuclear waste storage that we now face in the Nation, regardless of the future of nuclear power.

The facts are that we now have vast quantities of nuclear waste scattered across rural America. And the volume of this waste is formidable. We already have 80 million gallons of liquid high-level radioactive waste, almost 20,000 highly radioactive spent fuel rods, 15 million cubic feet of low-level radioactive waste, and nearly 150 million tons of radioactive uranium mill tailings.

There is no question, even if we just stopped any more construction today, these volumes will increase, and, of course, we are planning further construction.

It is all but a foregone conclusion; that permanent and temporary waste storage facilities will be located in rural areas near small communities, away from large major population centers.

Rural America will most likely become the repository for all of the country's nuclear wastes, military and commercial, whether it is produced in urban or rural areas. And even limited amounts of wastes produced in other countries, other than the United States, may be stored there.

Our charge in this committee is to insure that rural America does not become the indiscriminate dumping ground for nuclear waste. Rural residents are people, too. Those of us who live in rural America—myself included—are entitled to the same high standards of health and safety to be applied if these facilities were to be located in the big cities. A solution to the safe and permanent storage of nuclear waste has to be found. While so doing, the crucial issues of social and economic impacts in nearby rural communities must not be overlooked. And, quite frankly, up to this point, I think those impacts have been overlooked.

The experience of poorly insulated, overcrowded mobile homes, unpaved muddy streets, raw sewage in open trenches, rising alcoholism rates, other health problems that plagued rural energy boomtowns of the west must not be repeated. Rural towns cannot be expected to bear such a burden as our Nation struggles with its energy future.

And while the similar effects of rapid growth in boomtowns will be investigated, we will also review the potentially unique results of nuclear waste storage in small towns that could, without cautious and deliberate care, create in the public's mind nuclear waste doomtowns.

Such impacts on small communities need Federal study now, even though the more technical and political problems of storing these wastes have not yet been resolved. If they are not addressed early on in the process, they never will be.

That does not necessarily translate into Federal funds. It is important that the full cost of each alternative energy source be fully and accurately assessed. Hidden subsidies must be uncovered and brought to the taxpayers' attention who, after all, paid for these subsidies. We want to uncover the true and full costs of storing nuclear waste. We want to make certain that the cost borne by waste site host communities are included in the cost assessment of an energy resource.

Obviously, in the case of military wastes, these costs should be borne by the Federal Government. Likewise, commercial producers of these deadly wastes should pay their fair share through user fees or other appropriate mechanisms.

Most importantly, 60 million people in rural areas are entitled to these answers. Unplanned, overcrowded, and revenue starved rural towns are an unacceptable result of any plan to dispose of our nation's nuclear wastes. Rural people deserve better. The subcommittee intends to make sure they receive better.

I should point out again that this is a most serious matter, the most important matter, to come before this subcommittee.

I fully expect, should I be chairman of this subcommittee next year, to have a followup hearing to see where we have gone from today. And during the next several years if I am—indeed, if I am subcommittee chairman, I would hope that we would have periodic updates, because, apparently, we are the only committee in the Congress that is looking at this aspect of it. If I am not subcommittee chairman, then I will urge whoever is to do that.

What I would like to do is hear from the first panel—it includes Elizabeth Peelle, sociologist from Oak Ridge National Laboratory in Oak Ridge, Tenn.

Ms. Peelle, are you here? Would you come forward, please? How badly did I mispronounce your name?

Ms. PEELLE. That is exactly right.

Senator LEAHY. OK, thank you.

And Dr. Roger Kasperson? Would you come forward, please, doctor? The political scientist from Clark University, Worcester, Mass. And Dr. Steve Murdock, who is a rural sociologist with Texas A. & M., College Station, in Texas.

Dr. Murdock, will you come forward, please?

I would ask of each of you—you each have very lengthy and, I think, excellent statements—I would ask if you might summarize the statements for the panel. A full statement will be made part of the record. Because I would like to take as much of the time as we have here for this panel for me to ask some questions that have occurred to me, having read your statement, and ask some questions on behalf of some of the other subcommittee members who are actually at other hearings, at other meetings, at this time of the day.

So, Ms. Peelle, if we could begin with you, go to Dr. Kasperson, and then go to Dr. Murdock.

But if you would summarize your statement, and if the other two would summarize theirs, we will go right to questions.¹

¹See p. 119 for the prepared statement of Ms. Peelle

STATEMENT OF ELIZABETH PEELLE, SOCIAL IMPACT ASSESSMENTS GROUP, ENERGY DIVISION, OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.

Ms. PEELLE. Rad waste repository siting is probably the ultimate example of the inverse tragedy of the commons. Unlike the tragedy of the commons, where people overuse or misuse a public resource such as air or water, in the inverse tragedy people commonly avoid their share of a public responsibility for siting noxious or undesirable facilities which fulfill essential public purposes.

Both of these tragedies occur because of the absence of institutional arrangements to regulate and limit use, and thus allocate risks and benefits in an equitable manner.

In the absence of appropriate risk-sharing mechanisms—and that is going to be the focus of my testimony today—the risk will be borne primarily by those who receive little or no benefit from the electricity generated by nuclear reactors; namely, rural residents of sparsely populated States and those along transportation routes to the repository.

I concentrate today on the factors that contribute to the difficulties of equitably resolving the rad waste siting problem, which I think are amenable to Government action.

I have made a longer list, but I will discuss only five that I think are amenable. These are the fact that there are limited benefits and no incentives for host areas, that there is a common occurrence of dissociations of costs and benefits resulting from the construction and operation of almost all large energy facilities, rad waste repositories included.

Third, the remoteness and inaccessibility of the decisionmaking process for large energy facilities causes us a large amount of difficulty, and I think is one of the causes underlying the current ferment and aversion to the whole idea of waste repositories.

Fourth, the relatively undeveloped, or nonexistent state of institutions that provide protection and accountability for those who will be affected by siting, and institutions to allocate the risks of “public bads”—which I think we might consider this to be—more equitably.

And, finally, congressional authority can be used to deal with the fact that there are current constraints on DOE's present ability or authority to mitigate impacts.

Then there are four main points to my testimony. I think the conventional social and economic impacts are being addressed, and can be mitigated. There are some problems but, in general, I believe that is true.

There are, for instance, a number of large-scale, multimillion-dollar reasonably successful mitigation plans in existence now, for instance, the TVA Hartsville mitigation plan for the communities, a five-county area surrounding the four nuclear plants being built in Hartsville, Tenn., or the Wheatland, Wyo., multimillion-dollar-mitigation plan.

Likewise, it is, of course, the intent of the recently passed Energy Impact Assistance Act, Senate bill 1699, to mitigate these same types of community impact problems, though I think it remains to be seen whether the fragmented sources of aid and the administra-

tive complexities of this act will really, actually permit any timely mitigation of impacts for the host communities.

In addition, I was discouraged to learn, by reading the act this week, that much of the political and administrative leverage needed to develop mitigation plans has been undercut by section 608 of that act which prohibits delays in siting and construction. I have had some experience in trying to devise and develop and implement mitigation plans, and the critical feature is how much leverage you have with the developers for requiring that community impacts be mitigated.

I believe that a viable program of impact mitigation should concentrate first upon mitigating everything that is mitigable. And there have been too hasty decisions in the past assuming that some things, a large number of things, are unmitigable and, therefore, we should not deal with them.

In general, our studies at communities that host nuclear reactors and large coal plants have found that local attitudes tend to be favorable toward facilities that provide employment and financial benefits, and where the perceived local benefits exceed the perceived local costs. The question to be asked, for those of us concerned about rural communities is: Does this situation apply for rad waste repositories?

The principal, unresolved issues toward mitigating of the conventional impacts here, are the constraints on DOE's authority to mitigate as, for instance, the very limited authority given DOE in the Atomic Energy Communities Act of 1955, the limited and problematic assistance offered in the Energy Impact Assistance Act, and, third, one of the most difficult things, the inconstant, shifting record of Federal funding for various types of local assistance. One year the aid is here, but is it also there 5 years later, or 10, or 15? We are talking about a long-term emplacement of a facility and we are asking the community to make a similar long-term commitment. The question is: What commitment, and how long term is our commitment to mitigate impacts?

A third point, the biggest problem, I believe, in the entire rad waste repository siting business is the institutional gap, or the absence of appropriate institutions. There has been some progress made in institution building: For instance, the formation of a State planning council, and the consultation and concurrence process that has been set up by the President's Executive order of February 12 of this year.

But to counter the inverse tragedy of the commons, I think we must have arrangements whereby the majority which does not bear its share of the risk or impact of these facilities should compensate those who bear a disproportionate burden. And I make some suggestions in the testimony for institutional development options. These might include ample compensation for possible health or accident risks, full insurance to protect property values, and incentives to cover the uncertainties and that portion of risk that is borne for others who are beneficiaries but bear little or no risk.

Many of these arrangements are already being emplaced by States in their toxic waste management programs. But the effectiveness of all such arrangements is seriously and adversely affect-

ed by the problem of assuring continuity and dependability of arrangements over time.

Who can guarantee that needed protective and accountability arrangements will survive shifting government priorities and budget cuts for a generation or more? How do we arrange these structures that I claim we need to protect those bearing special risks in the national interest? How do we avoid the Indian treaty analogy when making commitments to local areas?

Perhaps contractual arrangements will provide the institutional certainty that is needed to enable resolution of this dilemma.

In my view, this institutional gap is so serious that the risks to rural communities from this gap are more serious than the health and safety risks to local residents in the host areas.

There are a number of examples I can give. For instance, Ausmus, in his review, claims that most of the past nuclear waste management failures are institutional, not technical. Second, health risks can obviously and are frequently dependent on the nature, structure, and the viability of the waste management organization.

And, of course, this institutional gap really increases the hazard to any local community of being first, because in this situation where we have an undeveloped area with no structures for accountability and compensation or incentives for a local area, it greatly increases the hazard of being first. There is a distinct possibility that first will become only in the present confusion, and that hazards would then increase, actually, as the volume and rate of waste handling increases and the original purposes are altered or expanded.

I think one can see the concerns of residents of New Mexico relative to (WIPP) as the purpose is changed. To prevent the hazard of being first requires a multiple siting effort that is serious and definite.

Finally, I think the incentives to host areas—the incentives to local areas to be hosts and to participate in the process—must outweigh the perceived costs and risks.

There has been remarkably little attention, really, devoted to this area of how do you develop and what are the options we have in providing incentives. Incentives should be distinguished from mitigation of impacts caused by repository construction or from compensation for injury or damage caused by repository operation. Those are two different matters, both of which should be fully and adequately addressed. But beyond that, I think incentives should provide a benefit apart from compensation. And these might include financial or in-kind payments, as well as political, environmental, or other benefits. Substantial local tax payments to local areas in the communities that we have studied that host nuclear powerplants, for instance, act as such incentives.

Incentives may need to be increased furthermore to balance out costs and uncertainties or malfunctions in any other part of the siting and mitigation process. Incentives, finally, need to be substantial in order to overcome such perceived disbenefits.

The key to producing some willing host areas or, in fact, any willing host area, I think, lies in having real monetary and other incentives. I doubt personally that very much progress is going to

be made in resolving the dilemmas until someone pays attention to the incentive matter. The attention, concern and help of the Congress is needed to address and resolve these difficult institution-building tasks.

In summary, what can be done to address and to resolve these problems? Policy and programs directed toward this end might include real efforts to distinguish mitigable effects from unmitigable, and to reduce the number and scope of the unmitigables.

Second, aggressive mitigation of all mitigable effects in a prompt, adequate and complete manner. Third, compensation for risks and hazards borne by host areas for more distant beneficiaries. I have indicated some of the possibilities for how to do that.

Incentives to participate and to host rad waste repositories, providing a significant, unencumbered benefit. There is need for development of stable, long-term, guaranteed arrangements for communities which are asked to make similar long-term commitments to the national interest.

And, finally, there is need for development of additional citizen, local and State government participation mechanisms building on the newly created mechanisms of the State planning councils in the consultation and concurrence process.

Senator LEAHY. Thank you very much. I appreciate an excellent statement, and I am glad to have you here.

We talk about energy boomtowns on through, and look at just the experience, certainly, within my lifetime, of Oak Ridge and what happened there. I recall my uncle, who, during the war and afterward, had worked on the military aspects of the Manhattan project. At that time we were children, of course. We had no idea what it was he was working on. But I know he spent a great deal of time at Oak Ridge.

And he, like myself, was an avid photographer. And I recall the photographs coming back of the temporary sidewalks and the mud in the spring, and cars being pulled out, and so on and so forth, and realized that something happened to Oak Ridge almost overnight.

Dr. Kasperon, why do you not give us a summary of your statement, too? And, Dr. Murdock, and then we will go into questions.

STATEMENT OF DR. ROGER KASPERON, POLITICAL SCIENTIST, CLARK UNIVERSITY, WORCESTER, MASS.

Dr. KASPERON. Thank you, Mr. Chairman. I do wish to note at the outset that I concur with your judgment that this problem has received inadequate attention to date, and so I am delighted to be here to contribute to the subcommittee's deliberations.¹

Over the next several decades, the United States will plan and begin the implementation of a complex system of nuclear waste handling, movement, and storage, a system whose precise outlines are still only dimly perceived. This will involve, first, an augmentation of the storage capacity for low-level wastes to relieve the pressure upon the three commercial facilities still accepting wastes.

Also imminent in the near term is the development of a program of interim storage located either at reactor sites or at away-from-

¹ See p. 57 for the prepared statement of Dr. Kasperon.

reactor facilities. Meanwhile, planning is underway for geologic mined repositories for the long-term storage of both spent fuel and high-level defense wastes slated to begin operations toward the end of the century.

Since remoteness from population centers is a prime site selection consideration for safety, this network of facilities will be located chiefly in rural America where small communities are least prepared to act as hosts and most vulnerable to potential adverse impacts.

At issue is the extent to which, in anticipating these adverse impacts, we may be either retreading familiar terrain or traveling down unfamiliar paths. There are several reasons to expect the implementation of a full-fledged network of waste facilities to create novel problems.

First, there is the turbulent search, both here and abroad, for prospective sites for a high-level waste repository. It amply indicates that substantial political conflict is almost certain to occur. The siting of a nuclear waste facility cannot be dissociated from the nuclear controversy as a whole. The sites and their inhabitants will become the testing points between those committed to and those opposed to the nuclear enterprise.

Second, these facilities, and especially the high-level waste repositories, are first-of-a-kind ventures. They have never been implemented in the same form within the same social context previously. Thus, experience is lacking to alert us to the adverse impacts and miscalculations recorded in the past, and the workability of perspective designs and processes for overcoming such problems. Instead, it is necessary to depend upon knowledge accumulated with other large-scale industrial facilities or projects located in remote areas whose relevance and applicability are uncertain.

Third, unlike most nuclear power reactors, the facilities will involve only limited benefits for the host communities. What they will have are risks which, while judged small by most technical experts, are still not well understood and are particularly feared by the public.

The acquiescence of communities for uncertain risks with few compensating benefits will require a high degree of trust and confidence at a time when the very absence of these ingredients has plagued the orderly development of nuclear power in the United States.

Prediction of these impacts is sharply limited by the current underdeveloped state of theory and methodology in social impact analysis. The past work, however, suggest several generalizations. Impacts are likely to be quite site-specific, they will vary with the scale and ruralism of the host area, a number of the impacts may be expected to be essentially irreversible, and different impacts will occur at various stages in the life cycle of the facility. Sociopsychological impacts and political conflict may be more important than more conventional impacts. Equity problems will occur at several scales. There is, first, a systemic inequity in the dissociation of beneficiary and risk-assuming regions. Second, the host area itself, will show a complex pattern of gainers and losers. And finally, many adverse impacts may well be exported to future generations at the site.

The experience of the abortive waste reprocessing plant at West Valley, N.Y., reveals that only limited boomtown effects actually occurred, that information on impacts was quite inadequate, that disappointed ambitions and fear over safety were the more serious long-term impacts, and that the nuclear industry and Federal Government were the major beneficiaries at the expense of the community and the State.

How should society respond to the adverse socioeconomic impacts of nuclear waste facilities, given our underdeveloped capacity to anticipate and assess these impacts and the significant uncertainties that remain? What I propose here today is not a blueprint for response but three guiding principles.

First, avoiding rather than mitigating risks: The time-honored tradition in both the workplace and in facility location in communities has been to treat risks in *ex post facto* fashion. The assumption has been that the worker and community exposure are the reasonable prices of progress, and that society's responsibility is largely confined to side payments for compensation.

A number of facts bear emphasizing. For example, the most serious socioeconomic risks are also the most likely to be poorly understood. Many socioeconomic risks will be apparent only in the long term, and the number of them will be essentially irreversible in nature. Socioeconomic risks will also prove extremely resistant to quantification as a basis for calculating compensation. Residents of rural communities are among the most vulnerable members of our society.

The foregoing observations call for a risk management strategy that stresses risk avoidance and risk reduction. Community risks should be subject to the same procedures as those applied to other risks of the nuclear fuel cycle. Reactors contain layers of safety systems that either prevent initiating events or prevent the occurrence thereof from inflicting eventual adverse consequences on the public. Radiation protection requires that risks be kept as low as reasonably achievable. The same philosophy and similar risk management systems are needed to protect the exposure of rural communities to social harm. Such a risk management system should be predicted on the assumption of relative current ignorance and specifically designed to deal with uncertainty and surprises.

Second, unavoidable risks should be accompanied by compensating benefits: Not all risks can be avoided, of course, in reactors or in waste facility locations. For those risks which are unavoidable, there should be compensating benefits. Such a principle is recognized in the 1980 Presidential statement on nuclear waste management wherein the designated beneficiaries of commercial and defense wastes, respectively, are the utility consumers in the Nation, as a whole. The statement calls for these groups to internalize the burden of cost. The costs should be social risk defined, however, to include avoidance in management.

There is a very good chance that full compensation for harm will not occur, however. This is due, in part, to the very limited identification of harms, both in type and in timing, achieved by current social impact assessment methodology, in part to the inability to place values upon harm for which ready indicators do not exist, in part to a fragmented governmental programmatic and delivery

structure which is piecemeal in nature and beset by restrictive eligibility requirements and built-in delays, in part to the fact that a significant part of the risk is exported to future generations at the site, and in part to the reality that these communities lack the political clout to squeeze implementation of past commitments.

Finally, informed consent for unavoidable risks: For those social risks which cannot be avoided, the assumption of such risks by host communities should be made as voluntary as possible. Achieving this will involve both success in informing residents of the full range of impact likely to be experienced and in mechanisms by which the host community can participate in and influence the locational decision. The experience at West Valley and the search for prospective repository sites over the past several years indicate how difficult this will be.

Informing host site residents of the socioeconomic and other risks to the community requires, from the outset, a scientific definition and assessment of those risks. It is essential that the host area not be a dependency in this process, but that it possess its own financial and technical capacity as risk or impact assessor, and that it have an enlarged capability in the public sector to plan for and manage the impacts comprehensively. This will require new support from higher levels of government.

While the assumption of community risks cannot be made fully voluntary if we are to have nuclear waste and other noxious facilities, the more voluntary the risks can be made, the better. In West Valley, the private industry, the State of New York and the Federal Government were the power brokers with only a very limited role of the host area in the decision process. Specifically, host communities should be enabled to negotiate in defining the acceptability of various social impacts and actions needed to reduce and/or mitigate their risks.

It may also be helpful to have explicit recognition that adverse or unassessed social impacts in the host area are appropriate grounds for State nonconcurrence.

These principles may not suffice to ensure an equitable and conservative siting process and will certainly require translation into detailed institutional processes and programs. They may, however, suggest some beginnings for a long overdue, serious effort toward dealing with the community impacts in the Nation's nuclear waste management program. Thank you.

Senator LEAHY. Thank you very much, Dr. Kasperson.

Dr. Murdock?

**STATEMENT OF DR. STEVE MURDOCK, RURAL SOCIOLOGIST,
TEXAS A. & M., COLLEGE STATION, TEX.**

Dr. MURDOCK. Thank you.¹ The socioeconomic impacts associated with the siting of nuclear waste repositories are among the most important and difficult to solve dimensions of the siting process. In fact, I believe they are likely to be the key factors in the determination of the siting process, and clearly require the attention of committees such as yours, analysis by social science researchers, such as those represented in this panel, and concerted mitigation

¹ See p. 63 for the prepared statement of Dr. Murdock.

processes that ensure the early involvement of local area residents in the formulation of mitigation policies.

These impacts result both from the fact that the employment and population associated with the construction and operation of a repository are likely to be relatively large in comparison to those in the rural site areas, and because these are nuclear facilities subject to the effects that result from public perceptions of nuclear power and nuclear waste.

The employment and population impacts—what we might call the standard impacts—resulting from the construction and operation of such a facility, are similar, I believe, to those that have occurred at other large-scale projects. These include such things as increased business activity, business volume and employment, increases in population, increased demands on all types of public services, increased public revenues and public costs, and changes in social patterns, social relationships, and social behavior.

These types of impacts, however, I believe, can be investigated and be projected, and can have effective mitigation strategies developed for them.

The other effects that result from the fact that these are nuclear facilities, what we might call special effects, are more difficult to address. I think Ms. Peelle has provided an excellent overview of some of these types of effects.

Both of these types of effects require mitigation. The mitigation of both, but particularly the latter types of effects, will be difficult. And I think it should be recognized that there can be no guarantee that all of these impacts can be mitigated. It is also essential to keep in mind that there is, perhaps, no ideal general mitigation strategy, but rather that strategies must be tailored to the local area's needs and preferences if they are to be successful and acceptable.

It seems essential to me, however, that such mitigation, although we cannot give a specific mitigation plan at this point in time, must involve some of the following features. First, there must be early involvement of local residents and local decisionmakers. It is essential that persons at potential site areas be involved as early as possible in the siting process, and clearly before all siting decisions have been made, and before the full mitigation policy has been developed.

Second, I think it is important that local area planning and other technical assistance be provided. Most local rural areas do not have the technical expertise necessary to take advantage of mitigation policies once they are developed. Such local planning assistance is necessary both to insure adequate local involvement and to insure that local residents will be able to ask the questions they need to ask and be able to properly utilize any mitigation programs that are developed.

Third, I think there needs to be developed a comprehensive information base on impacts and the processes associated with the site of a repository. This information must be disseminated to local residents, it must be in a form that is directly accessible to them, that is understandable to them, and that can be interpreted by them.

Fourth, I think it is necessary for us, as a nation, to simply recognize that such a process will require long term financial and other commitments. It is essential to acknowledge to ourselves, as a nation, that we must make these commitments if we want this process to continue. And it is even more important that such commitments be made evident to residents in local siting areas. Early commitments may help alleviate many of the financial fears that people in potential impact areas feel concerning such projects.

Finally, I think it may be necessary for our Nation to begin to think of repositories in a much broader perspective, as one of a number of different resource management problems we must deal with as a nation. That is, it may be necessary to have a broad enough policy to insure that our less desirable projects, that is, our chemical storage sites, our nuclear repository sites, and some military installations are shared by various regions of the country. If the residents of an area could be assured that, although they were being asked to accept a nuclear repository site, other areas would receive other undesirable facilities, they might find the siting of such a facility much less onerous.

There are, then, I believe, a number of difficult problems to be addressed in the area of socioeconomic impacts related to repository siting. I believe, however, that research in progress today will be able to provide much of the information base required to address these impacts, and that if local involvement is assured in the research and the policy process, the socioeconomic dimensions of nuclear repository siting may be effectively addressed. Thank you.

Senator LEAHY. Thank you. Doctor, I was interested especially in the last part of your statement, the idea of somehow spreading the wealth, in this case, spreading the burdens. What you are saying is that one community gets a chemical manufacturer, another community gets a military depository, another community gets something else.

How do you see that kind of planning? Do you see that as some form of national planning or the States joining to do that, or what happens in a case like that?

Dr. MURDOCK. I guess I do not have all the answers to that. But it seems to me that it would have to be on a national level, the planning effort. I guess my motivation for that statement lies in the fact that, as I talk to people, for example, from the State of Utah, they say, "Well, now, they want to give us the MX missile system. Now we understand they want to give us some nuclear waste repositories, also." And I think that if it was—

Senator LEAHY. They would tend to be getting it all. [Laughter.]

Dr. MURDOCK. I think that there must be a feeling that all of these problem types of sites are going to be passed around and shared so that the people in the West or the people in the Southern part of the United States do not feel like, "Here it comes again." I think that if this were done there might be more acceptance of any one given type of facility.

Senator LEAHY. Of course, that, in a way—and I do not want to break my own ground rules on the hearing, but then, in all of those, at some point, too, at the national level, debate has to be had just to what extent—whether it is chemical waste, nuclear waste,

or whatever, that the steps that created such wastes prove all that necessary and alike and many are, many are.

But it is—that, in itself, has to be a second debate or perhaps primary debate. But assuming that that debate is had, and assuming that it is decided that certain types of nuclear power, nuclear weapons, chemical waste, and whatever, are going to occur, do you see these as being almost exclusively impacting on rural areas, as compared to urban areas?

Dr. MURDOCK. I think there is nothing evident in any of the information related to any of these that they will not most likely be placed in rural areas. And there is certainly an important equity question here related to the need for rural people to be compensated for dealing with or accepting a national societal responsibility.

And there seems at least little doubt from what I discern in reading about all of these types of facilities that they are not going to be in rural communities, and rural communities are going to be disproportionately impacted, both in terms of standard impacts and special impacts, by these facilities.

Senator LEAHY. I once had somebody give me a long lecture when I was expressing my concern about what was happening to rural areas, and saying, "But, of course, these things are all perfectly safe. You should not mind having them there at all." I suggested, if that is so, why not put it down next to their subway stop in their own urban area. But that debate broke down at that point.

Ms. Peelle, would you explain why you think there is greater risk to rural communities from the failure of institutions, rather than from health and safety failures, at the disposal facility? Could you just elaborate on that a little bit more for me, please?

Ms. PEELLE. I am making certain assumptions. I think that part of the reason people are so concerned about nuclear waste is that most of the examples we see are bad examples of institutional mismanagement. Some of them likewise resulted in health risks as a result of the institutional failure. But I am making an assumption that rad waste repositories will be technically the best that is available, and that nuclear wastes 2,000 feet underground are probably not a serious health risk.

I do see, in the present absence of appropriate institutions, rural communities being left holding the bag, so to speak, relative to the social and institutional problems, especially in the compensation area.

Senator LEAHY. But how do we insulate for that? Who guarantees those costs? We have, for example, various Federal impact aid programs in schools where we have our Federal facility, a sudden, large military installation, something like that. Impact aid of some sort is given to the communities. That sometimes works and sometimes does not.

I know a lot of Federal impact aid goes out to Fairfax County, Va., which has a median income certainly much higher than most other areas in the country.

But how do we do this? Do we just say that wherever this is going to happen, somehow we will look to spread the burden equally across the country? We will just take it out of the Federal

Treasury and designate a community, and then just have it all from one level just from the Federal Treasury? Or do we go to the companies, themselves, that are going to do it and say that "You have just got to tag this on as part of your user fees"? Or do we determine that, having power, even if the power is being provided in another part of the country, that that is a good societal goal and, thus, again, all of society should pay for, whatever happens from now, one particular facility? Who pays?

Ms. PEELE. You have asked several questions at once.

Senator LEAHY. I understand.

Ms. PEELE. I will take it from the back, through. I think there are many ways of doing this, but most of the ways we currently have, I believe are inadequate to do the job.

One of my concerns about the current legislation is that it goes in the wrong direction in that it attempts to have all taxpayers bear the burden of impact assistance for energy development, whereas it seems to me that if we are interested in closing the gap between the dissociations of cost and benefits, the users who ultimately benefit from whatever product is produced—energy—obviously ought to be the ones ultimately paying those costs.

So it seems to me a more direct way of assuring that is to somehow fold in all these mitigation costs for a siting or repositories, whatever, into the costs of the developer. That is my basic concern with most of the Federal impact legislation that I have reviewed. It tends to place the burden somewhere else, on all taxpayers rather than on the developers who, in turn, pass those costs on to where they belong, that is, to the beneficiaries of the energy that is produced.

Senator LEAHY. Well, is not one of the problems in this whole area the fact that nobody has really developed a kind of model to tell us what the costs are going to be? If we put a nuclear dumping site in northern Wyoming, for example, do any of us really know what those costs are going to be, not only the cost, the initial cost, but the long-term cost? Is that not part of the problem in trying to build into any kind of a model, to figure out what the cost is going to be?

We can almost pose it, like, if you are building a nuclear power-plant, you can somehow set aside money for the decommissioning of it. What do you do for the dumping?

Ms. PEELE. In general, I think we have technical ability to know about many more impacts than we currently mitigate. One can look at some good examples, though, on mitigation and see where developers have taken the responsibility, frequently because they were required to by either a Federal or State agency, to mitigate impacts, and some very credible jobs can be done. Perhaps some sort of contingency fund or trust fund needs to be set aside to allow response to future impacts which are as yet unknown and unexpected. Otherwise we can only resort to after-the-fact, patch-up mechanisms as are being considered now in the proposed superfund for toxic waste management. In this latter case, chemical manufacturers would be asked to provide money to repair past mistakes and compensate those who have been affected.

It is true, however, that we do not have models that tell us everything we want to know. But, in general, I feel we are a long

ways from doing the things we already know how to do. In this case, our problem is not lack of models, but lack of policy to mitigate and lack of will to implement what we already know how to do.

Senator LEAHY. Mr. Kasperson, you are a political scientist. What are your views on that? I mean, who pays, and how do we determine what the payment is going to be?

Dr. KASPERSON. Well, as I was sitting here, I was thinking how difficult the calculation of those benefits and costs are in many cases. We have tended to take a rather narrow viewpoint, I think, to date on that subject, even the question of—for example, who benefits from a nuclear reactor in a particular area is a rather complicated question because there is an initial set of primary winners, if you may call them that, who live particularly in the host community, but also who are electric consumers, that consume electricity at different levels obviously. There are secondary benefits that emanate from that region to the rest of the Nation from the lower prices that result in the manufacturer of items using that electricity.

And so, as a beginning point, I guess, one of the things that needs to be done is to go beyond the rather gross kinds of assessments that have been made to date of the beneficiaries and to try to gain a finer breakdown of who is actually benefiting.

Now, having said that, the question for the host community—I would argue, is that if we compensate the host community only for the cost that we can project is likely to occur, either from public health risks of the repository or from social impacts, we will almost certainly not fully compensate the community for the social risks they will experience.

I am very much impressed with the difficulties created by a waste repository being the first of a kind facility. And I would argue, as Ms. Peelle has argued in her testimony and in other things she has written, that we will need incentives that go beyond compensation. Now, how that is achieved is an interesting institutional challenge. I suspect that we need to recognize that a waste repository is renting a very valuable piece of real estate. Appropriate sites for waste repositories are, becoming one of the more valuable pieces of real estate in this country as we become aware of the toxic waste problem and as the very complicated nuclear waste system begins to unfold.

Senator LEAHY. Of course, conversely, some of the things that make it valuable are the same things that encourage rural people to want to live there, absent any type of facility or any major change in their overall lifestyle or overall complexion of their community.

Dr. KASPERSON. Indeed, so the loss is probably greater than what would occur from most normal kinds of calculation, because it has a particular value to the people who live there.

Let me add just one point, because I am going on too long in response to the question. Some form of insurance or escrow, if you will, is probably necessary as an institutional arrangement. We need to compensate people for the uncertainty connected with the state of technical scientific knowledge in regard to the risks of the repository and to the complexity of the social impacts involved

when you are dealing with a nuclear question. Some long-term guarantee that a community will not be left to bear our underestimated expenses would be a very desirable kind of innovation.

Senator LEAHY. Thank you.

Dr. Murdock, you studied energy development in the West. Are there cases there, in your studies, of private industry paying for the cost of mitigating social economic impact on broad scale, or were they of almost a public relations type thing?

Dr. MURDOCK. No, there are several examples of this. And I think the most notable one is one that Ms. Peelle referred to, that in the State of Wyoming. Wyoming's siting laws require, often as a condition of siting, a great deal of mitigation. This mitigation can include such things as building a designated number of housing units, it can include front end financing for local school systems in which the private developer, in fact, builds or provides the money to build an elementary school system, for example. It includes, in most cases in that siting requirement, long-term monitoring and adjustment of mitigation payments, if necessary, over time. That is, the company is required to keep track of what the impacts actually are, and if they exceed those that were projected, they are required to come up with additional funds to mitigate those additional impacts.

Senator LEAHY. Well, just mechanically on that, if they are monitoring on a long-term basis, are they also doing anything like a sinking fund, a special escrow account, or something?

Dr. MURDOCK. They are not the same types of facilities. And, of course, we are talking about a facility, in most of these cases, with a 30- or 40-year life.

Senator LEAHY. I understand.

Dr. MURDOCK. Not something with perhaps thousands of years life. But, in most cases, As I understand it, at least, it is a pay as you go process. But that siting council has a great deal of freedom to set those conditions, and those conditions are made specific to the particular project at interest. So they will vary from project to project.

Senator LEAHY. But in those cases, the ability to fulfill the project's needs are really contingent upon the company, itself, staying in existence and being economically viable?

Dr. MURDOCK. Yes. You do have to depend on the existence of the utility in that particular case for it to continue over time.

Senator LEAHY. Which raises a whole separate question if you are talking about long-lived waste?

Dr. MURDOCK. Yes. Though I think that there might be a lesson here, or something to be said here, related to the question that you asked Ms. Peelle. It seems to me that one obvious source for some of the funding is the utility that will store that waste. And I think that, in many cases, the utilities would be quite willing to bear some of that burden for the costs, at least those costs that are in the foreseeable future.

Senator LEAHY. Do you know of any major energy projects rejected solely on the basis of social/economic impacts?

Dr. MURDOCK. I did not catch the question.

Senator LEAHY. Do you know of any major energy projects, just in your experience, that were rejected solely on the basis of the social/economic impact?

Dr. MURDOCK. Yes, there have been several.

Senator LEAHY. Ms. Peelle?

Ms. PEELE. Perhaps the largest one I know of is the rejection in the NRC's recent final environmental statement of the proposed Greene County, N.Y., nuclear powerplant. It was rejected solely on socioeconomic issues, of which the prime one was esthetics.

Senator LEAHY. Where is Greene County?

Ms. PEELE. It is 30 miles below Albany on the Hudson. I did the social/economic portions of that analysis. And the adverse impacts I found, some of which were unmitigable, led also, in part, to the conclusion that the request for a construction permit should be denied. And that is the finding of the final environmental statement.

Senator LEAHY. That is rolling valleys, very, very pretty rural area.

Ms. PEELE. Yes.

Senator LEAHY. It kind of gives you a slight hint of the beauty that is waiting in Vermont, just north of—

[Laughter.]

Senator LEAHY. I am sorry. I could not resist that. I know the area.

Dr. MURDOCK. I think, also, that one might say that the recent opposition to MX in the State of Utah, for example, has been largely on the basis of social economic dimensions, how it will change, how it will impact the way of life in that part of Utah.

Senator LEAHY. It is very interesting to watch the debate on the MX and see some of the most hawkish Members of the Congress come out in opposition to it, not because the thing, as designed, was a military turkey of the first water, but rather because of its impact on their own constituencies. Political scientists could have fun with doing a history of that.

But it is true it is a major thing. And here, again, even just assuming the MX, as originally designed, was very necessary to the security of our country, again, it brings in all the same social questions, too, if that is so, and if something is necessary for the country's good, providing energy, providing national security, whatever.

Having spread the benefits of the country around, how do you spread the detriments around? And are we really saying, on a number of these things, that there is—while benefits may be spread about, the impact of the detriments may be very concentrated. And that is really the difficult part.

Let me just go into one last area here. The Energy Impact Assistance Act, as amended by the Senate this year—and there has been some discussion of that already—but it is to include Federal assistance to communities impacted from nuclear waste sites. Would any of you like to just give me a quick thumbnail of your own evaluation of the act, up to date, and whether more is needed to insure more effective assistance to rural communities?

I personally am concerned about rural communities trying to handle all the multitude of—or deal with all the multitude of

Federal agencies. Should we have just one Federal agency? Should we simplify it? What should we do?

Ms. PEELLE. I think there are many problems with the impact assistance, even for the regular energy boomtowns for whom it was designed. I feel it is generally inadequate to deal with the special problems of repository communities. The good point about it is that it recognizes the need for impact assistance. But most of the other arrangements that I have looked at, usually miss the mark; they do not assure that aid will actually get to the community in a timely way.

There is an extraordinary amount of administrative complexity and coordination required, which puts an extreme burden on rural communities and their elected officials.

Senator LEAHY. An insurmountable one, I might say, in some instances.

Ms. PEELLE. I believe that it is an administrative obstacle course from the local view. But, you know, this is a sample of where things from the Federal view look entirely different than they do from the local view. One reads the legislative history of 1699. It is clear that the Senators who wrote those sections and added amendment after amendment were intent on several things; minimizing Federal expenditures by using Federal funds only as a last resort, and requiring that communities must go to many doors, exhausting all other sorts of possible avenues of support, before they could use Federal funding.

The underlying assumption, which is faulty relative to rad waste communities is that these communities will be rolling in money. Now, for those energy development communities for whom it is basically only a front-end problem, the goals of 1699 are laudable. However, the apparatus set up to maximize Federal goals and minimize Federal expenditures will ultimately defeat most of the principal goals of assisting rural communities.

As I have indicated, I feel it is a questionable approach for the Federal Government to be assuming the prime responsibility for impacts. I believe that the Federal role here might be to create a market for those externalities by requiring local developers, utilities, or whoever, to negotiate with local communities and set up programs, perhaps under State aegis, as in Wyoming, that attempt to deal with the problems as they are at the local level. That is much more easily arranged at a lower level of administration than the Federal level. But the Federal role might be to set up the market by requiring mitigation be done within a certain framework.

And, finally, as I indicated, I think most of the advantages or possibilities of developing an adequate mitigation plan for a given area are undercut by section 608 which says that none of the above sections can or shall be used to delay the going forward of the energy project. My own experience in setting up these plans is that they are very difficult to negotiate, even with a Federal requirement, as at Hartsville which required the developer to sit down and negotiate and develop a plan. And that is part of your leverage in creating a plan—the importance attached to a mitigation plan; 608 removes that. So I think it is more or less a toothless monster.

Senator LEAHY. Gentlemen, do either one of you want to add anything?

Dr. MURDOCK. Well, I guess, in watching this act in the past, I have noted really two difficulties with it for areas in my region. One is that the requirements for qualifying to receive such assistance have often been set in ways that excluded areas that were receiving major impacts. For example, as this act existed in the past, it was heavily tied to a certain growth rate in terms of mining employment.

Now, for instance, in Texas we have many communities that are heavily impacted but are using imported western coal to run, say, coal-fired electric generating plants. They could not qualify under provisions of this act.

The second thing, I think, that has been evident—and it goes back to a point that I made earlier—is that if a local community does not have an active regional planning base or an active planning base of some kind to go out and find all these hoops that have to be jumped through and help them jump through them, they are put off so much by the initial sets of requirements that they, in fact, do not see the process through to obtaining any kind of assistance. You need that kind of local area planning assistance.

Senator LEAHY. Doctor?

Dr. KASPERSON. I would simply add that, in my testimony, I suggested three principles to guide Federal policy in this area. The legislation is largely inconsistent or in conflict with these three principles. The emphasis of the legislation is not upon impact avoidance or risk reduction, but upon mitigation of compensation after harm has occurred. There is, in my opinion, inadequate attention to the question of consent, to the role the community can play in consent procedures, and whether or not it will have some right to nonconcurrence. And, as Ms. Peelle has pointed out, it does not provide adequate emphasis upon internalizing the cost for the beneficiaries of nuclear power use. So, for those reasons, I would have some problems with it.

Senator LEAHY. Dr. Kasperson, Ms. Peelle, and Dr. Murdock, I appreciate very much your attendance here today. I am going to take a 10-minute break before we go to the next panel. I hope you get a chance to enjoy a little bit of Washington, too, while you are all here. Thank you very, very much.

Back to order. The next panel is Jerome Joyce, State senator from Morris, Ill.; and representative William Wilkerson from Lucedale, Miss.; and Frank Huitt, county supervisor, Dane County, Madison, Wis.

Representative Wilkerson, I should tell you that Senator Cochran, who is a valuable and respected member of this subcommittee, saw me at lunch yesterday to tell me that you were going to be testifying and to say nice things about you.

He is on his way in here and had run afoul of what happens to us country folk when we try to drive in Washington traffic. He is caught somewhere twixt here and home in a traffic jam.

Mr. WILKERSON. One of the hazards of the trade, I guess.

Senator LEAHY. I am sure it is. Where is Lucedale?

Mr. WILKERSON. Lucedale is about 30 miles due north of Pascagoula and about 40 miles from Biloxi, also about 30 miles west of Mobile, rural coast.

Senator LEAHY. It sure is. And, Senator Joyce, where is Morris, Ill.?

Senator JOYCE. That is about 60 miles south of Chicago, 55 or 60, central Illinois.

Senator LEAHY. And Mr. Huitt, Dane County, that is Madison itself?

Mr. HUITT. It is, yes. Madison is about half of Dane County.

Senator LEAHY. So you get a little bit of both rural and urban?

Mr. HUITT. We have an intensely urban center and a very rural surrounding area.

Senator LEAHY. Except for more people, it is somewhat similar to the county that I am from in Vermont, which has our largest community and the closest thing to any kind of an urban center in Vermont and then that extremely rural areas, too. It is one or the other.

Mr. HUITT. One of the pleasant things about living in Madison is you are never more than 10 minutes from a farm.

Senator LEAHY. Yes. I have been there. It is very, very pretty.

Senator Joyce, if you could start first, we will go to Mr. Wilkerson and then to Mr. Huitt, then I have a few questions.

STATEMENT OF HON. JEROME JOYCE, ILLINOIS STATE SENATOR, MORRIS, ILL.

Senator JOYCE. Thank you, Senator Leahy, it is a privilege to be here. I represent in Illinois the area where there is an away-from-reactor storage facility right now working collecting spent fuel from other States.

I am going to deviate from my testimony here.¹ There has been a lot of talk about compensation benefits. Now, I farm in central Illinois and there is a power line one of the utilities was putting in, and they put three towers through my farm.

Well, they come up to me and said, "Well, you know, we will give you \$300 a tower." And I would say to them, "Well, I will give you \$300 a tower if you do not put them there."

So it seems that that is the kind of a situation we are in in Morris, Ill. We would rather not be compensated. We would rather not have it.

I think one of the problems we were presented with in getting into what you are trying to work on here is the people in Morris themselves, the county boards, the city council, they do not know what is going on. They know what they see in the paper that the Federal Government is talking about taking over this facility and bringing in spent fuel from all over the Nation, perhaps even foreign countries.

This is very disturbing to them. They do not know where to grasp. They do not know where to turn. It is one of the problems that we are all faced with in any kind of a government office. It is one of the reasons that people do not trust the Federal Government or their elected representatives.

¹ See p. 72 for the prepared statement of Senator Joyce.

We are talking about literally hundreds of tons by the year 2000 of spent nuclear fuel. It seems to me that once you find a site, have a site working and collecting nuclear waste, it becomes politically impossible to move it from there and to find another place.

To borrow a quote from Governor Riley, who is the chairman of the council that I am on, he says he does not understand much about physics but one thing he knows is wherever you put nuclear waste it stays.

We are very concerned that if we are going to be an away-from-reactor site and we are a leading candidate, we would like to know where the end of the road is in this. What is temporary? Is it 5 years or is it 10 years or is it 100 years or maybe 5,000 years?

Another little part that I would like to inject for you to think about and for your subcommittee is what happens—I do not want to get out of your boundaries here—but what happens to nuclear reactor facilities when their life span is over, when the 35 or 40 years comes? That is a nuclear waste issue that has not seemed to have been addressed very much.

The last thing that I heard was that you would fill these things up with concrete and you would leave them there with a guard for 100 years and then hopefully at that end of time, you would know what to do with them.

Well, these sites are put in agricultural areas, along rivers, along the most productive part of our country, and for those just to sit there and be tombs for our grandchildren to look at, it seems to me that that is something that needs to be addressed also.

One thing that I would like you to think about is, just because it is the cheapest, finding a site, for instance, we have one working. It is the only one in the country and it seems that that would be the cheapest one for the Government to use. It may not be the best one.

I would defer to any questions later on.

Thank you.

Senator LEAHY. Thank you very much, Senator. I do have a number of questions, but I think what we ought to do is go to Representative Wilkerson first and then Mr. Huitt and then come back, because some of the questions I am going to have I have a feeling will be appropriate to all three of you.

Mr. Wilkerson?

**STATEMENT OF HON. WILLIAM WILKERSON, MISSISSIPPI
STATE REPRESENTATIVE, LUCEDALE, MISS.**

Mr. WILKERSON. Mr. Chairman, it is certainly a privilege for me to be here to bring testimony¹ I have for whatever benefit it may be to you and your subcommittee. Of course, nuclear energy and radioactive waste, whatever type that you want to call it, is certainly new kids on the block down my way.

We had a delightful experience some 20 years ago with testing that was done by the then Department of Defense. The Department of Defense conducted tests of an A-bomb in salt domes, near the Hattiesburg, Miss., area. At the conclusion of the tests, the wells were sealed and something like 3 of 4 years ago the wells began to leak tritium, one of the elements escaping from the well.

¹ See p. 75 for the prepared statement of Mr. Wilkerson.

So therefore, that experience helped my people to get a course in nuclear related waste materials. Anyway, we have three salt domes which are apparently attractive to the Department of Energy as potential repository sites.

Two of those domes are located in Perry County, Miss., and if you are going to talk about rural, Perry can qualify. In a lot of cases, Senator, the sun sets between the house and the mailbox. So it is very, very rural.

But the other county is Marion which is something like 40 miles to the west. But the experience that we have had in the last few years with DOE's consideration of those sites is always typical of the good news and the bad news type situation.

However, during the last session, 1980 session of the legislature, we authorized by statute, the State entering into a consultation and concurrence process with DOE. That process was developed something like 6, 7, 8 weeks ago.

I have heard some of the arguments pro/con for the consultation/concurrence process but nonetheless I feel, personally, it is an adequate mechanism to reach the people of a local community whereby they may be exposed to the, quote, "educational process" that is necessary in order to help mitigate some of the problems that will develop.

There are three things I would like to say about the consultation and concurrence process. One, the importance or the relevancy or the materiality of whatever goes into that process is very important, and if you have some player in the game who begins to take away or minimize some of those aspects of the information under consideration, you have a tendency to take away.

Therefore, when you take away, you have a loss of confidence in those who participate. As a result, you create more problems than are solved.

Second, it is my feeling that the Federal Government should come to the States with a blueprint rather than the States having to awaken one morning to read in the paper or learn otherwise of activity within their boundaries.

Third, is to not have the consultation and concurrence process an adversary proceeding. To me the whole process would be defeated if a State or local community would have to appear before a Federal panel and argue the merits or demerits of their conclusion about a particular location.

The consultation and concurrence process we have developed in Mississippi, though it is in its infant stages, is working well. We have the confidence of the local community. We have the confidence of the city of Richton and the county of Perry, and we have the confidence of those who live in Marion County.

Our consultation and concurrence process flows information through our State office of energy and transportation, to the local community. All communiques from the Federal level, and all communiques from the local level flow through that one agency of government.

This has a tendency to centralize all aspects of information. It keeps splinter groups from picking up pieces and developing something which may or may not prove to be good in the end.

But anyway, it is my feeling that some of the real answers to a site location would be through an educational process where the people of a local community will know the when, what and where of the site or of the reason why their community is being considered.

When we begin to talk about cost of a location of a site, of course, the only thing I can tell you here is some of the standard costs. But there is a second part to what I want to say which, hopefully, will make the greater impact here.

One, is the loss of ad valorem taxes. Let me give you an example. In Perry County, Miss., the county wherein two of the salt domes are located, presently there are 359,600 total acres in the county, of that total acreage, 159,400 acres of that is in Federal ownership, either Federal forest lands or Camp Shelby military training base.

Therefore, you can see that approximately 50 percent of that county's acreage is in Federal ownership. There are in-lieu payments that are made to the county, but once you put the pencil to this, you can readily see that these in-lieu payments certainly do not meet the cost or at least the money that would be generated if the property was in private ownership.

There are going to be costs in streets and highways which come about as a result of the location of a repository in the community, both during the construction phase and for those who are in permanent residence there for the operation of the repository. Highways are going to have to come to some type of a standard to make possible the safe transportation of radio active waste materials.

The impact on schools and medical facilities for the additional numbers of people that come in, water and sewerage facilities, and there are certainly a lot of others such as police protection, bus service, auto traffic control, fire safety, et cetera.

Those are the standard costs that I can see. Perhaps there are others which have to be, some way or another, met for a local community to survive the impact which will be brought about by the location of a repository.

Certainly, I know that there are resources available through the Federal Government that would minimize these costs. But the second cost item I want to bring to your attention is the experience we are having in Mississippi right now.

For the past 4 or 5 years, our bureau of economic development which is our industrial agency of the State has undertaken a very, very detailed and comprehensive study for the potential location of a petrochemical complex for the production of synthetic fuels.

Our bureau of economic development has, of course, gotten all the support they will ever need from the State, local and district levels for their effort. They have moved very thoroughly into this effort. I think possibly it could have been finalized by now had not one of the corporations that had become a part of the conglomerate saw fit to get out awhile back, but nonetheless, we feel that the petrochemical complex is going to be located relatively soon.

One of the prime raw materials to be used in the petrochemical complex is the brine and chemical elements that are located in salt domes. The petrochemical complex will be located in Pascagoula, some 50 miles south of the dome. Nonetheless, you are talking about a dramatic economic impact to that entire area, not only to

south Mississippi or Mississippi generally, but you are talking about Alabama with the use of the ports, the Alabama River or Louisiana with the ports of New Orleans and the Mississippi River, just to mention that immediate area.

So it is my contention, then, that looking at the economic impact or the cost to a particular community, one must not concentrate just in the immediate vicinity of the potential repository site but must look on out to other areas.

Certainly, Mississippi is blessed with the lowest per capita income of any State in the Nation, we need all the help we can get. It is rather hard for us to see that the economic benefits that might be derived from a waste repository would equal that of a multi-billion-dollar petrochemical complex.

Generally, Senator, that is the conclusion of my statement. I will add one thing, that a lot of time and effort has been put into developing the technology presently available in the nuclear energy and nuclear waste disposal process. Perhaps an equal amount of time and resources should be put into the socioeconomic institutional impact affecting nuclear waste storage.

Senator LEAHY. I could not agree with you more and our whole question, of course, is who should do that and how it should be done kind of study. I rather suspect that at the moment the Federal Government with the problems you mentioned about the atomic bomb testing and the leaking now in the wells and so forth, that the Federal Government is probably not held in the highest of esteem at the moment for their own planning.

I am reminded of the study made of the various kinds of lies most often told. One is the check is in the mail. The other is that I gave at the office. Of course, I will respect you in the morning. And then the last one being, I am from the Federal Government and I am here to help you. [Laughter.]

And we want to make sure that the help, if it comes, is going to be worthwhile.

Mr. Huitt?

**STATEMENT OF FRANK S. HUITT, SUPERVISOR, 27TH DISTRICT,
DANE COUNTY, WIS.**

Mr. HUITT. Thank you very much, Senator.¹ I confess I feel a little bit overwhelmed by this whole process which I think makes me probably pretty representative of the way local governments generally tend to feel about dealing with matters related to nuclear energy, particularly to nuclear waste.

I think overwhelmed probably characterizes exactly what happens to a local government when they begin thinking that they may become in some way involved in the whole question of nuclear waste disposal.

I want to make only a couple of points. They relate largely to, how the Federal Government and local governments relate to each other in this process.

The first point is one that I hesitate to have to make, but it continues to come home to us in Wisconsin and to the other supervisors that I speak to around the country on occasion, that the process must be entirely honest and open to us.

¹ See p. 78 for the prepared statement of Mr. Huitt.

The worst thing that can happen to us is to find out something that we didn't know, find out that we have been led to believe one thing and that another has, in fact, taken place.

Occasionally, I guess we think that maybe this problem is solved, that people are taking us into account, but as recently as a couple of months ago Wisconsin found out that we, again, had not been informed by the Department of Energy.

There are granite deposits in the northern two-thirds of the State which the Department of Energy is currently looking at as possible deposit sites for high level nuclear waste. This is part of a nationwide study that they are doing of a variety of different kinds of geological formations.

There had been rumors kind of running through the State that Wisconsin was being looked at as a potential site for high level nuclear waste, and in response to those rumors, the Governor's office tried to contact the Department of Energy to see if this was, in fact, true, and they were assured, no, Wisconsin was not being investigated.

A colleague of mine on the Dane County board who is also a member of the State planning council called who she could in the Department of Energy and the State planning council and was assured, no, they were not looking at Wisconsin at this point, that they had only sort of looked at maps, and so forth.

Then one of the local newspapers discovered that, yes, in fact, there had been a drilling rig out and they had been doing some surveying. They had been doing some other things like this.

Senator LEAHY. Who had sent out the drilling rig? Had the Department of Energy done that?

Mr. HUITT. It had been hired locally by the Department of Energy.

Senator LEAHY. At the same time they were telling you they were not doing it.

Mr. HUITT. Yes.

Senator LEAHY. I do not necessarily mean this as a defense of the Department of Energy, but the fact that you got a lot of high level people there who do not know what each other are doing or what the Department is doing does not necessarily mean that they are lying to you.

There is a certain consistency in operations with a lot of the people in the Department of Energy consistently ill-informing people, consistently being screwed up. I am trying to give them the benefit of the doubt in this particular area.

So it may not have been a—

Mr. HUITT. I am not trying to assess any blame and I am not trying to—

Senator LEAHY. I understand, but it certainly does not instill a great overwhelming feeling of confidence in you or your department, I mean, toward the Federal Government if you are seeing this happen.

I suspect that the reaction of the public in Wisconsin was not very good.

Mr. HUITT. This is exactly the point. The public in Wisconsin was extremely upset. They were more upset by finding out after the fact through the newspaper that in fact the surveying had been

going on than they were that the surveying had actually taken place.

We in local government and my friends in State government were particularly upset that they could not even find out. Now, again, I am not accusing the Department of Energy or anybody of intentionally trying to mislead the State of Wisconsin, because I do not know that that is the case. In fact, I would suspect that it is probably not the case.

The point remains that there was created by this a considerable reservoir of hostility that persists and will persist for some time. It required, at one point, a hearing at which some representatives of the Department of Energy tried to come in and explain exactly what had happened and to inform the Governor and the State of exactly what was going on, a little after the fact, and it is a problem.

And I think that this leads into a second point that I would like to make and that is that I think that in matters of nuclear waste I would like to see the Federal Government speaking to us with a single voice. I am not sure that we know where to go for information. If there is a question in the State as to what might be going on, I do not know that I would know who to contact and I am not sure that anybody can guarantee that they know the right person to contact.

I would like to see some kind of single focal point, in effect a clearinghouse, for information as it relates to State and local governments.

The final point that I would like to make is that I think it is important that individual representatives from local governments be involved in the site selection process from the earliest stage at which you can identify an area that is specifically under study clear through to the final construction and operation phase of the facility.

We have felt considerably left out. I recognize and appreciate the Department of Energy's difficulty in trying to deal with a number of often hostile governments from the State level and ultimately down to the local level.

If they extend themselves down to the local level it, of course, considerably increases their communication problem in that they have so many more people to keep track of, but I am of the belief that, at the point we are in the debate now, it is absolutely essential that we not re-create the kinds of problems I described to you a moment ago.

Senator LEAHY. Thank you.

You have raised a point that bothers me as much as anything in this and a point that I hear whenever I go to Vermont with my own constituency, and I hear it as I go around on behalf of this committee in other parts of the country. I hear it especially in the smaller communities, 50,000 down, to the various levels, is that, one, they do not know where to go for information to just get final definitive word, this energy area probably more than any other.

We see it in other areas, of course, but my own staff had that same difficulty in finding people in DOE or NRC to discuss just this issue, and I think that the most trying part of all, that is, that

in small communities you so often have people who are doing the work almost as a labor of love.

We have part-time members of the town council, part-time mayors and so forth, and to try to go through and at each door be told that you are in the wrong place, go somewhere else almost as though they are talking about a foreign government as the other place is extremely discouraging.

And I think, at the same time, when you raised the point, and a very valid point, that the local people should be involved, the local communities, counties, States should be involved, that the only way they are going to be involved is if, indeed, they can focus on one Federal entity, whichever is the appropriate one for what they are doing.

And it is going to be impossible to try to get any kind of a cohesive voice from the local and State level if they do not have one place to go with it.

Senator JOYCE, let me ask you a question. If the Morris facility is selected for a future high level waste storage site, do you think the nearby communities would be more willing to accept such a decision if Federal funds were provided to offset socioeconomic costs or do they trust the Federal Government enough in this process that such a decision would not concern them because of their faith in the quality of Federal actions?

In other words, can such trust be bought by Federal funds?

Senator JOYCE. Well, first of all, the taxes that the GE facility is presently paying are over \$300,000 a year. Now, if DOE takes that site over, they lose that or else they are compensated some other way.

But to go back with what Mr. Huitt said, we had a town meeting in Morris about 6 months ago and Under Secretary Deutch was there and there were 400 or 500 people, and he said, "Don't worry. If you do not want that facility here, it will never be here."

We read in the paper a few days later where he has gone on to some other institution to work, and business goes on as usual. We read in the paper where it is getting closer and funds are being appropriated and so forth.

So when Under Secretary Deutch told the people if they did not want it there, it would not be there, they went out and circulated a petition. They have over 10,000 names from a community of about 8,000. So they have got virtually everyone saying, "No, we do not want it there."

So I really cannot see that all that trust is there in the Federal Government. An away-from-reactor site, temporary storage facility, what-have-you, I would guess that people would feel much more at ease if they knew, as I said before, just what temporary is.

Senator LEAHY. And nobody is in a position to give you than answer.

Do you know if any studies have been done on the socioeconomic impacts on the communities near the Morris and Sheffield sites?

Senator JOYCE. I think that DOE is presently doing one now.

Senator LEAHY. Do you know who is going to be responsible for the costs, the Federal Government, the users or the local residents?

Senator JOYCE. I do not.

Senator LEAHY. Has there been any kind of a effect that you have been able to see with tourism in a site like this? For example, reopening the site, expand the site, what kind of an effect would that have on tourism?

Senator JOYCE. Well, we are mostly corn fields, Senator.

Senator LEAHY. Is not anything wrong with those.

Senator JOYCE. Not a thing. We would like to keep them that way, too.

Senator LEAHY. I guess the buzzer is not working but the lights are working. That little white light on the side says that there is a vote on on the Senate floor, and I will recess for just a couple of minutes and then come back.

[Whereupon, a short recess was taken.]

Senator LEAHY. I apologize to you all for the interruption. This should discourage any of you ever wanting to be in the U.S. Senate. You cannot have orderly lives. I always try to tell that to anybody from Vermont who is over 30 and thus eligible to run.

Mr. HUITT, you work closely, as you said before, with the county and local governments. Depending upon the size of the county or local government, I suspect you have a great variance in the type of expertise available to analyze or review the impacts of a possible nuclear waste disposal facility.

And in any event, in most communities, most counties that are suddenly faced with the fact that they might be picked, they probably would not have that expertise, certainly in-house. Would you recommend Federal technical and financial assistance to develop that capacity in a community or in a county that might suddenly find itself targeted to be a waste disposal site?

Mr. HUITT. Absolutely. The resources that a county has to bring to bear on an issue of this magnitude simply are not only inadequate, they are almost nonexistent. This trip of mine today to appear before you represents something of an investment for Dane County simply in buying my ticket. I cannot even find somebody who is available to type a statement for me which is one of the reasons I have no prepared statement.

If we are to try to take those kinds of resources and evaluate technical reports coming from the Government on nuclear waste, we simply cannot do it, and I represent a fairly urban county with resources that are much greater than many of the rural counties further north in Wisconsin. They would be even more strapped than we are.

Senator LEAHY. Let me ask you another question in that regard, and I will ask this, actually, of all three members of the panel. Should local governments, either at the municipal level or at the State level, have final veto power in the location of a nuclear waste repository facility?

Mr. HUITT, let me start with you, sir.

Mr. HUITT. My initial reaction to that is—it may be an interesting one. I would hesitate to be vested with that power because my constituents would ask why I did not use it if I had it available to me.

It is kind of dangerous, but I think it is essential in the sense that it is an assurance to local governments that the people we are

dealing with are willing to put their honesty and their claims to reliable technology on the line.

So to try to come to a brief answer to your question, I think, yes, it ought to be available, and our efforts ought immediately to work toward never having it used.

Senator LEAHY. OK. How about you, Mr. Wilkerson?

Mr. WILKERSON. I am like Mr. Huitt. I would love to say yes, they should have it and forget it, but I realize that if all 50 States could say that, then we would be in trouble.

In our memo of understanding with DOE, we have the Governor acting for and on behalf of the State. The highest official within DOE who has signed the memo of understanding will act for the Federal Government as two members of a three-member arbitration panel.

The third member would be selected through some agreed process. Of course, that has not been worked out yet, but a third member would be completely removed from the process. The third member of the panel would sit and arbitrate something that failed to be concurred in by the main actors.

If the consultation/concurrence process works as it should and there has been proper and open and so forth understanding all the way through on all points and with some form of an arbitration proceeding on those things that cannot be concurred in, no, I do not think the States should have that veto.

Senator LEAHY. Senator?

Senator JOYCE. It is a difficult question. I do not think they should either. I think that there should be consultation and concurrence, but certainly, we do not have that right now.

So until things get better, I would almost say, yes, that there ought to be a veto somewhere, whether it be Congress where, I guess, it is now, or shifted to the general assemblies of the States or to a county. I am not sure.

Senator LEAHY. But you are on the State planning council in Illinois, and you do not feel that the current consultation and concurrence procedure is working as well as it should?

Senator JOYCE. No, I do not, not at all. I think that that is our biggest hangup. I guess with any people in political power, knowledge is power and that does not get shared the way it ought to. So that presents a problem to me and I think to the rest of my constituents.

Senator LEAHY. Have you talked to others in other States in similar situations?

Senator JOYCE. Oh, sure. I think everyone has the same fears in Mississippi; we are sure going to be watching to see how that does work. The tools may be there, but we certainly are not getting them funneled in the right direction.

Senator LEAHY. Mr. Wilkerson, I know Senator Cochran is going to give me a quiz afterward to make sure that I learned something from this and behaved myself so you feel free to add whatever else you would like.

Senator Stennis is, too. One gets me early in the morning, and one gets me late in the afternoon. I get doubled-teamed by Mississippi here.

Mr. WILKERSON. We are very hepped up about our C. & C. process. Now, we got all the hopes, and we have had apparently a little different relationship with DOE than my friends from Wisconsin and Illinois and perhaps other States.

We have had a good working relationship with them, and certainly hopefully it will continue to be the same, and even though our memo of understanding and the C & C process, as I said awhile ago, is only 6 to 8 weeks old, we have all the high hopes in the world for that. We feel like it is going to work.

I mean, as far as the people on the State level are making every effort, the local people, people right in Perry County where two of these domes are located, they have all the confidence in the world. They have expressed to me confidence in this process where they work through the State and from the State on to the Federal level and vice versa.

We are rather hepped up about it. Locally, we do not have the relationship or what is happening to my friend in the State of Illinois. That boggles our mind, so to speak. Hopefully, it will work, and if we could get this to work in Mississippi, perhaps, it will be the first time the State of Mississippi has taken the lead on anything that other States of this Nation could copy from.

Senator LEAHY. Thank you, sir.

We will have, as we will with the others, once we have the full transcript, we will send you copies of your transcript. If you want to add any further material, certainly we will keep the record open for that purpose.

Thank you. Thank you all for being here. I hope you all have very safe trips back and hope you get a chance to see a little bit of the District of Columbia while you are here. Maybe you have seen enough of Washington, D.C. [Laughter.]

The next panel is Secretary George Cunningham, Assistant Secretary for Nuclear Energy of the U.S. Department of Energy; Deputy Director of the Office of Nuclear Materials Safety and Safeguards at NRC, John Davis; and Gordon Cavanaugh, the Administrator of the Farmers Home Administration, U.S. Department of Agriculture.

So Secretary Cunningham, why do we not start with you, sir?

STATEMENT OF GEORGE W. CUNNINGHAM, ASSISTANT SECRETARY FOR NUCLEAR ENERGY, U.S. DEPARTMENT OF ENERGY, ACCOMPANIED BY SHELDON MEYERS, DEPUTY ASSISTANT SECRETARY FOR WASTE MANAGEMENT

Secretary CUNNINGHAM. Thank you, Mr. Chairman. I am pleased to be here this morning, and we do have a prepared written statement, which, with your permission, I will enter for the record, and I will summarize with a few comments.¹

Senator LEAHY. I appreciate receiving the statement, and I have tried to go through each one of these as far as I could this morning. The statement from the Department of Energy was late in arriving. So why do you not give us a summary, then we will go right to questions.

Secretary CUNNINGHAM. Thank you. I also have with me Mr. Sheldon Meyers, the Deputy Assistant Secretary for Waste Man-

¹ See p. 79 for the prepared statement of Secretary George W. Cunningham,

agement who will also be pleased to participate in questions you may have.

Senator LEAHY. Always glad to have you here, sir.

Secretary CUNNINGHAM. I would like to begin by saying that we do believe that it is important to introduce this consideration now. It is an essential component of responsible overall waste management planning.

We also believe that participation in the planning is required of all concerned parties, that is, the Federal, State, local governments as well as the commercial entities who might be involved.

The waste arising from the defense, research and development and commercial activities fall into three categories, low-level waste, spent fuel and reprocessed high-level waste.

Now, under our current policy, responsibility for low-level waste belongs to the States. Supervision and possible impact assistance will be provided by the States and I should also say that in general in our early meetings with the State Planning Council on Radioactive Waste Management which was set up by Executive order of President Carter, the States have expressed a desire to maintain responsibility on either a State regional basis for low-level waste burial grounds.

So in general, I would expect, through the procedures available there, impact assistance to be considered in the normal manner.

Spent fuel will be stored, providing legislation is passed, in away-from-reactor interim storage facilities by the Department of Energy as required. Now, those facilities will have to be considered again in terms of possible impact assistance.

Also high-level wastes are the full responsibility of the U.S. Government and, in fact, the responsibility of the Department of Energy, and that is true from both defense programs and power reactors, and those wastes will be permanently disposed of in deep geological facilities. In fact, the President's program, in which a statement was issued earlier this year, calls for an expanded program on geological repositories and we have initiated that program as part of our ongoing efforts, and it is timely to consider potential impacts at this time.

In considering the impact assessments to date, there are both positive benefits and negative effects. Probable benefits to the surrounding areas will be first of all, from channeling the outside financial resources into the affected community through the repository workers' salaries and payments for local supplies and services. There would be certainly increased tax revenues from additional expenditures in the community.

I should say, in line with these points, the generic estimates of repository manpower requirements as well as construction and operating costs are included in the Department of Energy Draft Environmental Impact Statement on Management of Commercially Generated Radioactive Waste.

I have a number of tables here which I will submit for the record,¹ but briefly the range of 1,000 to 3,000 people will be directly employed during peak construction years, and around 1,000 to 2,000 would be employed during the operational phase.

¹See p. 83 for the above preferred to tables.

Secretary CUNNINGHAM The construction cost in 1978 dollars will range from \$1 to \$3 billion. That is not a range of uncertainty. It is a range depending on the type of media used, that is, whether it is salt or a hard rock such as granite or basalt.

Basically, the conclusions that we have made with regard to the generic environmental impact statement is that there would be a minimal, long-term environmental impact because of the selection process of highly qualified sites and a multibarrier construction and a systematic evaluation of the process.

The main, short-term environmental impact would result from nonradioactive airborne, waterborne release from small piles accumulated from mining activities. For example, land near repositories in salt could be contaminated by windblown salt and nearby streams polluted by runoff containing salt.

These effects could, of course, be obviated by available methods of salt removal such as dilute dispersal at sea. Again, I emphasize I am speaking of nonradioactive impacts.

Now, specific impacts will, of course, have to be assessed in site-specific environmental impact statements, for, first of all, acquiring the sites, and second, for construction of the facilities.

Now, if I may, I would like to summarize briefly the authority for handling socioeconomic impacts. Under the existing law, the Department of Energy is allowed to make payments in lieu of the tax revenues which would have been paid for such property in the condition in which it was acquired.

Second, we are allowed to provide for financial assistance to local educational agencies upon which the Government has placed a financial burden.

Third, I would say that several Federal loan and grant programs may apply. For example, there is a Department of Energy-Department of Agriculture administered program of energy impact assistance which provides coverage for coal and uranium mining activities.

There is also legislation now in Congress which would extend this program to radioactive waste disposal activities. That is covered under the DOE authorization which has been passed by the Senate.

In the past, the Atomic Energy Commission was empowered to finance services for communities, such as Los Alamos and Oak Ridge whose original existence was due primarily to the presence of an Atomic Energy Commission program. This precedent could also be used in considering legislation which would allow for direct financing of community services by the waste isolation program.

I would also say that we do have some good experience with nuclear communities. For example, at the Hanford operation, the economic benefits have been and continue to be positive, and we would expect positive benefits there. In this particular case, waste management facilities might actually prove added benefit because of the concentration of the total fuel cycle at that site.

Senator LEAHY. Is Hanford the one where they had the leakage of several hundred thousand gallons of radioactive materials?

Secretary CUNNINGHAM. There have been leaks from the radioactive waste tanks which were placed there under the early defense program. Those waste tanks, constructed during the early

part of the nuclear program during the war, are being replaced. New tanks are being constructed.

That program is almost complete, and we are transferring waste into the new tanks there.

With regard to prospective mechanisms for dealing with socioeconomic impacts, the Department of Energy is currently studying the possible requirement for a program of assistance which would be based on impact associated with nuclear waste disposal and transportation activities.

One area which requires further study and clarification is the policy of allowing incentives to encourage States and localities to accept location of nuclear waste repositories within their jurisdiction.

The Department of Energy is interested in developing a variety of mechanisms for dealing with the added cost to a community for providing the services needed by the repository work force and their families.

If such assistance were considered appropriate, a possible source of compensation would be charges paid by the utilities for disposal of their waste. Assistance in developing appropriate mechanisms to handle this type of impact is desired from institutions such as the State Planning Council, the National Academy of Sciences, and other appropriate Government agencies.

I will also submit for the record a listing of some of the more pertinent studies that have been performed which are aimed at identifying and assessing socioeconomic impacts. [See prepared statement, p. 83.]

From these studies, and others that we will initiate in the future, we plan to develop our impact strategy in concert with the State and local groups.

In summary, I would say that on the face of it, a nuclear repository would appear very similar to other construction and mining activities. Although we recognize that this is a special type of facility, there are special types of impacts which must be considered, we believe they should be considered and if necessary special legislation should be passed.

Thank you.

Senator LEAHY. Thank you very much.

Mr. Davis?

STATEMENT OF JOHN DAVIS, DEPUTY DIRECTOR, OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS, NUCLEAR REGULATORY COMMISSION, ACCOMPANIED BY GUY H. CUNNINGHAM, CHIEF REGULATIONS COUNSEL, AND JOHN B. MARTIN, DIRECTOR, DIVISION OF WASTE MANAGEMENT

Mr. DAVIS. Thank you, Mr. Chairman.

I would like to comment that I am accompanied today by Mr. John Martin who is the Director of the Division of Waste Management of the NRC and Mr. Guy Cunningham of the Office of the Executive Legal Director to provide answers that you may require.

Senator LEAHY. We are pleased to have them here, and thank you for bringing them.

Mr. DAVIS. First, I would like to comment in general terms on the NRC role in the national waste program. The NRC's authori-

ties and responsibilities for the waste program are derived from the Atomic Energy Act of 1954 and the Energy Reorganization Act of 1974.

Basically, these assigned the NRC its responsibilities to regulate the receipt and possession of certain nuclear materials, including waste, to protect the public health and safety and promote the common defense and security.

Hence, NRC neither owns nor operates any nuclear waste disposal site.

Turning toward the specific matters raised in your letter of invitation, first, let me point out that the exercise of our regulatory authority to protect public health and safety and to promote the common defense and security will not normally require NRC to deal with cost allocation issues which have been identified, and the Commission has no plans to address these issues.

As your letter suggests, the impact will be different in degree if not in kind for high-level waste and low-level waste facilities. Low-level waste accounts for the various volumes to be disposed of that typically does not contain radioactivity that is so high, so penetrating, nor so long-lived as to make it unsuitable for near surface shallow land burial. Disposal entails some long-term control and surveillance after closure of the site to assure against exposures from intrusion or the unanticipated ground migration of radionuclides, but not a commitment comparable to that of high-level waste.

Licensing of commercial low-level waste facilities can be done by the NRC or by agreement States. NRC responsibilities for commercial low-level disposal licensing and regulation may be delegated to an interested State under an agreement pursuant to section 274 of the Atomic Energy Act as amended. There currently are 26 of these agreement States.

All three of the currently operating commercial low-level waste burial facilities are regulated by such agreement States. My comments and this testimony concerning low-level waste apply to NRC licensing of commercial facilities, not to agreement State licensing.

The NRC does, however, stand ready to assist agreement States.

We believe the socioeconomic impact of commercial low-level waste facilities are relatively small compared to those of a high-level waste facility, primarily because the handling facilities do not require the degree of shielding and because excavation is not nearly as extensive and is typically carried out incrementally as waste is received.

The impacts of such facilities are quite site specific, however, and are considered by the NRC in an environmental impact statement for a given proposed low-level waste site.

By contrast, the selection of sites for high-level waste disposal and the design, construction, operation, and decommissioning of disposal facilities has been left exclusively to the U.S. Department of Energy, subject to NRC licensure and regulation.

These DOE functions, in our view, carry with them the primary burden of responsibility to mitigate their social and economic impacts. Disposal of high-level waste requires more capital investment and more labor than the low-level waste disposal to complete

subsurface excavation and construction of surface facilities for material handling and security.

From a generic sense, this could translate into socioeconomic impacts considerably greater than other waste management facilities since the project is likely to bring in more workers and their families. It may require expanded educational facilities, hospitals, roads, and so forth.

While the kinds of impacts that a host community would be likely to incur from a high-level waste repository can be anticipated, we believe that DOE, as the agency responsible for selecting the site and designing, constructing, and operating the facility, would have the prime Federal agency responsibility for specifically identifying those impacts and of estimating the likely costs of mitigating them for a particular host community well before the Commission's formal licensing would begin.

We do consider socioeconomic considerations in our licensing process. However, a more strategic point for the examination of these issues arises before the process formally begins: When DOE is selecting sites, considering options for possible facility designs, and conducting its own NEPA review process for a site characterization program as a part of the decision on whether to apply for NRC authorization to construct at the site.

Now, turning to the matter of State and local role in nuclear waste facility siting, we expect that the social and economic impacts of siting an HLW waste repository would first be identified and considered by DOE. But we also anticipate that these impacts may change as the project encounters needs for adjustments in design, construction, or operation.

Some of these changes will probably arise during our licensing review. We are convinced that the States, working cooperatively with their local counterparts, are in the best position to know what these impacts are likely to be.

For this and other reasons, our proposed rules for the licensing of both high-level waste and low-level waste disposal facilities provides extensive opportunities for State participation. To help identify impacts as early as feasible, these rules also encourage a prospective applicant to begin consultation with State and local government even during the development of the license application.

Senator LEAHY. But the final determination is still NRC's. I mean, the State, even with all that consultation, and all, if they disagree, you still have the authority to override them.

Mr. DAVIS. I am sorry, sir?

Senator LEAHY. The final determination is still that of the NRC. Even though the State may participate, help identify impacts, and so forth, if the Federal Government disagrees with the State on any aspect of it, it is the Federal Government that has the final word, is that correct?

Mr. DAVIS. It is our final authority to issue or deny the license, right.

Senator LEAHY. OK.

Mr. DAVIS. Both our proposed rules for high-level waste and for low-level waste give the States an opportunity to participate in our review and evaluation of license application before the Commission

actually receives a license application. When the applicant files notice of intent to submit the application, this triggers an NRC notice to State and local governments, and begins a process under which States can develop proposals in consultation with local governments to participate in NRC staff analysis of the application and its supporting documentation.

In a procedural rule for high-level waste disposal, the State has the same opportunities in proposals for participation much earlier in the process. At the point where DOE is ready to begin characterizing a particular site to gather data, here DOE would submit a site characterization report.

When the report is received, NRC staff would notify State and local officials, and States could propose to participate with NRC in analyzing it for DOE's further guidance as DOE considers whether and how to prepare an application.

The second theme common to both our proposed rules is flexibility. They afford States a broad degree of discretion according to the needs, resources, and relationships with local government in which to participate with us. The State may request to participate in several ways. For example, it could review specific portions of a license application on technical assistance work for the Commission, or perform environmental radiation monitoring.

It should be noted here that, under both rules, these provisions for early State participation are an addition to the separate opportunities for States, local governments, and the public to participate formally in our license review to make input into our environmental impact statement. Both of these opportunities would, of course, be available later, after receipt of an application.

Most of the waste management bills now pending in the Congress contain some provision for DOE to inform and consult with States throughout the site screening and characterization stages. The Commission supports such State and Federal interactions which, hopefully, will serve to resolve State concern.

If a significantly affected State's concerns on socioeconomic or other matters are not resolved, we believe it should have an opportunity to object formally to the construction and operation of a high-level waste repository within or adjacent to its borders. However, we believe that opportunity should come only after the NRC hearing on DOE's application for construction authorization. At that point, there would be a full record of information on the proposed site, the repository design and the waste form, to serve as a basis for evaluating the State's objection. But it will still be early enough that large commitments of resources to a particular site will not yet have been made.

We agree that a procedure should be defined whereby the President and/or the Congress reviews and resolves such formal State objections. NRC has no position on what these details of the procedure should be.

With regard to Price-Anderson——

Senator LEAHY. I read the material in Price-Anderson. Let me just ask you a couple very quick questions on that.

Could the Price-Anderson Act be considered a hidden subsidy to the nuclear industry? Would their insurance costs be higher without it?

Mr. DAVIS. I believe some would so characterize it, Mr. Chairman.

Senator LEAHY. Would their costs be higher without Price-Anderson?

Mr. GUY CUNNINGHAM. Mr. Chairman, let me just clarify. You are asking about the applicability, now, of the Price-Anderson Act to waste facilities?

Senator LEAHY. No, just generally, then I will go to the next question.

Mr. GUY CUNNINGHAM. At the time the act was enacted, the assumption was that private insurance would not be available, and private firms would probably not even enter the nuclear industry.

Senator LEAHY. But would they today, to the extent that it is available? Does Price-Anderson, in effect, lower the insurance rates of the nuclear utilities?

Mr. GUY CUNNINGHAM. I believe, Mr. Chairman, that is the practical effect as noted in the recent GAO report to the Congress in that aspect.

Senator LEAHY. Now, relative to the testimony, we have talked about the fact the NRC has the authority to extend Price-Anderson to nuclear waste sites, but that that has not been extended. Now, Price-Anderson was enacted to get utilities to move into nuclear energy. To the extent Price-Anderson applies to waste sites, does that serve that purpose, as well?

Mr. GUY CUNNINGHAM. I believe it is premature to ask that question, as I understand it. There has not been a consideration yet of whether or not Price-Anderson indemnification would be made available to waste sites.

Senator LEAHY. Are there specific risks or questions that have kept the NRC from extending Price-Anderson to waste sites?

Mr. GUY CUNNINGHAM. Not to my knowledge, Mr. Chairman. I think it is a matter that is premature. Before the national waste policy is fully determined, which the Congress is now endeavoring to do, and before a complete record as to the nature of the risks, and so forth, is developed in the context of licensing, it is just too early to decide what those risks are and what the need for indemnification is.

Senator LEAHY. Fine. Thank you, sir.

Our next witness, Gordon Cavanaugh, is no stranger to this subcommittee. I think, during each year, when the various agricultural bills are coming through, I believe they forward your mail over to our committee room. You spend enough time between here and the House, and we are delighted to have you back here again. If you could just give us a summary of your—actually, it is fairly easy to give a summary of the statement. The statement is short.

Perhaps, if you could go through that, Mr. Cavanaugh, and then I will go to questions for all three witnesses.¹

STATEMENT OF GORDON CAVANAUGH, ADMINISTRATOR, FARMERS HOME ADMINISTRATION, U.S. DEPARTMENT OF AGRICULTURE

Mr. CAVANAUGH. Thank you very much, Senator. And I am pleased to be here and have the opportunity to discuss some as-

¹See p. 97 for the prepared statement of Mr. Cavanaugh.

pects of the issue of nuclear waste disposal sites and their effect on our rural communities.

This issue is new to Farmers Home. It is one that has not really required much of our attention to date, and we certainly do not consider ourselves expert on the subject. We are, however, aware of the public's concern and the conflicting opinions on this very important issue.

And as had been indicated by the witnesses who testified here earlier today, including those on this panel, the location and the impact of such sites is going to have a dramatic impact, in my view, on the small communities of the country. Such sites, it appears, are apt to be located in the less densely populated sections of the country. And, of course, they are the ones that we deal most regularly with in assisting them with their development and community problems.

As some of the elected officials on the preceding panel indicated, the small communities are quite fragile, and are ill-equipped to deal with the needs to plan and provide assistance and, generally, to accommodate the rapid expansion that can be associated with such installations.

I was struck by the numbers of jobs that were indicated by the first witness of this panel that would be associated with developing such a nuclear waste site. When you speak of 1,000 to 3,000 workers, if I recall the figures correctly, you are talking about the size of most incorporated bodies in the United States, if my census data is reasonably accurate.

We, as an agency, do not presently have any policy or program that deals with nuclear waste disposal and storage, nor do we have any regulatory authority, nor do we seek it. It presumably is lodged in the agencies that have more direct involvement with the development of such sites.

However, I am pleased that you invited our agency to be here today, because I think that the issues suggested by the testimony are ones that we should spend more time considering how our programs can assist the communities that will become involved in meeting the expansion that they face, as well as a number of other problems that they are apt to be confronted with, such as relocation of water facilities, and the like.

Our most analogous experience is with the—that is, our most analogous experience to small towns undergoing a boom expansion is in the energy impact areas, that is, those sections of the country where there has been a dramatic exploitation of energy resources with all of that entails in the way of enlargements of both the work force developing the mines, and other plant aspects, as well as the people who come to operate them in the long run.

We have seen, as the country has seen, that this has caused tremendous socioeconomic impact on these communities, calling for major capital expenditures in expanding housing, health care, educational, and all of the assorted community facilities that make life decent for the inhabitants.

At Farmers Home, we are making some efforts to improve our knowledge of the impacts that do come from rapid community growth. We are currently involved in a survey of all existing research and articles that have been done on the subject, preliminar-

ily to undertaking some studies of our own. Moreover, the Department of Agriculture, through its Science and Education Administration, is sponsoring a research project under a USDA/DOE inter-agency agreement to assess the socioeconomic effects of repository sitings in rural areas, that is, its effects on both agriculture and, I believe, small towns, as well.

That is a 5-year project, and we do hope that what is learned through their project will be made available to us as it progresses.

I believe one of your witnesses this morning, Dr. Murdock, from Texas A. & M., is one of the principals in the project. As I say, the 601 Energy Impact bill, whereby we receive funds through the Department of Energy under the Power Plant and Industrial Fuel Use Act of 1978 is operated by Farmers Home. Under it, we can provide grants up to 100 percent for financing growth management and/or housing planning. In addition, we can authorize grants up to 75 percent of the cost of site acquisition and/or development of sites for housing and necessary community facilities.

Senator Leahy, I know you will be pleased to know that we have obligated all the funds that have been given to us under the 1979 appropriations, and we are in the process of obligating what we believe will be all of the \$43 million that was allocated to us in the current year.

The provisions of that bill, and I am sure that you and the committee are aware, are limited to areas experiencing rapid population increases caused by coal or uranium mining, processing and transportation. It does not apply, at this point, to nuclear waste disposal sites.

The Senate recently passed S. 1699 which extends the energy impact program. This bill would allow USDA, through Farmers Home, to provide loans, grants and loan guarantees to areas affected by nuclear waste disposal sites. And I am advised that similar amendments are pending in several committees on the House side.

We support the extension of the program to include communities affected by nuclear waste disposal sites, and the design to encourage the States to assume responsibility for—some responsibility, rather, for energy impact assistance.

I would just like to note, in conclusion, that the President, in December of last year, announced his small community and rural development policy. And, of course, this is meant to focus the attention of all Federal agencies on the problems of small towns and rural areas, and represents a strong commitment of this administration to the welfare of those communities. And I am sure that that type commitment will continue in seeing that they are adequately assisted on the impacts that come from nuclear site development—nuclear waste site development.

Again, I would just like to say that I appreciate the opportunity for us to be at this hearing, and to learn more of the issue and its potential impact on the communities that we serve.

Senator LEAHY. Thank you, Mr. Cavanaugh.

In February of this year the President sent a message to the Congress, and he said, and I will quote:

All costs of storage, including the cost of locating, constructing and operating permanent geologic repositories will be recovered through fees paid by utilities and other users of the services, and will ultimately be borne by those who benefit from the activities generating the waste.

And I certainly agree with that. But I wonder will the—I ask this, Mr. Assistant Secretary, of you—would the administration's policy that all costs of storage of high-level nuclear waste be covered through fees paid by the users be extended to low-level-waste storage—uranium mill tailings stabilization. And will the cost include social, economic and R. & D. costs?

Secretary CUNNINGHAM. Under our policy, we would certainly expect that all of the costs, including the socioeconomic costs, research and development costs, the actual costs of transportation and operation of the facilities, would be borne by the person who generates the waste.

As I indicated earlier, the low-level repositories will be managed, most likely, either under license to the NRC or under State NRC licensing arrangements. There, again, it would be the administration's expectation that all costs of a similar type would be, again, reimbursed by the person who generates the waste.

With regard to the question on uranium mill tailings, this is somewhat of a separate issue because we do have, at present, the Uranium Mill Tailings Radiation Control Act under which we are actively proceeding to clean up and make corrections of old mill tailings sites which were not adequately covered under the law at that time. Insofar as any new activities are concerned, they will, to the best of my knowledge, be completely covered under NRC licensing arrangements.

I believe that covers all points of your question.

Senator LEAHY. Thank you.

There was a comment made earlier by Mr. Huitt from Dane County, Madison, Wis., that there had been drilling for sites. And I has asked him by whom. He said contracted by DOE at a time when DOE was saying that they were not considering that area of Wisconsin for a site. I thought, while you are here, that is something you may want to respond to either here today or for the record.

Secretary CUNNINGHAM. Well, I would just make a very simple statement, Mr. Chairman. First of all, we have had no drilling rigs in Wisconsin which are associated with a nuclear waste management program. We have no intention of doing any drilling or any extensive geological work there without prior consultation with the State. We are trying very hard to place into a workable consultation/concurrence process. And to do that—we believe the most effective way is by creating a memorandum of understanding with the States in which we intend to perform either exploratory work or simple geologic investigations.

We have started off with a not too good record in New Mexico, but I believe we now have a good record there. I was pleased to hear the testimony from Mississippi where, again, we have tried to establish this process. It is our policy and our intent to establish a workable consultation/concurrence process in every State in which we work.

Senator LEAHY. Did you have a chance to talk with Mr. Huitt about that situation at all?

Secretary CUNNINGHAM. No, sir, I have not.

Senator LEAHY. Do you know who is contracting for that drilling?

Secretary CUNNINGHAM. No, sir. But I will be happy to see if there are any Department of Energy contractors in Wisconsin. If there are, I will provide that information for the record. There are certainly none associated with a nuclear waste management program.

[The following information was subsequently submitted by Mr. Cunningham:]

Project offices of the Department confirm that there is no drilling activity in Wisconsin for either the nuclear waste, geothermal energy or uranium resource evaluation programs.

Senator LEAHY. Mr. Cavanaugh, does FmHA support extension of "Section 601: Impact Assistance Program," without provisions for cost recoupment from users of sites?

Mr. CAVANAUGH. I am not sure I understand that. I do not know whether there is any amendment pending currently. If I understand the issue, this is after we have made a grant in combination with the local grant. The site then is disposed of. It has been our practice that, on that sale of the property, the local community recovers its contribution. We have recently been advised by our counsel that we may not be interpreting the law correctly in that respect.

I think it is our view, at least at Farmers Home, that the practice we had been following is a desirable one, and if it needs legislation correction, it should receive it.

Senator LEAHY. Secretary, I hope you will forgive me if I ask a question which may appear to have as much of a parochial bent as a national bent. There is part of an unpublished volume of Jefferson's Rules of the Senate which says the chairman of any standing committee or subcommittee is allowed to ask at least one parochial question at every hearing.

When the site selection process is carried out for high-level waste repositories, you are going to be looking for sites that are safe, least costly, and cause minimal impact on surrounding rural areas and small communities. Now, Vermont granite has been—perhaps still is being considered for a permanent waste repository. I know it had been at one time. But DOE information provided to an earlier congressional hearing show that, of the four major storage mediums under consideration, salt, granite, shale and basalt, granite requires significantly more manpower to construct and operate than two of the other mediums; I guess it is roughly the same as basalt.

Now, is it correct, then, to say that a granite depository would cost more to construct and operate and, due to significantly higher manpower requirements, would carry with it greater social and economic impacts on surrounding communities than either a salt or shale repository?

Secretary CUNNINGHAM. I think it is correct as you have stated, Senator. We have indicated that, certainly, mine construction in a hard rock repository such as granite does require both a greater cost and a greater manpower. As a result of that, I would also expect that the peripheral socioeconomic impacts will be greater.

Senator LEAHY. Does that rule out Vermont?

Secretary CUNNINGHAM. No, sir. The President's statement you referred to earlier asked us to expand our geologic investigations to

include other media. These other media also include hard rock which do include granite formations. There are a number of granite formations of interest in the country. Some of these, for example, are in the Wisconsin and Michigan area that was referred to earlier. There is granite, obviously in Vermont. But there are also several other hard-rock-type areas, such as the basalt in Hanford, and granite formations, as well, in the other regions of the West which are of interest to us. So, at this stage, it would be premature to rule Vermont out. But it—

Senator LEAHY. You would not like our granite, anyway. It is not the kind you would—

[Laughter.]

Secretary CUNNINGHAM. No, sir, your granite is already radioactive.

Senator LEAHY. Let me just backtrack. But the basic questions that you are looking for sites as safe, least costly, and cause minimal impact on surrounding rural areas in small communities, those are still basic criteria of the Department of Energy?

Secretary CUNNINGHAM. Yes, sir. In addition, we are also very interested, as indicated earlier, in mitigating any of the socioeconomic impacts and planning for that.

Senator LEAHY. I understand. Should a State have the option to veto the location of a nuclear waste storage site within its borders?

Secretary CUNNINGHAM. This is a question, as you know, that has been debated extensively and discussed to a great extent in both the Senate and the House. And there remains a considerable amount of concern about the process which would be involved here.

In a strict legal sense, we in the Department do not have the authority to grant a veto. However, we do believe that we should work very closely with State and local officials, that there should, indeed, be a real form of concurrence in which all the interested parties have an opportunity to participate to the extent needed to obtain the information available. If there are questionable areas where more information is needed, that there should be a means of working that out. And this is the reason that we believe it is desirable to enter into a formal memorandum of understanding, even though we do not presently have authority to grant a veto. In my personal view, we should not grant a veto.

Senator LEAHY. Well, then, let me go to another step of that. Should a local government have the option to ban the transportation of nuclear waste within its own jurisdiction?

Secretary CUNNINGHAM. Well, again, this becomes a question which is more complex than just a simple yes/no answer because it does involve the Interstate Commerce Commission rules. It involves transportation; certainly in the transportation of any Defense-related radioactive materials, I think it should not have that permission or that opportunity. On the other hand, with regard to commercial waste which is transported within the United States, it certainly should have the opportunity to participate in a means of establishing a reasonable way in which that material can be transported around the country.

Senator LEAHY. Are you saying that, for example, the District of Columbia should not be able to pass an ordinance which says that

you cannot trundle nuclear waste down through Pennsylvania Avenue or Constitution Avenue, Connecticut Avenue?

Secretary CUNNINGHAM. Well, I would not go so far as to say they should not pass a rule prohibiting it going down Pennsylvania Avenue because it could be a nuisance, as any other major transport activity. On the other hand, I do not believe the District of Columbia should be in a position to ban the transport of radioactive waste either through or into or out of the District.

There are hospitals operating within the District of Columbia which must handle radioactive material, and there must be means for their being able to do this.

Senator LEAHY. There would be a ban allowing anybody else to come through the District of Columbia?

Secretary CUNNINGHAM. I am sorry?

Senator LEAHY. Should they be able to ban anybody else from coming through the District of Columbia? For example, should they be able to ban somebody going from Maryland to Virginia, but going through the District of Columbia?

Secretary CUNNINGHAM. Well, there is a proposed Department of Transportation regulation which would preempt local restrictions on transportation of nuclear materials. And, in my view, that regulation should be permitted to stand.

Senator LEAHY. Preempting?

Secretary CUNNINGHAM. Preempting local jurisdiction, yes, sir.

Senator LEAHY. And that would be irrespective of the size of the community?

Secretary CUNNINGHAM. Yes, sir. The point I would like to make here is there is no reason that Federal regulations cannot accommodate local community concerns or needs. On the other hand, the transportation of radioactive materials is an important matter. It should be regulated and controlled at the national level to assure the safety and health and well-being of the people of the entire country.

Senator LEAHY. So you do not feel that there would be any reason to allow, for example, the District of Columbia to ban such transportation, but not allow Dorset, Vt., or a small town in Texas, or anywhere else, from banning it?

Secretary CUNNINGHAM. No, sir. The point I am trying to make is that I believe that local communities should have the opportunity to propose alternate routes for various reasons which they may have if those alternate—

Senator LEAHY. But not in such a way they preclude all transportation, itself?

Secretary CUNNINGHAM. Yes, sir.

Senator LEAHY. Will DOE include socioeconomic costs in their user fees, user fee calculation?

Secretary CUNNINGHAM. Yes, sir.

Senator LEAHY. How do you determine what the socioeconomic costs are going to be?

Secretary CUNNINGHAM. Well, as I indicated, we cannot, today. We are attempting a number of studies. I have appended a list of some of these studies to the hearing statement. And we hope to be able to identify in a more definitive way what those socioeconomic

costs are. It is a difficult question, but we believe they should be accounted for in some manner.

Senator LEAHY. What Federal agency department will have ultimate responsibility for setting user fees at a nuclear waste site? Would that be you?

Secretary CUNNINGHAM. The user fees, I would expect to be set by the Department of Energy, yes, sir.

Senator LEAHY. Let me just give you a little background on something. The FmHA last year testified in support of an amendment to the energy impact assistance program that would expand that program from its current coverage of coal and uranium mining boomtowns to include these nuclear waste storage sites. A bill passed the Senate, what, about a month ago, or recently, and it provides grants and loans to States for energy impact assistance to towns and communities. It does not require the users of the nuclear waste sites to repay the Federal Government for these loans and grants. This may be a moot question because the amendment is going to face a tough time in conference. Its provisions may expire before a large scale nuclear waste site is constructed.

But how can the Government call for full cost recoupment from users of a waste site, on one hand, then turn around and support a bill providing for Federal funding to pay for many of these costs? Do we have a contradiction here? Would anybody like to—would you?

Secretary CUNNINGHAM. Well, I would just make one brief comment, Senator. I think it perhaps is not as contradictory as it may appear.

Senator LEAHY. OK.

Secretary CUNNINGHAM. As you know, the time period required for locating repositories, constructing them, placing them in operation and actually beginning to collect fees may extend over a long enough time period that a major impact would have already occurred to the community.

Now, while it is our position that all of those costs should be recovered as a part of user fee charges, that many local communities, particularly the smaller ones, do not have resources available to them to handle the initial cost impact involved. And there should be some kind of Federal assistance available early in the program so that that impact can be avoided or mitigated.

Senator LEAHY. Mr. Cavanaugh, did you want to add anything to that?

Mr. CAVANAUGH. No, sir.

Senator LEAHY. Wise man. [Laughter.]

The NRC has recommended that States be given Federal funds to participate in the siting and selection process for nuclear waste disposals. Should these costs be recouped from the users of the site, eventually?

Secretary CUNNINGHAM. My view is yes. I will let NRC answer the question, though.

Mr. DAVIS. The NRC recommendation there is not, of course, that NRC provide these moneys, but rather that they go through DOE. We would assume they would come from the user funds.

Senator LEAHY. In your testimony, you said NRC is not required to deal with the social, economic cost allocation issues. Who should address those issues?

Mr. DAVIS. We believe DOE should address them.

Senator LEAHY. Those costs, you believe, should be paid by users of the site?

Mr. DAVIS. They would flow from the user, the user charges.

Senator LEAHY. Would you be willing to require such cost recoupments as a licensing requirement?

Mr. DAVIS. I am not certain we have that authority, Mr. Chairman. I would have to reply for the record on that.¹

Senator LEAHY. In DOE, how much would you estimate the Federal Government has spent to date on trying to solve the problems of nuclear wastes? Has that ever been tallied up?

Secretary CUNNINGHAM. Well, I would have to provide that for the record. But it has been a substantial sum, certainly within a billion dollars.

[The following information was subsequently submitted by Mr. Cunningham:]

Through fiscal year 1980 the Federal Government will have spent approximately \$1.7 billion on defense waste management and \$660 million on research and development associated with commercial nuclear waste and spent fuel.

Senator LEAHY. Does that come directly from the taxpayers? That has not come out of user fees?

Secretary CUNNINGHAM. No, most of that has been associated with our defense nuclear waste program, handling wastes which have been generated as a result of the production of defense nuclear materials.

Senator LEAHY. Which is a vast majority of our nuclear waste?

Secretary CUNNINGHAM. Yes, sir. By far, they are the major portion of our high-level waste, and, certainly, until recent years, even the low-level waste was generated as a part of our defense program.

Senator LEAHY. But the benefits are available to commercial users?

Secretary CUNNINGHAM. Yes, sir.

Senator LEAHY. Would it be fair to say that geologic formations will not be the controlling factors in the setting of away-from-reactor or AFR facilities?

Secretary CUNNINGHAM. Yes, sir, that is correct. We believe that the away-from-reactor facilities will not be particularly sensitive to the site selection and could be located almost anywhere.

Senator LEAHY. So it could just as well be in urban as well as rural communities?

Secretary CUNNINGHAM. Well, I should qualify the statement to say that, normally, we would certainly follow the same procedures used for siting commercial reactors, and there is a population density factor that has to be considered there.

Senator LEAHY. But if they are safe for us folk out in the rural areas, why are they not safe for those folk in the urban areas, especially if geologic formations are not the controlling factors?

¹ See p. 87 for the response by Mr. Davis.

Secretary CUNNINGHAM. Well, insofar as away-from-reactor storage is concerned, actually, you are correct, they are safe, but—

Senator LEAHY. The social, economic impacts would be less in the urban areas than in the rural areas, would they not?

I mean, we appreciate all the attention to the rural areas but there is sometimes like the man who is being ridden out of town on a rail. He says if it was not for the hour, he would just as soon walk. And some of us would just as soon pass up some of the glory here with some of our urban neighbors.

Secretary CUNNINGHAM. Well, actually, in the past, limited amounts of spent fuel have been stored in urban areas, and as a matter of fact, there are small research reactors operating in urban areas.

But we simply have not considered siting regulations other than those which are being considered for commercial reactors.

Senator LEAHY. I have some questions on payments in lieu of taxes that I will submit for the record.

The State planning council, let me just ask about that. Is it required that every State be represented on the State planning council?

Secretary CUNNINGHAM. No, sir, the way the State planning council was set up was with the understanding that it would consist of several Governors as well as a few people from local jurisdictions as well, which would be small enough that they could deliberate and consider the problems in question.

At the same time, it was clearly stated and expected that any negotiation involving a specific State or a specific local area would require direct communication and negotiation between the Department of Energy and that local jurisdiction.

Senator LEAHY. Do you feel if a State was really being actually considered for a nuclear waste site, that they should have representation on the State planning council?

Secretary CUNNINGHAM. Well, in general, what has happened to date is that where a State has expressed a particular concern or a particular interest, the State planning council has made provisions for a representative from that State to participate even though they were not a member of the original selected group.

Now, I would expect that practice to continue. Most of the people would be selected for a specific terms but there is no reason that it could not continue to be this expanded participation.

Senator LEAHY. I see.

NRC testified to the Senate Environmental Committee earlier this year that a State may have the power to block a nuclear waste site construction under its land use rights. Is that NRC's opinion? And has any State tried to do that?

Would you like to answer that one for the record?

Mr. DAVIS. Yes, sir, I would prefer to answer that for the record.¹

Senator LEAHY. That might be better. Then in answering for the record, one is NRC's opinion that the State may have the power to block a nuclear waste site construction under its land use rights. And if it is, how would that power be exercised and has any State tried to do it?

¹ See p. 87 for the response by Mr. Davis.

Naturally, on any of these things in a number of these areas, we have gone into some fairly technical ones, and in reading the transcript afterwards, you may find that there have been areas left out. Certainly feel free to make whatever appropriate questions for the record.

And I emphasize that because, again, as I have stated at the outset of these hearings, to my knowledge, these are the only hearings we have had of this nature, the socioeconomic impact, and we will have further as we go along. If not this year, certainly next.

And I want to have as clear and as thorough a record. Certainly, if you feel there are things that have been left out that should be added, we would be happy to have that for the record.

I want to have something that the various committees that have to deal with this, and there are dozens of committees between the House and the Senate, have some kind of a record available to them so everybody does not have to reinvent the wheel.

I have no question in my mind that our government, as a government, State, local, Federal, wants to do what is right by its citizens, and there is no question that we have, again, no matter whether someone is pro and anti nuclear power or indifferent, the unavoidable fact, though, remains we have nuclear waste.

And we just alluded to that the largest amount of our nuclear waste comes from nuclear weapons, and eventually, at some time, if we reach any type of nuclear arms control and a significant type of nuclear arms control in not only our country but the Soviet Union and others, we may have to start cutting back, and that creates more nuclear waste.

So, I mean, it is always going to be there. What I am just concerned about is how, within the borders of our own country, how we react to that.

Now, DOE has allowed States to adopt health and safety standards for nuclear powerplants that are more strict than Federal standards, or have they? I think we do in Vermont, but that may be just a unique situation, is that correct?

Secretary CUNNINGHAM. I think NRC is best to answer that.

Senator LEAHY. Is not the Vermont Legislature allowed to set higher safety standards for Vermont Yankee than those required by the Federal Government, and if so, is that unique to just Vermont?

Mr. GUY CUNNINGHAM. Senator, I believe there was a unique arrangement with the State of Vermont several years ago.

Senator LEAHY. You got to watch us up there. We slip them by all the time.

Mr. GUY CUNNINGHAM. I do not know the background of that, Senator, but recently, in 1977 to be exact, the Congress amended the Clean Air Act to provide specifically that States could set more strict air emission standards than the Nuclear Regulatory Commission set.

The law, however, as affirmed by the Supreme Court in the Northern States Power decision, is still that the States may not set stricter water quality standards than the NRC.

Senator LEAHY. Has DOE or NRC considered allowing States to adopt stricter standards for low-level nuclear waste sites or even high-level sites or has the issue even been presented?

Mr. GUY CUNNINGHAM. The issue has never even been presented.

Senator LEAHY. Are we now storing foreign nuclear waste? Are we going into a classified area?

Secretary CUNNINGHAM. No, sir, to my knowledge, the answer is no.

Senator LEAHY. If we are, I would just be curious who is paying for it, that's all.

Secretary CUNNINGHAM. We have, under previous programs, where we have provided U.S.-origin material to foreign research reactors. We have had some of that material returned to the U.S. and that is stored here, but that is material of U.S. origin.

Senator LEAHY. We talked earlier of the Hanford waste site, and it has leaked a little over 400,000 gallons of liquid high-level waste. Has there been any assessment of what the effect of that leak has been on nearby rural areas or small communities? I mean, has there been any kind of an assessment on whether it has had an economic effect on agriculture or health effect?

Secretary CUNNINGHAM. Well, first of all, I should say that any radioactivity as a result of the leak has been entirely contained on the site and within a relatively small area.

We are fortunate in the Hanford area in that the particular type of soil there, because of the chemical exchange mechanisms does tend to prevent very much migration of the radioactive materials.

In addition, we are fortunate in the sense that the water table level is quite deep compared to many other sections of the country. So, in fact, there have been no actual impacts off site.

But with regard to, perhaps, a more philosophical question, that is, the question, you know, do people refuse to buy apples from the Yakima Valley because it is near Hanford, to our knowledge, the answer is no, but I do not believe we have done a thorough study to that fact.

Senator LEAHY. Has anyone ever brought suit for damages resulting from past leaks at this or any other nuclear waste site?

Secretary CUNNINGHAM. I will have to provide the answer for that to the record.

Senator LEAHY. I would be interested to know who they sue, private operator of the site or DOE or NRC, the licensor. If there have been suits, I would just be curious who they sue.¹

Secretary CUNNINGHAM. Well, there may have been some suits filed with regard to low-level waste under commercial burial grounds. If so, I presume the NRC would have the answer to that question.

I will provide for the record the answer regarding the Department of Energy sites.

[The following information was subsequently submitted by Mr. Cunningham:]

There have been no suits brought for damages resulting from past leaks of radioactive wastes at any DOE site.

¹ See p. 87 for the response of Mr. Davis, NRC.

Senator LEAHY. Are either of you gentlemen, the NRC or DOE, conversant with the purported radioactive waste explosion occurring in the Soviet Union in 1957?

Secretary CUNNINGHAM. Yes, sir.

Senator LEAHY. In an unclassified fashion, has there ever been a conclusion made as to whether there was an explosion and whether it was from nuclear waste?

Secretary CUNNINGHAM. There have been a number of reports in the unclassified press which have suggested that the activities there were relevant to storage of radioactive waste. I can, again, provide a copy of the statement of that conclusion for the record of the hearings.

Unfortunately, I cannot go into a discussion of the classified facts relative to that. I would only say that, in general, those factors which have appeared in the press have been largely based on speculation and not much fact to support the conclusions.

[The following information was subsequently submitted by Mr. Cunningham:]

The enclosed article taken from the March/April issue of Nuclear Safety, published by the Department of Energy, is a very concise and complete evaluation of the 1957 nuclear accident in the Ural Mountains of the U.S.S.R. The same authors prepared a somewhat more complete explication of their analysis and an extensive bibliography on the subject which was published as document number ORNL-5613, dated December 1979. This is available through the DOE Technical Information Center, Oak Ridge, Tennessee 37830.

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OPERATING EXPERIENCES—ANOTHER PERSPECTIVE OF THE 1958 SOVIET NUCLEAR ACCIDENT

(By J. R. Trabalka,* L. D. Eyman,* F. L. Parker,* E. G. Struxness,* S. I. Auerbach*)

ABSTRACT: The occurrence of a major Soviet nuclear accident involving stored, reprocessed, long-lived fission wastes has been reported by former Soviet citizens. Z. A. Medvedev, writing in the popular science magazine New Scientist, believed that the accident resulted in significant loss of life and required the permanent evacuation of the civilian population from a large area (several thousand square miles). Although Medvedev appears to have reached untenable conclusions about the exact origin and extent of the contaminated area, it does appear that a credible case can be made for an accidental airborne release of fission wastes in the general geographic location he suggested. In view of the growing importance of nuclear power as a world energy source, an exhaustive critical review of the Soviet literature is warranted to resolve doubts about the nature and consequences, indeed even the occurrence, of the postulated accident.

Retrospective accounts by former Soviet citizens[1-4] have indicated the presence of an extensive, uninhabited area contaminated by radioactive materials in Cheliabinsk Province (in the Ural Mountains) of the U.S.S.R. Two independent sources (Medvedev[1,2,4] and L. Tumerman[3]) have indicated that the highly radioactive restricted area, which lies between the cities of Cheliabinsk and Sverdlovsk, was established after an explosion at a storage site for long-lived high-level military nuclear waste during the winter of 1957-1958. They both believe, on the basis of information supplied to them from a variety of sources, that the accident resulted in a significant loss of life (hundreds of people) and required the permanent evacuation of the civilian population from a large area.

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Extensively edited and unevaluated information released from the files of the U.S. Central Intelligence Agency (CIA) to a citizens' group[5] indicated the presence of military nuclear facilities near the city of Kasli (Fig. 1). Although the accident has been designated in various reports[2-6] as the "Kyshtym Disaster," the choice of the name appears to be associated with the largest city near the accident site. The actual facilities reported were located northeast of Kyshtym.[5] The city of Kasli may be a more suitable reference point for the actual location (Techa, Sungul) of the nuclear facilities described in the CIA documents. These facilities were located among many large lakes in the upper Techa River drainage. The Techa River itself reportedly[5] has been contaminated with radioactivity throughout its course. The CIA documents[5] indicated the occurrence of a nuclear-related incident (or incidents) and subsequent high-level radioactive contamination in this area between 1956 and 1961, most probably during the winter of 1957-1958. No cause was clearly identified; the possibilities suggested were either an explosion in a high-level-waste storage area or an experimental airborne nuclear weapons test. The scope of the accident, in human terms, was not well-defined but appeared to involve some loss of life (magnitude undetermined), evacuation of the civilian population from a large area, and establishment of a restricted, radiation contamination zone near the Kasli site.[5]

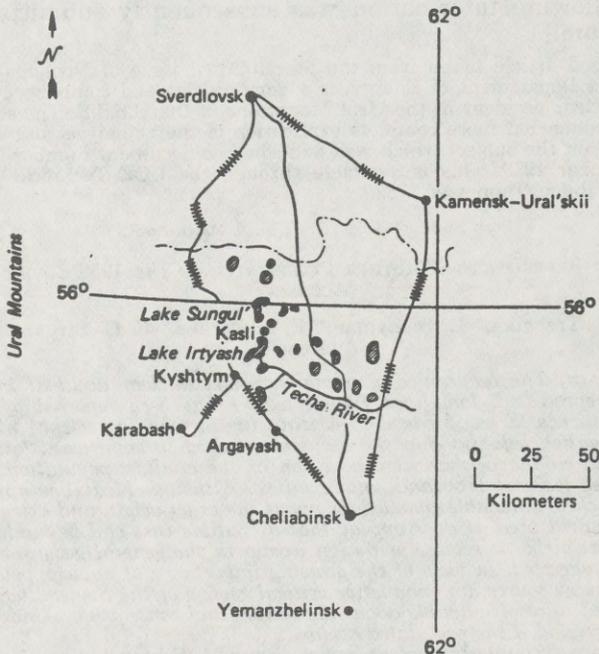


Fig. 1 Geographic region in which major Soviet nuclear accident reportedly occurred. ———, railroad; ———, road or (where named) river; - - - - - , boundary between Sverdlovsk and Cheliabinsk provinces.

The CIA documents appear to corroborate some important aspects of the conclusions drawn by former Soviet citizens. However, any objective observer must also conclude that there are significant inconsistent elements present in these two separate sets of information. For example, two CIA reports, based on interviews conducted in November 1961, are questionable in terms of their relationship to the Kasli incident (our nomenclature). Internal inconsistencies about dates in the two reports, coupled with the location of alleged radioactive fallout (130 km south of Kasli), raise serious doubts about their validity or that they refer to the same event. A disturb-

ing feature of both sets of information (from the CIA and from the Soviet citizens) is the notable absence of either first- or second-hand accounts of the incident itself or confirmed authoritative information related to its aftermath. The absence of first-hand information originally led Medvedev to conclude in his original report[1] that the accident occurred near the city of Blagoveshensk (over 300 km west of Kashi). From his literature search and Tumerman's subsequent account, Medvedev concluded that the accident actually occurred in an area between the large Ural cities of Cheliabinsk and Sverdlovsk, east of Kyshtym.[2] We have no reason to doubt either the veracity of sincerity of the reports made by these former Soviet citizens. However, we concluded that additional objective information might be needed for a scientific evaluation of the incident.

The first (and most comprehensive) reports are attributable to Medvedev,[1,2] an internationally recognized geneticist now living in London. During a recent visit to Oak Ridge National Laboratory, he reiterated his claim[2] that the location, year of occurrence, areal extent, and even the type of nuclear accident could be confirmed within reasonable limits by a critical analysis of the extensive USSR radioecology literature based on studies of the contaminated area (over 100 publications).

MEDVEDEV'S CASE

Medvedev's contention was first published in an article in the popular science magazine *New Scientist*. [2] Response to this article has been mixed and in some cases highly critical.[2,6] A careful examination of Medvedev's article provides some support for the reported negative responses. For example, in one line of reasoning, he suggested that 1×10^9 Ci of ^{90}Sr was present in the watershed of one large contaminated lake.[2,7] If it is assumed that the watershed area is one or two orders of magnitude larger than that of the lake itself (10 to 20 km²), the original level of surface contamination is calculated to be approximately 1 to 10 Ci/m². This concentration is 10^3 to 10^4 greater than levels reported in terrestrial studies (~ 1 mCi/m²) in the same area. Yet Medvedev concluded that runoff and erosion from the terrestrial zone was responsible for the activity present in the lake. If one assumes that the activity reported to be in the lake's watershed is correct and that all the ^{90}Sr originated from fission in plutonium-production reactors, this would correspond to a reactor operating history of 10^5 to 10^6 MW(t)/year in order to generate the ^{90}Sr waste inventory required.[8] This is clearly inconsistent with the known accumulated history of reactor operation (all types) in the entire world during 1957 and 1958. Further, the total activity of ^{90}Sr wastes in storage at Hanford (the primary U.S. production site for weapons-grade plutonium) in 1978 was 1.27×10^6 Ci^a—less than Medvedev's estimated 1×10^9 Ci after a much longer time.

Both terrestrial and freshwater studies reviewed by Medvedev indicate that ^{137}Cs was a minor constituent in the contaminated zone. For example, in the terrestrial studies, concentrations of ^{90}Sr reportedly ranged from 0.2 mCi to 3.4 mCi/m², and ^{137}Cs concentrations ranged from 4 μCi to 7 $\mu\text{Ci}/\text{m}^2$. Further, in another aquatic radioecology study discussed (that conducted by Rovinski[10]), there is no evidence that ^{137}Cs contributed significantly to the total initial activity. Cerium-144 was the dominant isotope ($^{144}\text{Ce}/^{90}\text{Sr}$ activity $\approx 10:1$); ^{106}Ru and ^{90}Sr appeared to account for the remainder ($^{106}\text{Ru}/^{90}\text{Sr}$ activity $\approx 1:1$). The conspicuously low levels or absence of ^{137}Cs in these studies, coupled with the observed levels of ^{144}Ce and ^{106}Ru , argues strongly against an accident resulting in release of materials from a *long-lived-waste* burial facility—the case so firmly maintained by Medvedev.

DISCUSSION

Criticisms leveled at the interpretation of both the scale and type of accident may appear to be warranted by the evidence presented by Medvedev himself. The evidence in Soviet radioecology publications alone indicates a more complex case than that suggested by any observer (including critics) thus far. The inconsistencies in Medvedev's argument might have led some to doubt even the existence of a nuclear accident. However, one must recognize the likelihood that Medvedev encountered difficulties in interpreting information about an actual nuclear accident because he is a geneticist attempting to draw conclusions in areas in which he has not been formally trained, i.e., radioecology and nuclear technology. Thus it would seem prudent first to perform an objective analysis of the information he presented, with no prior judgments being made about either the type or the scale of a potential nuclear accident or an alternative source of radioactive contamination.

An independent source, L. Tumerman,[3] reported encountering a zone of radioactive contamination extending along 20 to 30 km of the highway between Cheliabinsk and Sverdlovsk in 1960. The zone was encountered northeast of Kyshtym, approximately 100 km south of Sverdlovsk. Tumerman, former head of the Biophys-

ics Laboratory at the Institute of Molecular Biology in Moscow, would certainly appear to be a credible scientific observer. The CIA reports, although highly edited, also indicate that some type of abnormal occurrence involving the release of radioactivity was probably associated with the same general area.

The major thrust of Medvedev's argument is that certain radioecology studies were conducted in areas far larger and more heavily contaminated than one would expect to have been set out for purely experimental purposes. For example, two contaminated lakes were reported to be 4.5 and 11.3 km² in area[10] another contaminated lake was estimated by Medvedev to be 10 to 20 km² in extent. In addition, at least 21 deer were collected from a contaminated terrestrial site estimated to be at least 260 km² in area.[2] The areal estimates were based on the carrying capacity of the system in relation to the size of the sample collected.

We should point out here that we believe that the assumptions Medvedev used to estimate the size of study areas appears to be valid. Our own calculations of the area required to support the fish populations and the deer herd are in reasonable agreement with his. However, we recognize that if the total populations were removed, rather than a subsample, these estimates would be invalid. Thus the actual size of the contaminated areas might be much smaller (order of magnitude) than previously stated. Another estimate of the contaminated terrestrial area[2] based on the migration rate of rodents during a lifetime, is not well-founded and was not considered further. A reasonable estimate of the total minimum area required in the cited studies is well in excess of 25 km² under the most conservative assumptions. This area is far greater in size than any known radioecology study area established by deliberate design.

Genetics studies conducted on the contaminated area indicate that the levels of ⁹⁰Sr were approaching radiotoxic levels (as indicated by significant increases in chromosome aberrations and other genetic effects[2]). Yet much of the research effort reviewed by Medvedev has been on studies of radionuclide transport in the associated ecosystem. Biological studies involving radiotoxicity and radionuclide transport are generally considered to be mutually exclusive because radiotoxicity confounds investigations of radionuclide cycling. The reported levels of ⁹⁰Sr contamination (~1 mCi/m²) are many orders of magnitude above those required for analytical purposes (fallout background <1×10⁻⁴ mCi/m² through 1972)[11] and would be considered high (by the authors) for anything but radiation effects studies. The pattern of ⁹⁰Sr contamination in a 100-m² plot from the contaminated terrestrial area (Fig. 2 in Ref. 2) appears to be almost random—hardly that which one would design for a carefully controlled experiment.

Again, we agree with Medvedev's conclusion about these points. We can also estimate the initial ⁹⁰Sr surface concentrations in the two lakes studies by Róvinskii[10] by graphical analysis. The estimated areal ⁹⁰Sr concentrations are both approximately 0.8 mCi/m² (mean depth 1.0 and 1.9 m², respectively)—far higher than one would consider using in research on such large systems with such a long-lived, radiotoxic material. We believe that there is sufficient evidence that these study areas were not deliberately contaminated for research purposes, but rather that radioecology studies were designed to take advantage of a large, inadvertently contaminated area.

The previous estimate (by Medvedev[2]) of 1×10⁹ Ci of ⁹⁰Sr in the drainage area of one large contaminated lake is much too high for several reasons (one reason was cited previously). The original estimate of 5×10⁴ Ci of ⁹⁰Sr in lake water[2] is perhaps reasonable, but the activity in biota and sediment may have been only a relatively small multiple (<20) of this total, not 1,000 times greater as suggested by Medvedev. We believe that this assumption resulted from a misinterpretation by Medvedev of statements made in the original papers.[7,12]

If the lake in question had a closed drainage and the ⁹⁰Sr activity reported in the water represented only soluble material (no suspended sediment included) under equilibrium conditions, we might obtain a total activity 20 times that in the water for the entire lake ecosystem [i.e., 1×10⁶ Ci of ⁹⁰Sr (Ref. 10)]. Since the lake described appears to have had an open drainage[2,12] all, or a significant fraction, of the radioactivity may have entered from upstream waterborne (e.g., river) sources (or, conversely, from direct airborne inputs to the lake alone) rather than from its immediate watershed. Equilibrium conditions did not appear to exist in any event.[2,12] Thus the total activity in the lake and its own watershed may have been much less than 1×10⁶ Ci. The great disparity between the ⁹⁰Sr concentrations in other terrestrial areas subjected to study and the surface concentration applied to this lake (and its watershed) are eliminated under this set of conditions.

Medvedev suggests that the nature of the plant and animal species described in research papers indicates the approximate geographical location of the contamination zone. One reference apparently specifies the Cheliabinsk region as the source of

biota obtained for research purposes. We would agree that, given enough information, this technique of biogeography would be useful; however, additional sources beyond those already cited by Medvedev would be required to define properly the study area.

CONCLUSIONS

We believe that Medvedev may have reached untenable conclusions about the exact source of the radioactive materials and the extent of the original contamination zone. From all the available evidence, it appears that a fairly large area (≥ 25 km²) contaminated with relatively high levels of radioactivity (≈ 1.0 mCi/m² ⁹⁰Sr reference radionuclide as opposed to $< 1 \times 10^{-4}$ mCi/m² from nuclear weapons fallout) probably exists in Cheliabinsk Province of the USSR in an area northeast of the city of Kyshtym. The total area of contamination may be significantly greater than indicated; Medvedev's literature citations do not provide information for an accurate estimate of the total area involved.

On the basis of the cited radioecology data, a waterborne release (i.e., involving contamination of a river system, a series of lakes/reservoirs, and associated flood-plain/marsh areas) cannot be completely ruled out; however, the occurrence of an accident cannot be conclusively demonstrated. For example, one could speculate and suggest that the contamination resulted from imprudent chronic releases from a large radiochemical separations complex over a number of years. However, proponents of this argument would have to negate the observations of Tumerman and some of the information provided by the CIA. Thus the most credible case does appear to involve some sort of accidental airborne release.

The disparity of reported ⁹⁰Sr/¹³⁷Cs activity ratios in terrestrial studies relative to unseparated fission wastes and the dominance of ¹⁴⁴Ce activity at the start of one aquatic study suggest (1) that an intervening mechanism for ¹³⁷Cs removal was present and (2) that long-lived wastes (aged ≤ 1 year) were not prominently involved. The absence of short-lived fission products in radioecology studies suggests that events involving nuclear explosives (weapons test, weapons accident, construction accident involving nuclear explosive, etc.) or reactor accidents as the sole source of the decontamination are not presently very credible unless data collection and analysis were delayed for a period of time.

However, a number of cases can be postulated wherein the venting mechanism is not reflected in the resulting contamination produced. These would include (1) accidental detonation of a small nuclear device (either a weapon or construction device) near a radiochemical separations or waste storage facility, (2) conventional explosive following a nuclear criticality either in a radiochemical separations plant or in a waste storage tank, (3) explosion following ignition of highly flammable solvents used in some radiochemical separations, (4) detonation of certain nitrate wastes in a radiochemical separations facility or high-level-waste storage tank, and (5) venting of a high-level-waste storage tank by an explosion resulting from either steam pressure buildup or ignition of radiolytic hydrogen. The range of possible explanations for the contamination zone in Cheliabinsk Province appears to be potentially much broader than the explanations suggested by Medvedev or his critics.

The implications of a catastrophic release from a nuclear waste storage facility are obvious. We believe that an exhaustive critical analysis of the Soviet literature associated with both nuclear technology and radioecology is warranted in order to resolve doubts about the exact nature and consequences, indeed even the occurrence, of the postulated accident.

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Senator LEAHY. Thank you. And I suspect that the Soviets have not been eager to have us come over and sort of do a post mortem with them.

Let me just ask one last question. We discussed earlier today the fact that small communities, and especially, well, small communities and counties in most States do not have the kind of expertise or financial ability to participate effectively in the review process for nuclear waste disposal.

An NRC review process may be a fine, open forum for participation, but I think most rural communities just would not have the technical abilities. There is not that much in the way of technical ability available anywhere in the country for that matter.

Do you think the Federal Government should provide local communities with assistance to develop this needed expertise and do you think such capacity or assistance should be a licensing requirement?

Mr. DAVIS. The NRC, I believe that the State planning council has taken a position on this which is that expertise should be provided, and NRC is in agreement with that. With regard to a licensing requirement, we believe that the provision of that support would perhaps better come from DOE.

Senator LEAHY. How do you feel, Secretary?

Secretary CUNNINGHAM. Yes, we have proposed in this year's request for appropriations funding for some assistance to the States in the form of grants to help provide improved expertise. We do support the idea that in many areas the expertise does not exist to effectively deal with us in a concurrence/consultation manner without some additional assistance.

Senator LEAHY. Thank you.

I would include in the record a statement by Senator Cochran.¹ Senator Cochran is a valuable member of this committee and has raised many of the same points that will be before our committee today, and again has expressed the type of concern that I believe we all share both within the executive branch and the legislative branch how any of these waste sites might effect a rural area.

That is a concern that has no partisan monopoly to it by any means. It is a concern that we all share. And I want to thank the people who have testified here today. It has been a long day.

But it has been valuable to me. It has been valuable to the committee, and I really think it will be valuable to Members of the

¹ See p. 56 for the prepared statement of Senator Cochran.

Congress. I am surprised at the number of Senators who have made a point in the last couple of days to ask me about these hearings, ask me what kind of a summary there is going to be.

And I want to thank Ken Pierce and David Clavelle of my own staff especially for the work that they did, and thank you all very much for being here.

We will stand in recess subject to the call of the Chair and keep the record open for adequate time to submit extra material.

[Whereupon, at 12:09 p.m., the subcommittee adjourned, subject to call of the Chair.]

APPENDIX

STATEMENT OF HON. THAD COCHRAN, A U.S. SENATOR FROM MISSISSIPPI

I want to commend Senator Leahy for calling this hearing to study the impact of nuclear waste storage on rural areas and small communities. The implications of this storage are extremely significant, and I am pleased that the Senate Agriculture Committee is taking a role in this matter.

I have been actively involved in working on legislation to ensure that the states and communities which are considered as repository sites have a meaningful voice in the selection process. Mississippi State Representative Bill Wilkerson, who is appearing at these hearings today, will be an advisor to the State Planning Council. This council will play a key role in the site selection process.

The Senate recently passed legislation which allows affected states and localities to voice their concerns about waste storage. We cannot expect effective, cooperative decisionmaking unless these concerns are given complete consideration.

I am particularly interested in this subject because geologic activities to identify potential sites for a nuclear waste repository have been under way in my region of the country since 1972. In 1978, eight salt domes, including three in Mississippi, were selected for further study. Two or three domes in the Gulf region will be evaluated in more detail in December of this year.

The salt domes in Mississippi which are being looked at are located in Marion County and Perry County. These counties lie in the long leaf pine belt in the southern portion of the state. The combined population of the two counties in 1978 was 34,600. The area consists of small communities with an economy based largely on manufacturing, of which timber plays a very valuable roll.

The surface area over the three domes is generally covered by pine forest. One of the salt domes is located beneath the best managed game reserve in the state. The 7,000 acre game reserve has been used as a model of good wildlife management and is popular for the hunting of deer, turkey, quail and squirrel.

I have received numerous letters and phone calls from citizens of Mississippi who are concerned about the prospect of having a permanent, geologic repository for nuclear waste under the land on which they live. The emission of radiation from nuclear waste will exist for thousands of years and any change in the geologic structure in which it is stored could allow radiation to enter the biosphere, working its way up food chains to man or contaminating an underground water supply. Even very small amounts of radioactive materials have a high concentration of toxicity.

What economic effect will nuclear waste repositories have on rural areas? The Environmental Impact Statement on Commercial Waste Management released by the Department of Energy in April 1979 estimates that 1,200 to 3,100 workers will be needed during the construction years of a repository, and 900 to 2,300 will remain over the operating lifetime of the facility. The largest town in Perry County, where two of the salt domes are located, has a population of only 1,212. How will growth affect such small communities? How will they provide the housing, social services and health services that will be needed?

How will the everyday life of the people in these small communities be affected? We should not subject any area of this country to the storage of nuclear waste until all environmental, economic and social questions have been fully examined.

STATEMENT OF ROGER E. KASPERSON, CENTER FOR TECHNOLOGY, ENVIRONMENT,
AND DEVELOPMENT, CLARK UNIVERSITY, WORCESTER, MASS.

ANTICIPATING FOR THE SOCIOECONOMIC IMPACTS OF NUCLEAR WASTE FACILITIES
UPON RURAL COMMUNITIES¹

Over the next several decades, the United States will plan and begin the implementation of a complex system of nuclear waste handling, movement, and storage, a system whose precise outlines are still only dimly perceived. This will involve first an augmentation of the storage capacity for low-level waste to relieve the pressure upon the three commercial facilities currently still accepting waste. Also imminent in the near term is the development of a program of interim storage, located either at reactor sites or in away-from-reactor (AFR) facilities. Meanwhile planning is under way for geologic mines repositories—for the long-term storage of both spent fuel and high level defense wastes, slated to begin operations toward the end of the century. Since remoteness from population centers is a prime site selection consideration for safety, this network of facilities will be located chiefly in rural America where small communities are least prepared to act as hosts and most vulnerable to potential adverse impacts.

At issue is the extent to which, in anticipating these adverse impacts, we may be either retreading familiar terrain or travelling down unfamiliar paths. There are several reasons to expect the implementation of a full-fledged network of waste facilities to create novel problems. First, as the turbulent search, both here and abroad, for prospective sites for a high-level waste repository amply indicates, substantial political conflict is almost certain to occur. The siting of a nuclear waste facility cannot be dissociated from the nuclear controversy as a whole; the sites, and their inhabitants, will become the testing points between those committed to and those opposed to the nuclear enterprise. Second, these facilities, and especially the high-level waste repositories, are first-of-a-kind ventures—they have never been implemented in the same form with the same social context previously. Thus, experience is lacking to alert us to the adverse impacts and miscalculations recorded in the past, and the workability of prospective designs and processes for overcoming such problems. Instead, it is necessary to depend upon knowledge accumulated with other large-scale industrial facilities or projects located in remote areas, whose relevance and applicability are uncertain. Third, unlike most nuclear power reactors, the facilities will involve only limited benefits for the host communities. What they will have are risks which, while judged small by most technical experts, are still not well understood and are particularly feared by the public. The acquiescence of communities for uncertain risks with few compensating benefits will require a high degree of trust and confidence at a time when the very absence of these ingredients has plagued the orderly development of nuclear power in the United States.

This statement addresses four major questions:

- (1) What major socio-economic impacts may be expected in rural communities from the implementation of waste storage facilities? How adequate is our understanding of these impacts?
- (2) What equity problems are likely to occur?
- (3) What can be learned from the experience at West Valley?
- (4) How may society best respond given the imperfect understanding and the large uncertainties involved?

Adverse socioeconomic impacts: How adequate is our knowledge?

Predicting the likely socioeconomic impacts of nuclear waste storage facilities is sharply limited by the current underdeveloped state of theory and methodology in social impact analysis. To understand the variety of harms which a particular change may precipitate in a small community, it is necessary first to understand the structure and dynamics of that community, a generally neglected area of American social science research. Even with this in hand, one must trace through analytically the causal chain of social perturbations which lead to certain associated consequences. The tendency in most social impact studies, however, has been to treat the affected communities as inert objects, assumed to be alike at a given population size, upon which outside forces act. A simple model keyed to the size and timing of in-migration has been used to distribute a series of expected outcomes, usually restricted to those for which quantitative data and indicators are readily

¹ The author wishes to acknowledge his indebtedness to his colleagues at CANTED, Clark University, and the support in part of the National Science Foundation under grant No. OSS 77 16564. Any opinions, findings, conclusions or recommendations expressed herein are those of the author and do not necessarily reflect the view of the National Science Foundation.

available rather than for those problems of greatest concern or potential impact. Rarely have the long-term social changes associated with a project been included as a part of the assessment. The preparers of such analyses have often found it unnecessary to set afoot in the communities under study. It is not surprising, then, that such analyses have earned the social impact sections of environmental impact statements the near-universal disdain of both the academic and practitioner communities. Conventional social impact studies, in short, are unlikely to identify and evaluate the range of social and economic harms which small communities may experience as a result of the construction of a nuclear waste storage facility and will not, in the view of this researcher, provide an adequate basis for fashioning appropriate impact management and compensation programs.

Extant studies aimed at establishing a data base for anticipating the socioeconomic impacts of a nuclear waste repository unfortunately suffer from the limitations noted above. This is quite apparent in the socioeconomic assessment in the U.S. Department of Energy's draft Generic Environmental Impact Statement (GEIS), "Management of Commercially Generated Radioactive Waste."² In its evaluation of the GEIS, the Committee on Radioactive Waste Management of the National Academy of Sciences concluded that this analysis suffered seriously from—

- (a) failure to estimate systemic impacts of changes in scale, especially the socioeconomic and institutional impacts of a stable 400-GWE nuclear economy;
- (b) sensitivity of estimates of effects to choice of reference site;
- (c) inappropriate application of the analysis across various disposal options;
- (d) overly simplistic indicators for assessing complex social and economic impacts; and

(e) incomplete analysis of impacts associated with repository decommission.³

Whereas some of these problems may well be resolved in the final draft due shortly, similar problems are apparent in the draft Statement of Position of the U.S. Department of Energy for the Waste Confidence Proceeding⁴ and the draft EIS for the Waste Isolation Pilot Plant.⁵ An adequate program to define and assess socioeconomic impacts has yet to be established as part of the nuclear waste planning program in the Executive Branch.

Having noted these gaps in scientific knowledge and the limitations of current governmental efforts, one must not overlook, of course, the understanding and past work which have been accomplished. In particular four generalizations stand out:

Site specificity.—Although rural communities appear to the outside observer to be quite homogeneous and simple in social structure, in fact they are quite complex in their webs of social relationships. Social organization and political structure appear to be quite sensitive to the variations in demography and occupational groupings found in different regions of the country. Previous studies of highway impacts indicate the varying nature of social impacts with different communities. The socioeconomic impacts of a nuclear waste facility, then, are likely to be site specific and not subject to ready generalization (as in hypothetical or reference sites) across communities.

Scale and ruralism.—Generally, the smaller and more rural the community, the greater will be the amplification and severity of social disruption from the project or facility. Larger more urban communities tend to have economic and service structures which cushion the perturbations and added demands. Newcomers can be absorbed more easily and with less threat. This is quite apparent even in the analysis of three reference sites in the backup studies for the GEIS.⁶ Whereas the larger midwest site had impacts judged to be minor, the smaller and more rural sites in the southwest had impacts judged as considerably more severe. Small, rural communities may be desirable sites in terms of lowering accident potential, but they are more likely to suffer greater social disruption and pathology.

Irreversibility.—Some socioeconomic impacts are quite susceptible to amelioration by subsequent changes or government intervention; others are likely to be largely irreversible. So while it is possible to expand, for example, the public service sector

² U.S. Department of Energy, Draft Environmental Impact Statement, "Management of Commercially Generated Radioactive Waste," DOE/EIS.0046.D (Washington: 1979).

³ Committee on Radioactive Waste Management, National Academy of Sciences, Letter to Dr. Colin A. Heath, U.S. Department of Energy, April 18, 1980.

⁴ U.S. Department of Energy, "Statement of Position of the U.S. Department of Energy in the Matter of the Proposed Rulemaking on the Storage and Disposal of Nuclear Waste" DOE-NE-0007 (Washington: 1980).

⁵ U.S. Department of Energy, Draft Environmental Impact Statement, "Waste Isolation Pilot Plant," DOE/EIS-0026-D (Washington: 1980).

⁶ U.S. Department of Energy, "Environmental Aspects of Commercial Radioactive Waste Management," DOE/ET-0029 (Washington: 1979), Vol. 3, Appendix C.

to accommodate larger demands, increased social conflict or isolation of particular community groups may defy both measurement and corrective intervention.

Life-cycle dependency.—The history of a waste facility is likely to be quite long: high-level storage facility, for example, will command a period (perhaps 4–5 years) of site characterization and facility planning, a construction period of perhaps 3–5 years, an operational period, dependent upon loading rates, of some 15–30 years, and a period of monitoring and retrievability of perhaps 50 years. Rather different socioeconomic impacts are likely at each of these stages, with cumulative effects registered over the long run. Generally, the construction period has been viewed (partly for methodological reasons) as the major impact time, but it is entirely possible that political conflict and fear might render the initial planning period a highly disruptive time for nuclear waste facilities, or, alternatively, that either a planned or premature post-operative period might have more substantial effects than presently projected.

Should past experience with large-scale industrial facilities in rural areas prove applicable to nuclear waste facilities, some reasonably well understood impacts may be anticipated. Accommodating the initially small group (1,000–1,500) of construction workers and the eventually larger contingent (2,500–3,500) of construction and operational personnel and other newcomers will be a challenging task if the host community is small. Table 1 shows the manpower requirements projected for different wastes facilities. The newcomers will probably enjoy income and educational levels considerably (perhaps 25 percent) higher than and life styles differing from most existing community residents. Competition for workers between the waste facility and existing host area employers may be a source of conflict. Incoming construction and operational workers will, depending upon the balance of commuting and migration rates, make necessary additional housing. The increased housing demand will inflate the cost of housing and property values, increase property taxes, and perhaps force some fixed income residents to relocate. Expansion will be needed in various public services, particularly school systems, fire and police protection, solid and liquid waste disposal, and recreation. The degree of impact will depend upon both existing slack in the service sector and the lead times available for meeting increased demands. These impacts are quite conventional to large scale facilities, there is ample past experience to guide response, and there are currently available studies which suggest the likely magnitude involved for a nuclear waste storage facility.⁷ It is entirely possible that these boom-town impacts will be smaller than for other large-scale energy facilities.

TABLE 1.—MANPOWER REQUIREMENTS FOR REFERENCE WASTE FACILITIES

[Man-years, per year]

Facility	Mean annual construction employment	Mean annual operation employment
FRP production facility.....	1,630	1,000
FRP waste management reference system.....	1,195	275
Combined.....	2,825	1,275
MOX FFP production facility.....	571	300
MOX FFP waste management reference system.....	54	16
Combined.....	625	316
Independent spent fuel storage system.....	1,350	301
Extended fuel storage system.....	1,690	361
Retrievable waste storage facility.....	1,060	164
Waste repository:		
Salt formation:		
U and Pu recycle.....	1,570	1,000
Once through.....	1,430	688
Granite:		
U and Pu recycle.....	3,140	1,200
Once through.....	4,290	800

⁷ See, for example, Robert D. Brenner, "The Social, Economic and Political Impacts of National Waste Terminal Storage Repositories" (Princeton, N.J.: Center for International Studies, Princeton University, 1979); Marjorie R. Green and Ted Hunter, "The Management of Social and Economic Impacts Anticipated with a Nuclear Waste Repository: A Preliminary Discussion" B-HARC-ell-008, Battelle Human Affairs Research Center, 1978; Elizabeth Peelle, "Mitigating Community Impacts of Energy Development: Some Examples for Coal and Nuclear Generating Plants in the U.S.," Nuclear Technology, 44 (June, 1979), 132–139.

TABLE 1.—MANPOWER REQUIREMENTS FOR REFERENCE WASTE FACILITIES—Continued

	Facility	Mean annual construction employment	Mean annual operation employment
Shale:	U and Pu recycle	1,860	1,000
	Once through	2,000	722
Basalt:	U and Pu recycle	3,710	1,170
	Once through	5,290	760

Source: U.S. Department of Energy, "Environmental Aspects of Commercial Radioactive Waste Management," Vol. 3 (Washington: 1979), pp. C4-C5.

More problematic will be those impacts associated with radiation hazards, equity issues, and the halo effect of the nuclear controversy. It is now well established that the public is hypercritical of the risks of nuclear power.⁸ Psychological research on the public perception of technological hazards has shown that the public inevitably ranks nuclear power high on the danger list.⁹ Fear is particularly evident over the catastrophic potential of the technology and its perceived link with nuclear weapons. Polls and survey research consistently indicate that waste disposal is at or near the top of public concerns over the risks of the nuclear fuel cycle.¹⁰ An organized national opposition exists to combat new facilities and sites, and vigilant mass media point out errors and failures. The siting of a waste facility, in short, is almost certain to be conflict-ridden and politically volatile. In fact, political conflict may well be one of the most serious social impacts to be anticipated. Another, as community response at Three Mile Island has made clear, is public risk perception, with its associated socio-psychological stress. This, too, may constitute a very significant, if ill-defined, long-term price for the community. These problems are both novel and formidable; they will likely interact with and exacerbate more conventional impacts and challenge efforts at impact prediction and management.

Equity problems

Equity problems will occur at several different levels in the implementation of a nuclear waste system. Unlike nuclear power plants there is not a visible tangible "good", something society desires (e.g., electricity), which is produced within the region by the operation of the facility. Waste, by definition, is a substance without value. A waste facility exists in one place so that benefits can be realized elsewhere. The unwillingness to date of beneficiary regions to share the burden of risk proved an issue in the temporary closure of low-level waste facilities at Hanford, Washington, Beatty, Nevada, and Barnwell, South Carolina during 1979. The current impetus for state responsibility and regional repositories for low-level waste embodies a useful attempt to narrow the geographical dissociation of risks and benefits, though intra-regional inequities will of course persist.

Equity problems are likely to be more severe for the transport processing, and storage of high-level waste. Involved are not only the repositories themselves, but AFR interim storage facilities, nodal points to the transport network, and the waste transport corridors. Inhabitants at sites and along routes are asked to bear risks so that the nation, and especially those areas served by nuclear power, may benefit. Although some benefits will likely accrue to local areas in the construction and operation of waste facilities through improvements in employment opportunities, public services, business profits, and property values, they will be distributed unevenly and unpredictably through the host region and are unlikely to compensate adequately or in timely fashion of the negative impacts involved. So ways must be found to narrow the inequity between waste-producing and waste-storing regions.

⁸ Christoph Hohenemser, Roger Kasperson and Robert Kates, "The Distrust of Nuclear Power," *Science*, 196 (1 April, 1977), 25-34.

⁹ Paul Slovic, Sarah Lichtenstein, and Baruch Fischhoff, "Images of Disaster: Perception and Acceptance of Risk From Nuclear Power," in A. Perlmutter et al. (eds), *Proceedings of the Second International Forum on an Acceptable World Energy Future* (Cambridge, Mass: Bolinger, forthcoming).

¹⁰ Roger E. Kasperson et al., "Public Opposition to Nuclear Energy: Retrospect and Prospect," *Science, Technology, and Human Values*, 31 (Spring, 1980), 11-23.

The second scale of inequity is within the host region itself. Previous research has shown a complex pattern of winners and losers resulting from the erection of large-scale energy or other industrial facilities.¹¹ Consider the following:

- elderly residents with fixed incomes generally suffer from the effects of boomtown related inflation;

- newcomers attracted by the facility share disproportionately in benefits while experiencing relatively few losses;

- school facility and personnel expansion often fail to keep pace with burgeoning demands, and school children suffer from overcrowding and lower quality education;

- small businessmen with inadequate capital to adjust to market changes suffer, whereas those with more adequate access gain;

- spouses of long-term residents seeking to enter the labor market will find increased competition from the spouses of newcomers, particularly in retail trade and professional service occupations; and

- while long-term property holders benefit from increased value of their holdings, the gain can be reaped only by moving out of the host area.

In short, there will be a complex pattern of relative gains and losses, even without considering the variable psychological responses to radiation hazards, within the host region. Mitigation and compensation programs should be designed to permit discrimination among host community members.

Finally, there is an equity problem which is time or generation-related. There is residual uncertainty concerning both existing ability to predict and control all future radiation hazards at the facility site as well as the possibility of abrupt nuclear waste program changes. Given the approximately 50-years of planning-construction-operation and the following 50-years of monitoring, social changes over long time periods are involved. Many of the possible adverse impacts could well be experienced by future rather than present site residents. Insuring proper technical and financial resources to deal with anticipated and unforeseen events should be part of a host region planning effort.

*Learning from the West Valley experience*¹²

The Western New York Nuclear Service Center at West Valley, New York may provide some lessons relevant to the task at hand, for it too was a first-of-a-kind facility, a nuclear waste reprocessing plant. It was planned at a time, the early 1960's when the prospects for nuclear energy seemed bright and the commercial reprocessing of spent fuel a logical next step toward closing the nuclear fuel cycle. New York State purchased the original tract of land, state officials enthusiastically boosted the predicted 2,000 new jobs, and local newspapers foresaw a period of industrial growth which would convert the rural, economically underdeveloped area into the "Detroit of the Atomic Age." Local residents embraced the rosy picture offered.

Between 1966 and 1971, the plant reprocessed some 640 metric tons of reactor fuel as well as serving as a burial ground for low-level waste. By 1972, however, when the facility had shut down for modifications and enlargement, government regulations had become considerably more stringent. Citing its inability to meet these standards, Nuclear Fuel Services, the operator of the plant, announced that it was abandoning the reprocessing facility. The facility sits unoccupied today, its future uncertain.

My colleagues and I have over the past several years reconstructed the socioeconomic impacts of that facility on the community, the state, and the nation. In this evaluation, we reviewed a large number of available documents and reports, conducted interviews with plant officials, former plant employees, local and county residents, and representatives of state and federal agencies. Where data could not be reconstructed, we made our best estimates.

Our findings suggest that despite an influx of some 200 "imported" laborers during the construction period, a boomtown, in fact, never materialized in the local area. The facility attracted less than 100 new residents to the host region, and, in West Valley itself, added no more than 10 to 15 pupils to an existing school population of about 500. A number of benefits, by contrast, were forthcoming: the facility provided some 20 percent of the town and county taxes and 17 percent of the

¹¹ See the various publications of the Energy Impacts Project, Department of Urban Studies and Planning, M.I.T.

¹² The following summarizes findings of Robert W. Kates et al., "The Locus of Benefits and Risks of West Valley Nuclear Wastes," Chapter 5 in R. E. Kasperson and R. W. Kates (eds), "Equity Issues in Radioactive Waste Management" (Cambridge, Mass: OG and H Publishers, forthcoming).

school district taxes while contributing to the upgrading of local roads, the local fire department, and the postal union.

The major adverse impacts lay not in the conventional boomtown changes which pervade most impact models but in two more intangible impacts—the disappointed expectations of local people for the future and the enervating public concern over safety. Local people clearly expected the facility to inaugurate a period of economic growth and increased employment. And certainly the rosy picture painted by plant and government officials encouraged that perception. Today, hopes have faded in the face of widespread resentment that the community was sold “a bill of goods,” fear that tax revenues will be lost when government takes over the facility, and concern over possible long-run declines in property values and local business. Ironically, West Valley has become a symbol for the anti-nuclear movement.

Despite the low level of radiation exposure (about .01 percent of whole-body radiation dose from all sources) to the local populace, local concern over safety is pronounced. This is apparent in the public meetings held by DOE in the region, in the local newspapers, and in our interviews with local residents. For those who worked at the plant, either as temporary or permanent employes, however, occupational exposure was high by current industry standards; in fact by 1971 the average whole body exposure to full-time employees had increased to 7.23 rems per year. As in Middletown, Pennsylvania, anxiety and worry are clearly long-term social burdens.

When the West Valley area is put in the context of the flow of costs and benefits to the state and nation, a number of observations may be made as to the equity of impacts:

- the nation and the nuclear industry were the chief beneficiaries, because of accumulated valuable experience with reprocessing and the bargain prices for disposing of wastes;

- 30 percent of the radiation exposure accrued to workers with less than a few days stake in the industry;

- a number of utilities were made slightly richer and wiser at the expense of the corporate aspirant and the state government; and

- the local community traded a brief flurry of jobs taxes, and some marginal improvements for disappointed hopes, an uncertain future, and nagging anxiety over long-term safety.

Several lessons are also clear. Information projecting future costs and benefits proved to be quite deceptive for the townspeople who had to strike the long-term bargain. The short-term boom town impacts turned out to be of less importance than the longer term socio-psychological prices. In the final analysis, the community was left to cope with the uncertain fate of the facility and the real and imagined fears of radiation hazards left in the wake of the nuclear enterprise. It was not well equipped to deal with either.

Fashioning appropriate responses

How should society respond to the adverse socioeconomic impact of nuclear waste facilities, given our underdeveloped capacity to anticipate and assess these impacts and the significant uncertainties that remain? What is proposed here is not a blueprint for response but three guiding principles:

(1) *Avoiding rather than mitigating risks.*—The time honored tradition in both the workplace and in facility location in communities has been to treat risks in *expost-facto* fashion. The assumption has been that worker and community exposure are the reasonable prices of progress, and that society's responsibility is largely confined to side payments for compensation.

A number of facts bear emphasizing:

- the most serious socioeconomic risks are also the most likely to be poorly understood;

- many socioeconomic risks will become apparent only in the long term, and a number of them will be essentially irreversible in nature;

- socioeconomic risks will prove extremely resistant to quantification as a basis for calculation compensation; and

- the residents of rural communities are among the most vulnerable members of our society.

The foregoing observations call for a risk management strategy that stresses risk avoidance and risk reduction. Community risks should be subject to the same procedures as those applied to other risks of the nuclear fuel cycle. Reactors contain layers of safety systems that either prevent initiating events or prevent the occurrence thereof from inflicting eventual adverse consequences on the public. Radiation protection requires that risks be kept as low as reasonably achievable (ALARA). The same philosophy and similar risk management systems are needed to protect the exposure of rural communities to social harm. Such a risk management system

should be predicted on the assumption of relative current ignorance and specifically designed to deal with uncertainty and surprises.

(2) *Unavoidable risks should be accompanied by compensating benefits.*—Not all risk can be avoided, of course, in reactors or in waste facility location. For those risks which are unavoidable, there should be compensating benefits. Such a principle is recognized in the 1980 Presidential statement on nuclear waste management wherein the designated beneficiaries of commercial and defense wastes, respectively, are the utility consumers and the nation as a whole. The statement calls for these groups to internalize the burden of costs. The costs should be social risk defined, however, to include avoidance and management.

There is a very good chance that full compensation for harm will not occur. This is due in part to the very limited identification of harms, both in type and in timing, achieved by current social impact assessment methodology; in part to the inability to place values upon harms for which ready indicators do not exist; in part to a fragmented governmental programmatic and delivery structure which is piecemeal in nature and beset by restrictive eligibility requirements and built-in delays; in part to the fact that a significant part of the risk is exported to future generations at the site; and in part to the reality that these communities lack the political clout to squeeze implementation of past commitments.

(3) *Informed consent for unavoidable risks.*—For those social risks which cannot be avoided, the assumption of such risk by host communities should be made as voluntary as possible. Achieving this will involve both success in informing residents of the full range of impacts likely to be experienced and in mechanisms by which the host community can participate in and influence the locational decision. The experience at West Valley and the search for prospective repository sites over the past several years indicate how difficult this will be.

Informing host site residents of the socioeconomic (and other) risks to the community requires, from the outset, a scientific definition and assessment of those risks. It is essential that the host area not be a dependency in this process but that it possess its own financial and technical capacity as risk or impact assessor and that it have an enlarged capability in the public sector to plan for and manage the impacts comprehensively. This will require new support from higher levels of government.

While the assumption of community risk cannot be made fully voluntary if we are to have nuclear waste and other noxious facilities, the more voluntary the risks can be made the better. In West Valley, the private industry, the state of New York, and the federal government were the power brokers, with only a very limited role of the host area in the decision process. Specifically, host communities should be enabled to negotiate in defining the acceptability of various social impacts and actions needed to reduce and/or mitigate their risk. It may also be helpful to have explicit recognition that adverse social impacts in the host area are appropriate grounds for state non-concurrence.

These principles may not suffice to ensure an equitable and conservative siting process and will certainly require translation into detailed institutional processes and programs. They may, however, suggest some beginnings for a long overdue, serious effort toward dealing with community impacts in the nation's nuclear waste management program.

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Preliminary identification of alternative sites for nuclear waste repositories (U.S. Department of Energy, 1980) indicates that many of these sites may be located in rural areas of the nation. The construction, operation and maintenance of such facilities will lead to significant socioeconomic impacts for these rural areas. These impacts will result both from the fact that waste repositories are large-scale developments being located within a rural context, (these impacts can be referred to as standard development impacts) and because of the special socioeconomic characteristics of nuclear repository developments (these impacts are termed special effects or impacts). If rural areas are to be equitably compensated for the services to society they will perform in housing such repositories the impacts of repositories must be identified, and mitigation, community development and public participation plans developed on the basis of a careful program of research and local area involvement.

In this statement an attempt is made to: (1) briefly delineate the major areas of standard and special socioeconomic impacts likely to occur in rural areas as a result of repository siting; (2) provide a preliminary discussion of essential characteristics of strategies for mitigating these impacts and; (3) describe ongoing research and community development efforts aimed at further identifying the impacts of reposi-

ories and means to mitigate these impacts. Each of these issues is briefly described below:

IMPACTS OF REPOSITORY SITING IN RURAL AREAS

The impacts of repository projects on rural areas result in part from the fact that such projects are large-scale projects relative to the areas where they will be located. These facilities will involve from 1,400 to 1,800 workers during their construction and roughly 900 to 1,200 workers during operation (U.S. Department of Energy, 1979) and are likely to require monitoring for an indefinite period. Although actual sites have not been selected many of the most geologically acceptable prototype sites (U.S. Department of Energy, 1980), particularly in the West and Southwest, are in relatively sparsely settled rural areas with unique social and cultural conditions. For such prototype sites as those in Anderson, Freestone and Leon Counties in Texas with 1975 populations of 1,244, 11,924 and 8,777 respectively (U.S. Bureau of the Census, 1977); Bienville Parish, Louisiana (1975 population, 16,478); Perry County, Mississippi (1975 population, 9,830); and San Juan County, Utah (1975 population, 11,964) the relative magnitude of the impacts of such a development would be significant. The siting, construction and operation of nuclear waste repositories may thus involve factors and are likely to have many impacts that are similar to those for other large development projects in rural areas.

On the other hand, repositories will also have effects that are unique or special because they are nuclear repository sites and thus subject to the effects that result from public perceptions of nuclear power and nuclear waste. These special impacts are difficult to identify and require extensive analysis. Both standard and special effects must be identified if mitigation efforts are to be successful. Some of the most important and special effects of repository projects are identified below.

STANDARD EFFECTS

Factors affecting the socioeconomic impacts of large-scale projects

The magnitude and distribution of the standard socioeconomic impacts of large-scale projects can be seen as a function of three general sets of factors. These are: (1) the characteristics of the project; (2) the characteristics of the site area and; (3) the characteristics of project-related immigrants (Murdock and Leistritz, 1979). It is the unique combination of these factors and the interaction of these factors that determine the magnitude and the nature of socioeconomic impacts in rural areas.

The characteristics of the project play a central role in the determination of impacts. In particular, a project's location, its level and type of direct employment requirements, its potential to produce indirect and induced industry employment, the length of its construction and operational phases and the employment policies of the developer may all affect the level of impacts. If a project is located close to a relatively large population center, its direct employment requirements are small, its potential for generating indirect and induced employment are limited, its construction period is relatively long and the developer employs a large number of existing residents the population growth in the impact area and the social impacts of that growth will be relatively small. If the project is located in an area distant from any major center, has large direct and indirect employment requirements, has an expedited construction schedule and the developer employs few local residents, immigration to the site area will be extensive and the impacts significant.

The socioeconomic characteristics of the site area and its residents will also affect the magnitude and distribution of socioeconomic impacts. Such factors as the number of alternative settlement sites in the impact area, the skill levels of the local labor force, the availability of local labor for employment at the project, the level of development of local community service and organizational structures and the preferences of residents in local communities are among the most important of such factors. If there are a large number of alternative settlement sites the new population is less likely to concentrate at any one site. The compatibility and availability of the labor skills of existing residents with those required by the project will determine how many jobs can be taken by indigenous residents and how many new residents must immigrate. The existing service bases of communities and the growth preferences of community residents often serve to decrease or accentuate the attractiveness of communities to new residents and alter the number of new residents received by a community and the positive and negative impacts associated with that population growth.

Impacts in rural areas also depend on the characteristics of the workers, and of the families of the workers, moving to the impacted areas. Characteristics of the worker, such as marital status, age, education and ethnic background, as well as the worker's family characteristics, such as family size, spouse's employment status, age of dependents and settlement, service, and other preferences, all affect the nature of

impacts in the area and the distribution of those impacts. If the sociocultural background and preferences of the new residents differ substantially from those of longtime residents, pressures may arise for changes in community leadership and governmental structures, the interaction patterns of community residents may be drastically altered and the levels of conflict between new and longtime residents may increase (Albrecht, 1978; Little, 1977).

The characteristics of the project, the site area and new populations seldom operate independently for it is the interaction of these three factors that determine the actual level of socioeconomic impacts. The complementary or contravailing nature of these three sets of factors can work to reduce or accentuate the socioeconomic impacts likely to result from any given project.

Identification of standard impacts

In this section, some of the standard economic, demographic, public service, fiscal and social impacts of large-scale developments on rural areas are identified. In so doing, an attempt is made to delineate specific areas of actual and potential positive and negative impacts.

Economic impacts

For many rural communities, past economic patterns have been ones of decline, decreasing economic and population bases and decreasing levels of business activity. Large-scale developments offer both promises and problems for such areas. Thus, such developments are likely to have significant impacts on employment, business activity, income and price structures in rural areas.

In general, large developments result in increased business activity and employment in rural areas. Wage levels often increase markedly from predevelopment levels, aggregate personal income usually increases and business sales and income from project-related activities increase the overall economic base of the area. At the same time, some job opportunities are created for local persons and some young people who might otherwise leave the area are retained. There are, then, many positive economic benefits (Murdock and Leistritz, 1979).

On the other hand, most of the development costs of such projects will not be spent in the site areas. Because rural areas seldom have large industrial manufacturers or similar business suppliers, purchases of materials will usually be made outside the area. The employment created for local residents is likely to range from 30 to 50 percent of total employment during the construction of the project (Mountain West, 1975) and up to 75 percent during operation of the facility (Wieland et al., 1979). The jobs created for local residents will likely be manual or non-skilled jobs and, although this employment will tend to provide higher incomes for the workers employed, it may also reduce labor supplies for other sectors of the economy and increase the cost of living in the area (Gilmore and Duff, 1974). As a result, farmers and small businessmen may find that their labor costs increase rapidly and people on fixed incomes, such as the elderly and the poor, may find it difficult to pay for needed services. It is not unusual to find rent costs doubling or tripling in impacted communities and for food and other costs to show relatively large increases. In addition, if growth is substantial, local business interests may find that they cannot compete with new large volume stores that are attracted to the area (Gilmore and Duff, 1974).

The economic effects, then, may be both positive and negative. In general, the effects are most positive for those whose interests (through business sales or employment) are most directly tied to the development and least positive for those who have no direct link to the development (nonbusiness people, the elderly, the poor and farm owners).

Impacts on population

Other major impacts result from changes in population growth, distribution and composition. The key issues involved in such impacts relate to levels of project-related population growth, the settlement patterns of new populations and the timing of such growth (Murdock and Leistritz, 1979).

Growth rates of 10 or 15 percent a year have been experienced in many rural areas in the Western United States as a result of such developments (Federal Energy Administration, 1977), but predicting the extent of this growth and the areas that will actually receive such growth has been technically and pragmatically difficult. Available data related to population growth indicate that the population growth accompanying large-scale developments is likely to be substantial but not as large as is often portrayed in the boomtown literature (Gilmore and Duff, 1974) and this growth may, in fact, induce population stability rather than excessive growth (Murdock, et al., 1980a). It may not lead to area-wide growth or stability, however,

but may be quite localized. This growth is likely to slow once the construction period has ended and the population of areas may decline when the project is ended.

Data on the types of communities likely to grow as a result of a large development indicate that the magnitude of growth is usually small for communities of less than 1,000 people. Thus, a recent study of 84 western impacted communities (Murdock et al., 1980a) that had experienced energy-related impacts from 1970 to 1975, indicated that although the rates of growth were quite similar for communities of various sizes the actual numerical growth was very small for communities under 1,000 persons. Impacted communities under 1,000 gained an average of only 76 people for the five years between 1970 and 1975, while places of 1,000 to 2,499 gained an average of 561 people and places over 2,500 population gained an average 1,009 people per community during the five year period (Murdock et al., 1980a: 16). It appears that unless communities have a sufficient population base and accompanying infrastructure, they are unlikely to grow substantially because of such developments.

For those areas that do grow, however, the new population is likely to bring patterns of population growth that have long been desired by rural areas and to result in increasing demands for many basic services. In many cases, however, although the level of growth is as desired, its timing is problematic. The construction phase of a project is likely to lead to temporary populations that are 2-to-3 times as large as the permanent population that will settle in the community during the operation of the facility. The problem of providing services for this temporary population without creating long-term debts for the permanent population is one of key public concern.

Extensive analysis of patterns of settlement among new workers in rural impacted areas (Dobbs and Kiner, 1974; Mountain West Research, 1975; Wieland et al., 1977; Murdock, et al., 1978; Wieland, et al., 1979) provide general findings about the patterns of population distribution in impact areas. These analyses reaffirm that few workers choose to settle in relatively small communities, few choose to commute farther than 60 miles and commuting in rural areas is more heavily dependent on area characteristics and less dependent (Wieland et al., 1979) on worker characteristics than in urban areas (Clemente and Summers, 1975).

Finally, data showing the characteristics of populations migrating to impacted areas and comparing new populations to indigenous populations in impact areas are also accumulating (Murdock, et al., 1980b; Wieland et al., 1977; Murdock, 1977). There is considerable agreement in the findings from these analyses and agreement between these findings and those of studies of migrants in general. These findings indicate that development-related migrants are like other migrants (Murdock, et al., 1980b). Comparisons of longtime residents to migrants to such developments reveal that, like migrants in general (Ritchey, 1976), migrants to rapidly developing areas are positively selected on the basis of age, education, and income. They are younger, better educated and likely to have higher incomes than longtime residents. They are likely to have smaller families, to live in mobile homes and to obtain a higher proportion of the skilled and managerial jobs at a project than longtime workers. The demographic effects of migrants, then, are likely to be evident in an increased number of young adults in the area, higher area incomes, and a more highly skilled area workforce (Murdock, et al., 1980b). Thus, new project-related populations will increase the long-term viability of the area, but these new residents will also have different tastes and lifestyles and will demand different services than longtime residents. These new populations may not only increase the size but also change the nature of rural areas.

Impact on community services

The population growth resulting from large-scale developments may have marked impacts in the quantity, quality and forms of community service delivery in rural areas. As with other types of impact, service impacts may be either positive or negative.

For some services in some areas, predevelopment levels of demand have been insufficient to produce an adequate level of services. For such services, increased levels of service demand resulting from a development may improve the quality of the service and the economic viability of the service organization (Schriener, et al., 1976). Thus, in many rural areas, declining birth rates have led to decreased school enrollments and a smaller range of educational services and for rural hospitals occupancy rates have often been too low to maintain many specialized services. For such services, developments may have positive impacts, increasing the stability and improving the quality of the service.

For other services such as water or sewer services and particularly for housing, medical personnel and recreation, the new demands may overtax, strain or completely disrupt community service delivery (Courtess and Jones, 1977). Planning and

management difficulties may thus be created for local officials such as city managers, law enforcement officers and social service personnel.

These developments may also change the mix and form of delivery of such services. Whereas part time law enforcement personnel or non-scheduled garbage collection may have been sufficient in the past, the new residents may demand more professionalized and more formalized services.

Fiscal impacts

The increased service demands and costs associated with the rapid population increases that accompany large-scale developments often cause severe fiscal problems for local governments. These problems lie, in large part, in the timing of revenue collection in relation to public service costs and in the distribution of costs and revenues between jurisdictions. The problems are especially exacerbated by the larger the population bases associated with, and the larger the differences between the size of the construction and operational work forces.

Perhaps the major timing problem for local fiscal structures lies in the fact that, although new service demands arise immediately during construction of the project, many of the revenues necessary to meet those costs are not available until the operation of the project begins. This condition arises because local governments tend to be dependent on property taxes and construction populations are likely to live in temporary housing with low taxable values and because secondary development of taxable business property occurs relatively slowly. Project-related taxes typically do not become available until the plant becomes operational. As a result, the revenue-cost squeeze may become critical (Toman et al., 1977; Gilmore et al., 1976). Local governments must decide whether to invest in local service structures during construction periods when demands are high and be faced with excess capacity to support during operational periods or to muddle through with severely impacted service bases during construction periods and build service structures to meet the lower level of demands expected during operational periods. Equally problematic, local governments must attempt to convince local citizens of the need to increase taxes to pay for services when the uncertainties concerning actual new operational populations, the degree of local dissatisfaction with services and government and fears about tax increases are all high.

The distributional problems may be equally severe. The facilities and resources that generate new revenues may be located in one county while the impact-related populations are located in a different county or even a different state. In such cases, the governmental entity receiving the new revenue benefits will experience a tax windfall while the area with the influx of new population will be faced with especially severe fiscal problems.

Even when there are not jurisdictional distribution problems, the fact that many tax structures distribute a majority of resource-related revenues to state or county governments while the costs often are greatest at the municipal or school district levels may be problematic. Thus, for many areas the major tax problems of large developments are related to the distribution of revenue and not to the overall levels of revenue generated (Gilmore et al., 1976; Stinson and Voelker, 1978; Gray et al., 1977; Toman et al., 1977).

Rural impacted communities in general are learning to develop effective strategies to deal with fiscal funding and fiscal timing problems (Murdock and Leistriz, 1979), but it is not unusual for local communities to be faced with net fiscal deficits at the end of a project even when a 30 or 40 year project life is anticipated. The fiscal problems related to such developments clearly require careful consideration by public decision and policy makers.

Social impacts

Data on the social impacts of large-scale developments are less readily available than those on other impacts and must be viewed with extreme caution. Some general patterns are gaining at least preliminary empirical support, however, and may be described. Thus, it is clear that large-scale developments are likely to alter the way in which persons in rural areas interact with and relate to one another, to change existing organizations and institutions, to change leadership and other status arrangements in rural communities, to decrease the levels of social control and the quality of life and to create conflict between new residents and longtime residents in impact areas.

For many rural areas, the influx of large numbers of new persons changes the informality and intimate nature of social interactions. Although many rural areas are characterized by interactions between residents that respond to one another on the basis of long social histories, the influx of new residents has led to a decreasing level of informality in relationships and to increased formality in interaction pat-

terns (Gold, 1974; Freudenberg, 1978; Cortese and Jones, 1977). As a result, residents often feel that their communities become less familiar and less friendly.

In addition, because of increased levels of formality in interaction patterns, many organizations and institutions may be altered. That is, organizations may adopt new, more formal procedures, institutions such as local governments are likely to be less tolerant of departures from formal rules and special relationships between residents and community leaders may be replaced by technical roles. Also, because of increased demands on local institutions, the requirements for leadership in such organizations may change (Schriner, *et al.*, 1976) and technical expertise may become more important. As a result, new technically oriented officials may replace longtime residents and new residents may come to dominate many organizations and institutions that formerly served longtime residents' needs (Little, 1977). Newcomers and longtime residents may also come to compete for less formal leadership and status roles and once dominant groups, such as those employed in agriculture, may be replaced in leadership positions by persons employed in the newly dominant industry (Gold, 1974).

Equally significant, the large influx of new persons and decreases in informal social control mechanisms in rapidly growing areas may lead to much increased levels of divorce (Gilmore and Duff, 1974; Albrecht, 1978), crime, drug abuse and mental illness (Little, 1977; Thompson, *et al.*, 1978). Conflicts may arise between new and longtime residents over the control of resources and levels of services and the overall quality of life may decline.

Large-scale developments may also alter the ways in which residents view their community and its characteristics. Although persons in rural areas often have very high levels of satisfaction with their communities (Murdock and Schriner, 1977; Lopreato and Blisset, 1978) and community services (Gessaman *et al.*, 1978) and strongly value environmental conservation and preservation (Thompson, *et al.*, 1978; Murdock and Schriner, 1977) they also clearly desire development (Lopreato and Blisset, 1977; Selbyg, 1978; Mountain West Research Inc., 1975). As developments proceed, however, respondents come to have a less favorable but more realistic appraisal of their impacts. That is, they come to see that the major benefits of developments are in terms of increased economic and demographic growth, but that many social and service impacts may be more negative than anticipated (Mountain West Research Inc., 1975; Thompson, *et al.*, 1978). Overall, residents usually come to see the developments as generally beneficial. Finally they come to see their communities as less friendly, less personal and tend to see them as significantly different than they were before the development.

These standard socioeconomic impacts are thus receiving increased documentation but yet require additional analyses. Even more important, the areal variability in such impacts clearly requires the development of generalizable impact assessment methodologies and areally specific impact assessments.

SPECIAL EFFECTS

Special Characteristics of Repository Projects

The unique socioeconomic effects of such developments have received much less attention than standard impacts (Hebert, *et al.*, 1978) and their identification and assessment are clearly more difficult. In large part, however, these impacts can be said to result from the special characteristics of repository projects. These include such characteristics as: (1) Radioactivity, (2) project duration, (3) project-related experience, and (4) form and duration of project management.

Thus, the fact that such projects will involve the handling and storage of radioactive materials, that these materials will remain dangerous for thousands of years, that there is no base of experience with such projects to which local residents can relate and the fact that such projects shall be federally managed in concurrence with state and local authorities leads to serious socioeconomic and psychological misgivings and concerns about repositories among rural residents.

Identification of special effects

Although only a few of the many special effects of repositories can be identified here, among the most significant of these effects are those related to:

- (1) Fear and Anxiety—related to:
 - (a) Present Health and Safety,
 - (b) Health of Future Generations
- (2) Equity,
- (3) Institutional Concerns—related to:
 - (a) Security,
 - (b) Short-term and Long-term Site Control, and
 - (c) Transportation and Handling of Materials,

(4) Public Participation and Monitoring.

Fear and anxiety

Among the major effects of repositories is the fear caused by them. Because they involve the handling and storage of nuclear materials and because of the highly publicized nature of recent events related to nuclear power, populations are apprehensive about the siting of nuclear storage facilities in their areas.

This fear and anxiety stem both from a fear for residents' own health and safety and from an equally strong fear that, although they may not be affected, future accidents or disturbances of repository sites may lead to health problems for future generations. Particularly strong are concerns related to the contamination of ground water and the subsequent increase in exposure to radiation.

Equity effects

Yet another major result of the fact that such facilities involve the storage of nuclear wastes involves the issue of equity. Residents in potential site areas may find it difficult to accept that their areas should be forced to accept an unwanted facility that may store the nuclear wastes of an entire nation. Such perceptions may be particularly strong in rural areas where residents have long perceived themselves as being exploited by urban residents and urban areas. For many residents in the South and West, for example, the perceptions of themselves as frequently being exploited by persons from the Eastern and Western parts of the United States are strong (Murdock and Leistriz, 1979).

Institutional concerns

Another major set of concerns surrounds the institutional arrangements for the management of repository sites. The security of such sites from natural or man-induced events, from terrorism and from simple human carelessness is of major concern. Recent information related to nuclear test sites in Nevada and Utah have increased this concern and caused people to question whether even the best of available techniques can predict longterm impacts. Concern over the maintenance of control over such facilities for the hundreds of years for which potential risks will exist is also evident. Questions have been raised about the maintenance of even the most carefully designed systems over a period of several centuries. There are additional institutional concerns related to the transportation and handling of wastes. How will such wastes be shipped, protected during shipment and how will areas around transportation routes be protected? These questions are ones which many residents feel have not been adequately answered.

Participation and monitoring

Finally, another concern of local residents is that their involvement in the siting process will be minimal. There is apprehension that the major decisions affecting repositories are being made by others and that local residents' involvement will occur only late in the process and involve only a token level of activity. In addition, there is concern that the monitoring of such projects may not be adequate nor carefully validated, particularly in relation to risks within local areas.

These are only some of the special concerns that are appearing in local rural areas in anticipation of the siting of low and high level waste facilities. Although difficult to identify and assess, addressing these concerns appears to be particularly crucial for the continuance of the siting process.

MITIGATION OF SOCIOECONOMIC IMPACTS

Principles of impact mitigation

The process of impact mitigation can be generally defined as the alleviation of those effects which are viewed as adverse and/or the accentuation of those effects which are viewed as beneficial. Mitigation inevitably involves dimensions of project management, community development and public involvement. In general, mitigation can proceed by either attempting to alter the characteristics (magnitude or distribution of factors) that lead to certain impacts or by alleviating the impacts after they occur.

Under the first of these strategies, attempts are made to alter conditions such as various project characteristics that determine the extent of impacts. For example, project construction periods can be lengthened to reduce the magnitude of the impacts within any given year and local recruitment efforts can be expanded to increase local employment levels and reduce immigration.

The second strategy involves providing direct assistance in dealing with impacts as they become apparent. A number of measures have been employed but providing planning assistance, financing new service needs and front-end financing of service costs are some of the most frequently used procedures.

Whatever strategy is used it is essential to note that there is no ideal mitigation strategy. The strategy to be used must be developed to meet the needs of a given area and must involve an integrated package of: (1) timely impact information; (2) coordinated planning; (3) financial assistance and; (4) growth and longterm monitoring. Finally, it must be recognized that some impacts simply cannot be mitigated. This is a particularly critical admission in relation to many of the special effects of repository sites.

Mitigation of repository impacts

The delineation of any specific mitigation plan for nuclear repositories must await the completion of research efforts, such as our own, and any mitigation strategy must be framed in terms of the needs and desires of the population of a specific site area. It is possible, however, to suggest several factors that must appear in any mitigation strategy developed for rural areas.

First, early involvement of residents and decision-makers from potential site areas is essential. This involvement must allow for meaningful local input during all project phases as well as provide a means for public information dissemination. Local residents and leaders must receive the same information presently being provided to state-level officials and, once a site is selected, they must be allowed to help formulate the mitigation plan. Finally, local persons must be involved in the ongoing monitoring of the project, particularly that related to project safety and project safety management. If the impacts of repository sites, particularly those related to the special characteristics of sites, are to be addressed local involvement is absolutely essential.

Equally important, potential site areas must receive planning assistance. Many of the potential site areas have no formal planning agencies, public officials serve on a part-time basis and knowledge of existing mechanisms for impact alleviation is likely to be limited. Assistance must be provided to allow local residents to establish in-area planning expertise. Only with such assistance will local residents be able to effectively prepare for such impacts and their involvement be effective.

Yet a third requirement for successful mitigation must be a comprehensive information base that is readily available for site area planning and information dissemination. Thus, information on the likely range of socioeconomic impacts must be provided in a timely manner and in a form that allows residents and their planning specialists to evaluate them effectively and to analyze the implications of changes in key assumptions that would change the magnitude and distribution of impacts. Information on project phases and processes must also be made available and widely disseminated. Only if such information is made readily available, and at an early stage in the siting process, will it be possible to overcome the tendency for misinformation to become dominant and rumor to be seen as equally credible as factual project information.

A fourth essential feature is the need to perceive and to manage repository siting as part of a much broader national program of resource management. That is, residents in many areas would find such sites much less offensive if they believed that other undesirable projects would be placed in other areas. It is essential that the perception be established that projects that require sacrifice to meet national needs will be shared and not always placed in rural, poor or other similarly labeled areas. A coordinated national program that places undesirable nuclear storage sites, defense establishments, chemical storage sites and similar projects within a common pool such that no single area of the nation is required to absorb a disproportionate share of such developments is essential.

It is also necessary to acknowledge that such mitigation will almost inevitably require substantial longterm financial and other commitments. The site selected will likely require payments to mitigate standard development impacts and other forms of payments may be necessary to address many of the special effects. Equally important, it will be necessary to insure that the mitigation policy is perpetuated over time and that other commitments for project maintenance and security are maintained across time. Policy-makers should give serious consideration to what the dimensions of such commitments should entail.

In sum, we maintain that it is essential that mitigation strategies provide local area involvement, local planning expertise, timely impact information, a means of including repository siting in a broad national perspective and that all strategies be formed so as to insure that longterm commitments are maintained. The major need, then, is for early involvement of local residents and the provision of comprehensive information and assistance within a context of longterm commitment.

Research and community development efforts in impact assessment and mitigation

The need to more thoroughly analyze assesment and mitigation issues, such as those above, has been recognized. Assessment and mitigation issues related to the

socioeconomic impacts of repositories in rural areas are being examined by the socioeconomic research program in the Department of Energy's Office of Nuclear Waste Isolation. A major project entitled "The Socioeconomic Analysis of Repository Sites" has been initiated through an interagency agreement between the U.S. Department of Energy and the U.S. Department of Agriculture. Department of Energy funds are being used to employ the strengths of the U.S.D.A. research system of State Experiment Stations to address research and mitigation issues related to repository sites.

Specifically, the Rural Development Center at Oregon State University in conjunction with the Texas Agricultural Experiment Station and the North Dakota Agricultural Experiment Station are leading an effort which involves researchers in six other states. The major rationale behind this project is to bring together personnel with research and extension experience in rural areas in a variety of settings across the nation to complete three tasks:

(1) To develop the methodologies for assessing the socioeconomic impacts of repository sites in rural areas;

(2) To examine the broad regional and local economic implications of such siting; and

(3) To develop mitigation, community development and public participation strategies that can be applied in rural siting areas across the county.

To achieve these tasks computerized, user-accessible impact assessment models and mitigation and community development plans will be developed and field tested over the next several years. The project will insure that the necessary materials are available for use for the assessment and mitigation of siting impacts prior to the actual designation of a repository site.

Identifying and mitigating the impacts, both standard and special, of the siting of nuclear repositories in rural areas clearly provides a challenge to policy makers. Not all of these impacts can, in fact, be mitigated and no assurance can be given that such siting can be done in a manner that is acceptable to rural areas. However, given a careful program of rural oriented research for identifying these impacts and developing strategies to mitigate them, and a longterm commitment by siting agencies to involve local residents in the siting process, the socioeconomic dimensions of nuclear repository siting may yet be effectively managed.

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STATEMENT OF HON. JEROME J. JOYCE, ILLINOIS STATE SENATOR, MORRIS, ILL.

State Senator Jerome J. Joyce of Essex, Illinois was first elected to the Senate in November, 1974 and was re-elected in 1978. Before entering the Illinois General Assembly, he was a member of the Kankakee County Board of Supervisors. During the 81st General Assembly of the State of Illinois, Senator Joyce has served as vice chairman of the Senate Committee on Agriculture, Conservation and Energy. The Committee is responsible for handling all energy-related legislation in the Senate, including legislation pertaining to nuclear waste and disposal. In February of this year, Senator Joyce was selected to serve as an adviser to President Carter's State Planning Council on Radioactive Waste Management. In June, he was granted voting rights as a member of the SPC. He also serves as chairman of the Senate Special Committee on Nuclear Safety.

Those of you familiar with the nation's current nuclear waste disposal policy are aware that only one away-from-reactor facility in the United States is presently accepting out-of-state shipments of high-level spent nuclear fuel for storage. That facility is the General Electric Company's plant near Morris, Illinois. I am very familiar with the facility. It is located in my legislative district.

As it was originally designed in the late 1960s, the GE plant near Morris would have been a spent nuclear fuel rod reprocessing center. However, the Carter administration has taken a wait-and-see approach to nuclear fuel rod reprocessing and, as a result, the General Electric facility has been converted somewhat to a temporary repository for high-level spent nuclear fuel. The plant's current capacity is 700 metric tons; currently, the holding pools at the plant contain some 350 metric tons of spent nuclear fuel and the company is accepting, at a rate of two metric tons per week, spent fuel from the San Onofre, California reactors.

Although there are two similarly constructed facilities in the U.S.—one at West Valley, New York and another at Barnwell, South Carolina—the Morris operation is the only plant currently accepting new shipments of spent nuclear fuel rods. The other two plants have been placed on indefinite moratoriums.

Morris, Illinois is located near the confluence of three rivers—the Des Plaines, Illinois and Kankakee Rivers. The land surrounding Morris is among the most productive agricultural land in the world. And, like virtually every town in the Midwest United States, Morris lies within a belt that is frequented by tornadoes.

In addition, the area is located on an earthquake fault which has been considered inactive. One wonders, especially in the wake of the eruption of Mt. St. Helen's in Washington, how really inactive geological masses tend to be.

Perhaps the most frightening fact, in terms of potential accidents at the General Electric plant near Morris, is that the facility is located within a 70-mile radius of more than 7 million. That in itself is serious food for thought when one is considering the question of temporary or permanent away-from-reactor fuel storage.

Until recently, the people of my district had not really voiced any real opposition to nuclear power and its byproducts. Perhaps the major reason that they did not lies in the fact that this region alone is host to seven nuclear power reactors. I can safely say, without qualification, that I represent a district with more nuclear power plants per capita than any other legislative district in the United States.

When proponents of nuclear and plant construction made their pitch for building reactors in my area, they talked of the obvious benefits: jobs and real estate taxes. They talked of unqualified safety. That was before the near-disaster at the Three Mile Island plant in Harrisburg, Pennsylvania.

The TMI accident and the recent announcement by the U.S. Department of Energy regarding the possible federal takeover of the GE facility has made the natives in my territory a little restless. In addition to determining the realization that nuclear power has its dangers as well as its benefits, the people of my district have begun to piece together their situation in terms of long-range economic impact. It would almost be funny if the situation were not so serious, but as recently as three years ago, there were school superintendents within my legislative district who could not spend their revenues fast enough. The real estate taxes paid by the utility companies operating the reactors and by General Electric were tax windfalls to what has been a relatively poor area.

For example, General Electric pays more than \$300,000 annually in real estate taxes to the County of Grundy. That, ladies and gentlemen, buys a lot of school books, pencils and erasers.

But the people of the Morris area have been struck recently with a very sobering fact of life. They now realize that if, as some DOE officials have recommended, the General Electric spent fuel repository is purchased by the United States Government, that \$300,000 in annual real estate tax will evaporate.

More importantly, they now have been made too painfully aware of the potentially fatal dangers they face if the facility is purchased and expanded by the federal government for either temporary or permanent storage of high-level spent nuclear fuel.

And the picture begins to gain more and more focus as more and more facts and data are made public. For example, the people of my district weren't aware until recently that the General Electric plant cannot, even if there is a policy reversal by the Carter administration or any subsequent administration, reprocess nuclear fuel rods. The plant cannot convert to reprocessing because of serious and potentially dangerous design and construction flaws.

So, in essence, General Electric is holding a very large bag. Inside that bag is a \$60 million white elephant. And quite frankly, ladies and gentlemen, the people of my district and throughout the state of Illinois do not want the federal government to assume that white elephant for the purposes of storing—even temporarily—high-level spent nuclear fuel rods.

The people of Illinois are just beginning to realize that the only spent nuclear fuel currently being stored in pools at General Electric are fuel rods that were burned at reactors outside Illinois. Every nuclear reactor within the boundaries of the State of Illinois store their spent fuel rods on site. The people of my district have just

recently been made aware of their newly-found role as the "nuclear waste babysitter of the nation."

Yes, the people living in Morris, Illinois are becoming frightened. Senator Leahy, in inviting me to testify before this panel today, asked if I would explain what impact the nuclear waste storage problem has had on the physical and mental well-being of my constituents.

Unfortunately, it is too early to tell what, if any, physical effects are to be encountered because of nuclear waste storage in my area. But I can honestly tell you that the people of my district have serious doubts, questions and fears about the GE plant at Morris. Testimony to that fact is the recent delivery of petitions bearing the signatures of 10,000 people to the Illinois Commission on Atomic Energy. The people who signed those petitions did so in complaining that our governor has not done enough to prevent a federal takeover of the Morris plant.

The people of Morris are just now being told that the liner of the storage pool at the GE plant has an expected life of only 35 years and that 10 of those years have already been spent. And they are just now being made aware of the fact that the life expectancy of a nuclear power plant is a mere 35 to 40 years. What happens after a reactor "dies"? What happens after a nuclear power plant can no longer safely generate electricity?

Nobody knows. Nobody knows what to do with a nuclear power plant that has outlived its productivity because we have not yet crossed that bridge. I recently attended a conference on the decommissioning of reactors which was held in the State of Washington. I was shocked to hear the so-called "plans" for decommissioning nuclear power plants.

Our best bet, at this point in time, is that we will fill the reactors with concrete—they call it entombment. So our children and our grandchildren face the prospect of hundreds of "tombs"—totally useless monuments build by their ancestors—dotting the countryside, from sea to shining sea.

In Illinois alone, in the area where I farm and where I hope my family will farm for hundreds of year to come, there will be no fewer than 14 nuclear reactor crypts. Those crypts will stand out like eerie headstones in a cemetery. And that cemetery just happens to be some of the best farmland in the world.

I am afraid—and I am not a fatalist nor am I a doomsayer—that our generation is mortgaging the future of our children's children. It is almost as if we have sold our souls to the devil for some immediate wealth and happiness, ever ignoring the future when we will have to make payment for our pleasure.

We have committed ourselves and have leaped headlong into the world of nuclear power and I believe we have done so because many of us believed that it was a panacea for our energy needs. In our attempt to provide for the future, we have instead cast doubt and question upon it.

And so it is my belief and that of my constituents that we must carefully and painstakingly consider every alternative before we establish a nuclear waste policy for this nation. As you can guess by my testimony today, neither I nor the vast majority of my constituency wants the General Electric plant to be designated by the Department of Energy as even a temporary nuclear fuel repository.

That has become our stand, quite frankly, because we don't think such a designation makes much sense; it just doesn't appear to be in the best interests of more than 7 million people living nearby to truck all of this country's spent nuclear fuel rods into what we consider nature's very own greenhouse.

Experts have already stated—and I am a farmer, not a physicist—that there will be, by the year 2000, some 100,000 tons of highly-radioactive nuclear fuel rods that will be all dressed up with nowhere to go. If the Department of Energy follows through with the suggestion of designating Morris as a "temporary" repository, then I, even though I am not an expert on the subject, can see a very serious threat to nuclear waste storage in this nation. Once a "temporary" site is designated, it will become more and more politically difficult to designate a "permanent" repository for spent fuel rods.

If I may borrow a quote from my colleague and chairman of the State Planning Council on Radioactive Waste Management, Governor Richard Riley: "I don't know much about physics, but I do know that wherever you put nuclear waste, it stays there." And, quite frankly ladies and gentlemen, I don't want hundreds of tons of highly-radioactive waste "staying" a mere 50 miles southwest of the City of Chicago.

There are already blueprints for the expansion of the Morris facility in the event of a federal takeover. It is estimated that the plant can eventually be expanded to store 7,300 metric tons of spent fuel rods—more than 10 times its current capacity. And what further frightens me and the people of my district are press reports that contend that Morris is the early odds-on favorite for federal takeover because it is by far the cheapest facility to convert.

We are faced with the very real possibility that Morris could very well become the nuclear waste capital of the world because it would be the cheapest route to take. Think about that for a moment.

So what, then, is our alternative?

At a recent meeting of the State Planning Council, we adopted a resolution which states that no final decisions in the field of nuclear waste disposal should be made unilaterally. The State Planning Council has recommended that the federal government agree to a "consultation and concurrence" policy in dealing with the states in the area of radioactive waste disposal. As I said earlier, the deeper we get into nuclear waste storage, the more and more politically difficult it becomes to reverse our field.

There will be no easy solution. There will be no answer which mollifies everyone involved. But the final decision on where we can safely store our byproducts of the nuclear age must be made fairly and with utmost concern for the health and safety of our citizens.

If nothing else, we owe it to our children's children.

STATEMENT OF HON. WILLIAM A. WILKERSON, MISSISSIPPI HOUSE OF REPRESENTATIVES, LUCEDALE, MISS.

It is a personal honor and privilege to be invited to testify before this honorable body. Also it is an honor for one from the great magnolia State to be recognized and afforded an opportunity to make a contribution to your investigation.

The letter of invitation from Senator Leahy was very inclusive of the subject matter which you wish to investigate. I will attempt to address each of those items in any statement. However, I invite questions for further details at such time as you may choose.

Nuclear energy and nuclear (radioactive) waste materials are "new kids on the block" to my constituents. We who studied chemistry in high school or as freshmen in college never received more than a casual introduction to those elements on the periodic chart which make up radioactive isotopes. Therefore, we are having to begin an educational process unlike any known to man.

Mississippi is blessed with three salt domes which are apparently attractive to the Department of Energy as suitable media for the storage of radioactive waste materials. Thus we find ourselves in much the same set of circumstances as a football player who needs to take a quick "cram" course in order to be eligible to play football this fall. Such activity leads ultimately to two directions: One direction is to take the course, learn as much as you can, try hard to pass the exam and qualify to play football; the other direction is to feel that the pain and suffering of meeting such a requirement does not merit the joy and thrills received by those who succeed. In any event, one usually finds the more ambitious first group I described as "players on the field." The second group become spectators who not only are critical of every move the players make, but they also assume the role of knowing more about officiating than the guys in the striped shirts.

Accordingly, gentlemen, I have tired to set the stage whereby I may give you a candid impression of the concerns of my constituents toward nuclear energy and radioactive waste materials. I would recommend an educational process unlike any tried before. The Federal Government, who will be privileged to have fee title ownership of radioactive waste materials, must assume the lead in this educational process.

I am in complete agreement with the process of consultation and concurrence (or consult and cooperate, if you prefer) as an adequate mechanism to institute the educational process. What ever the process or relationship is, there must be an open display of information on the part of each side. The "sides" I speak of include the Federal, State and local/tribal governments, and the consultation and concurrence process should include:

1. A full and complete sharing of information. The importance, relevancy or materiality of the information is very important, however, if one begins to screen information which enters the consultation and concurrence process, then the process will lack the degree of confidence needed for a full understanding of the issues under consideration.

2. The Federal Government should come to the States with a complete "blue-print" of their mission, whether such mission be surveys, testing, site characterization, siting, construction, operation, decommissioning, or otherwise. It seems that the State or local/tribal governments are forced to go to the Federal Government much too often. Numerous cases are reported where a State or local/tribal government learned of Federal Government activity within their jurisdictions which far

surpassed any previous agreements, or which was totally unknown in the State or local/tribal entity.

3. Never create an adversary atmosphere in the consultation and concurrence process. A State or local/tribal government should never have to stand before panel of Federal officials and "plead their case" as to why a particular site within their jurisdiction should not be selected for a radioactive waste repository. Such a conclusion can totally defeat our present concept of a consultation and concurrence process.

The consultation and concurrence process should begin with the State government and then flow through an agreed mechanism with the local/tribal government. The educational process must begin with elected State officials and be carried on down to the smallest group or individual in the community wherein any activity of the site selection process begins. It is just good business to have a complete, total and candid display of information in the process whereby suspicion could not be allowed to cloud anyone's mind. All players must play with both hands on the table.

I would now like to turn to the second area of concern in the chairman's letter of invitation, which is cost to the community. The cost to a community wherein a radioactive waste repository is located would vary as many times as there are sites or communities involved. Costs that come to mind immediately are:

1. *Loss of ad valorem tax revenue due to removal of acreage from county and city tax rolls when title to such acreage vests in the Federal Government*

Example: Presently in Perry County, Mississippi, there are 359,600 total acres of land. The Federal Government owns 159,400 acres in that county. Therefore, you can see that approximately one half of the ownership of Perry County, Mississippi presently vests in the Federal Government. The county does receive an in lieu tax from the Federal Government on the property. Revenue comes from the sale of timber from the land and the county receives a percentage of the sale. However, the amount of in lieu taxes received is far less than that amount of taxes the county would receive if the land were in private ownership.

2. *Cost of street and highway construction and maintenance*

Tremendous pressure will be exerted upon the roads and streets during the construction phase of a radioactive waste repository. Also, I would assume certain highways would have to be in excellent condition for the safe transportation of radioactive materials.

In my opinion the Federal Government should be responsible for the construction and maintenance of roads and streets in the community wherein the repository is located. Furthermore, financial responsibility for construction and maintenance of any and all highways selected as routes for the transportation of radioactive waste materials should be borne by the Federal Government.

3. *Impact on schools and medical facilities*

I would assume there would be an immediate influx of people into a community where a radioactive waste repository is sited, especially during the construction phase. Any extraordinary increase of school enrollment would place a burden upon the school system; i.e., plant facilities (classrooms, cafeteria, recreational as well as all other space necessary to accommodate students), teaching personnel, books and supplies, transportation, etc. Such added and unanticipated costs should be borne by the Federal Government.

4. *Water and sewer facilities*

Added facilities would be required to support the additional homes and there would be new requirements for public services such as schools and hospitals. Furthermore, the radioactive waste facility would be dependent upon these accommodations in some form, whether they be located on the repository site or connected with the community-owned facilities.

5. *Other cost factors*

There would be many additional costs to the community which I may fail to list; however, some I would like to mention before closing this part of my testimony are police protection, bus service, auto and traffic control, safety, fire and service personnel.

The above five items are crucial costs to a community and readily come to mind. However, as I mentioned, there are far greater costs associated with the siting of a radioactive waste repository not included in the above comments.

Mississippi has been in the process of locating a petro-chemical complex on and along the Mississippi Gulf Coast for the past four to five years. The Mississippi board of economic development is the lead agency in this effort. They have the complete support of state government, cooperation of many state agencies, district

and county economic development authorities, and cooperation of municipal governments. This location process has seen the expenditure of many thousands of dollars and many man hours of work.

The Mississippi Gulf Coast, particularly Pascagoula, Mississippi, is fifty miles south of the largest salt dome of the three presently being considered. Salt, as well as other minerals from the domes, will be used in the petro-chemical process for the manufacture of synthetic fuels. However, if the salt domes are selected as a nuclear waste repository, no materials will be voluntarily or involuntarily taken from the domes and used for the manufacture of synthetic fuels or for any purpose.

Accordingly, the multimillion-, perhaps multibillion-dollar economic boom in Mississippi, along with benefits to Alabama and Louisiana through the employment of workers and use of waterways, to mention only two benefits, will be lost. I intend to furnish you a copy of the petro-chemical facility study about which I have been speaking. Last Tuesday I asked the Mississippi board of economic development, the Mississippi research and development center and the Mississippi department of energy and transportation to file in report form the study and process Mississippi has underway in locating a petro-chemical complex. This report will document the statements I have already made as well as substantiate such statements as:

1. The salt domes of South Mississippi can provide an indefinite supply of brine which is necessary in the synthetic fuels process.

2. A 40-foot ship channel, soon to be 50 feet, presently exists to accommodate water transportation associated with the complex.

3. The cost of energy necessary to operate a petro-chemical plant would be less in the Pascagoula, Mississippi area than anywhere in our nation by 1990.

4. The plant site in Pascagoula, Mississippi and the salt domes are now authorized to be connected to the ethylene grid system located in the state of Louisiana, whereby the synthetic fuels produced can be readily introduced to the nation's pipeline system.

Therefore, gentlemen, I trust that from listening to the Mississippi example you can see and more accurately understand what may be involved in siting a radioactive waste repository. There is more than immediate or standard cost to the community wherein the site is located, but there are cases, such as Mississippi, whereby the costs spread far and wide. The use of ports, harbors and waterways of three states which become involved, and the millions of dollars of capital outlay for construction are only two examples to indicate the magnitude of the economic impact of a radioactive waste repository siting within our area.

Last and foremost, I have not begun to show the importance of a supply of synthetic fuels being placed into the nation's energy pipeline-grid system for the use of all Americans. I am trying to show that there are areas of consideration in a radioactive waste repository site selection process far greater in cost to the state or local community involved. I am firmly convinced that the resources of the Federal Government are sufficient to satisfy the needs of any one particular state or local community. That site selection process should be an all-inclusive process taking into consideration a much greater area than the community wherein the site may be located.

To accurately explain what the Federal Government should be doing to help mitigate the negative impacts of a radioactive waste repository on a community is far beyond my intellectual capability. Again I refer to the educational process (consultation and concurrence) previously mentioned. The opponents of nuclear energy have been most successful in getting their point across; perhaps the proponents of nuclear energy should use the same tactics.

Since I have been involved in the subject of nuclear energy and nuclear waste, I have become convinced that sufficient technology exists for the construction and operation of an experimental (test) radioactive waste facility. I think if the local community had an opportunity to read, review and have explained the information to which I have been exposed, this would help mitigate negative impacts of siting of a radioactive waste repository.

At the present time, my constituents are vehemently opposed to storage of radioactive waste material in our area. I have tried to present as best I can why they have that feeling. The economic question (loss of industrial potentials, loss of tax revenues, etc.) and social impacts (citizens moving out of the community from fear of potential hazards associated with the repository, as well as few or no sales for new real estate) bear heavy on their minds. A lot of time and effort has been put into developing the technology presently existing in the field of nuclear energy and nuclear waste disposal; perhaps an equal amount of time and resources should be put into the socio-economic and institutional impact of a nuclear waste storage site in rural areas and small communities.

Thus far I have made no comment on low level nuclear waste. My comments on low level waste coincide generally with all that I have said in this report. I feel that low level waste should be the responsibility of each individual state, with each state disposing of low level waste generated within that state. Whether a state wishes to assume this responsibility individually or with other states through a compact or agreement is rather immaterial.

Low level waste is a greater problem than high level waste because of its quantity. It is a well known fact that we have a far greater supply of low level waste and the potential of much more: Therefore the problem will continue to escalate. It is my feeling that each state has a suitable geologic media for the safe disposal of low level waste. However, such has to be resolved by the technical staffs of the Federal and State Governments regarding the safety of a suitable media.

Again I wish to thank you for the opportunity of appearing here today. Hopefully the views I have shared with you will be helpful in your investigation of the socio-economic and institutional impacts of a nuclear waste storage site in rural areas or communities.

STATEMENT OF FRANK S. HUITT, SUPERVISOR, 27TH DISTRICT, DANE COUNTY, WIS.

Chairman Leahy and members of the committee, I appreciate this opportunity to testify before your Committee both because I hope I may be able to provide you with a different perspective on the issue and because I am pleased by your recognition that local government does have special needs and concerns in the nuclear waste siting debate. For a long time, we, at the local government level, have felt almost entirely left out of the nuclear waste disposal discussion. The Federal government has communicated with state government leaders, but all too often, the communication has stopped there. My invitation to appear before you today is a clear indication that we are now being included in the discussion even if we are not yet as full partners.

Of the several points I wish to make, the first should not require mention at all, yet, we are continually reminded that despite assurances to the contrary, much of the Federal government's activity in selecting waste disposal sites is shrouded in secrecy. My first point is that the nuclear waste disposal site selection process must be totally open and honest. We cannot have faith in what we are told if we continue to suspect that there is a great deal more we are not being told.

A recent example in my State illustrates my point. Rumors began to circulate that Wisconsin was being considered as a possible high level waste disposal site. Speculation, reported in various newspapers, was that a three County area in Central Wisconsin had been selected and was actively being considered as a potential site. Yet, State and Local officials were assured that, beyond broadly mapping possibly suitable geologic formations, some of which were in Wisconsin, there was no special focus on the State.

As it turned out, reality fell between the exaggerated speculation of the newspapers and the benign assurances of the Department of Energy. The examination of Wisconsin's granite deposits had gone well beyond the simple map reading exercise which had been implied. Furthermore, the three County areas in question had been used as a model for a generic environmental impact study of nuclear waste sites. However, Wisconsin seems not to be any more actively under consideration as a nuclear waste disposal site than anyone of a number of other states.

In retrospect, I do not find the DOE activities to be objectionable. Their investigation is a necessary part of their mandate to find a reasonable method of dealing with nuclear waste. But the uncertainty surrounding the proceedings has left a reservoir of ill-feeling and mistrust which will effect further dealings on the issue for sometime to come.

My second point leads directly from my first; not only should the Federal Government speak to us openly and honestly, it should speak with a single voice on nuclear facility siting. Again, the incident I previously mentioned is illustrative. In attempts to find out exactly what was happening, various officials contacted the Department of Energy, The White House, Congressional Offices, The State Planning Council, even the Department of the Interior. None of the contacts provided the right answers. Some even proved to be misleading. If a similar situation were to develop tomorrow, I have no idea who I would contact to find out what was really happening.

I suggest a single source for information, probably within DOE, which would serve as a clearing house for information about nuclear facility siting. While waste disposal facilities are most germane to today's discussion, such a clearing house could also provide information about other nuclear facilities and, ultimately, any major energy facilities. Not only would this be a major improvement in correcting

false rumors before they become widespread, it would be invaluable in DOE's ultimate responsibility to notify and communicate with state and local governments.

I see a commitment by the Department of Energy to aggressively seek communications with local governments throughout the site selection process as essential and probably the most important recommendation I can give to you. It is a recommendation I make, fully realizing the difficulty it may present to the Department. Communications with the offices of fifty State Governors is a manageable and identifiable task. Extending that communication to the more than three thousand county governments in this Country and to the numerous cities, villages, and towns within them might seem unmanageable, particularly when one considers the very limited capability many of these local units of government have in dealing with the complex and technical issues of nuclear waste disposal.

But, I believe the communication is absolutely essential; state governments, no matter how well intentioned, cannot respond on behalf of the local governments. Their view of the problem is appropriately a broader one than ours. State governments cannot and should not be expected to relate to the very close and personal kind of problems county and municipal governments have been established to deal with.

To make the problem a more manageable one, a point at which effected local governments are brought into the selection process should be established. This point should come very early in the process and should certainly come before any on site work of any kind is done.

To make this local government involvement meaningful, we in local governments are going to ask for your help. As I have pointed out, the complexity of nuclear waste issues is far beyond the in-house evaluative capability of all but a few local governments in the Country. To participate as equal partners in the site selection process, we must be able to contract for our own, independent consultation services. The cost involved, particularly in the early stages of site evaluation, will be quite modest in relation to the cost of selecting a site, but the benefits in terms of increased understanding and cooperation will be tremendous.

I will not attempt to give you a "Laundry List" of local government services which might be effected by the selecting of a particular locality as a nuclear waste disposal site and for which we might justifiably seek compensation. Almost any service we provide might be included in such a list, but those services and impacts vary widely from one locality to the next and they should be fairly easy to identify in the process. I will only say we believe it fair to expect localities will receive full compensation for these effects. Beyond this, I think it also fair to anticipate these communities will receive compensation beyond mere mitigation of adverse impacts. Since there will be very few communities who are asked to shoulder burdens, both real and perceived, for the general good of the nation, they deserve to see some real benefit beyond the traditional notion of "trickle down" benefits of economic growth. In this, however, I do not suggest direct government payments, but charges assessed against those who produce the waste to be stored.

In closing, I would like to leave you with a thought. The Nation already has a number of sites at which nuclear wastes are stored, but one never hears reference to the South Carolina disposal site, the Nevada site, or the Washington site. They are universally referred to by the names of their host committees: Barnwell, Beatty, and Hanford. We seldom talk of the nuclear waste problems in New York State, but of the problems at the West Valley site. Local governments and the people they represent are deeply involved in the question of nuclear waste management. We want and deserve to be involved as full partners in the waste disposal process.

STATEMENT OF GEORGE W. CUNNINGHAM, ASSISTANT SECRETARY FOR NUCLEAR ENERGY, U.S. DEPARTMENT OF ENERGY

NUCLEAR WASTE REPOSITORY SITING

Mr. Chairman and Members of the Subcommittee, I am pleased to appear before you today to take part in the discussion on the socioeconomic impacts of a possible nuclear waste storage or disposal site on nearby rural areas and small communities. These discussions are particularly timely now that our siting studies are progressing such that we are identifying specific regions of potential interest. They also serve to focus on the resolution of institutional issues which may well be as important as finding solutions to the remaining technical problems. We recognize that dealing with these impacts will occupy a considerable amount of the time of the Administration, the Department of Energy, and the Congress in the next several years. Decisions will have to be made involving several levels and branches of Government. We believe, however, that the Presidential statement of February 12, 1980, contains a

framework for resolving issues which will arise in this regard over the next several years. The President emphasized a policy of constructive partnership whereby the States have full participation in the decisionmaking process and are able to both understand and influence the development of the program.

As a preface to our assessments, we wish to note that most of the possible mitigating measures provided for low-level radioactive waste land burial sites would be provided by the waste generators and commercial waste disposal site operators. Under the evolving policy of State responsibility for the disposal of commercially-generated low-level waste, additional impact assistance in the form of grants and improved services might be provided by the State. Under current authorities, the Department of Energy has little or no role in mitigating the socioeconomic impacts of a low-level waste site. Thus, our following assessments are applicable to Away-From-Reactor interim storage facilities for spent fuel and repositories for the isolation of high-level waste.

At present, only limited economic or social benefits are visualized for localities in which interim storage or permanent repositories for high-level radioactive waste may be sited. These benefits would be the same as those typically associated with any relatively large Federal project. They would result primarily from the channeling of outside financial resources into the community through repository workers' salaries and payments for supplies and services which could be locally supplied. Local and State governments could also be expected to gain by the increased tax revenues from the increased expenditures throughout the community. The degree to which this infusion would be considered "beneficial" is subjective and dependent to a large extent on the pre-repository situation of the involved community. For example, the prospect of economic growth would not please those who favor preservation of the pre-repository status quo, and the impacts on a small community could be much more pronounced than on a large community.

The discussion of potential socioeconomic impacts in DOE's draft Environmental Impact Statement on Management of Commercially Generated Radioactive Waste, as stipulated in DOE/EIS-0046-D, dated April 1979, estimates repository manpower requirements and repository construction and operating costs. Depending upon such parameters as the choice of repository host rock, nuclear fuel cycles, and load capacities, the estimates for a single repository can vary considerably. Again, with your permission Mr. Chairman, I would like to enter for the record a few tables from the draft EIS which present these estimates for different assumptions. To illustrate the order of magnitude of a repository project in terms of jobs and financial impact, I would cite a range of from 1,200 to 3,100 people directly employed during the peak construction years and from 900 to 2,300 people employed during the operational phase. Estimates of construction costs in 1978 dollars range from \$1.0 billion to \$3.1 billion and operating costs over the repository lifetime range from \$0.6 billion to \$2.4 billion. These ranges for manpower and cost are influenced by the range of repository types and, therefore, do not reflect a range of uncertainty. The implications of these numbers in terms of (a) total project-related in-migrants, including primary and secondary workers' and associated household dependents, and (b) their needs for locally provided social services—such as health, education, sanitation, fire and police personnel, recreation areas, government services, etc.—are also described for several different hypothetical settings and repository conditions.

The detailed fiscal and economic impacts will depend upon the specific site. For an AFR, these impacts will be examined in the EIS for acquiring existing facilities and in the EIS for site selection for construction of a new AFR. For repositories, these impacts will be evaluated in the site-specific Environmental Impact Statements which will be prepared prior to banking sites as candidate sites are being considered and reexamined. The review of the site-specific Environmental Impact Statements will be completed prior to a decision to actually construct a repository at one or more of these sites.

The long-term environmental impacts of waste repositories are covered in considerable detail in the Department's draft EIS on the Management of Commercially Generated Radioactive Waste. The draft EIS concluded there will be minimal long-term environmental impacts due to the considerable program efforts to engineer multiple barriers and to search for highly qualified sites.

The short-term environmental impacts were also considered in the above cited EIS. Our analysis indicates that the main environmental concern during repository construction and operation is the potential for the very large mine spoils piles to contaminate the environs by non-radioactive airborne and waterborne releases. Land near repositories in salt could be contaminated by windblown salt; nearby streams could be harmed by runoff contaminated with salt. Removal of the salt to a nonharmful environment, such as through dilute dispersal at sea or by stabilization

of the salt piles could obviate the problem. Repositories in shale do not appear to pose as serious a problem, although reduction of pyrite, a mineral found in shales, could lead to contamination of streams. The spoils piles from repositories in granite and basalt are not expected to have a significantly adverse affect on the environment. For as long as it takes to fill the repository, wildlife will probably concentrate in the restricted area; and, in these terms, the change in land use may be considered beneficial.

Potential socioeconomic impacts fall into two categories. First, there are those socioeconomic impacts which would be typical of any Federal project having the conventional work force and supply service requirements previously described. To deal with these impacts, existing law: (1) allows DOE to make payments in lieu of the tax revenues which would have been paid for such property in the condition in which it was acquired and (2) provides for financial assistance to those local educational agencies upon which the Government has placed financial burdens. Generally speaking, "in lieu" payments serve merely to reduce probable tax losses. Similarly, educational assistance would only have the effect of easing a burden placed upon the community by the Federal project. Several Federal loan and grant programs, as described in the Catalog of Federal Domestic Assistance, may apply to impacted jurisdictions. DOE, in conjunction with the Department of Agriculture, administers an energy impact assistance program authorized by section 601 of the Powerplant and Industrial Fuel Act. It is, however, currently limited to assistance for coal and uranium mining activities. Legislation now in Congress would extend this program so that radioactive waste disposal activities would also be covered. (Title III of S. 2332, and H.R. 7358.)

The DOE authority referred to above to make payments to State and local governments in lieu of property taxes arises when the property is acquired by DOE pursuant to the Atomic Energy Act of 1954, and providing certain other criteria are met. Section 168 of the Act permits DOE to make such payments in localities where DOE activities are carried on and DOE has acquired property previously subject to State and local taxation. Section 168 provides that DOE should be guided by the policy of not making payments in excess of the taxes which would have been payable for such property in the condition in which it was acquired, except where "special burdens" have been cast on the State or locality by DOE activities. In such cases, any benefit accruing to State or local governments by reason of such activities must be considered in determining the amount of the payment.

The legislative history of the Atomic Energy Act itself does not shed any light on the meaning of "special burdens" or "any benefit". There is, however, a legislative history reference to "special burdens" as that term is used in Section 91 of the Atomic Energy Community Act of 1955 which references Section 168 of the Atomic Energy Act. Senate Report 1140, on the Atomic Energy Community Act of 1955, dated July 25, 1955, states, "The special burden which will be imposed on those communities is the burden of maintaining services which will attract the caliber of personnel which are needed to maintain the Atomic Energy plants." This appears to be an indication that Congress previously felt that the special burdens referred to in Section 168 was not intended to provide broad relief. Therefore, Section 168 does not provide broad authority needed to meet the socioeconomic problems.

In the past, the Atomic Energy Commission was empowered to finance directly community services such as fire protection and water treatment at communities such as Los Alamos, New Mexico; and Oak Ridge, Tennessee, where the original existence of the community was due primarily to the presence of the AEC program. This precedent could be used in considering legislation allowing for direct financing of community services by the waste isolation program.

Provision of financial assistance for those local educational agencies upon which the Government has placed financial burdens is made pursuant to 20 U.S.C. 236 et seq. We are further studying the applicability and availability of the various programs described in the Catalog of Federal Domestic Assistance.

I have just described some of the current mechanisms for dealing with the conventional socioeconomic impacts. A second class of impacts is far less predictable. These impacts result from a public perception of risks to health and safety associated with nuclear waste disposal and transportation. Whether such risks create impacts which require special compensation is a question which DOE has under study. However, to the best of our knowledge, there is no Federal or other compensation or assistance program currently available to deal with such impacts. If a determination is made that special forms of compensation or assistance are appropriate, it appears that the cost of such a program could be included in charges paid by the utilities or other waste generators for disposal of their wastes. We are hopeful that institutions such as the State Planning Council on Radioactive Waste Management; the National Academy of Sciences, which has recently established a

Panel to consider the integration of socioeconomic criteria into the siting program; and other Government agencies, such as the Department of Agriculture and the Federal Housing Administration, can help us develop the appropriate policies or legislation if needed for dealing with such impacts. The Administration supports energy impact assistance legislation which will assist States and communities in (1) identifying any potential impacts from rapid growth due to energy development activities, including waste disposal; and (2) planning for and anticipating any potential impacts.

Further, the policy of incentives to encourage States and localities to accept location of nuclear waste repositories within their jurisdictions is in need of more examination.

The significant incentives presently derive from the potential benefits described earlier; i.e., jobs and prospects for increased business activity and the introduction of high-technology activities and interests into areas or localities seeking economic growth. The Department realizes that if you bring a large work force into rural areas and small communities, socioeconomic problems may arise. We are assessing the extent of this problem at present with those States and communities in which we have conducted our site exploratory studies leading to the identification of potential repositories. We are interested in developing a mechanism for dealing with the added cost to a community for providing the services needed by the repository work force and their families. Among the mechanisms under study is the possibility of defraying such costs as part of the disposal fee for users of AFR's and waste repositories.

We recognize that potential repository States and communities are very much concerned about how a repository would affect them socially and economically and that these concerns should be addressed as part of the consultation and concurrence process preceding site selection. Anticipating and establishing mechanisms for management of possible impacts will be far more desirable in this process than ad hoc reparations and fixes as difficulties arise. The energy impact assistance legislation before this Congress could provide some financial relief, once problems are identified. With your permission, Mr. Chairman, I would like to submit for the hearing record a listing of some of the more pertinent studies that have been performed which are aimed at identifying and assessing socioeconomic impacts. We strongly believe that this is one aspect of our waste management program in which State and local governments can and should actively participate, particularly in the planning and policymaking end. Accordingly, from those studies—and others we will initiate in the future—we plan to develop our impact strategy in concert with State and local groups.

In summary, we are mindful of the need to get on with this task. The President's February 12, 1980, announcement called for a decision by January 1986 as to which of several candidate sites should be pursued for repository development. This site selection decision should take into account the net social and economic impacts to the host locale and should have impact compensation or mitigation measures in place at that time. Thus, Federally-approved policies and plans for dealing with these impacts should be consolidated and approved well before the site selection decision.

This concludes my statement. I will be pleased to respond to any questions you may have.

MANPOWER REQUIREMENTS FOR CONSTRUCTION AND OPERATION OF SINGLE COMMERCIAL NUCLEAR WASTE REPOSITORY BY DISPOSAL MEDIUM, FUEL CYCLE, AND IMPACT CONDITION

[Mean man-years per year]

	Construction		Operation	
	Expected impact ¹	Maximum impact ²	Expected impact ³	Maximum impact ⁴
Salt:				
Once-through.....	1,400	1,800	870	1,200
U recycle.....	1,200	1,600	1,000	1,300
U and Pu recycle.....	1,300	1,600	1,300	1,600
Granite:				
Once-through.....	2,200	2,900	1,100	2,100
U recycle.....	1,700	2,200	1,300	1,800
U and Pu recycle.....	2,100	2,200	1,300	1,700
Shale:				
Once-through.....	1,900	2,300	880	1,200

MANPOWER REQUIREMENTS FOR CONSTRUCTION AND OPERATION OF SINGLE COMMERCIAL NUCLEAR WASTE REPOSITORY BY DISPOSAL MEDIUM, FUEL CYCLE, AND IMPACT CONDITION—Continued

[Mean man-years per year]

	Construction		Operation	
	Expected impact ¹	Maximum impact ²	Expected impact ³	Maximum impact ⁴
U recycle.....	1,600	1,900	1,100	1,300
U and Pu recycle.....	1,600	1,900	1,200	1,400
Basalt:				
Once-through.....	2,400	3,100	1,100	2,300
U recycle.....	1,800	2,400	1,300	2,000
U and Pu recycle.....	1,800	2,400	1,500	2,100

¹ Mean man-years per year for three years centered on year of peak manpower requirement.

² Mean man-years per year for year of peak manpower requirement.

³ Mean man-years per year for operations from 1985 to end of project, excluding last 5 years of operations manpower data from calculation.

⁴ Mean man-years per year experienced from 1986 to 1990.

Source: Draft Environmental Impact Statement, Management of Commercially Generated Radioactive Waste, April 1979, DOE/EIS-0046-D, volume 1 of 2, page 3.1.127.

COMPARISONS OF COMMERCIAL NUCLEAR WASTE REPOSITORY OPERATING COSTS¹ BY GEOLOGIC MEDIA AND FUEL CYCLE

[In millions of 1978 dollars]

Fuel cycle	Salt	Cranite	Shale	Basalt
Once-through.....	590	2,360	810	2,390
Uranium-only recycle:				
Pu in HLW.....	830	1,880	800	1,630
Pu stored.....	1,280	1,880	800	1,630
U and Pu recycle.....	1,210	1,940	830	1,740

¹ Total operating expenditures over the life of the repository. Uncertainties in cost estimates are approximately ± 25 percent.

Source: Draft Environmental Impact Statement, Management of Commercially Generated Radioactive Waste, April 1979, DOE/EIS-0046-D, volume 1 of 2, page 3.1.134.

COMPARISONS OF COMMERCIAL NUCLEAR WASTE REPOSITORY CONSTRUCTION COSTS¹ BY GEOLOGIC MEDIA AND FUEL CYCLE

[In millions of 1978 dollars]

Fuel cycle	Salt	Cranite	Shale	Basalt
Once-through.....	1,000	2,600	1,300	3,100
Uranium-only recycle:				
Pu in HLW.....	1,100	2,000	1,200	2,300
Pu stored.....	1,200	2,000	1,300	2,300
U and Pu recycle.....	1,200	2,000	1,300	2,300

¹ Includes mining, backfilling, and shaft sealing costs. Uncertainties in cost estimates are approximately ± 20 percent.

Source: Draft Environmental Impact Statement, Management of Commercially Generated Radioactive Waste, April 1979, DOE/EIS-0046-D, volume 1 of 2, page 3.1.133.

NUCLEAR WASTE REPOSITORY STUDIES

The following is a partial listing of recent studies of the social science aspects of waste management:

Impact/Siting Problems

Cluett, Christopher; Mertaugh, Michael T.; Micklin, Michael. *A Demographic Model for Assessing the Socioeconomic Impacts of Large-Scale Industrial Development Projects*, October 1977.

Herbert, J. A. et al. *PNL-2400. Nontechnical Issues in Waste Management: Ethical, Institutional, and Political Concerns*, May 1978.

Brenner, Robert D. *The Social, Economic and Political Impacts of National Waste Terminal Storage Repositories*, January 1979.

Hunter, Ted. *Nuclear Waste Repository Land Use Control Considerations in Selected States*, September 1978.

Lindell, M. K. et al. *Radioactive Wastes: Public Attitudes Toward Disposal Facilities*, October 1978.

Maynard, W. S. et al. *Public Values Associated with Nuclear Waste Disposal*, June 1976.

Siting Incentives

Cole, Roland, J. et al. *Compensation for the Adverse Effects of Nuclear Waste Facilities*, July 1978.

Garvey, Gerald, *NWTS Policy and Public Choice*, January 1979.

Greene, Marjorie, R. and Hunter, Ted. *The Management of Social and Economic Impacts Anticipated with a Nuclear Waste Repository: A Preliminary Discussion*, May 1978.

Decision Issues: Public, Local and State Participation

Smith, Randall F. *State and Local Regulation Relevant to Nuclear Waste Isolation Facilities*, September 1978.

Bishop, A. Brace et al. *Public Consultation in Public Policy Information: A State-Of-The-Art Report*. 1977.

STATEMENT OF JOHN G. DAVIS, DEPUTY DIRECTOR, OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS, U.S. NUCLEAR REGULATORY COMMISSION

Mr. Chairman, and members of the Subcommittee, I appreciate your invitation to testify on the socioeconomic impacts of nuclear waste management facilities and related matters of interest to the Subcommittee. Although your invitation indicates an interest in waste "storage" we interpret "storage" to include disposal, the impacts of which are likely to be greater in scope and duration. Accordingly, I will focus my remarks today on the impacts of permanent disposal facilities.

In order to describe the perspective from which my testimony will be given, I first will comment in general terms on the NRC role in the national nuclear waste program. The NRC's authorities and responsibilities in the national nuclear waste program are derived from the Atomic Energy Act of 1954 and the Energy Reorganization Act of 1974. Basically, these assign to NRC its responsibility to regulate the receipt and possession of certain nuclear materials, including waste, to protect public health and safety, and promote the common defense and security. Hence, the NRC neither owns nor operates any nuclear waste disposal site. Rather, the NRC—giving primary regard to public health and safety—regulates the disposal and storage operations.

With this perspective, I would like to turn to the specific matters raised in your letter of invitation. First, let me point out that the exercise of our regulatory authority to protect public health and safety and promote the common defense and security would not normally require this agency, as opposed to a facility operator such as DOE, to deal with the cost allocation issues you have identified, and the Commission has no plans to address them. We have given consideration to socioeconomic impacts and extensive thought to the question of state and local participation in the selection and licensing of high- and low-level nuclear waste disposal facilities. In addition, we have considered the applicability of the Price-Anderson Act to radioactive waste disposal facilities. I will discuss these matters, in turn, from the perspective of the regulator of these facilities.

As your letter suggests, the impacts will be different, in degree if not kind, for high-level waste (HLW) and low-level waste (LLW) facilities. NRC has authority to license both kinds of facilities.

LLW accounts for the greatest volume to be disposed of, but typically does not contain radioactivity that is so hot, so penetrating, or so long-lived as to make it unsuitable for near surface shallow-land burial. LLW comes from a variety of sources—for example, including research, medical diagnostic and therapeutic activities, industrial radiography, and the filtering and chemical purification of cooling water for commercial nuclear power reactors and reactor parts and components. Disposal entails some long-term control and surveillance after closure of the site to assure against exposures from intrusion or the unanticipated ground migration of radionuclides, but not a commitment comparable to that of HLW. In licensing LLW activity, the Commission has historically received applications from private con-

cerns, although there is nothing to preclude a state authority or local jurisdiction from assuming the role of operator of a LLW site. It should be noted that licensing of commercial low-level waste facilities can be done by the NRC or by Agreement States. NRC responsibilities for commercial LLW disposal licensing and regulation may be delegated to an interested state under an agreement pursuant to Section 274 of the Atomic Energy Act, as amended. There presently are 26 "Agreement States". All three currently operating commercial LLW burial facilities are regulated by such "Agreement States". My comments in this testimony concerning LLW apply to NRC licensing of such commercial facilities, not Agreement State licensing. The NRC stands ready to assist Agreement States in such licensing.

A commercial disposal site is essentially a well-maintained and controlled burial ground, sited so as to provide proper consideration for the health, safety, and environmental impact on the public. The largest operating shallow-land burial facility in the U.S., located at Barnwell, South Carolina, is licensed by the State of South Carolina for disposal over an area of about 250 acres, and currently employs about 100 people. Construction costs and, we believe, the socioeconomic impact of such a facility are relatively small compared to those of a HLW repository, primarily because handling facilities do not require the same degree of shielding, and because excavation is not nearly as extensive and is typically carried out incrementally as waste is received. The impacts of such facilities are quite site specific, however, and will be considered by NRC in the Environmental Impact Statement for a given proposed LLW site.

By contrast, the selection of a site for HLW disposal and the design, construction, operation, and decommissioning of disposal facilities has been left exclusively to the U.S. Department of Energy (DOE), subject to NRC licensure and regulation. Those DOE functions, in our view, carry with them the primary burden of responsibility to mitigate their social and economic impacts. Mostly, radioactive waste treated as HLW is derived from DOE defense materials, and includes spent fuel from commercial power reactors. In general, HLW is hotter and more radioactive than LLW and remains so longer. HLW requires careful handling and disposal such as deep geologic burial to assure a sufficient degree of isolation from the biosphere for hundreds or thousands of years. Disposal of HLW, therefore, requires more capital investment and more labor than for LLW disposal to complete subsurface excavation and the construction of surface facilities for material handling and security.

In a recent submission to NRC, DOE stated its opinion that a typical geologic repository would require an operational area of about 2,000 acres, with excavations for waste emplacement at about 2,000 feet below the surface. Surface facilities would be needed for waste receipt, preparation for emplacement, and transfer to the underground workings. From a generic sense, this could translate into socioeconomic impacts considerably greater than for other waste management facilities, since the project is likely to bring in more new workers and their families, who may require expanded educational facilities, hospitals, roads, water and sewer systems, and other public facilities and services. Other impacts may be radiological monitoring and emergency planning costs on the state or local jurisdiction throughout the operational life of the facility.

We note that DOE has identified impacts on a generic basis in its draft environmental impact statement on the Management of Commercially-Generated Radioactive Waste (DOE/EIS-0046D pp. 4.17-4.18 and Appendix B). While the kinds of impacts a host community would be likely to incur from a HLW repository can be anticipated, we believe that DOE, as the agency responsible for selecting the site and designing, constructing, and operating the facility, would have the prime federal agency responsibility of specifically identifying those impacts and of estimating the likely costs of mitigating them for a particular host community well before the Commission's formal licensing review begins.

Socio-economic considerations will be examined in our licensing process—indeed as I will discuss, we have taken care to design a licensing process to provide opportunities for such examination. However, a more strategic point for the examination of socioeconomic issues arises before our licensing process formally begins: when DOE is selecting sites, considering options for possible facility designs, and conducting its own NEPA review process for its site characterization program to support a decision on whether to apply for NRC authorization to construct at a particular site.

Turning to the matter of the state and local role in nuclear waste facility siting, as previously noted, we expect that the social and economic impacts of siting an HLW repository would first be identified and considered by DOE, but we also anticipate that these impacts may change as the project encounters needs for adjustments in design, construction, or operation. Some of these changes will probably arise during our licensing review, and we are convinced that the states,

working cooperatively with their local counterparts, are in the best position to know what the social and economic impacts are likely to be. For this and other reasons, our proposed rules for the licensing of both HLW and LLW disposal facilities provide extensive opportunities for state participation. To help identify impacts as early as feasible, these rules also encourage a prospective applicant to begin consultation with state and local government even during the development of a license application.

I have included for your examination copies of both our draft 10 CFR Part 61 licensing regulation of LLW shallow land burial facilities, and our proposed 10 CFR Part 60 procedural rule for the licensing of geologic HLW repositories. We expect to promulgate our LLW licensing rule in final form by the end of 1982. I would like to point out some common themes in our approach to state participation in both of them.

First, both rules give the states an opportunity to participate in our review and evaluation of a license application before the Commission actually receives a license application. In the LLW rule, there is a provision for a prospective applicant to file a notice of intent to submit an application. This triggers an NRC notice to state and local governments, and begins a process under which states can develop proposals in consultation with local governments to participate in NRC staff analysis of the application and its supporting documentation.

In the procedural rule for geologic repositories, the state has the same opportunity to submit proposals for participation much earlier in the process, at the point where DOE is ready to begin characterizing a particular site to gather data to support a potential application for construction authorization. At this point, DOE would submit a site characterization report to describe how the site was selected and how it would be evaluated. Among other things, the report would also contain a description of how DOE obtained state and public views. When the report is received, NRC staff would notify state and local officials, and states could propose to participate with NRC in analyzing it for DOE's further guidance as DOE considers whether and how to prepare an application.

A second theme common to both rules is flexibility. The provisions for early participation were deliberately drafted with a minimum of formal requirements to afford states a broad degree of discretion to participate in NRC deliberations according to their needs, resources, and relationships with local governments. A state may request to participate in several ways. It could assist in the review of specific portions of a license application. It would perform other technical assistance work for the Commission, particularly in the area of environmental studies and socioeconomic impact analysis. It might perform environmental and radiation monitoring for the NRC throughout the proposed facility's operation and perhaps after closure as well. A state could also participate through employment or exchange of state and federal personnel under the Intergovernmental Personnel Act. Finally, it should be noted here that under both rules, these provisions for early state participation are in addition to the separate opportunities for states, local governments, and the public to participate formally in our license review and to make input to our environmental impact statement. Both of these opportunities would, of course, be available later, after receipt of an application.

Most of the waste management bills now pending in the Congress contain some provisions for DOE to inform and consult with states throughout the site screening and characterization stages. As our proposed regulations demonstrate, the Commission supports such state-federal interactions, which hopefully will serve to resolve state concerns. If a significantly affected state's concerns on socioeconomic or other matters are not resolved, we believe it should have an opportunity to object formally to the construction and operation of an HLW repository within or adjacent to its borders. However, we believe that opportunity should come only after the NRC hearings on DOE's application for construction authorization. At that point there will be a full record of information on the proposed site, the repository design, and the waste form to serve as a basis for evaluating the state's objection, but it will still be early enough that large commitments of resources to a particular site will not yet have been made. We agree that a procedure should be defined whereby the President and/or the Congress reviews and resolves such formal state objections. We have no position on what the details of the procedure should be.

I now turn to the final matter of concern in your letter: Price-Anderson Act indemnification for waste management facilities. I take it that your primary concern is the possibility of an incident at an HLW repository, since the quantity and intensity of radioactivity at such a facility far exceeds that of other waste management facilities.

The Price-Anderson Act, (principally Section 170 of the Atomic Energy Act of 1954) is designed to accomplish two basic objectives: protection of the public by

assuring availability of funds for the prompt payment of claims arising from a nuclear accident; and encouragement of private participation in the development of nuclear power by limiting the liability of certain NRC licensees, DOE contractors, and third party suppliers who could be liable for damages in case of a nuclear accident. While the original focus of Congressional concern was on reactors, the Act gave the Commission discretionary authority to extend Price-Anderson coverage to nuclear materials licensees. The Commission subsequently decided to extend this coverage to plutonium fabrication facilities, but has not considered further extension of coverage to HLW repositories. We would probably defer such consideration until the development of a more extensive record on the nature and scope of repository risks.

This completes the written portion of my testimony, but I would be happy to respond to any questions you may have.

U.S. NUCLEAR REGULATORY COMMISSION,
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS,
Washington, D.C., September 30, 1980.

Hon. PATRICK J. LEAHY,
Chairman, Subcommittee on Rural Development, Committee on Agriculture, Nutrition, and Forestry, U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: We are pleased to submit responses to the questions from the record of the Subcommittee's August 26, 1980, hearings on the socioeconomic impacts of radioactive waste disposal. In connection with the inquiry on state land use rights as a basis for blocking a proposed waste disposal facility, we have attached copies of our previous correspondence with the Subcommittee on Nuclear Regulation chaired by Senator Hart. In addition, we have appended a list of states with laws restricting or banning radioactive waste disposal within their borders. I hope you will find these responses adequate for your purposes, but if you need additional information or clarification, please let me know.

Sincerely,

JOHN G. DAVIS, *Director.*

Enclosures:

1. Responses to questions from the Record.
2. Insert for the record for hearings on January 23-24, 1980.
3. Letter to G. Hart, from J. F. Ahearne, dated March 6, 1980.
4. Summary of laws enacted by States.

ENCLOSURE 1

RESPONSES BY THE NUCLEAR REGULATORY COMMISSION TO QUESTIONS FROM THE RECORD OF SUBCOMMITTEE ON RURAL DEVELOPMENT OF THE SENATE COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY DURING THE AUGUST 26, 1980, HEARING ON THE SOCIOECONOMIC IMPACTS OF WASTE DISPOSAL

Question. "NRC testified to the Senate Environmental Committee earlier this year that a state may have the power to block a nuclear waste site construction under its land use rights. Is that the NRC's opinion? And has any state tried to do that?"

Answer. The Commission has never advocated that a state be able to block a proposed high-level waste (HLW) repository simply by exercising its land use management authority. In the attached response to a question from the Senate Environment and Public Works Subcommittee on Nuclear Regulation, the Commission did suggest that radiological health and safety and environmental concerns might be appropriate grounds for a state veto, and that such grounds might take the form of an "unresolved conflict" between a proposed repository and a potential host state's comprehensive land use plan. In its testimony before the Subcommittee and in all responses on state veto rights since then, however, the Commission has consistently held the position that regardless of land use priorities, no state should have the authority to impose a flat prohibition on HLW disposal before the characteristics of any particular site within the state can be ascertained and evaluated. If such prior veto authority were permitted, the Commission believes that sites would ultimately have to be selected less on their technical soundness than their political acceptability.

If, however, a state were to continue to object after careful examination of the record of health, safety, and environmental considerations, after consultation with DOE, and after participation in NRC licensing proceedings, the Commission believes that a strong argument can be made for the repository siting process to be suspended pending review of the record either by Congress, the President, or both.

Since land use management is often a vehicle for the implementation of public health, safety, and environmental priorities, the Commission cited a conflict between a proposed repository and a state comprehensive land use plan as an example of the grounds on which a state might exercise its right to suspend the siting process. In the attached response to a subsequent request from the Subcommittee for a clarification of this point, however, the Commission noted that its comment "was not intended to provide a mechanism for states to prevent, in an irresponsible manner, siting of a nuclear repository." Nor did the Commission have a specific land use conflict in mind when this example was mentioned. Our general concern was to acknowledge a legitimate state interest in the exercise of historically sanctioned state powers.

Consistent with our earlier views on state participation in the repository siting process, we do not believe that the simple existence of a conflict between a proposed repository and a state land use plan should furnish a basis for an unreviewed state veto. We believe a state's right to raise objections for third-party review would normally arise only where a state had designated a site for a specific use before that site had come under consideration for a potential waste repository, and then only after the conclusion of an NRC construction authorization proceeding. Only then would a record be available to those who would consider whether the state's objections should be upheld.

To our knowledge, no state under active DOE consideration for potential repository sites has invoked land use management prerogatives to prevent further consideration of such sites. It should be noted, however, that several states have enacted laws banning the disposal of HLW, or permitting such disposal only with the approval of the legislature or other authorized state entity. A list of states with such legislation is attached.

A potential host state could easily block the siting of a low-level waste burial facility proposed on non-federal land, however. In 10 CFR Part 20.302(b) current NRC regulations provide that "the Commission will not approve any application for a license to receive licensed material from other persons for disposal on land not owned by the federal government or by a state government." Thus, for any land use considerations, a state could prevent the issuance of a license for such activity simply by refusing to take title to the proposed site.

Question. "Does NRC have the authority to require as a licensing requirement cost recoupments associated with a waste disposal operation?"

Answer. Determination of fees to be charged users of DOE waste facilities is a matter for DOE decision and, in our view, is beyond the scope of NRC licensing authority.

It is not likely, however, that DOE could include "socioeconomic" costs to a community in user fees established for a DOE-operated waste disposal facility, unless the Congress specifically authorized recovery of such costs. Under present general fee setting authority (31 U.S.C. 483a) an agency of the United States is limited to recovering the direct and indirect costs incurred by the agency itself in providing the service for which it is charging a fee. See *Mississippi Power and Light v. NRC*, 601 F.2d 223 (1979), cert denied, 44 U.S. 1102 (1980).

Question. "Has anyone ever brought suit for damages resulting from past leaks at any nuclear waste site? (p. 116, l. 2) The Committee would be interested to know who they sue, private operator of the site or DOE, or NRC, the licensor."

Answer. We are not aware of any suits for damages against present or past licensees on account of leakage of radioactive material outside the boundaries of a waste disposal site.

ENCLOSURE 2

RESPONSES BY THE U.S. NUCLEAR REGULATORY COMMISSION TO QUESTIONS POSED BY THE SENATE SUBCOMMITTEE ON NUCLEAR REGULATION FOR THE JANUARY 23 AND 24, 1980, HEARINGS ON THE FEDERAL NUCLEAR WASTE MANAGEMENT PROGRAM

Question b. At what point or points should a State have the right to exercise its veto power?

Answer. If a State veto is provided in legislation, the Commission's view as stated in NUREG-0539 is that subsequent to receipt of an application by DOE a State should not exercise its veto until the Commission had decided to authorize facility construction. This would allow the NRC licensing review to run its course in an orderly manner, so that a fully-developed factual record would be available for use in the resolution of any differences between State and federal views.

Question c. Should a State be able to exercise its veto power only on certain narrow grounds (e.g., protection of public health and safety or the environment)? What grounds for exercising the veto power do you suggest?

Answer. Clearly, some delineation of the grounds on which a State could exercise a veto is in order. In calling for a clarification of the circumstances under which a State veto could be exercised, and in suggesting that the veto should become available only after completion of the licensing process, the Commission believes that radiological health and safety and environmental concerns might be appropriate grounds for the State's decision. Such grounds might take two forms: (1) that public health and safety can not be adequately protected; and (2) that there is an unresolved conflict between the proposed repository and a potential host State's comprehensive land use plan. This would suggest the need for careful State evaluation of the technical aspects of the DOE application and NRC's decision to approve it.

Question d. Should Federal legislation specify whether the Governor, State legislature, or other state entity has the authority to exercise the veto power?

Answer. NRC has no preference on whether the State veto should be exercised by the legislature, the Governor, or some other State body. NUREG-0539 suggest that a federal statute should identify the party to whom the State's action should be addressed and the time allowed for filing.

ENCLOSURE 3

U.S. NUCLEAR REGULATORY COMMISSION,
Washington, D.C., March 6, 1980.

Hon. GARY HART,

Chairman, Subcommittee on Nuclear Regulation, Committee on Environment and Public Works, U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: We are pleased to submit answers to the questions contained in your letter of February 13. You will note that there are different opinions expressed by the Commissioners on several of these issues. I hope that you find these answers adequate for your purposes. If you need clarification or additional information, please let me know.

Sincerely,

JOHN F. AHEARNE.

Enclosure.

Question 2. In your written responses for the hearing record to question 1(c) on grounds for a state's exercise of its veto power, you suggest that a state could veto a proposed repository if it conflicts with that state's comprehensive land use plan. Please explain this ground for a state veto.

Answer. The Commission had no specific land use conflict in mind when recommending that the state veto be allowed in event of an "unresolvable conflict with a comprehensive state land use plan." The general concern was to recognize legitimate state interest by recognizing traditional land planning authority. This comment was not intended to provide a mechanism for states to prevent, in an irresponsible manner, siting of a waste repository. It would normally apply to a state designation of a specific use for a site which was made before that site was under consideration as a waste repository. This veto should also be exercised after the conclusion of an NRC licensing authorization proceeding so that a record of the site suitability would be available to those who would consider whether or not the state veto should be overturned.

With regard to questions 1 and 2, Commissioner Hendrie still holds the view he expressed on June 27, 1979 in testimony before the Senate Subcommittee on Energy and Power: "While the state should have every opportunity and should participate in the process of selection, reviewing the design, and licensing proceedings and so on, and their difficulties, objections, and interests should be fully considered and resolved in the best technical fashion, it is my view that ultimately a decision for Federal preemption of the construction decision may be necessary."

ENCLOSURE 4

SUMMARY OF LAWS ENACTED BY STATES

[Complete as of June 13, 1980]

Banning the disposal of all radioactive waste:

- Alabama (1979) HB-176
- Maryland (1978) HB-428
- Michigan (1978) S-144 et. al.
- Oregon (1977) S-272

Indiana (1980) SB-22 ¹

Louisiana (1977) H-14 ¹

Requiring legislative approval for disposal of radioactive waste:

Colorado (1979) SB-335

Connecticut (1979) HB-5097

Kentucky (1980) H-98

Louisiana (1978) S-38

Maine (1979) H-799

Minnesota (1977) H-1215

Mississippi (1980) S-2674

New Hampshire (1979) H-91

North Dakota (1979) S-2168

Bans disposal of high-level radioactive waste:

Connecticut (1979) H-5097

Montana (1977) H-254

New Hampshire (1979) H-91

South Dakota (1977) H-822

Texas (1977) H-1560

Vermont (1977) H-261 & (1980) S-199

West Virginia (1980) H-986

Requires consultation and concurrence before disposal is permitted:

New Mexico (1979) H-106 et. al.

New York (1979) A-3197B

[The following includes a brief description of the above legislation arranged in alphabetic order by state.]

SUMMARY OF LAWS ENACTED BY STATES RESTRICTING RADIOACTIVE WASTE STORAGE OR DISPOSAL

Alabama

Waste Repository Ban H-176. Bans disposal in Alabama of any spent fuel or other radioactive waste generated outside the State. Effective immediately. (Approved 5/14/79)

Colorado

Radioactive Waste Facility S-335. No Facility or site for the disposal of radioactive waste shall be constructed unless the Governor and legislature approve it. The Department of Health is to develop the criteria to be used in evaluating an application. Allows the radiation control agency to collect fees for radioactive materials licenses. (Approved 6/15/79)

Connecticut

Waste Repository Ban H-5097. Bans the disposal of nuclear waste in the State unless the General Assembly approves it. Excludes low-level medical and university wastes. (Approved 6/18/79)

Kentucky

Nuclear Waste H-98. Sets final authority for approving or disapproving the locating, opening, closing or reopening of a low-level radioactive waste disposal site or facility within the State legislature. Before reopening of the Maxey Flats site could occur, the following must be obtained: (1) a finding by the Department of Human Resources and the Department of Natural Resources and Environmental Protection that all reasons for site closure have been addressed and resolved; (2) public hearings have been held; (3) majority approval of the legislature; and (4) approval by the Governor. The Department of Natural Resources and Environmental Protection shall proceed toward stabilization and decommissioning of nuclear waste facilities owned by the State in order to place the facility in such a condition that active ongoing maintenance is eliminated and only surveillance and monitoring are required. (Approved 3/3/80, effective 7/15/80.)

Louisiana

S-38. Amends the existing law to add ". . . should the local governing authority of the parish or parishes in which said tests to occur, the natural resources committees of the House of Representatives and the Senate of the Louisiana legislature object in writing to the continuation of said tests, then such tests shall cease." (Approved 7/13/78)

¹ For Legislative Description see "Update," p. 93.

[An amendment to the existing law prohibiting disposal of radioactive material in Salt Domes.]

Maine

Waste Repository Ban H-799. Bans the storage, deposit or treatment of radioactive waste unless the legislature approves it. Directs that a study be performed on the effects of the act, waste disposal methods proposed for Maine, the State of the art and the amount of waste generated, treated, stored or disposed of in Maine. The study is due by 2/14/81. (Approved 6/22/79)

Maryland

H-428. Amends the current State Code banning the establishment of "any permanent storage facility, burial ground . . . for the long-term storing of waste nuclear materials . . . within the State . . . except that temporary storage shall not exceed two years" by adding a sentence to enable the Secretary of Health and Mental Hygiene to vary the two-year time limitation if he determines it is in the public interest. (Approved 4/11/78)

Michigan

S-144. States that "Radioactive waste may not be deposited or stored in this state." The ban does not apply to: facilities at educational institutions, spent fuel storage pools at nuclear power plants, mill tailings from uranium mining within the State, medical uses of radioactive material, temporary storage of low-level waste for not more than six months, the storage of waste which was being stored before January 1, 1970. The act takes effect immediately. (Approved 4/14/78)

S-153, S-688, S-689, and S-690. All of these laws ban the State's consent to the acquisition by the Federal Government by purchase, condemnation, of any land or building for use in storing, depositing, or dumping of radioactive material. They amend different codes relating to the State's jurisdiction over certain lands and buildings. (Approved 4/13/78, effective immediately.)

Minnesota

H-1215. Prohibits the construction or operation of a "radioactive waste management facility" within Minnesota unless authorized by the legislature. Prohibits the transport of wastes into the State for disposal or storage unless authorized by the legislature, except that "radioactive wastes may be transported into the State for temporary storage for up to 12 months pending transportation out of the State." The act is effective immediately. (Signed by Governor 6/2/77)

Mississippi

Waste Disposal Facility S-2674. Provides for the completion of certain technical, environmental and socioeconomic studies before the Governor can recommend that the legislature approve a site for a radioactive waste disposal facility. (Approved 5/8/80, effective immediately.)

Montana

H-254. Prohibits the disposal in Montana of large quantities of radioactive materials produced in other States. (Signed by Governor 3/21/77)

New Hampshire

Radioactive Waste Isolation Action H-91. Prohibits the storage or disposal of radioactive waste in the State unless the legislature approves it by concurrent resolution. Spent Fuel from other plants or facilities cannot, under any circumstances, be stored in the State. Establishes a task force to negotiate on behalf of the State during the consultation and concurrence process. (Approved 6/23/79)

New Mexico

Radioactive Waste Consultation Act H-106, 360, 500 and 527. No person can store or dispose of radioactive waste until the State has concurred in the creation of the disposal facility. Creates a radioactive waste consultation task force to negotiate with the Federal government in all areas relating to the siting, licensing and operation of disposal facilities for high, low and transuranic waste. Creates a joint interim legislative committee to make recommendations on the consultation and concurrence process, including procedures, methods and times to the next session of the legislature. The committee is to consider the applicability of Price-Anderson, the transport of the material, compliance with NEPA and other things. (Approved 4/6/79)

New York

Permanent Waste Repository Ban A-3197B. No permanent waste repository can be sited in the State unless the governor and legislature approve it by statute. Prior to

approval, the New York State ERDA shall conduct a complete study on all issues of waste disposal, prepare an EIS, certify that a particular site is suitable and a proven technology exists, conduct public hearings, prepare a detailed estimate on the costs. (Approved 7/11/79)

North Dakota

Waste Repository Ban S-2168. Bans the disposal of radioactive waste, which has been brought into the State for that purpose, in North Dakota unless prior approval has been granted by the Legislature. (Approved 3/8/79)

Oregon

S-272. Bans the establishment or operation of radioactive material waste disposal facilities within the State. The previous ban would have expired January 1, 1978. (Signed by Governor 7/27/77)

South Dakota

H-822. Bans the "containment, disposal or deposit of high-level nuclear wastes, radioactive substances or radioactively contaminated materials or the processing of high-level nuclear wastes" within the State unless prior approval is granted by the legislature. Exempts uranium ore and mill tailings from the provisions of the act. (Signed by Governor 4/16/77)

Texas

H-1560. Authorizes the Texas Water Quality Board to regulate the discharge of waste or pollutants into any water within the State; however, no permits shall be issued authorizing the discharge of "any radiological, chemical, or biological warfare agent or high-level radioactive waste." (Signed by Governor 6/15/77)

Vermont

H-261. Bans the construction or establishment of a high-level radioactive waste repository within Vermont, unless the General Assembly approves it, through either a bill or a joint resolution. (Signed by Governor 4/26/77)

Storage Of Radioactive Wastes S-199. No facility for deposit, storage, reprocessing or disposal of spent nuclear fuel elements or radioactive waste material shall be constructed or established in the State unless the General Assembly first finds that it promotes the general good of the State and approves. The construction or establishment of low-level, temporary storage facilities is exempt. (Approved 6/5/80, effective 7/1/80)

West Virginia

Waste Disposal Ban H-986. Bans the storage or disposal of radioactive waste within the State except medical, educational, research or industrial waste. The industrial waste may not include any materials produced in conjunction with the operation of a power reactor or reprocessing facility. (Approved 3/24/80.)

UPDATE

[July 17, 1980]

Indiana

Waste Disposal Restriction S-22. Forbids the use of any land within a national forest "for the disposition, storage, or handling of nuclear or hazardous waste, including but not limited to nuclear material, radioactive material, and the radioactive remains of a nuclear facility." (Approved 2/22/80.)

Louisiana

Radioactive Waste Disposal Prohibition—LA H-14. Prohibits the use of salt domes in Louisiana as temporary or permanent disposal sites for radioactive wastes. Requires prior notification of the House and Senate Natural Resources Committees and the Department of Natural Resources for suitability testing of salt domes and subsequent notification of the results of the studies so they can "determine the advisability of removing continuing, or extending the prohibitions and limitations". (Signed by Governor 7/5/77)

A SUMMARY OF LEGISLATION RELATING TO WASTE MANAGEMENT

[Completed June 17, 1980]

Waste Disposal Siting Restrictions:

Arizona (1980) SB-1283

Indiana (1980) S-22
 Kansas (1977) H-2559 and (1980) SB-532
 Louisiana (1977) H-14
 Minnesota (1977) H-1215
 Oregon (1975) S-163
 Vermont (1980) S-199
 Virginia (1980) HJR-44
 South Carolina (1980) H-3350¹
 New York (1980) A-10604-A¹

Permit Requirements:

Alaska (1978) S-45
 California (1977) A-1593

Hawaii (1977) H-199

Fee Assessments:

Illinois (1977) H-1739
 Nevada (1977) S-38

Waste Disposal Studies:

Kentucky (1978) HR-70
 Mississippi (1980) S-2674
 Nevada (1975) AJR-15

[The attached includes a brief description of the above legislation arranged in alphabetic order, by State.]

A SUMMARY OF LEGISLATION RELATING TO WASTE MANAGEMENT

Alaska

S-45. A general amendatory bill relating to radiation control in the Department of Health and Social Services. Adds a new section "Facilities Siting Permit Required" which prohibits construction of a nuclear fuel production facility, utilization facility, reprocessing facility, or nuclear waste disposal facility in the State unless a permit is obtained from the Department of Environmental Conservation. No permit can be issued unless the legislature, local government and Governor have approved the permit. (Approved 7/17/78)

Arizona

Hazardous Waste Disposal Sites SB-1283. A hazardous waste disposal site or facility shall not be located within (a) a one hundred year floodplain; (b) an area close to public roads, residences or public and private water supplies; (c) an area where up to one mile from the perimeter of the site the depth to the groundwater level is less than 150 feet; (d) an area where surrounding land use for one square mile may impede proper long-term maintenance of the site; and (e) an area where subsidence has occurred or is likely to occur. The Director of Health Services shall recommend an initial disposal site to the legislature for approval by January 1, 1981; after: (1) public hearings are held and (2) consideration is given to transportation distances and routing. The director shall be given the authority to acquire, construct or operate a hazardous waste disposal site or facility and to assess reasonable fees for its use. (Approved 4/22/80.)

California

A-1593. Revises the State code to require the State Department of Health to issue regulations and permits governing the transport, handling, processing, storage or disposal of hazardous wastes. (Signed by Governor 9/22/77)

Hawaii

H-199. Requires a permit for release of wastes and pollutants, which include radioactive material, into the air or water. (Signed by Governor 5/31/77)

Illinois

H-1739. Authorizes the Public Health Department to assess fees for radioactive waste disposal, with the proceeds going into a trust fund for the perpetual care of the sites. (Signed by Governor 9/20/77)

Indiana

Waste Disposal Restriction S-22. Forbids the use of any land within a national forest "for the disposition, storage, or handling of nuclear or hazardous waste, including but not limited to nuclear material, radioactive material, and the radioactive remains of a nuclear facility." (Approved 2/22/80.)

¹ For Legislative Description see "Update," p. 95.

Kansas

H-2559. Amends the Kansas Solid Waste Act to include the regulation of hazardous wastes. The Department of Health and Environment is authorized to adopt rules and regulations governing hazardous wastes "stored, collected, transported, processed, treated, recovered or disposed" within the State. (Signed by Governor 4/5/77.)

Hazardous Materials SB-532. No geologic investigation to determine the suitability of any site in the State for disposal or storage of radioactive waste materials shall be undertaken until the Governor and the legislature have first been notified of all details of such investigations. The State shall also acquire the lands comprising the physical site of any commercial radioactive waste disposal or storage facility other than facilities which contain radioactive wastes for a period of time not exceeding four years. Additions are made to the duties of the Division of Emergency Preparedness which include: (1) determining the requirements of the State, counties and cities for food, clothing and other necessities in event of a disaster; (2) procuring and distributing supplies, medicines, materials and equipment deemed necessary for use during a disaster; (3) publishing standards and requirements for local disaster emergency plans; (4) periodically examining or reviewing and approving local and interjurisdictional disaster emergency plans; (5) establishing and operating training or public information programs relating to emergency preparedness; (6) surveying and arranging for private facilities, services and property for emergency preparedness activities; (7) establishing a register of persons, equipment and housing for use in a disaster; (8) preparing drafts of orders or proclamations for use by the Governor during a disaster; and (9) coordinating and supervising all agencies that are involved in the transportation of hazardous materials. (Approved 5/14/80, effective immediately.)

Kentucky

HR-70. Appoints a Special Advisory Committee on behalf of the General Assembly to assume an oversight role on all matters pertaining to nuclear waste during 1978-1980. It is to report its findings and recommendations to the Legislature no later than January 1, 1980. This resolution continues a 1976 Advisory Committee which had completed its duties. (Approved 3/30/78)

Louisiana

H-14. Prohibits the use of salt domes in Louisiana as temporary or permanent disposal sites for radioactive wastes. Requires prior notification of the House and Senate Natural Resources Committees and the Department of Natural Resources for suitability testing of salt domes and subsequent notification of the results of the studies so they can "determine the advisability of removing, continuing, or extending the prohibitions and limitations". (Signed by Governor 7/5/77)

Minnesota

H-1215. Prohibits the construction or operation of a "radioactive waste management facility" within Minnesota unless authorized by the legislature. Prohibits the transport of wastes into the State for disposal or storage unless authorized by the legislature, except that "radioactive wastes may be transported into the State for temporary storage for up to 12 months pending transportation out of the State." The act is effective immediately. (Signed by Governor 6/2/77)

Mississippi

Waste Disposal Facility S-2674. Provides for the completion of certain technical, environmental and socioeconomic studies before the Governor can recommend that the legislature approve a site for a radioactive waste disposal facility. (Approved 5/8/80, effective immediately.)

Nevada

AJR-15. Urges ERDA to choose Nevada Test Site for disposal of nuclear wastes. (Adopted 5/16/75)

S-38. Transfers responsibility to the Department of Human Resources for the acquisition and maintenance of sites for the disposal of low-level radioactive materials. Authorizes the State Board of Health to establish licensing fee requirements for users of these sites. (Signed by Governor 3/10/77)

Oregon

S-163. Authorizes Department of Environmental Quality to establish and operate site(s) for disposal of environmentally hazardous wastes. (Approved 6/30/75)

Vermont

Storage of Radioactive Wastes S-199. No facility for deposit, storage, reprocessing or disposal of spent nuclear fuel elements or radioactive waste material shall be constructed or established in the State unless the General Assembly first finds that it promotes the general good of the State and approves. The construction or establishment of low-level, temporary storage facilities is exempt. (Approved 6/5/80, effective 7/1/80.)

Virginia

Low-Level Radioactive Waste Disposal HJR-44. Authorizes the Solid Waste Commission to assist the Department of Health in site evaluation, selection and plan development for a disposal facility for low-level radioactive waste in the State. A progress report and recommended legislation is to be submitted to the Governor and General Assembly during the 1981 session. (Adopted 2/25/80.)

UPDATE

[August 6, 1980]

South Carolina

Transportation and Disposal of Radioactive Waste HB-3350. Requires a shipper of radioactive waste to: (1) deposit and maintain with the Department of Health and Environmental Control a cash or corporate surety bond or provide evidence of liability insurance sufficient to protect the State and the public at large from possible radiological injury provided that any insurance carried pursuant to Section 2210 of Title 42 of the U.S. Code and Part 140 of Title 10 of the Code of Federal Regulations shall be sufficient to meet the requirements of this section; (2) comply fully with all applicable laws and administrative rules and regulations, both State and Federal, regarding packaging, transport, storage, disposal, and delivery of radioactive waste; (3) certify to the Department that it will hold the State harmless for all claims, actions, or proceedings in law or equity arising out of radiological injury occurring during the transportation of radioactive waste; (4) provide to the Department for each shipment a shipping manifest; (5) provide to the Department for each shipment certification that the foregoing requirements have been complied with and any other certifications that the Department may find necessary; (6) provide such other information as the Department may deem necessary for the protection of the health and safety of the public and the environment; and (7) purchase a permit. Nontransferable permits shall be issued by the Department based on compliance with the above provisions. After acceptance of and departure with a shipment of radioactive waste, a carrier shall immediately notify the Department of any variance from the shipper's notification of primary route and estimated date of arrival. The carrier shall provide to the Department certification that: (1) the shipment is properly placarded; (2) the vehicle has been inspected and meets the applicable requirements; (3) the carrier has received a copy of the shipper certification of compliance and the shipping manifest; and (4) the carrier has complied with all applicable laws and administrative rules and regulations, both State and Federal, regarding the transportation of radioactive waste. The Department shall issue interim regulation as needed for implementation and establish a schedule of fees for permits. Final regulations shall be promulgated within 125 days from enactment. Rules and regulations may be enforced, within their respective jurisdiction by the Department, the State Department of Highways and Public Transportation, and the Public Service Commission. A notification period shorter than 72 hours may be required by the Department for shipments greater than 75 cubic feet. Owners and operators of disposal facilities shall permanently record, and report to the Department within 24 hours after discovery any and all conditions in violation of these requirements. No operator shall accept radioactive waste unless the shipper has a valid permit. Violations may be subject to fine, penalty, or suspension or revocation of a permit. These are assessed by the Department giving consideration to: (1) degree of harm which has resulted or might result; (2) degree of exceedence of the radiation level; (3) duration of violation; and (4) record of violator. Funds from fines, penalties, or fees shall accrue to the general fund. Funds from permits shall be sufficient to administer and enforce the permitting provision. When an emergency exists the Department without notice or hearing may issue an order reciting the existence of such emergency and require that action be taken as necessary to meet the emergency. A hearing shall be held within thirty days and the emergency order shall be continued, modified or revoked within thirty days after such hearing. (Approved 5/26/80, effective immediately.)

New York

Nuclear Waste Repositories A-10604-A. Amends the current energy law and establishes a Board on Temporary Nuclear Waste Repository Sitings and prohibits the establishment of any temporary nuclear waste repositories for the storage of spent fuel until the Board has granted certification. The Board will be comprised of the Commissioner of Environmental Conservation, the Commissioner of Health, and two appointees of the Governor (one to be designated by the Speaker of the House, the other by the speaker of the Senate). The procedure for certification is outlined. No State agency, municipality or any agency thereof may, except as expressly authorized by this article by the board, require any approval, consent, permit, certificate, or other condition for the construction or operation of a temporary nuclear waste repository. (Approved 6/17/80, effectively immediately.)

ADDITIONAL RESPONSES BY THE NUCLEAR REGULATORY COMMISSION TO QUESTIONS FROM THE RECORD OF SUBCOMMITTEE ON RURAL DEVELOPMENT OF THE SENATE COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY DURING THE AUGUST 26, 1980, HEARING ON THE SOCIOECONOMIC IMPACTS OF WASTE DISPOSAL

Question 1. To what extent would the price-Anderson Act, if applied to waste sites, encourage utilities to move into the nuclear energy industry?

Answer. The application of Price-Anderson to high-level waste (HLW) disposal sites would not, in our view, have any appreciable effect on utility decisions regarding the use of nuclear generating units. The major factors influencing such decisions are the large capital investment required for nuclear reactors, the time required to construct and license reactors, public acceptability of nuclear power, and the anticipated growth in baseload demand. These factors are independent of the extensions of Price-Anderson coverage to future waste sites. Although utilities are certainly concerned over waste disposal generally, their primary concern is the availability of short-term storage of spent fuel rather than on long-term disposal. The latter is expected to be the responsibility of the U.S. Department of Energy (DOE) and, through the licensing process, the NRC. While utilities may also be concerned over the eventual cost of long-term disposal, this cost should not be significantly influenced by Price-Anderson coverage.

Question 2. Are there specific risks or questions that have kept NRC from extending Price-Anderson to waste sites? What are they?

Answer. There are no specific risks which have deterred the NRC from extending Price-Anderson to waste disposal sites. Such extension is simply premature at this time, since no such sites have either been decided upon or licensed. In any event, risk is not a controlling factor in deciding whether Price-Anderson coverage of such facilities is appropriate. Application of the Price-Anderson system would be appropriate if it appeared that the public would not be adequately protected by conventional insurance and the possibility of recovery under state law. This decision cannot be made with any assurance until a waste disposal site has been chosen, designed, and submitted to the NRC for licensing. At that time, all of the information available will be considered by the NRC in deciding whether Price-Anderson should be extended to waste sites. As you may be aware, DOE also has discretionary Price-Anderson authority with respect to its contractors, and could determine independently of the NRC that coverage should be extended for this purpose if the waste facilities were operated by DOE contractors.

Question 3. Will NRC extend Price-Anderson coverage to nuclear waste sites? When will this decision be made?

Answer. As our previous answer indicates, it is premature at this time to decide this issue. We would expect to make the decision when the first waste disposal facility is before the NRC for licensing.

Question 4. Will NRC require through its licensing process that all costs of a nuclear waste site, including socioeconomic costs, be recovered from users of the site as is the President's stated policy? Specifically, why do you feel this is beyond NRC's licensing authority?

Answer. The basic statutory mandate of the NRC is to protect public health and safety in regard to commercial nuclear power and other uses of radioactive materials. The National Environmental Policy Act requires that NRC consider the environmental consequences of its actions. In its licensing process the NRC is thus able to impose only those requirements which serve one or both of these two purposes. The recovery of socioeconomic costs associated with the nuclear waste disposal program is a basic question of policy which neither statute empowers the NRC to decide. If Congress were to amend the Atomic Energy Act to provide the NRC with this authority, cost recovery would be made a condition of the NRC license. A more direct approach, however, would be to require DOE to recover these costs as part of

its user fees for waste disposal facilities. In testimony before your Committee on August 26, Assistant Secretary Cunningham stated that DOE already intended to recovery socioeconomic costs resulting from waste disposal:

"Under our policy, we would certainly expect to include all of the costs, *including the socioeconomic cost* as well as the research and development cost, as well as the actual cost of transportation and operating of facilities would be borne by the person who generates the waste." (Transcript at 94; italics added.)

Question 5. In NRC's opinion, should states be allowed to set higher safety and community protection standards for the construction and operation of a nuclear waste site than those set by the federal government?

Answer. The Commission has not to date taken a position on this question. It is obvious that a national policy for the storage and disposal of nuclear waste is needed. So long as state standards were reasonably compatible with federal standards, a cooperative state-federal licensing program would be feasible. If state standards become prohibitively restrictive, it would become impossible for waste disposal facilities to be constructed and licensed. The allocation of state and federal responsibilities and powers in this area is a fundamental decision of national policy which must be made by the President and the Congress. The NRC licensing program can only operate within the limits set by statute, and NRC standards for waste facilities, at least in regard to radiological health and safety, would prevail as federal standards unless Congress decides otherwise.

STATEMENT OF GORDON CAVANAUGH, ADMINISTRATOR, FARMERS HOME
ADMINISTRATION, U.S. DEPARTMENT OF AGRICULTURE

Mr. Chairman, thank you for the opportunity to discuss and raise questions on the issue of nuclear waste disposal sites and their effect on America's rural communities.

This issue is new to Farmers Home Administration. It is one which has not required much of our thoughts or attention in previous years, and certainly we do not consider ourselves experts on this subject. We are, however, aware of the public's concern and conflicting opinions on this important issue.

In the 35 years since the U.S. entered the nuclear era, ever increasing amounts of radioactive wastes have been generated, most by national defense and commercial nuclear power programs with a lesser amount by industrial, medical and research activities.

All of us here today are aware of the problems of nuclear waste disposal and storage. We are aware of the dangers to our environment.

Farmers Home Administration does not presently have any policy that deals with nuclear waste disposal and storage. We have no regulatory authority on site selection, and we do not propose to seek it since the appropriate government agencies have already been vested with this authority.

How these sites will exactly affect rural American life just isn't known yet. However, some thoughts can be related to what happens in the socio-economic make-up of rural communities that have become energy "boom" towns.

With those communities, in discussing nuclear waste disposal, many aspects must be taken into consideration such as housing, education, fire and police protection, roads and streets, consumer services, sewage collection and treatment, water and solid waste collection, health care and specialized emergency services.

However, the Science and Education Administration (SEA) of USDA has sponsored a research project in accordance with a USDA/DOE Interagency agreement, to assess socio-economic effects of repository sitings in rural areas on United States agriculture.

This five-year project will systemically design methodology for the socio-economic impact determination and the design of strategies for mitigating the effects of a siting on nearby rural populations and communities.

SEA will receive periodic reports and recommendations from participating organizations including the Western Rural Development Center, Oak Ridge, Texas A&M, North Dakota State, Ohio State, and Western Kentucky Universities. Final results and recommendations will be turned over to the Department of Energy for use in developing the criteria for selecting sites for nuclear waste repositories.

It is my understanding that a representative from Texas A&M University, Dr. Steve Murdock, will address this project in more detail today.

As I have indicated, the Farmers Home Administration does have some experience dealing with energy "boom" town situations.

Farmers Home has been authorized to award grants for growth management, housing planning, and site acquisition and development under Section 601 of the Powerplant and Industrial Fuel Use Act of 1978, passed by Congress and signed by

President Carter. Under the Section 601 Program, FmHA can provide grants up to one hundred percent for financing growth management and/or housing planning. FmHA can also authorize grants up to 75 percent of the cost of site acquisition and/or site development for housing, or community facilities.

I am pleased to report that Farmers Home Administration obligated virtually all \$20 million of our fiscal 1979 appropriations. The Department of Energy designated 85 areas in 22 states as eligible for this impact assistance. This was expanded to 92 areas in 24 states for fiscal 1980 for which we anticipate obligating virtually all \$43 million appropriated this fiscal year.

Under present Section 601 authorities, the Farmers Home Administration cannot assist rural areas affected by nuclear waste disposal sites. Section 601 grants are restricted to those areas experiencing rapid population increases caused by coal and uranium mining, processing, and transportation only.

The Senate recently passed S. 1699 which extends the impact assistance program. This bill would allow U.S.D.A. to provide loans, grants, and loan guarantees to areas affected by nuclear waste disposal sites. This legislation is presently pending in three committees in the House of Representatives.

The Department of Agriculture supports extension of an Energy Impact Assistance Program that is broadened to include communities affected by nuclear waste disposal sites and designed to encourage the States to assume some responsibility for energy impact assistance.

On December 20, 1979, President Carter announced the Administration's Small Community and Rural Development Policy. This policy, which focuses on the needs of our Nation's rural communities, specifically addresses the issues of rural energy concerns and reaffirms the Administration's commitment to a program of energy impact assistance.

Mr. Chairman, the current Section 601 Program will expire on September 30, 1980. S. 1699 amends Title VI of the Powerplant and Industrial Fuel Use Act of 1978 to extend the Energy Impact Assistance Program through fiscal 1985 and to expand and increase these authorizations to assure the continuation of assistance to energy impacted areas.

In closing, while Farmers Home Administration is not directly involved in the selection or regulation of sites or the highly technical and scientific aspects of this issue, we are concerned about their effect on America's rural communities. The life of this agency has been devoted to the preservation and improvement of rural life, this will continue as our objective.

I appreciate the opportunity to address our concerns with you here today.
Thank you.

U.S. ENVIRONMENTAL PROTECTION AGENCY,
OFFICE OF THE ADMINISTRATOR,
Washington, D.C., August 29, 1980.

HON. PATRICK J. LEAHY,
Chairman, Subcommittee on Rural Development, Committee on Agriculture, Nutrition, and Forestry, U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: This is in response to your August 19, 1980 letter requesting a statement and material concerning the socioeconomic impacts of nuclear waste repositories on nearby rural areas and small communities.

Attached are the Environmental Protection Agency's comments on the Department of Energy's Draft Generic Environmental Impact Statement on the Management of Commercially Generated Nuclear Waste. Also attached is a statement discussing EPA responsibilities in this area, as carried out by our Office of Radiation Programs.

If you need any further information for the hearing records, please be sure to contact me.

Sincerely yours,

SUSANNE L. WELLFORD,
*Acting Director,
Office of Legislation.*

Attachments.

STATEMENT OF THE ENVIRONMENTAL PROTECTION AGENCY

The Environmental Protection Agency standard setting philosophy, as carried out by our Office of Radiation Programs, is largely based on the recommendation of the International Commission on Radiological Protection, which stated in 1965 that:

"... the Commission recommends that . . . all doses be kept as low as readily achievable, economic and social considerations being taken into account".

The Office of Radiation Programs examines both the social and economic impacts of its regulatory actions. We evaluate the social impacts in terms of the decreased risks of cancer incidence and genetic defects to individuals and populations. To the extent possible, we examine the economic costs in terms of incremental increases for various alternatives. To a lesser extent, we also examine other social impacts, such as possible degradation of the environment or the feasibility and public acceptability of certain options.

Our estimates of the biological risks of radiation exposure are largely based on the reports issued by the Committee on the Biological Effects of Ionizing Radiation of the National Academy of Sciences. Our estimates of economic impacts are based either on evaluations of the applicable control technologies, or on evaluations of the projected impacts on an industry (such as for changes in the guidance for occupational exposures). In some cases we have carried out limited cost-benefit evaluations, but have not used these as the sole basis for numerical standards. Our recommendations involve judgments which attempt to balance the social and economic considerations and are deemed protective of the public health.

The environmental standards and guides published by the Office of Radiation Programs under its several legislative authorities are generic, and are not generally designed to cover one specific incident or location. These standards are then implemented by other Federal agencies, such as the Nuclear Regulatory Commission. Therefore, while our standards may consider health impacts on existing and future populations at hypothetical or actual specific sites as part of the technical data on which our decision is based, we do not consider the temporary dislocations in local communities due to construction of facilities, or other similar impacts. Such considerations are not part of the standard setting activity, but rather are part of the construction, implementation, and/or licensing phase. In activities such as construction of a waste disposal facility, we expect the appropriate agencies to consider these socio-economic costs in preparation of Environmental Impact Statements and to inform the local populations by all suitable means.

U.S. ENVIRONMENTAL PROTECTION AGENCY,
Washington, D.C., September 27, 1979.

Dr. COLIN A. HEATH,
Director, Division of Waste Isolation, MS B-107,
Department of Energy, Washington, D.C.

DEAR DR. HEATH: The Environmental Protection Agency (EPA) has reviewed the Department of Energy's (DOE) Draft Environmental Impact Statement (DEIS) for "Management of Commercially Generated Radioactive Waste," (DOE/EIS-0046-D). Our detailed comments are enclosed.

There are a number of serious deficiencies in the analysis which should be corrected in the Final EIS. They are: (1) failure to consider the time-integrated population dose as an important parameter in evaluating the impact from the waste disposal; (2) failure to consider individual dose to ground water users; (3) acceptance of a level of exposure comparable to background radiation (identified in the DEIS as 120 millirem per year) as a permissible additional dose to individuals; (4) lack of a sensitivity analysis showing which parameters in the risk analysis are important; (5) use of outdated, questionable and/or one-sided radiobiology references; (6) occasional improper consideration of waste chemistry and geochemistry; (7) incomplete economic analysis; and (8) failure to relate radiation doses to health effects. Also, some information is lacking, making a good comparison of options for disposal of radioactive waste incomplete.

It is to be noted that "Sub-seabed disposal" would be subject to the dumping requirements of the Marine Protection, Research, and Sanctuaries Act of 1972 and that the dumping of high-level waste is prohibited by the Act. The Final EIS should reflect these facts.

In addition, in preparing the Final EIS, reference is needed to the present development by EPA of Federal guides for radioactive waste management and standards for high-level radioactive waste. DOE should consider the requirements stated in the proposed criteria published in 1978 (43 F.R. 53262 *et seq.*). The proposed criteria are under review for promulgation as Federal guides and are scheduled to be published before the end of 1979. We will also publish our high-level waste standards in draft form in several months. These general guides and specific standards will identify what must be accomplished in waste management activities to provide assurance of public health protection and environmental preservation.

With proper attention to the above concerns, we believe the Final EIS can support a continuing program to develop a safe disposal system for high-level radioactive waste.

However, because we have reservations concerning the environmental effects of certain aspects of the proposed program, we rate this Draft EIS *ER-2*. This rating will be published in the *Federal Register*.

Should DOE have questions about our comments, please call Betty Jankus (NEPA matters-755-0770) of my staff.

Sincerely yours,

WILLIAM N. HEDEMAN, JR.,
Director,

For Office of Environmental Review (A-104).

Enclosure.

DETAILED COMMENTS OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE U.S. DEPARTMENT OF ENERGY'S DRAFT ENVIRONMENTAL IMPACT STATEMENT, "MANAGEMENT OF COMMERCIALY GENERATED RADIOACTIVE WASTE" DOE/EIS-0046-D

SUMMARY

The U.S. Environmental Protection Agency (EPA) has reviewed the U.S. Department of Energy (DOE) Draft Environmental Impact Statement (DEIS) for "Management of Commercially Generated Radioactive Waste" (DOE/EIS.0046.D). The DEIS replaces one (WASH-1539) that was issued in September 1974, by the Atomic Energy Commission (AEC) and withdrawn in April 1975, by the Energy Research and Development Administration (ERDA). It is clear that the comments of EPA regarding WASH-1539 were seriously considered by those who prepared this Draft EIS. After correction of the errors we believe the Final EIS will support a program leading to the safe, long-term disposal of radioactive waste.

We agree with DOE that the option selected for implementation appears to be the best of those considered; however, we believe that more information should be presented on the other nine options. We believe that the DEIS has many errors; nevertheless, we doubt that the correction of these errors will show that any other option is preferable to the mined, geologic repository. It is also unlikely that there would be any visible alternative available in the near future. For this reason we believe DOE's program should be vigorously pursued.

GENERAL COMMENTS

1. Other options need fuller treatment

The document Draft Environmental Impact Statement on "Management of Commercially Generated Radioactive Waste" considers ten alternative methods for disposal of high-level nuclear waste. However, all of the alternatives considered, except the mined, geologic repository alternative, are presented only in a general fashion. It is impossible to compare the options adequately, because detailed information is presented on only one of the options. Regulations developed by the Council on Environmental Quality specifically require agencies to "Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated" (40 CFR 1502.14 (a)). The difficulty is clearly displayed by the nature of Section 4.0, "Comparative Analysis of CWM Options." The DEIS appears inadequate to support decisions which would eliminate alternatives from the scope of a permanent disposal strategy. For example, Table 4.5.1 suggests that the "Very Deep Rock" concept is preferable to "Geologic with Resynthesis" for virtually all decision criteria. This would suggest dropping the resynthesis alternative. However, we do not feel that there has been sufficient analysis to justify such a conclusion. The final EIS should improve the comparative analysis as much as possible and should specify to what extent the program will pursue the nine alternatives other than the mined, geologic repository option, which has been selected for implementation. DOE should also consider changing the title of the Final EIS to "Management of Commercially Generated High-Level and TRU Radioactive Waste," in order to better reflect the thrust of the document.

A "no action" alternative should be presented. Although this alternative is neither socially nor environmentally acceptable, it would be useful to present this option. To some extent this alternative is discussed as the delayed decision options in Section 3.1. This specific alternative is required by 40 CFR 1502.14(d).

We believe the "Chemical Resynthesis" approach deserves further detailed consideration. The possibility of using a waste form which is thermodynamically stable, does not form metamicts over time, and is almost entirely insoluble in a wide range of geological liquids offers advantages over other waste forms, because the population dose from all events except intrusion and catastrophic releases (volcanism, meteorite breach, etc.) is very low. Several references in this field have been pub-

lished since the Draft EIS was prepared (for example, those of Ringwood, McCarthy, and Roy). As noted in the EIS, this option is really a variation of the geologic disposal option.

2. Sensitivity analysis is needed

In describing the impact from the mined geologic repository, the DEIS uses probability and consequence parameters which are currently very uncertain. The impacts calculated in the DEIS are frequently more pessimistic than results we have obtained in our program to develop environmental standards for HLW. Different assumptions about many parameters may have significant impact on the projected health risk. Consequently, we strongly recommend that the Final EIS contain sensitivity analyses to indicate the range of impacts which may result from varying these parameters. The uncertainties in these analyses should also be identified and discussed.

3. Dose calculations need improvement

There are substantial problems in the calculation of radiation doses and health effects to the public. The time-integrated population dose is frequently neglected. Furthermore, population doses are not always expressed as fatal, non-fatal, and genetic health effects; we think that they should be. The DEIS suffers technically from old references, occasional misquoting of data, and some lack of balance in presenting radiobiological concepts. The use of old estimates of natural background in developing risk perspective and the use of dated and/or questionable references coupled with a lack of balance in presenting radiation risk coefficients result in a less than satisfactory draft for public decision making. Additionally, the methodology used for the impact assessment is in need of improvement. (See specific comments for Appendices C, D, E, H, and I.)

The Draft EIS appears to indicate that the major hazards occur in the first few hundred years while Sr-90 and Cs-137 are present. As a result, long-lived nuclides, such as Tc-99 and I-129, are neglected despite the fact that they can be geochemically mobile under some circumstances. One of the major shortcomings is the fact that only one set of sorption constants has been used in this work. (This assertion is supported by a *caveat* on page 3.1.160.) Sensitivity analyses performed in our high-level waste program indicate that changes in sorption constants and other parameters lead to significant changes in time-integrated population dose and dose to maximum individual. Recent work suggests that the impact of some nuclides is controlled more by solubility considerations than by sorption considerations (See, for example: Bondietti and Francis, *Science*, 203, pp. 1337-1340, 1979). A range of sorption constants and solubility limitations for specific elements should be used.

4. EPA will soon publish criteria and standards

Our approach to the problems of radioactive waste disposal is to use as many independent barriers as feasible to reduce the environmental impact, taking into account social, technical, and economic factors. We are presently preparing criteria and standards for radioactive waste management. The criteria (applicable to all radioactive waste) were published in draft form last year (43 F.R. 53262 *et seq.*). The comments received from other agencies and the public are presently being analyzed for final publication in several months. The high-level waste standard now under development will also be published in draft form in several months. These criteria and standards will be applicable to any disposal of high-level waste or spent nuclear fuel.

ECONOMIC COMMENTS

1. The effects of costs are not considered

A major fault on the DEIS is that the potential economic impact resulting from the cost of commercial waste management is not addressed. Since payment of these costs will be made by the consumers of nuclear-generated electricity, it is necessary to determine what the impact will be on electricity customers. The DEIS estimates the cost of waste management but does not evaluate the economic consequences of incurring such costs. Analysis of both the microeconomic and macroeconomic impacts should be performed. Within the micro framework, the direct impacts on customers' electric rates and fuel bills should be investigated. Macroeconomics considerations should include the degree of secondary impacts stemming from a rate increase to commercial and industrial electric users which can influence the cost of producing other goods and services in the economy. The economic impacts of the cost of waste management also need to be discussed on a regional basis since they depend on each area's relative reliance on nuclear-generated electricity. The potential for these costs to influence the selection of power plant type should also be

addressed. In light of the relatively detailed analysis of the localized socioeconomic impacts associated with the siting of waste management facilities which was presented in the DEIS, the lack of an economic impact analysis of the cost of waste management is a serious omission in the report.

2. Impacts on nuclear power growth are not addressed

Another fault of the DEIS is the stated intent to exhibit neutrality regarding nuclear growth in connection with analysis of the effect of deferring the repository startup date to the year 2000. By assuming that there is no relationship between deferral of the repository startup and nuclear power growth, the analysis generates misleading results about the impacts of the deferral. By recognizing the existence of administrative and legislative obstacles to nuclear expansion, which are tied to the absence of a demonstrated waste management plan (e.g., the California moratorium), one must conclude that the deferral of a repository startup date for 15 years should result in a lower forecast of nuclear activity. As the DEIS indicated, different levels of nuclear activity produce different degrees of environmental and economic impacts. There is no objection, *per se*, to determining the respective impacts of two different situations which use the same nuclear power forecast but different repository startup dates. The objection arises when the inference is made that the effect of the deferral is simply the differences in these two cases should not be interpreted as representing the impact of deferring the repository startup date, since deferral necessitates a different (lower) level of nuclear activity with its accompanying level of environmental and economic values. Thus, the true impact of deferral must be estimated by varying the nuclear power forecast from the base case (1985 startup date).

The DEIS misleads the reader since the impact of deferral is presumed to be estimated from Table 3.1.84 which summarizes the environmental effects for alternative repository startup dates of 1985 and 2000 (see page 4.42, second paragraph). On page 4.45, second paragraph, it is stated that the variations in health and safety effects as well as cost impacts by different strategies, which include deferral of repository startup date, are small. Despite the *caveat* utilizing this neutrality in the estimation of the environmental effects the DEIS has incorrectly estimated the impact of deferral. A proper estimation procedure must address the fact that the forecast of nuclear power growth is dependent (among other things) on the repository startup date.

SPECIFIC COMMENTS

1. (Page 1.5, last paragraph, line 8) the bentonites referred to are sodium montmorillonites which lose water when heated to 100°C. Although the adsorption of metals is high in bentonites, the water release is an undesirable property in proximity to canisters. Perhaps illite could be utilized in lieu of bentonite to the assured 100°C isotherm.

2. (Page 1.9) Why is the statement made that "in either event, the HLW contains fission products, uranium, plutonium, and the balance of the TRUs?" In both the recycle options most of the uranium is removed, and in the U-Pu recycle most of the plutonium is removed as well. Furthermore, if one assumes U & Pu recycling, sooner or later one reaches the point where fuel elements no longer have sufficient fuel value to be worth recycling. This case should be considered.

The volatile materials and TRU elements separated in fuel processing and captured in accordance with the uranium fuel cycle standards (40 CFR 190) are omitted in this discussion. They should be included.

3. (Page 1.11) In comparing natural and manmade doses person-rem is the sum of doses to individuals in the population and so is a function of both individual doses and population size. The extra 260,000 person-rem in Colorado compared to Louisiana is meaningless in the population size selection was arbitrary. Why not use New York and Hawaii? Moreover, the data base is now obsolescent, see NCRP-45.

4. (Page 1.12) Media properties: This section appears to consider only the properties of a medium which make it possible to construct a mine in it. For example, ground water is discussed only in terms of the necessity to remove water from repository shafts and rooms. Ground water is more important as a potential way for the radionuclides to move in the geosphere.

5. (Page 1.15) Again bentonite is considered despite the limitations expressed above.

Under human institutions: Human back-up of the "carefully engineered geologic system" for periods of hundreds of years is not enough. Back-up for thousands of years, if not many thousands, would be necessary. It is for this reason that the proposed EPA criteria (43 F.R. 53262 *et seq.*, November 15, 1978) recommend against reliance on institutional controls for more than one hundred years.

The hazard indices discussed in Section 3.1.3.4 and mentioned here are at best crude estimates. The hazard of a material is based on three factors—(a) the quantity of the materials available, (b) the toxicity of the materials, and (c) the pathways between the materials and human beings. Hazard indices which do not consider all of these (and it is difficult to think of a generic hazard index which would be useful for specific pathways) are not particularly useful.

6. (Page 1.19) Accident analysis: The impacts associated with accidents after closure of the repository have been improperly assessed. The most suitable assessment measure is the time-integrated population dose over the time of interest which, for many accidents involving ground water flow, would be a very long time. Maximum individual doses would probably be associated with the ingestion and use of ground water; this was not calculated.

The chemical nature of the waste and of the geosphere appears to be largely ignored. Much of the reduction of radiation dose appears to occur as a result of the delay of radionuclides by sorption from the ground water. The sorption of radionuclides depends on several factors, including the oxidation-reduction state of the nuclide, the presence or absence of complexing or chelating agents, and the nature of the specific geological materials present. In some cases, particularly if large and rather exotic containment canisters are postulated, the ion exchange requirements of the canister materials may be quite significant and might overload the exchange capacity of the media in which the waste was emplaced.

7. (Page 2.2.1, Section 2.2.1.1) The document neglects to mention overall guidance provided by the FRC: Radiation Protection Guidance for Federal Agencies, 25 FR 4402 *et seq.* (5/18/60), for which 10 CFR 20 is one of several implementing regulations.

8. (Section 2.2.1.2, page 2.2.3 *et seq.*) There is no mention of EPA's regulations developed under the regulatory authority of the Marine Protection, Research and Sanctuaries Act of 1972 (Public Law 92-532). This authority should be referenced in this section.

9. (Page 2.2.3) Under EPA Uranium Fuel Cycle Standards, the last sentence in this section is in error. The effective date for application of 40 CFR 190 can be found in 40 CFR 190.12. This error should be corrected.

10. (Page 2.2.3) The way in which the EPA drinking water regulations would be applied, if at all, is not made clear. These regulations are not directly appropriate to the disposal of radioactive waste since they do not control the contamination of the environment. They are directed toward a water supplier and applied to monitoring and corrective treatment regardless of the source of the contamination. The Draft Environmental Impact Statement relates to activities of persons whose contaminations of the environment is being limited.

11. (Page 2.2.4, Line 6): This should be corrected to read: (b) Gross alpha particle activity (including radium-226 but excluding radon and uranium)—15 pCi/l.

12. (Page 2.2.5) Under "Clean Air Act Amendments of 1977" the text states: "The administrative and legal problems arising from the potential conflict with NRC regulatory authority and procedures originating in the Atomic Energy Act of 1954 have not been resolved. However, it is unlikely that existing EPA radiation standards will be changed, although administrative requirements may." This statement is presumptuous and does not reflect the major effort underway at EPA to develop regulations under the Clean Air Act, as amended. The text should be revised in the Final EIS.

13. (Pages 2.3.2 and 2.3.3, Tables 2.3.1 and 2.3.2) Both of these tables are taken from an obsolescent reference (ORP/CSD 72-1). More appropriate references would be EPA report ORP/SID 72-1 (reference 21, Section 2.3) with the cosmic ray doses augmented by the new information in NCRP Report #45 (reference 10, Section 2.3).

14. (Page 2.3.4, Section 2.3.2.2, 2nd paragraph, last three lines) The dose estimates for radon are obsolete. Currently, dissolved radon in the body would give a dose of about 2 to 3 mrem/yr and the range of estimated dose from inhaled radon and daughters at 0.7 pCi/liter would be 130 mrem/yr to 1800 mrem/yr. See *United Nations Scientific Committee on the Effects of Atomic Radiation Report (UNSCEAR) for 1977* for a more complete treatment of the question, also NCRP #45.

15. (Page 2.3.5, Section 2.3.2.2, Table 2.3.3)—The data in this table is obsolete, see UNSCEAR 1977 or NCRP 45 for current data.

16. (Page 2.3.5, Section 2.3.2.2, Table 2.3.4)—This table is obsolete. NCRP 45 summarizes natural background as follows:

ANNUAL EXPOSURE

[In millirem/year]

Source	Gonads	Lung	Bone		GI tract
			Surface	Marrow	
Cosmic.....	28	28	28	28	28
Cosmogenic.....	0.7	0.7	0.8	0.7	0.7
Terrestrial.....	26	26	26	26	26
Inhaled.....		100			
Radionuclides in body.....	27	24	60	24	24
Total.....	80	180	120	80	80

17. (Page 2.3.6, Section 2.3.3, 2nd paragraph, last line) The use of the Congressional Research Service (reference 23) estimate of 200,000 defective children per year does not agree with current estimates of 9.5 percent to 10.5 percent incidence of genetic disorders in newborn (see UNSCEAR 1977, p. 519). The UNSCEAR estimates suggest that this estimate of 200,000 is at least a factor of 2 low.

Estimates of malignancies occurring each year are better obtained from the American Cancer Society annual publication "Cancer Facts and Figures—19xx." For example, estimates have been: 395,000 deaths, 765,000 cases of cancer—1979; 390,000 deaths, 700,000 cases—1978; 385,000 deaths, 690,000 cases—1977; etc.

18. (Page 2.3.6, Section 2.3.3, 3rd paragraph, last sentence) The use of Frigerio and Stowe as a reference should be put in context. Aside from using the same obsolete reference of natural background used in this DEIS which inflates the probable difference in background between areas of the country, the authors neglect to consider the potential effects of other carcinogens in the work place and the environment. Some of these problems are highlighted in multi-author sections on "Demographic Leads to High-Risk Groups" and "Environmental Factors" in the volume *Persons at High-Risk of Cancer* (J.F. Franmeni, Jr., editor, Academic Press, New York, 1975). Little support is given for the assertions in the referenced paper.

In a more complete report by the same author (N.A. Frigerio, K.F. Eckerman, and R.S. Stowe, "Carcinogenic Hazard from Low-level, Low-rate Radiation," ANL/ES-26, 1973) where all methods and assumptions are given, there are several flaws. A major flaw is the assumption that "all forms of cancer show very similar doubling doses and closely similar increases in mortality rate per rad." This assumption is made contrary to the evidence in ICRP, UNSCEAR, BEIR, and other reports that variations in the susceptibility of tissue to induction of different forms of cancer by irradiation are quite large and not necessarily related to the marked variations in natural incidence of the diverse types of cancer.

There are also problems in the statistical analysis in ANL/ES-26: misuse or misinterpretation of the t-statistic, failure to use Scheffe's test or calculations of variance ratio to check the significance of the series of t-tests, and use of gross averages in the analysis.

In reality, the paper can be shown to be erroneous by inspection of Frigerio *et al.*'s source of cancer mortality data, *NCI Monograph 33, Patterns in Cancer Mortality in the United States: 1950-1967*. In Monograph 33, Burbank presented an analysis of Dynamic Geographic Distribution for each cancer. The complex pattern of increasing and decreasing cancer mortality by state and cancer show that factors other than background are the major driving force in cancer mortality rates and that natural background radiation is not.

Indeed, in a later publication (Jacobson, A.P., Plato, P.A., and Frigerio, N.A. "The Role of Natural Radiations in Human Leukemogenesis," *Am. J. Public Health*, 66, p. 31-37, 1976), a more reasonable major conclusion was reached: "It appears that conditions relative to populations and their environment could mask a radiation effect, if in fact one is present."

19. (Page 3.1) The main reason that the waste management system evaluation was emphasized on deep geological disposal in salt formations was that this alternative received the most study. We suggest other geologic media and other disposal methods receive adequate scrutiny.

20. (Page 3.1.3) The concept of the equilibrium release fringe does not appear to have significance for long-term isolation, considering the potential for disruption of the containment.

21. (Page 3.1.4, last paragraph) We recommend that the last paragraph on this page (mid-paragraph) address the fact that most of the intense tectonic activity and

virtually all of the volcanic activity of the North American continent occur along the global plate boundaries.

22. (Page 3.1.6, sixth paragraph) This discussion of resource potential of the host rock is incomplete. It treats only the loss of resource through use of the area for repository. In fact, such loss of resource potential cannot be maintained indefinitely since eventual loss of control over this site must be expected. The real problem with resource potential of the host rock is that it will tend to attract future human intrusion and so increase the probability that the repository integrity can be breached by man's activities.

23. (Page 3.1.8, last paragraph) We recommend that the low water content and drier nature of salt domes resulting from the diapirism process be cited as a particular advantage over bedded salt.

24. (Page 3.1.14—Table at bottom of page) There should be two categories of salt, Bedded Salt and Salt Domes, so that the difference in moisture content can be emphasized. Salt Domes have lower moisture content which is a major consideration.

Plasticity, ion exchange capacity, and linear discontinuities should be added to the properties for the rock types. Plasticity values would have the following relative scale values: Bedded Salt (3), Salt Domes (3), Granite (1), Shale (2), and Basalt (1). Ion exchange capacity would have values of 1, 1, 2, 3, and 2, respectively. Linear discontinuities would have values of 3, 3, 2, 3, and 1, respectively.

25. (Page 3.1.16, third paragraph) This statement is too vague to be useful in the site selection process. It is necessary to make a determination as to the period of time for which high-level radioactive waste must be kept isolated from the biosphere and also for how complete such isolation must be. Complete isolation for all time is probably not achievable and certainly cannot be assured in advance.

26. (Page 3.1.17) Somewhere it should be emphasized that global plate boundaries should be excluded as locations for potential repository sites because most of the catastrophic geologic events of this planet occur along these well defined linear features.

27. (Page 3.1.17) Several uncertainties exist in the projected behavior of the system, such as the philosophy for radionuclide containment, waste form, the host rock, etc. We suggest there also be a discussion as to how these uncertainties can be overcome.

28. (Page 3.1.20) How important is climatic change in determining the evaluation of the hydrologic environment? Increased precipitation might fill up an unsaturated aquifer, but how would it affect the permeability or porosity of an aquifer in the zone of saturation?

29. (Page 3.1.22, first paragraph) The first sentence should substitute volcanic activity for magmatism and a sentence immediately following should cite the fact that unlike other catastrophic events 98 percent of all volcanism on earth is confined to regions of global plate boundaries. Since this is a known fact, the reference to magmatism in line 11 should be deleted. A sentence following line 11 (with magmatism deleted) could state that volcanism (magmatism) is predictable since it is virtually confined to the region of global plate boundaries. In any case *volcanism* (*magmatism*) should be clearly separated from tectonism and this has not been accomplished on page 3.1.22.

30. (Page 3.1.22) Isotopic date provinces have been delineated in the Precambrian basement rock (Dott and Batten, *Evolution of the Earth*, 1976, p. 165), and the importance of these boundaries may be second only in significance to the global plate boundaries in site selection. While these boundaries are exposed in the Canadian Shield they are buried beneath sedimentary rocks in the rest of the North American continent; however, the extension of the Grenville isotopic boundary beneath the sediment has been correlated with major seismic events in the eastern portion of the North American continent. It is recommended that the isotopic date boundaries be addressed in site selection considerations.

31. (Page 3.1.23, third paragraph) It should be recognized that both climate and hydrologic gradients may change in the course of time.

32. (Page 3.1.24, middle) There is a reference to a nonexistent section 3.1.1.3.

33. (Page 3.1.24, seventh paragraph) It is not necessarily true that the primary geological barrier to waste migration will be the repository host rock. Intrusions by man or overriding natural processes and events may throw the primary dependence onto other geological formations.

34. (Page 3.1.25, bottom half) This material is of concern only in the short term.

35. (Page 3.1.26, third paragraph) This appears to be largely a list of problems, with only speculative solutions. How does DOE intend to cope with these problems?

36. (Page 3.1.27, line 19) The spelling of "intrusive" rocks should be corrected to "intrusive."

37. (Page 3.1.28, first paragraph) The measurement of the equivalence of the hazards of waste repositories and natural ore is a complex subject. Many of the hazard indices are concerned only with the amount of radioactive material and its toxicity, without consideration of routes by which the activity can reach man.

38. (Page 3.1.32) The discussion of ground water flow appears to be concerned only with maintaining a dry repository during the construction period. It is necessary to consider the ground water after the closure as a possible means of transport of the radioactivity.

39. (Page 3.1.35, fourth paragraph) There is an implication in this paragraph that the unknown problems listed will have an effect only on the cost of the repository, requiring generally greater spacing and therefore a larger, more expensive repository. The question of reduction of the effectiveness of the repository, for example by fracturing rock, is not addressed.

40. (Page 3.1.38, first paragraph) This paragraph suggests that the fission product problem terminates with the decay of strontium-90 and cesium-137. While this may be substantially true for the production of heat and for acute radiation hazard, it is not true for the significance of the waste as a health hazard. Doses from technetium-99, iodine-129, and cesium-135 are not negligible over a long time frame. This problem is repeated in the last sentence of the next paragraph.

41. (Page 3.1.38, fifth and sixth paragraphs) In the early phases, actinide elements, particularly plutonium-238 and plutonium-241, are significant. Tritium may also be significant. In the long time frame cesium-135 and carbon-14 might also be significant.

42. (Page 3.1.40, licensing) Does the waste package design refer to the container alone, the container plus waste form, or the entire system? It does not seem that the waste container and form problems are more difficult from a licensing standpoint than the other barriers.

43. (Page 3.1.40, physical protection) This part makes sense if it refers to physical protection during the operational phase of the repository. The first paragraph on page 3.1.41 is self-contradictory. It states that the waste would be essentially unavailable after placement in the geological repository. Because the operational controls will cease to exist long before any appreciable decay of plutonium-239, the protection must be inherent in the inaccessibility of the waste in the repository and the massive effort that would be required to remove it.

44. (Page 3.1.41, third bullet) Comparison of acceptable consequences from radiation in comparison with those from automobile accidents is invalid. There are two primary aspects to the establishment of bases:

1. How much will society accept on an absolute basis;
2. How much better than this can the technology provide?

45. (Page 3.1.41, last bullet) The use of adsorption coefficients from one set of Hanford subsoils, measured under laboratory conditions, is not an adequate basis for scoping the effect of adsorption. There are some substantial differences between the adsorption coefficients of the Hanford Subsoil and of those given on page K-20 of the Waste Isolation Pilot Plant EIS (DOE/EIS-0026-D), for example.

46. (Page 3.1.47—5th paragraph, last sentence) Isotopic age province boundaries should be added to the list of areas to be avoided in the preliminary selection of repository areas.

47. (Page 3.1.48, near bottom) The first statement under ground water implies that a repository can be sited in conjunction with a useful ground water source without affecting its quality. Since EPA analysis has shown that ground water can be significantly contaminated by a single drilling event, it is important that the repository should not be situated where it can affect a useful ground water resource.

48. (Page 3.1.49) The chemical nature of any aquifers around a repository should be briefly discussed. Reducing aquifers greatly limit the solubility of U, Pu, Np, and Tc. Sorption of these elements would provide a further reduction in the amount of nuclides reaching people, and sorption of the reduced states of these elements is higher than sorption of the oxidized states. This oxidation-reduction consideration should be briefly discussed.

49. (Page 3.1.49, third paragraph) "Flow rates and velocities of ground water that are insignificant over a 50 year period will have to be considered in terms of hundreds to thousands of years." This statement should be further discussed.

50. (Page 3.1.52, item four) It seems unreasonable to limit the search for an optimal site to areas with "availability of title". Surely this is an area where eminent domain is appropriate.

51. (page 3.1.52, last sentence) There is an unwarranted belief that all problems can be solved by major efforts. Investigations into a basic research area, such as this appears to be, do not necessarily have satisfactory outcomes. The research must first be performed before opinions as to its results are valid.

52. (Page 3.1.54, item two) The chemically separated high-level waste to be considered must include the iodine-129 (and the other volatiles and transuranics) which are excluded from discharge to the atmosphere from the fuel reprocessing plant by EPA's Uranium Fuel Cycle regulations (40 CFR 190.10(b)).

53. (Page 3.1.54, item three, last sentence) Unless the actinides from chemically separated high-level waste are recycled, they must be disposed of as waste and would still require consideration in this Environmental Impact Statement. Even if one assumes recycling of uranium and plutonium, one eventually reaches the point where recycling is not economically feasible and the transuranics must then be disposed as waste.

54. (page 3.1.55, second paragraph) The leach rates of spent fuel in room temperature deionized water are irrelevant. The leach rates of spent fuel in typical ground waters at temperatures to be expected in spent fuel repositories are more important.

55. (Page 3.1.59, second paragraph) The canister could prevent ground water intrusion for a period *provided that* there was no disruptive event which would destroy the canister. Such disruption would be expected in gas, oil, or mineral exploration. It therefore seems that it would be impossible to maintain canister integrity from credible accidents for a significant time period.

56. (Page 3.1.59, third paragraph) Reliance on the canister alone for long-term containment seems unwarranted, as indicated in the previous comment. This does not mean that canisters which would be durable in the absence of an intrusive event or traumatic geological events should not be developed.

57. (Page 3.1.62, first paragraph) The likelihood that oxygen will be introduced into the repository when it is constructed and therefore be available to the ground water should be considered in evaluating canisters. The mobility of some nuclides is also increased by the presence of oxygen. The possibilities that the copper would be a resource which would attract human intrusion should be considered.

58. (Page 3.1.62, fourth paragraph) The misspelling of alumina should be corrected.

59. (Page 3.1.62, Section 3.1.3.3) This section appears to assume long-term institutional functioning. Expectation that institutions will continue over thousands of years (or even that they will maintain their control over hundreds of years) is not well-founded.

60. (Page 3.1.64, first paragraph) The first century after closure of the repository would be critical for "hands on" corrective action only if the monitoring program established some deficiency in the repository. Although the radioactivity of the repository has been reduced substantially after 700 years, the threat is by no means negligible.

61. (Page 3.1.64, second bullet) What evidence is there that technical information can be maintained for a very long time? What constitutes "a very long time"?

62. (Page 3.1.64, fourth paragraph) The definition of *risk* as "the sum product of the magnitude of losses and the probability that the losses will occur" is questionable. There is a tendency for aversion of high consequence accidents, which would imply a valuation other than a strict p-c product.

63. (Page 3.1.64, seventh paragraph) This whole paragraph is very questionable. Hazard indices are not based on estimates of societal risks compared to other societal risks, in general. There is also the question of whether the hazard of the waste after several hundred years of decay, considering nuclides *and* pathways, is less than the hazard of the ores.

64. (Page 3.1.64, last paragraph) Consequence analysis for any release is the estimation of the effect of that release. It is not restricted to postulated worst cases.

65. (Page 3.1.65, fourth paragraph) The total quantity of radioactivity in curies is irrelevant. The nature of the radionuclides and their pathways to man are significant.

66. (Page 3.1.67, first paragraph) Are these probabilities best estimate probabilities, upper bound probabilities, or what?

67. (Page 3.1.67, second paragraph) Is ^{229}Ra a misprint for ^{226}Ra ?

68. (Page 3.1.67, third paragraph) Since the long-term behavior of the parameters is uncertain, risk assessment should be based on upper estimate predictions as well as on "reasonable" predictions.

69. (Page 3.1.71 seventh paragraph) Sorption of radionuclides is controlled by the site-specific geology. It seems unlikely that radionuclide behavior data from one site can be applied to another site.

70. (Page 3.1.100, first paragraph) The destruction caused by a meteorite striking one of our large metropolitan areas is irrelevant to this consideration. We have no control over where a meteorite will fall; therefore, one place is as good as another, and the possibility of a meteorite strike does not become a consideration in the location of cities. The probability that a meteorite will disperse materials from a

deep geological repository is controllable in that the probability of a meteorite large enough to cause disruption is a function of depth and can be reduced as much as desired by going deep enough.

71. (Page 3.1.100, sixth paragraph) The regional population for the types of releases considered most likely in the long term in waste disposal is the population in a river basin rather than the population within an eighty kilometer radius of the plant.

72. (Page 3.1.101, second paragraph) Why is bone an organ of principal interest? According to the BEIR work, more health effects would be expected from a dose to red marrow than from the same dose to bone. It is also probable that the liver should be considered a significant organ.

73. (Page 3.1.105, first paragraph) The Arthur D. Little work for EPA found that spent fuel heat loadings should be about the same for granite and salt. This seems reasonable considering that the salt has a higher conductivity than the hard rocks and is surrounded by shale which is not a good conductor. We would like to correct this discrepancy between the DOE and A.D. Little heat loading models.

74. (Page 3.1.106, third paragraph) There is no discussion of the air content of the repository following backfilling. The mobility of several significant radioelements, plutonium, neptunium, uranium, and technetium, are affected significantly by their oxidation state. (In some schemes for the *in situ* solution mining of uranium, air is used as the source of O₂ and is the oxidizing agent of the uranium.) The air content should be briefly discussed.

75. (Page 3.1.111, last paragraph) There should be some consideration of the possible interaction of the various wastes with each other. If the transuranic waste contains organic material, these may contain chelating materials, which could have an effect of mobilizing other waste.

76. (Page 3.1.129) Social service demands (Table 3.1.21) were derived by applying factors "to the project in-migration values" (Table 3.1.19). Therefore, the level of forecasted social service demands by individual site should be proportional to the estimated level of project in-migrants for each site. From Table 3.1.19, under the maximum impact condition the respective estimates for the number of project in-migrants for 1985 indicate the lowest value for the Midwest site (5800), followed by the Southeast site (8600) and the Southwest site (15,000). However, in Table 3.1.21, also under the maximum impact condition, some of the social services—physicians and dentists, and hospital and nursing care beds—indicate values for 1985 which reverse the relative position of the Midwest and Southeast sites. This apparent error occurs in similar tables throughout the DEIS.

77. (Page 3.1.129) The following statement appears to be incorrect in light of the information presented in the accompanying tables:

"Although the numbers of in-migrants are smaller, the potential for impacts in the Southeast maximum condition is quite similar to the potential in the Southwest site under maximum conditions. This is the case because the base population in the Southeast is capable of absorbing greater population influx, other things being equal."

It appears that the words "Southeast" and "Southwest" should be reversed, since if the number of in-migrants for site A is half the number of site B, and the number of in-migrants stated as a percent of each site's base population is the same for each site, then the base population of site B must be twice the base population of site A. Site B would be more capable of absorbing population influx.

The identical statement is repeated in other portions of the DEIS (p. 3.1.180 and p. 3.1.194) in referring to other estimates of the numbers of in-migrants associated with different types of waste management facilities.

78. (Page 3.1.137, last paragraph) The ground water releases did not appear to include the "two aquifer case," which is most significant for ground water releases. This case involves a hydrologic connection between two aquifers through a repository, with subsequent ground water transport. The analysis also appears to consider only release of the total radionuclide content, which does not appear to be a credible or useful form of analysis.

79. (Page 3.1.138, second paragraph) The presence of salt would probably not preclude the use of the water as a source of food or recreation. The salt would be diluted to acceptable levels by any reasonable amount of water far more quickly than the radioactivity.

80. (Page 3.1.139, third paragraph) What are the bases for assuming that 10 percent of the particulates suspended are of respirable size?

81. (Page 3.1.140) How is the uranium-238 depleted by so much over a period of one thousand years?

82. (Page 3.1.147, fourth paragraph) A meteorite of the described size would undoubtedly produce a local disaster area. The impact of the meteorite, however,

would also disperse radioactive materials into the atmosphere from which they would impact over an extended area. It is the additional impact of this radioactive material that is significant. It is not likely that the impact would be local or that it could be controlled by local monitoring.

83. (Page 3.1.148, fourth paragraph) This scenario does not appear to be a particularly bad case because of the limitation of the contact for one year. Such a limitation, together with slow leaching, results in a minimal release of radionuclides. What is the effect of continued erosion?

84. (Page 3.1.149, table) A leach rate of 10^{-4} g/cm²day, applied to a one centimeter cube of density 2, would result in a leaching rate of 3×10^{-4} per day, or approximately 0.1 per year. Is this the value that was used in the analysis?

85. (Page 3.1.150, fifth paragraph) Doses to a maximum individual are not the best measure of the impact of this accident. Total population dose and integrated dose are more significant. It might be noted that the emergency dose limits of 100 rem and 25 rem apply implicitly to the case where only one or a few people are exposed.

86. (Page 3.1.155, last paragraph) This is an improper combination of probabilities. If the probabilities are multiplied together, as has been done here, the result is the probability of all three conditions occurring in the same year. If the probabilities are taken over 10,000 years, for example, the probability of a fault intersecting the repository is 4×10^{-7} . The probabilities of failure of waste containment, or of aquifer intersection, over this period are likely to be one, each. The total probability is therefore about 4×10^{-7} , not 4×10^{-15} .

87. (Page 3.1.157, table) Dose commitments of 10^8 person-rem are estimated to result in 2×10^4 fatal cancers. The risk associated (including the probability) is much less.

88. (Page 3.1.161, second paragraph) The conclusion drawn from the comparison with the ore body would be improved if some analysis were provided.

89. (Page 3.1.162, last paragraph) Distribution of the waste would lower the maximum and regional individual doses, but would increase the probability of the event by a factor equal to the number of repositories.

90. (Page 3.1.163, second paragraph) It is not proper to assume doses to the regional population from a ratio basis with total body dose.

91. (Page 3.1.164, second paragraph) Diverting the entering stream until it is diluted by another stream does not change the population dose. It merely means smaller doses to more people.

92. (Page 3.1.165, third paragraph) The overall probability of a contaminated drilling event can exceed 0.005, since there is a chance of more than one drilling event over a period of time.

93. (Page 3.1.191, table) The quantity of krypton-85 released to the air should be related to gigawatts of electricity produced for comparison with uranium fuel cycle standards.

94. (Page 3.1.119) There is an inconsistency in the unit cost of spent fuel storage stated in Table 3.1.82 and the text (2nd paragraph) on p. 3.1.119. In Table 3.1.82, the cost for the cooling of spent fuel is based on 75 percent of the spent fuel being stored in reactor basins at \$30/kg. On p. 3.1.229, it is reported that 75 percent of spent fuel storage requirements are provided by power plant basins at an average cost of \$6/kg HM-yr, which would amount to \$36/kg for six years. Recalculating the spent fuel storage cost based on the assumption stated on p. 3.1.229, the cost of six-year cooling of spent fuel in Table 3.1.82 should therefore be \$44/kg instead of \$39/kg.

95. (Page 3.1.229, bottom) There is a brief discussion on the effects of using present worth costs as opposed to undiscounted costs. It should be mentioned that the relative ranking of the fuel cycle alternatives by their total costs is significantly different according to which set of costs is used. As indicated by Tables 3.1.89 and 3.1.90, the U & Pu Recycle under the Deferred Fuel Cycle Decision has the highest total cost, about 50 percent higher than the least expensive case, on the basis of undiscounted costs, while this same case possesses the lowest total cost of any alternative when discounted (at a 7 percent rate) costs are used.

96. (Page 3.1.242, third paragraph) The study of rock-waste interactions should include the geochemistry. Mobility of a number of radionuclides is strongly affected by the geochemistry (particularly the oxidation-reduction potential of the repository and ground water) and by the potential presence of complexing agents. These should be included in the proposed research program.

97. (Page 3.2, Section 3.2) This entire section appears to be largely speculative. The comment as to the speculative nature of the discussion applies to Sections 3.2, 3.3, 3.4, and, in fact, all the rest of Chapter 3.

98. (Page 3.2.2, 3rd paragraph, line 11) The word *pegmatite* should be replaced by *migmatite*. The reference (Leonardos, 1974) specifically states that "pegmatite contribution to monazite deposits are trivial" (p. 1126). On 1127, Leonardos states

"migmatites have supplied the material for the bands within the quartzite". Thus, migmatite is the term required to support the reference.

99. (Page 3.2.3, second paragraph) This paragraph does not consider the effect of radiation damage in the glass. This should be mentioned.

100. (Page 3.3.13, seventh paragraph) The possibility that oxygen introduced with the waste will change the reducing conditions should be considered.

101. (Page 3.6.1) The first paragraph of this section should state that at present it is illegal to put high-level wastes in, on, or under the seabed and that legislative action would be required before implementation.

The fourth paragraph states that a ship will monitor the emplaced wastes for an "appropriate length of time." How long (or short) is this "appropriate length of time?"

102. (Page 3.6.2) In mid gyre there is little benefit from deposition of sediments since this process is very slow there. The document states that less than .01 percent of the ocean floor would be used for disposal. What total area does this represent?

The last bullet under "Advantages" suggests that an advantage to seabed disposal is the lack of need to resolve Federal-State relations problems. This is not so because problems would surely arise from port use and the loading and transportation of waste to the port.

103. (Page 3.6.5, Table 3.6.1) The biological productivity of seamounts should be included in the table.

104. (Section 3.6.2.3, Page 3.6.5) There should be a mention that the philosophy behind this approach is isolation of the waste. This approach is required by EPA regulations.

105. (Page 3.6.7) Why would one expect low nuclide concentrations around a waste canister? If the canister failed, one would expect high levels.

106. (Page 3.6.7) Under "Water Column," there is a statement that bottom currents are slow and uniform. However, in Section 1.3.6 the DEIS says bottom currents are weak and variable. This inconsistency should be corrected.

107. (Page 3.6.7) Under "Basement Rocks," the fractured nature of the basalts could provide lenses for the transport of radionuclides. This should be mentioned.

108. (Page 3.6.8) Under current EPA regulations the canister *must* act as a barrier until the material decays to innocuous levels. The conservative calculational assumption, that the canister will release its entire inventory of wastes, does not reflect this regulatory requirement.

109. (Page 3.6.10, Section 3.6.2.8) Seabed disposal refers to a disposition of wastes and as such falls within EPA regulatory authority for the disposal of radioactive waste in, on, or beneath the ocean floor. The seabed disposal option for HLW is not legal under current domestic law. However, we think DOE should continue to study this option to see if this is an environmentally acceptable option.

Additionally, in Section 3.6.3.6, on page 3.6.22, the DEIS states, "implementation of a *sub-seabed* disposal program for non-HLW is now possible under EPA's ocean disposal permit program." DOE apparently believes ocean dumping and sub-seabed emplacement are intrinsically different for high-level waste and identical for low-level waste. We believe there is no legal difference between ocean dumping and sub-seabed emplacement and any difference between the two is purely semantic.

110. (Page 3.6.14) Bottom sediments in the mid-plate areas have extensive animal tracks. Furthermore, fish in these areas make extensive vertical and lateral migrations; this indicates that there is a possible pathway from the waste to people.

111. (Pages 3.6.22 and 3.6.23, Section 3.6.3.6) See comments for page 3.6.10, Section 3.6.2.8. Sub-seabed emplacement must comply with EPA regulations promulgated under authority given exclusively to EPA under Public Law 92-532, the Marine Protection, Research and Sanctuaries Act of 1972.

The fourth paragraph of this section perpetuates the notion that sub-seabed emplacement is not ocean dumping. We consider the difference between the two to be semantic.

Should high-level waste be released, it most certainly will affect other nations, contrary to the suggestions in the fifth paragraph.

112. (Page 3.6.24, Section 3.6.4.5) Port accidents occurred in the 60's during the loading of 55 gallon drums. This issue should be presented.

Is it proposed that several canisters go into one hole in the seabed, or will each penetrometer drop wherever it may, to be followed by monitoring of 9000 different holes per year?

113. (Page 3.6.25) Several ports have banned the shipment or receipt of spent fuel. Does the proposal include use of dedicated port facilities?

114. (Page 3.6.26) What is the range of error in the results of the "unverified, theoretical model" in projecting impact?

115. (Page 3.6.30, first paragraph) Is the \$15 million mentioned for R&D costs? If not, what costs does that figure represent?

116. (Page 3.6.31) Again we find the semantic difference between ocean dumping and sub-seabed emplacement. "Dumping" and "Dump" should not be in quotation marks. It is defined in the Marine Protection, Research, and Sanctuaries Act of 1972 as a disposition of materials. This misleading section should be corrected in the Final EIS.

117. (Page 3.6.32, third paragraph) The sixth option should be clarified. Considering the dollar input, what is the intent and what will be the output?

118. (Section 3.6) Somewhere in this section several other matters should be briefly considered:

How deep would the projectiles be sent? What distance beneath the sediment surface, and how far from the rock beneath? What about the concept of recovery, if unforeseen dangers are found to exist?

119. (Page 4.12) Figure 4.4.1 had been omitted. It should be included or the reference to it should be removed.

120. (Appendix C) This appendix is grossly unsatisfactory. It concentrates heavily on doses to individuals and does not appear to recognize that more recent standards, although they may be expressed in terms of dose to the maximum individual, have population dose as part of their basis. Among such regulations are:

1. Limitations on releases of effluents from power reactors (Appendix I to 10 CFR 50);

2. The uranium fuel cycle standards (40 CFR 190); and

3. The drinking water standard (40 CFR 141).

The limitations on releases of krypton-85, iodine-129, and transuranic elements, in 40 CFR 190, are explicitly based on population dose.

The general thrust of this appendix is that population dose is not a concept suitable for radiation standards. This is incorrect because the concept of ALARA usually involves balancing the cost against the reduction in population dose. It is perhaps significant that this appendix does not include any of the BEIR reports but limits itself to the 1969 BEAR reports of the National Academy of Sciences. For currency, the appendix should consider additional references, e.g., references 1, 2, 10, and 16 from Appendix E, to bring the appendix up to 1977 at least.

121. (Page C.2, 1st and 2nd paragraphs) The paragraphs ending the section on "Background" and initiating "As Low As Reasonably Achievable Application" reflect some bias and a lack of candor in describing the use of risk coefficients in radiation protection. Almost all government agencies, particularly the EPA but including the NRC and the MSHA, have used or are using risk coefficients to estimate impact of radiation exposure. The ICRP (reference 11) has gone entirely to a risk based radiation protection system, using estimates of risk in optimizing radiation protection. ICRP has stated, "These risk factors are intended to be realistic estimates of the effects of irradiation at low annual dose-equivalents (up to the Commission's recommended dose-equivalent limits)" (ICRP publication No. 28, 1978). The NCRP (reference 15) seems to stand alone in its position discounting the use of linear, nonthreshold risk coefficients in radiation protection.

122. (Page C.3, Table C.1) While the table is titled "Comparison Chart of Radiation Standards," it then lists "Standards or Criteria" and references ICRP and NCRP values or reports. ICRP and NCRP reports are *recommendations* or *suggestions* which may or may not be adapted or modified and adopted by national regulatory agencies. The references to ICRP and NCRP should be deleted from the table.

It should be noted, however, that there are ICRP reports pertinent to health effects. ICRP publication 26 (reference 11) and publication 27 ("Problems Involved in Developing an Index of Harm," 1977) both provide recommendations on "acceptable" numerical risk estimates for radiation workers.

123. (Appendix D) While the calculational models employed may be adequate, in light of the uncertainties inherent in the input data, they are not state-of-the-art, as claimed. For example, the calculation of the 5 cm gamma dose as the total body dose for air immersion could be improved by the use of an existing code which specifically yields organ doses. Again, while the DACRIN code used employs the TGLD model, it does not explicitly treat the daughter products formed after inhalation as do more complete codes.

124. (Page D.8)—The model used to estimate the population dose commitment from carbon-14 is too conservative (*i.e.*, overestimates the impact). If dilution by the Suess effect is not considered and the total number of health effects is integrated over all time, the release of 1.4 MCi (from Table 3.1.68) would result in about 5×10^6 deaths, assuming a stable world population of 6.4×10^9 people. It might be more realistic to make a comparison to the natural production of carbon-14 and associated health risk.

125. (Page E.1, last paragraph) The bias in selection of references is obvious. While the last sentence quotes the NCRP and its dislike of linear nonthreshold risk and its use in radiation protection, to maintain balance the ICRP's use of risk factors as realistic estimates (see comment on Appendix C, page C.2) for radiation protection and their use in ICRP publications 26 and 27 should also be documented. EPA's policy statement, 41 FR 28409 (1976), should also be noted.

126. (Page E.3, first paragraph) In the discussion of BEIR risk estimates, emphasis is put properly on the range of uncertainty. However, it should be mentioned that the BEIR Committee did report (reference 1, p. 168), "With this limitation in mind, the Committee considers *the most likely value* to be approximately 3,000-4,000 cancer deaths (or a 1 percent increase in the spontaneous rate)" (emphasis added).

127. (Page E.3, second paragraph) The paragraph considers only EPA's Uranium Fuel Cycle documents and states that the risk estimates there continue to be used by EPA. In reality EPA risk estimates have continued to change as new data becomes available. In addition to papers published by staff (e.g., Ellett, Nelson, and Mills, "Allowed Health Risk for Plutonium and Americium Standards as Compared with Standards for Penetrating Radiation," pp. 587-601 in *Transuranium Nuclides in the Environment*, IAEA, Vienna, 1976), various EPA reports (e.g., *A Computer Code for Cohort Analysis of Increased Risks of Death*, EPA 520/4-78-012, 1978, or *Proposed Guidance on Dose Limits for Persons Exposed to Transuranium Elements in the General Environment*, EPA 520/4-77-016, 1976, etc.) show updated risk estimates and how they were derived.

128. (Pages E.3 and E.5, discussion of the Reactor Safety Study, WASH-1400.) EPA's dissatisfaction with the health effects estimates in the Reactor Safety Study (RSS) is documented in reference 53. Recent literature has done nothing to dispel our belief that the use of a dose rate reduction factor is ill advised as is the minimal plateau duration (30 years) used in the RSS.

The UNSCEAR 1977 Report suggests (except for leukemia) a 50-year expression period unless the period has been shown to be shorter or longer for a specific cancer (reference 2, par. 12, page 363).

In particular, the two major human cancers associated with radiation, lung and breast, are considered to elevate risk for the duration of lifespan following exposure (Land, C. E. and Norman, J. E., "The Latent Periods of Radiogenic Cancers Occurring Among Japanese A-Bomb Survivors," *Late Biological Effects of Ionizing Radiation, 1*, IAEA, Vienna, pp. 29-47, 1978; Archer, V. E., Radford, E. P., and Axelson, O., "Radon Daughter Cancer in Man: Factors in Exposure-response Relationships," Health Physics Society Annual Meeting, June 1978).

The dose reduction factor in the RSS report appears to be derived from an analysis by Mays, *et al.* considering ten sets of animal data from nine studies. If an additional two studies (that happen to show a reverse effect) are included in the analysis, the dose reduction factor becomes 1.7 ± 4.5 instead of the 0.22 ± 0.20 reported by Mays, *et al.* As UNSCEAR 1977 points out, most of the existing animal carcinogenesis data comes from observations at doses above 50 rads and that each tumor-model system has peculiarities which prevent generalizations across multiple organ systems and cancers. See reference 53 of this appendix for comments on the dose reduction factor in the RSS.

As has been pointed out by Crump, *et al.* (Crump, K. S., Hoel, D. G., Langley, C. H., and Peto R., "Fundamental Carcinogenic Processes and Their Implications for Low Dose Risk Assessment," *Cancer Res.*, 36, pp. 2973-2979, 1976): "It is likely that the error in the acceptable dose associated with a simple linear extrapolation will be much less than that associated with species to species extrapolation to man from the laboratory animal data. The BEIR Report (ref. 16) recommended linear extrapolation on pragmatic grounds. The theoretical conclusions of the present paper are that linear extrapolation to low dose levels is generally valid as a realistic yet *slightly conservative procedure*" (emphasis added). That carcinogenesis by an external agent acts additively with any ongoing process is accepted by Crump, *et al.* and by Hilberg (Hilberg, A. W., "Low-Level Ionizing Radiation: A Perspective with Suggested Control Agency Options," in *10th Annual National Conference on Radiation Control*, HEW Publication (FDA) 79-8054, pp. 386-391, 1979) in his allusion: "And, conversely because man is living in an environment of chemical additives and pollutants, these may set the stage for action of a very small amount of radiation exposure."

Most of the argument on the RSS report centered on low dose rate, low LET radiation. Alpha radiation dose response curves are usually characterized as both linear and dose rate independent (BEIR, 1972; UNSCEAR, 1977) or as possibly providing underestimated effects at low doses, (Martin Brown, J., "Linearity vs. Non Linearity of Dose Response for Radiation Carcinogenesis," *Health Physics*, 31, pp. 231-245, 1976; Archer, V. E., Radford, E. P., and Axelson, O., "Radon Daughter

Cancer in Man: Factors in Exposure-Response Relationships," Health Physics Society Annual Meeting, June 1978). No reports except the RSS report consider a threshold curve a viable concept.

129. (Page E.4, Table E.1) A column in Table E.1, headed "Environmental Protection Agency," purports to be the risk estimates used by EPA. They are actually averages for various risk models used by EPA in reports and therefore are not directly comparable to the other risk estimates in the table.

The estimates of 54 leukemia deaths/ 10^6 person-rem listed in the table were extracted from EPA 520/9-73-003-B (reference 4). As stated in that report (p. A-14), the risk conversion factors are average values for absolute and relative risks in the BEIR Report, 1972. Moreover, they apply only to the dosimetric models used in EPA report 520/9-73-003-B.

The EPA risk for thyroid listed in Table E.1, 15 thyroid cancer deaths/ 10^6 person-rem, is referenced to EPA 520/4-76-017 (reference 6). That risk estimate cannot be found the cited reference. However, on p. 96, *ibid.*, it states ". . . , a population age weighted value of 60 thyroid cancers per million rems to the thyroid was used." A similar risk estimate is shown in Tables 45 and 46 of EPA report 520/9-73-003-C, *Environmental Analysis of the Uranium Fuel Cycle. Part II—Nuclear Power Reactors*, 1973. Note that these thyroid risk estimates refer to cases, not fatalities, and so do not fit into Table E.1.

130. (Page E.7, last paragraph and page E.8, Table E.3) Newcombe's estimate of ten genetic effects based on a normal incidence rate of 0.1 percent for autosomal dominant disorders has not been supported by other studies. Current incidence estimates are about 1 percent autosomal dominant and X-linked disorders, the estimate in UNSCEAR, 1977.

The genetic effects estimates attributed to the BEIR report and EPA in Table E.3 are not comparable to those given in the 1977 UNSCEAR report since they assume a 30-year reproductive generation time. To compare the BEIR and EPA estimates with those of UNSCEAR, the BEIR and EPA estimates should be multiplied by a factor of about 0.6 to adjust for a 30-year population generation *vs.* the current, approximately 50-year population generation. More recent EPA estimates have been adjusted for the current population generation (EPA 520/1-76-010), to yield 200 genetic effects, close to the UNSCEAR 1977 estimate.

131. (Page E.9, Table E.4) The column titled "Mays 19)" may contain an error. Mays, *et al.* (reference 19) estimated 200 bone cancer deaths/ 10^6 person-rads. Using a Q of 10, this would be equivalent to 20 bone cancer deaths/ 10^6 person-rem. In a contemporary paper (Mays, C. W., *Estimated Risk from ^{239}Pu to Human Bone, Liver and Lung*, pp. 373-384 in *Biological and Environmental Effects of Low-Level Radiation, Vol. II*, IAEA, Vienna, 1976), Mays estimated (again assuming a Q of 10) 20 lung cancer deaths, 20 bone cancer deaths and 10 liver cancer deaths per 10^6 person-rem.

EPA in its guidance on transuranium elements (EPA 520/4-77-016) provided an analysis of the health impact of exposure to transuranium elements in the environment which includes both risk and dose-rate estimates for a cohort of 100,000 exposed since birth. This guidance is supplemented by technical reports, Technical Report EPA 520/4-78-010 and Technical Note CSD-78-1, which provide background information for the basic guidance document. Since the health impact calculated in these reports is based on lifetime exposure and risk coefficients for specific organs, the results are not directly comparable with Table E.4 but they are a more realistic estimate of health impact from transuranium elements in the environment.

132. (Page E.10, paragraph 6) Although BEIR, 1972 did not provide a risk estimate for skin cancer, the 1978 Stockholm meeting of ICRP suggested if a skin cancer risk is required, an estimate of 1 fatal cancer per 10^6 person rem could be used. Averaging the risk estimates in UNSCEAR, 1977, the skin cancer incidence is around 0.5 cases per year per 10^6 person-rem; with a 6 percent mortality this would be about 2 fatal skin cancers per 10^6 person-rem. The 1977 UNSCEAR Report suggests alpha risk might be higher.

133. (Appendix F) The description of the geology at the bottom of page F.2 would be improved if there were some indication of the death of the basement rocks and of the general nature of the overlying rocks.

If the maximum flood of record was 3 meters above the normal river stage, and the one in a thousand year flood would be expected to be 5 meters above normal river stage, under what conditions would the "maximum probable flood" which is 10 meters above normal river stage be expected? Is this a once in a million year flood?

There is a short paragraph on ground water, but nothing as to the nature of the aquifer—permeability, hydraulic gradients, or retardation factors. This should be included.

134. (Appendix H) This appendix could well be omitted. Many of the hazard indices quoted are of no value as indices, and there is no information to enable one to select which, if any, of the indices are useful.

Although purporting to be a basis for determining the "hazard index," the material as presented in the appendix does not even approximate the potential hazard. The MPC is derived on the basis of dose to a "critical organ" rather than on the risk related to a given intake of isotope. The cumulative risk from intake of isotopes should be used as the basis for deriving a comparative "hazard index" since organ sensitivities are the controlling factor as noted in ICRP 26.

135. (Appendix I) This appendix is deficient. It is based on leaching of the entire repository by ground water, passage of the nuclides through a rather freely flowing aquifer, and discharge into a large surface stream (10,000 cubic feet per second or 8.9×10^{12} liters per year). If we apply the generic density of population in terms of river flow from our forthcoming dose assessment report, which is 3.3×10^{-7} person years per liter, the river is capable of being a water supply for about 3 million people, a great many of whom would receive close to the maximum individual dose.

There is an apparent conflict between the basic assumptions in the main text and Appendix I. The main text stated that "... disposal in salt has been emphasized ..." (Page 3.1). However, the assumptions made in Appendix I (Page I-9) for an earlier analysis (which was the basis of the current version of the impact statement) assumed that the repository is in a non-salt media. Furthermore, some of the details of the model should be briefly summarized in the appendix. The statement, "Detailed descriptions of these models are found in references 1-7" (Page I.4), is not sufficient. There should be a brief description of GETOUT (Page I.10), as well.

The consequence analysis as it bears on geological repositories appears to be too subjective. For example, the draft continually relies on a holdup period of about 1,000 years. Yet an independent study (EPA/520/4-78-004) by an Ad Hoc Panel of Earth Scientists concludes that "The containment cannot be relied upon to effect any significant (longer than 10 years) retardation of the release of the high-level waste." While it is obvious that finite numbers must be used as input for the programs employed in this appendix, the large variation possible in much of the input data suggests that incorporation of an uncertainty analysis and sensitivity analysis in such calculations would permit a clearer understanding of possible consequences.

The criterion for public acceptability of 120 millirems per year to the maximum individual is not defensible, and population dose needs primary consideration. If the approximately 3 million people who could be supported by the river were each to receive 120 millirems per year, the population dose would be 350,000 person-rems per year or approximately 70 health effects per year using the BEIR-I whole body estimate. Although all the postulated 3 million people would not receive the maximum individual dose and although these nuclides would not produce whole body doses, there is no reason to believe that the concentration of nuclides in the river would decrease substantially as the nuclides moved down river.

The analysis uses unquoted sorption equilibrium constants. These are probably the Battelle desert soil values which may be unreasonably high. The text on page I.6 refers to "5 miles of western U.S. subsoil," which is reminiscent of the Battelle "desert soil." These sorption constants are not necessarily typical of all soils and rocks and, in any case, should be listed in tabular form.

Just as it is improper to neglect population dose in the river, it is improper to neglect individual dose to users of ground water. This is completely omitted in this section. Since the ground water velocity is stated to be equal to one foot per day, or a little over 100 meters per year, the aquifer would be expected to be a good water provider and comparable to the aquifer of Appendix F which is stated as supporting "numerous shallow wells supplying residences and farms" and also a "public water supply well" for a City. Population dose from use of the aquifer may very well be significant in addition to individual doses.

The discussion of compensating for a poor site by an extremely durable waste container in the last paragraph of page I.2 is irrelevant, since human intrusion cannot be ruled out.

The concentration on individual dose rather than population dose is again shown in the fourth paragraph on page I.3 which speaks of reducing the iodine-129 dose by a factor of 10 by reducing the release rate by a factor of 10. Population dose would not be changed.

136. (Figure I.2) Why are there zero's on a logarithmic plot?

137. (Page I.7) The leach rate figures used throughout and specifically in Figure I.3 are unrealistically low. The "hypothetical waste management system characterization" is about a factor of ten better than the values we have been given by our consultant, Arthur D. Little, Inc., and contrast strongly with the estimate of the

EPA geologist panel: "There is no evidence that incorporation into a glass will ensure resistance to significant leaching over time scales over a decade." (page 7, EPA 520/4-78-004).

138. Figure I.4 appears to require a leach time of 100,000 years for "satisfactory" (less than 120 millirems per year) operation. This may not be possible for all contained nuclides, since some nuclides are geochemically mobile.

139. (Page I.10) The notion that the dose from Ra-226 can be reduced by limiting the leaching of U-238 is incorrect. It is doubtful that U-238 migration could be controlled over its half-life (4.5 billion years).

We believe that the impact analysis is in a premature stage in this section. The analyses stated in Appendix I are divided into two categories: past work and present work. Since the present work is only partially complete, the results presented in the DEIS may be revised when the present work is completed. This may change results in the stated conclusions in the DEIS. We believe the present work should include an error analysis and sensitivity analysis.

All the references to this appendix are from Battelle Pacific Northwest Laboratories work. Has any of this work been performed elsewhere?

140. (Appendix J) Figure J.1 should be explained. Its applicability is unclear.

141. (Appendix L) The statement that devitrified glass is stronger than ordinary glass and will resist further fracturing is not as important as the potential greater leaching from devitrified glass.

In this Appendix, and in Appendix M, there appears to be no consideration of any accidental releases other than sabotage.

142. (Appendix M) The accidents leading to releases of radionuclides (Tables M.3 and M.8) are not characterized, so it is impossible to understand what is involved. The basis for release of 0.1 percent of total krypton-85 (page M.52) is not given. The total releases of 22 Megacuries of krypton-85 should be compared with the permissible 40 CFR 190 values. There is no consideration of possible radionuclide releases from accidents in a spent fuel storage facility in Table M.52. There is some discussion in Table M.61 but there is no basis for judgment as to the releases or selection of accidents. For example, there is no discussion of the effect of loss of coolant in water basin storage through failure of the tank or through sabotage.

Note also that the risk estimates, pp. M.6, M.33, M.53, M.81, M.87, *etc.*, will require revision if numerical risk coefficients are changed since all are derived from the risk coefficients developed in Appendix E.

143. (Appendix N) Estimated costs are given for transportation of spent fuel and waste, but there is no indication as to how these costs were found. The bases for these estimates should be presented or referenced in the Final EIS.

144. (Page N.13) "Doses to the maximum individual . . . and population dose are comparable." This statement does not make sense, since there is a 10,000 times difference between the maximum individual dose and population dose in Table N.12. This should be clarified in the Final EIS.

145. (Appendix O) The 1,000 year storage and surveillance assumptions used in the calculations are in conflict with proposed Criteria for Radioactive Wastes (43 F.R. 53262 *et seq.*, November 15, 1978) developed by EPA. The appendix should be revised using the proposed period of storage and surveillance of no more than 100 years.

146. (Appendix P) Ringwood and co-workers have identified a suite of minerals for use in waste disposal. Their work should be referenced and seriously considered.

147. (Appendix Q) This is a rather interesting appendix although the development of the field does not appear to be sufficiently advanced for any convincing environmental impact analysis. There seems to be a contradiction between Tables Q.4 and Q.5. In Table Q.4 a 1 meter barrier is reported to retain strontium-90 and cesium-137 for about 30 years, or about one-half life for these nuclides. In Table Q.5 a 1 meter barrier is said to retain them for 30 half lives.

The possible competition for ion exchange sites on added minerals (or natural minerals for that matter) should be noted. Canister materials are elements of the transition series, notably iron, nickel, chromium, or titanium. In Sweden, lead and copper have been suggested for canisters. The ion exchange capacity of any added materials must be enough to handle the nonradioelements as well as the radioelements.

148. (Appendix R) This is an interesting discussion but the state of development of the technology does not permit more than qualitative information.

BROOKHAVEN NATIONAL LABORATORY,
 ASSOCIATED UNIVERSITIES, INC.,
 Upton, N.Y., September 4, 1980.

Senator LEAHY,
 U.S. Congress, Russell Senate Building,
 Washington, D.C.

DEAR SENATOR LEAHY: I am writing to express my concerns on the topic of mitigation following your August 26, 1980 subcommittee hearings and at the invitation of your staff. At this first of several proposed oversight hearings on the socioeconomic effects of a nuclear waste storage site on rural areas and small communities I heard the repetitious call to mitigate impacts, but no specifics or guidelines. Behind the motherhood word "mitigate" lies a quicksand or maze of local issues; this is also true of the word "equity."

I have divided my initial concerns into ten topics. Under each general topic question I try to present, mostly in question form, issues which need consideration. The following is my initial response, more time and effort would result in a more thorough topic search and issue identification.

1. Who determines the desired quality-of-life for a community about to be impacted? Rural communities are in all stages of health, wealth, and age; some communities have been through one or more boom/bust cycles, others have achieved long-term stability, and a few even have little or no economically viable reason to exist. A community's quality-of-life is partly the result of its residents own efforts, laws, and culture, partly a consequence of one or more changeable factors such as: mineral existence or absence, industry presence, highway location, weather, tourists, governmental regulations, etc. Is the Federal Government going to assume the role of quality-of-life manipulator for possible impacted communities? Is it the best judge of what is best for local area residents? When an energy development company becomes involved in an adjustment of a community's quality-of-life it is usually for one of two reasons: (1) to persuade the community that they can be a good neighbor, and (2) to assist in the attraction and maintenance of a quality, stable workforce, good business.

2. What quality-of-life particulars will be determined necessary for impacted communities? Should there be one or ten new tennis courts where possibly none existed before? Are new fire trucks preferable to the purchase of used ones? Should national standards be used to assure a proper number of hospital beds, teachers, policemen, swings, open space, etc.? What existing structures should be torn down and what new structures erected?

3. Who pays? Prior to impact a community would have an established tax rate, this will rise as a consequence of immigrants and their service needs. If the Federal Government presses for a high community quality-of-life is it the responsibility of the residents (old and new) to bear this higher than desired tax burden? What if the community does not have any taxing authority over the repository? Will any Federal impact money be on a one time basis or guaranteed 30 year annual basis?

4. Should equity payments be made to include those who relocated to the impacted community in order to benefit from mitigation and equity payments? Equity payments are supposed to compensate those who were impacted by the repository and who will live in its "shadow." How can those who made choice to live near a repository be detached from those who had no choice but to leave the area?

5. If nuclear generated electricity users are to compensate repository area residents through equity benefits, what of coal generated electricity users providing equity to coal mine area residents? Should nuclear generated electricity users compensate uranium mining area residents too? What of area residents experiencing acid rain?

6. Will there be Federal control over area housing? If the repository jobs are to last only 30-40 years should workers be allowed to build or purchase single-family homes? Will workers be pressured to relocate in presently viable, large communities 20-60 miles from a repository site and given free transportation? Will mobile home parks with 30-40 year life spans be built with a promise that upon sealing the repository the parks will be closed?

7. Will there be Federal guarantees of compensation to those who experience problems at project completion? Would all single-family homes of workers be purchased or moved at government expense? Will in-lieu of tax payments or equity/mitigation money disappear? What of all the secondary workers and their losses?

8. Are people desiring more regulation in the lives of site area residents? Many industries, mines, military bases, construction projects, etc. open and close with little being done to mitigate impacts, except where necessary with respect to workforce recruitment or as a gesture of goodwill. Some monitoring and mitigation programs can too closely regulate and adjust resident life styles. Possibly the use of

an ombudsman or grantsman service is an acceptable alternative. Impact mitigation is necessary in rural America when a large development such as a repository is being proposed but its control must be tempered.

9. What safeguards will there be for those communities with a bootstrap or self sufficient attitude? Will some communities be overcompensated, overdirected, and altered by overanxious mitigation so that the local leaders lose control over the destiny of their community?

10. Just as planned-unit-developments failed as a housing alternative in rural America so too might an over planning of a rural community. Mitigation of community impacts must be carefully performed or the cure could be worse than the problem.

I wish to thank you for this opportunity to express my views on the subject of mitigation and equity. Your hearings are a necessary step in ensuring that a well planned, carefully conceived mitigation effort is put into action in concert with the repository. The decade of the 1970's has provided us with a wealth of actual mitigation experience that needs to be further examined in terms of success and failure, acceptance and rejection, and benefit and cost.

Your letter of August 28 was very much appreciated.

Sincerely yours,

WILLIAM C. METZ, Ph. D.,
Regional Studies Division.

STATE OF VERMONT, AGENCY OF ENVIRONMENTAL CONSERVATION,
DEPARTMENT OF WATER RESOURCES AND ENVIRONMENTAL ENGINEERING,
Montpelier, Vt., September 2, 1980.

Senator PATRICK J. LEAHY,
Chairman, Rural Development Subcommittee,
Senate Office Building, Washington, D.C.

DEAR SENATOR LEAHY: I will try to respond to your request of August 21, 1980, seeking comments on the following subjects:

- (1) the geologic potential of Vermont as a high level nuclear waste storage site,
- (2) the suitability of Vermont as a low level waste storage site,
- (3) the suitability of Vermont for an away-from-reactor storage facility, and
- (4) how the Federal Government should work with states and local communities in selecting and operating nuclear waste storage sites.

1. As presently conceived, geologic disposal of high level nuclear waste would involve a repository constructed at depths of 2,000 or more feet below the earth's surface. In simple terms these repositories must be waterproof for upwards of 25,000 to 50,000 years to allow the stored radionuclides to disintegrate to harmless levels. In my opinion the historical geology of Vermont, the current geologic conditions, and the future geologic processes that could affect Vermont within this time frame would make Vermont a very high risk area for siting a high level nuclear waste disposal site. Allow me to expand on this somewhat. Historically all of Vermont's bedrock formations have been involved in some type of tectonic (mountain building) and/or metamorphic event. What we are able to see and map at the surface indicates that Vermont's bedrock is severely folded, faulted and fractured. There is obviously reason to believe that these same structures, that impair rock strength and integrity (and thus would make it difficult if not impossible to assure that a repository would remain waterproof), prevail in the subsurface today. In fact deep water wells and underground mines (although none penetrate to depths of 2,000 feet or more) currently bear witness to the fact that ground water penetrates to great depths in Vermont's fractured bedrock. The more recent continental glaciation has caused Vermont's bedrock to be depressed under the weight of a mile thick ice sheet. Vermont's bedrock has "rebounded" regaining its original state of crustal equilibrium as a result of the loss of weight of this thick ice cover. Some would argue that the rebounding continues. This type of glaciation may not be finalized and future continental glaciation may cause significant crustal instability in Vermont and adjacent regions. The point I wish to make here is that Vermont has been subjected to "geologically recent" crustal disturbance that could be repeated within the time frame required for maintaining a waterproof repository. Such crustal movement would have the capability of breaching a repository constructed in brittle rock such as Vermont's granite or other crystalline varieties. Such a breach could occur while human populations still inhabit the region in a pro-glacial environment.

In short Vermont is a low potential, high risk area—geologically speaking—for siting a high level nuclear waste repository.

2. Our knowledge of Vermont's geohydrologic environment and the connection between sediment and bedrock aquifers is so sadly lacking that no good answer or

comment can be made regarding Vermont's suitability for low level nuclear waste siting.

It is absolutely essential that we have the capability of confidently delineating ground water divides along with surface water divides so that waste disposal facilities can be isolated from existing or potential potable water supplies. It is a plain and simple fact that subsurface waste disposal (of any sort) is compatible with the use of ground water for human consumption only if the two activities can be completely separated.

I would like to emphasize that it will be virtually impossible for a small state like Vermont to provide the necessary funding to mount the geological program necessary to reach the confidence level as stated above. Federal funding and cooperative programs with the U.S. Geological Survey will be needed.

3. Vermont currently has a successful on-site spent fuel storage facility, i.e., the cooling basins at Vermont Yankee in Vernon. I see no reason why a properly engineered away-from-reactor surface storage facility could not function satisfactorily in Vermont. Site selection should however consider an optimum location so as to minimize transportation within the state. I would visualize a facility that might accommodate nuclear power plants in Maine, N.H., Mass., and Connecticut.

4. Open and frank communications should prevail at every step of the way toward selection of a nuclear waste storage site and during the operation of the same. Perhaps the Governor's office in each involved state should be widely advertised as the only source of official statements. So often the press picks up an idle comment from some DOE underling and makes a big splash which needlessly stirs up the public. These are serious and necessary projects that can influence our lives beneficially if properly conceived and implemented. Unnecessary emotional stress can be avoided by open communications and a responsible, knowledgeable, well informed press. Sensational headlines and irresponsible editorializing have no place in these matters.

Sincerely yours,

CHARLES A. RATTÉ,
State Geologist.

SUBMITTED FOR THE RECORD BY MARK WILLETTE, WORK/STUDY RESEARCH ASSISTANT, RURAL STUDIES CENTER, UNIVERSITY OF VERMONT, BURLINGTON, VT., AT THE REQUEST OF SENATOR LEAHY

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STATEMENT OF ELIZABETH PEELE, SOCIAL IMPACT ASSESSMENTS GROUP, ENERGY DIVISION, OAK RIDGE NATIONAL LABORATORY

SOCIAL IMPACT MITIGATION AND NUCLEAR WASTE REPOSITORY SITING

Mr. Chairman and Members of the Subcommittee. I am pleased to discuss with you today some aspects of socioeconomic impacts of siting, constructing and operating radioactive waste repositories in rural areas. My background in assessment of the social impacts of large energy facilities began with my work on the first socioeconomic assessment of any nuclear facility—that for the impact statement on the proposed Mendocino nuclear power plant in rural northern California in 1972. Mendocino would have created the first and probably the only nuclear plant "boom town", but it was never built because of geological and political problems. Since that time I have helped organize and develop the field of social impact assessment and mitigation, including the organization of the Social Impact Group at Oak Ridge National Laboratory in 1975. The group conducts a program of research and assessment on social impacts of coal and nuclear facilities, community technology assessments and decentralized solar, conservation and waste management. Our social impact work has included the first post-licensing studies of socioeconomic impacts of operating nuclear power plants on host communities, (Bjornstad, 1977; Purdy, et al, 1977; Shields, et al, 1979) mitigation studies, (Peelle, 1979a; Peelle et al, 1979b) and the Hartsville work (Sundstrom, et al, 1977; Bronfman, 1977, Kerley & Segrist, 1978). We have completed more than 50 socioeconomic impact assessments, for AEC, NRC, ERDA, DOE and others on impacts of nuclear, coal, synfuels, and uranium mining and processing facilities. A partial list of group publications in these fields is attached.

My experience in the social impact area includes field work in 10 host communities, testimony in the Hartsville (TVA) licensing hearings about mitigation adequacy, designing mitigation options for Cherokee County, S.C. following an impact assessment of the nuclear power plant under construction, contributing to assessment guidelines for NRC and DOE, conducting the socioeconomic assessment for the Final Environmental Statement on the (rejected) Greene County, NY nuclear power plant (1979), reviewing numerous impact studies, serving on socioeconomic advisory committees for the Atomic Industrial Forum and Electric Power Research Institute, and papers for the CONAES sociopolitical panel and the Social Science Research Council report to the Kemeny Commission. My current work involves the socioeconomic portions of the forthcoming EIS for the proposed Savannah River Defense Waste Processing Facility, and a project to analyze and device acceptable siting arrangements for nuclear waste repositories, both for DOE. My comments and concerns on repository siting arise about equally from my past work on community energy facility impacts and mitigation and from the current waste facility involvement. The views expressed here are my own and do not necessarily reflect those of Oak Ridge National Laboratory of the Department of Energy.

I. Introduction

Rad waste repository siting is probably the ultimate example of the "inverse" tragedy of the commons. Unlike the "tragedy of the commons" (Hardin, 1968) where people overuse or mis-use a public resource (public good) such as air or water, people commonly avoid their share of a public responsibility for siting noxious or undesirable facilities which fulfill essential public purposes. This results in the "inverse tragedy" of the commons, through aversion or shunning of responsibility for "public bads". Whereas everyone agrees that waste repositories must be sited somewhere, and we will all benefit from the existence of properly managed facilities, the "not-here" response is well-nigh universal. Both tragedies occur because of the absence of institutional arrangements to regulate and limit use, and thus allocate risks and benefits in an equitable manner. This problem is surely no less complicated than that of allocating public "goods" such as air and water. This "institutional invention" task is one of the most difficult ever required, but it is one which cannot be avoided in industrialized societies which also need to site numerous noxious or other undesirable facilities for handling toxic or hazardous chemicals, municipal solid wastes, airplanes, criminals, oil refining and various chemical processes, power generation, etc.

In the absence of appropriate risk-sharing mechanisms, the risk will be borne primarily by those who receive little or no benefit from the electricity generated by nuclear reactors—namely, rural residents of sparsely populated states and those along transportation routes to the repository.

The problem of properly addressing and equitably resolving the socioeconomic issues surrounding the siting, construction and operation of radioactive waste repositories is thus a difficult and complex one. Some of its several aspects include:

- (1) public perceptions of high risk and uncertainty
- (2) limited benefits and no incentives for host areas and states
- (3) the common occurrence of "dissociations of costs and benefits" resulting from the construction and operation of most large energy facilities
- (4) remoteness and inaccessibility of the decision-making process for large energy facilities
- (5) the relatively undeveloped or non-existent state of institutions that
 - (a) provide protection and accountability for those who may be affected by siting and
 - (b) allocate the risks of "public bads" more equitably
- (6) the fact that not all risks or impacts are fully mitigable, and
- (7) constraints on DOE's present ability or authority to mitigate impacts.

All of these aspects except (6) are amenable to government action in varying degree, and even (6) can be substantially reduced by appropriate analysis and action. Addressing (2), (3), (4) and (5) and (7) in a vigorous manner which develops options and helps create the needed institutional structure should help resolve the matter and significantly reduce pervasive feelings of powerlessness, vulnerability and confusion which many citizens express relative to nuclear matters and siting of any large and/or noxious facility.

The bulk of my remarks will thus concentrate upon those factors in the social impact area which I consider amenable to government action: Mitigation of community impacts of repository siting, reducing the gaps resulting from dissociations of costs and benefits, making the siting decision process meaningful by involving those who are affected, and creating the missing institutional structures to provide protection and accountability for those affected and to allocate the risks of this "public bad" more equitably.

II. Conventional social and economic impacts are being addressed and can be mitigated

It is convenient here to separate community social impacts into the conventional (i.e. those induced by incoming workers and money) and the special (all others, including fears, changes in social structure and quality of life, aesthetic, etc.). This division corresponds roughly, but not exactly, to impacts that are mitigable (the former) and those that are more difficult or even impossible to mitigate (the latter). For instance, mitigation programs are now in operation at the Hartsville (TVA) nuclear plant and the Wheatland (Basin Electric Power) coal plant sites which involve multi-million dollar payments and technical assistance for impacted schools, fire and police, water and sewer, health and other public services as well as impacted housing, transportation, and planning systems. Though some problems have developed, these programs are generally successful in addressing workforce, public services and growth-management impacts of the construction of these large facilities. These initial efforts are significant models for future impact mitigation efforts. Likewise, it is the intent of the recently passed Energy Impact Assistance Act (S. 1699) to mitigate these same types of community impact problems, though it remains to be seen whether the fragmented sources of aid and the administrative complexities of this act will permit

timely mitigation of community impacts. In addition, much of the political and administrative leverage needed to develop and implement the mitigation measures has been undercut by the "prohibition of delay" in Section 608.

What remains untouched by the conventional impact analysis and mitigation plants are those other impacts such as changes in quality of life and social and political structure. Frankly, researchers and policy makers have avoided these difficult areas because of the absence of methodologies or policies with which to address the problems when values differ and judgments vary as to desirability of one result over another. In other words, it is much easier to identify, plan for and provide resources for additional school children or increased demands for water and solid waste services, than it is to identify, or measure changes in social interaction or local decision making patterns. It is even harder to determine whether the latter impacts are desirable or not, and what, if anything, should be mitigated. Nonetheless, changes in the community quality of life may be real, keenly felt by local residents, and irreversible. One of the most comprehensive reviews of what is known in this area can be found in the Murdock and Leistriz book on western energy development impacts (1979).

I believe that a viable program should concentrate first upon mitigating all the mitigables, thus reducing the remaining unmitigables to more manageable proportions. It is important to define carefully which is which, since many social science tasks have been left undone till now because they have been consigned too hastily to the unmitigable category. In general, we have found that local attitudes tend to be favorable toward facilities that provide employment and financial benefits, and where the perceived local benefits exceed perceived local costs. (Shields et al, 1977).

In any event, the conventional social impacts of facility siting can be identified, analyzed, and mitigated according to the best of existing practice, providing the will to do so exists, and is translated into effective, timely and reliable institutional arrangements. The principal unresolved issues here are the constraints on DOE's authority to mitigate impacts as in the Atomic Energy Communities Act of 1955, and the limited, problematic assistance offered in the Energy Impact Assistance Act of 1980, and the inconstant, shifting record of federal funding for many types of local assistance. A clearer definition and wider scope of authority for some responsible entity is necessary for such mitigation programs to be actually effective in providing aid where needed.

The DOE ONWI Socioeconomic program is undertaking an active community development program developing plans and devising methods to deal with impacts, but further enabling legislation to implement their program may be needed.

III. The biggest problem impeding equitable solutions is the institutional gap or absence of appropriate institutions

I define institutions here as that interrelated collection of laws, agencies, organizations and procedures that define responsibilities, set requirements, provide accountability and liability, and determine and limit interactions in a given area.

Some progress in institution-building has already been made in the siting decision arena where a State Planning Council and the consultation and concurrence process have been initiated by the President's February 12, 1980, Executive Order. This good beginning needs to be elaborated and extended so that the authority, functions, roles and limits to each are further defined. Localities want to be involved in decisions that affect them, rather than to learn belatedly that others in the state or federal capitals or remote corporate boardrooms have made decisions to which they can only react. The limits and structure of public participation, as well as negotiation arrangements which involve as well as protect local interests must be defined.

To counter the "inverse tragedy of the commons", more equitable arrangements for sharing the risks and disbenefits of unwanted facilities must be developed. The majority which does not bear its share of the risk or impact of these facilities should compensate those who bear a disproportionate burden.

Thus, the institutional development should include options for ample compensation for possible health or accident risks, full insurance to protect property values in the affected vicinity, and incentives to cover the uncertainties and that portion of risk borne for others who are beneficiaries but bear little or no risk. This wide differences of viewpoint concerning compensation for eleven possible repository impacts are reviewed in the Human Affairs Research Center's compensation analyses (see for instance, Cole and Smith, 1979).

It will be easier to arrange some of these measures than others, and in fact some arrangements are already being created and emplaced by states in their toxic waste management programs (see recent legislation in Kentucky, Louisiana, Illinois, Massachusetts, for example). But the effectiveness of all such measures is seriously affected by another institutional problem: that of assuring continuity and dependability of arrangements over time. Congressional deliberations on the superfund for abandoned hazardous waste disposal facilities have addressed but not resolved this issue. Who

can guarantee that needed protective and accountability arrangements will survive shifting government priorities and budget cuts for a generation or more? How do we arrange structures and mechanisms needed to protect those bearing special risks in this national interest? How do we avoid the "Indian treaty" analogy when making commitments to local areas? Perhaps contractual arrangements would provide the institutional certainty needed to be able resolution of this dilemma.

The risks to rural communities from this institutional gap and from possibilities of institutional failure or inadequacy are greater than the risks to health or safety of host area, in my judgment. Some argue that most of the past nuclear waste management failures are institutional rather than technical (Ausmus, 1979). Health risks are frequently dependent on the nature, structuring and viability of the waste management organization (Smith, 1977, Carnes et al, 1980). And of course, the institutional gap intensifies the hazard to any given community of being first. Without a developed framework for siting and compensation, there is a distinct possibility that "first" will become "only" in the present confusion, and that hazards will increase as the volume and rate of waste handling increase and original purposes are altered or expanded.

IV. Incentives to host facilities and to participate in the process must outweigh perceived costs and risks

Despite widespread recognition of the aversion of citizens, communities, and states toward becoming host to some or all of the nation's radioactive waste, there has been remarkably little attention devoted to the development or evaluation of real incentives for host areas. Some work on bidding procedures and compensation has been produced by Susskind and O'Hare (1979), Sanderson (1979). My own technical research program will be devoted to evaluation of incentives in fiscal year 1981, but there is little experience and less evaluation on which to draw.

Incentives should be distinguished from mitigation of impacts caused by repository construction, or from compensation for injury or damage caused by repository operation. Mitigation payments merely attempt to return the original party to some previously undamaged state by compensating costs incurred. Incentives provide a benefit apart from compensation for costs, and may include financial or in-kind payments as well as political, environmental or other benefits. The substantial local tax payments resulting from operation of some privately-owned nuclear and other industrial facilities provide such incentives to local hosts and/or states, depending on local taxing structures.

Incentives may need to be increased, however, to balance costs, uncertainties or malfunctions in other parts of the siting and mitigation process. If the prescribed mitigation procedures are slow and burdensome, if compensation arrangements are lengthy and uncertain, if the prospect exists of malfunctions in any other part of the institutional system, incentives will need to be substantial in order to overcome such perceived disbenefits.

The key to producing some willing host areas, or even any entity willing to participate in the process, lies in real monetary and other incentives. I doubt that much progress will be made in resolving the repository siting situation until such incentives are provided. The attention, concern, and help of the Congress is needed to address and resolve these difficult institution-building tasks.

V. What can be done to address and resolve some of these problems

Much more effort and a greater proportion of available resources will have to be devoted to addressing and resolving the institutional, equity, and mitigation problems before reduction in public anxiety and conflict can be expected.

Policy and programs directed toward this end might include:

- (1) Significant effort to (a) identify and define the differences between mitigable and unmitigable community effects and (b) reduce the number and scope of the latter.
- (2) Aggressive mitigation of all mitigable effects in a prompt, adequate and complete manner.
- (3) Compensation for risks and hazards borne by host areas for more distant beneficiaries. Develop and evaluate various options in conjunction with states and localities: payments in-lieu-of taxes, the Price-Anderson Act, various fees and taxing arrangements, bidding procedures, and contracts.
- (4) Incentives to participate and to host rad waste repositories, above and beyond mitigation and compensation efforts, providing a significant unencumbered benefit.
- (5) Development of stable, long-term, guaranteed arrangements for communities which are asked to make similarly long term commitments.
- (6) Development of additional citizen, local and state government participation

mechanisms, building upon the newly created initiatives of the State Planning Council and the consultation and concurrence process.

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