BLUE RIBBON COMMISSION ON AMERICA'S NUCLEAR FUTURE

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DISPOSAL SUBCOMMITTEE

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MEETING

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WEDNESDAY,

SEPTEMBER 1, 2010

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The Subcommittee convened at 8:30 a.m. in Ballrooms D and E of the Washington Marriott at 1221 22nd Street, Northwest, Washington, DC, Chuck Hagel and Jonathan Lash, Co-Chairs, presiding.

MEMBERS PRESENT:

CHUCK HAGEL, Chair
JONATHAN LASH, Chair
VICKY A. BAILEY
SUSAN EISENHOWER
ALLISON MacFARLANE
RICHARD A. MESERVE
PER PETERSON

ALSO PRESENT:

TIM FRAZIER, Designated Federal Official

THOMAS COTTON, Consultant to the Commission

TIMOTHY McCARTIN, US Nuclear Regulatory Commission

JONATHAN EDWARDS, US Environmental Protection Agency

MARK PETERS, Argonne National Laboratory

ROBERT BUDNITZ, Lawrence Berkeley National Laboratory

WARNER NORTH, NorthWorks, Incorporated

WILLIAM MURPHY, California State University

DANIEL SCHULTHEISZ, US Environmental Protection Agency

ROBERT NEILL, New Mexico Environmental Evaluation Group

MICHAEL VOEGELE, Independent Consultant

STEVE FRISHMAN, Consultant to State of Nevada Agency for Nuclear Projects

HANK JENKINS-SMITH, University of Oklahoma

ROGER KASPERSON, Clark University

PUBLIC COMMENTERS:

JUDY TREICHEL

MARY OLSON

C-O-N-T-E-N-T-S

C-O-N-T-E-N-T-S (Cont'd)

P-R-O-C-E-E-D-I-N-G-S

8:32 a.m.

MR. FRAZIER: All right. If I could have everybody's attention, we're going to get started.

My name is Tim Frazier. I'm the Designated Federal Officer for the Blue Ribbon Commission on America's Nuclear Future, which makes me the Designated Federal Officer for the Subcommittees.

So, welcome to the Disposal Subcommittee meeting.

And I'm going to immediately turn it over to Mr. Lash.

CHAIR LASH: Thank you very much, Tim.

Good morning. And welcome to all of you on behalf of the Co-Chairman, Senator Hagel, and myself.

I want to welcome members of the public who have joined us here this morning, and the Commissioners, and in particular the group of witnesses who are joining us today. It's an extraordinary collection of experience and wisdom and we are deeply grateful to all of you for your willingness to participate.

These kinds of commissions are only possible because Commissioners are willing to donate their time and because witnesses are willing to spend the time trying to help us to sort through complex and difficult issues.

Our focus in today's meeting is on two questions about regulation. First of all, what are the essential elements of a technically credible, workable and publicly acceptable regulation for disposal in geologic repositories. And secondly, what are the essential elements for a technically credible and publicly acceptable institutional system and process for regulating the safety of disposal. We really couldn't ask for a better set of witnesses, probably collectively 8 or 900 years of experience, in addressing those questions.

And we've asked a member of the Commission staff to begin the presentations today, Dr. Tom Cotton, with giving us a history and some background on these issues. We've suggested to Tom he take a little longer than we will ask the rest of you to present to give us this background in order to save everyone else from having to do it, and because we have the opportunity to ask questions of Tom since he's a member of the Commission.

For the witnesses, I'd observe that in past hearings we have found that the question and answer is actually the most useful part of the sessions. And so we urge you to use your five minutes of presentation to provoke us and to get a discussion started and then you'll find us a very active group in terms of asking questions and following up.

So, before we start with Tom's presentation I'd like to ask the members of the Commission whether any of you have any opening comments or thoughts as we thought out?

Allison, no?

Okay. So we will go through Tom's presentation and then the first panel before our break.

Tom, do you want to join us?

DR. COTTON: Okay. This is a daunting task, in any event. And when I look out at the audience and I know who else is going to be presenting today, it's doubly daunting. Because a lot of these people were deeply involved in all of the things that I'm going to be talking about. In fact, one of them just reminded me or said he's interested to see whether my history is the same as his history. So, I'm very confident though that you have plenty of expertise here who will fix anything that I say. So with that, let me start.

What I want to do is go quickly

through the regulatory authorities that are involved, look at the timeline of things that happened, spend a little time on the initial regulatory structure that was developed, look at a major reversal that occurred in '87 which led to legislation in '92 that set us out on the path of two separate sets of regulations, one for WIPP and everything else and then one for Yucca Mountain. And then look at those two paths and see what happened on them.

So, generally, I'm going to look at the authorities under the Nuclear Waste Policy Act, but actually the authorities existed before the Act was passed.

Under the Act, EPA sets the generally applicable standards for protecting the environment from releases from repositories. It also has hazardous waste regulatory authority, which does apply to WIPP, and applies I guess in theory also to geologic repositories, other geologic repositories.

NRC sets the requirements for licensing that are consistent with the EPA regulations and the DOE sets siting guidelines.

Now the next viewgraph is a bit of a shock. I tried to put everything on the one slide to show happened; and, yes, pretty bad. But that's the message. I mean, basically the message is this was a pretty messy process. So, let me make a couple of points.

First was it's a very long process. It started actually out in 1977 when EPA started having public workshops on the principles for regulating repositories and NRC started working on it at that time, too. And it went all the way out to right now because there are pending lawsuits against the current EPA standards.

And some other things that happened:

One is it was characterized by multiple rulemakings by three agencies going on pretty much in parallel or slightly out of sequence, like here, or let's say here.

It was characterized by major legislative interventions. At 1982 the Nuclear Waste Policy Act. 1987 with the Nuclear Waste Amendments Act which selected Yucca Mountain leading to legislation in 1992 which set us out on the two paths: One was a standard specifically for Yucca Mountain and one for WIPP and everything else.

It was also characterized by a number of court decisions which set things on their heels, and basically was a start over on some issues. One was 1987 when the original EPA standard was remanded, and another in 2004 when the Yucca Mountain standard was remanded. And as pointed out, there's pending lawsuits out here on the current standards.

What this did, all these interventions, was leave the developers of repositories without standards, without definitive standards for extended periods of time.

For example, from 1987 through '83 for WIPP and from 1987 all the way out to 2001 for Yucca Mountain to get the first regulation, and that only lasted three years and then they're back to waiting for another four years. So, it's been a fairly complex and messy process.

So, let me spend a little time looking at the EPA regulations, because actually that's, as it stands now, is the one that would apply, I think, to any repository other than Yucca Mountain, and it's different in significant ways from the Yucca Mountain standard.

The first place, it is for repositories for high level waste and spent fuel, and transuranic waste, which is what's going to WIPP. It has three components:

A containment requirement to protect populations;

Protection requirements for

individuals and ground water, and;

Then some assurance requirements that provide added confidence in the disposal, and;

It defines a controlled area around a repository and says, look, the repository engineered area and part of the geosphere around the repository and you don't expect the standards to apply inside that repository system.

The containment requirements. And this is really the heart of it. This is the primary measure of performance in Part 191.

It protects populations, not individuals, and it does it by limiting the amount of specified radionuclides that can escape from the repository in a 10,000 year-period. And they are quantities that were calculated to produce on the order of 1,000 premature deaths in 10,000 years. And EPA looked at that, they did analyzes of comparable uranium ore bodies and found that those were essentially in the same range, and that this was an acceptable level. So it's a technology-based standard. They looked at what repositories could do and said this is very good, and that's why we'll set the limits this way. And they emphasized that it was not to be interpreted as setting a level of acceptable risk that could not be exceeded.

So, they said they looked at what repositories could do based on analyses of generic repositories, they said that looks very acceptable and we'll set the standards that way.

It is a complex standard in that it regulates the probabilities of exceeding the limits instead of just regulating limits. In other words, the applicant has to show that there's no greater than one chance in ten of exceeding the limits and no greater than one chance in a thousand of exceeding ten times the limits. And this is to be demonstrated using performance assessments, basically models of the repository system that take into account all the significant processes and events that could effect the repository and it includes human intrusion as one of the events. So that human intrusion was to be treated probabilistically; you make estimates of how much would occur, that gets rolled into the performance assessment.

And concerns were raised at the time, and Bob Budnitz can tell you about it, about the feasibility of implementing that particular kind of standard in a NRC licensing processing. It wasn't that they couldn't do the calculations. The concern was can you defend it in a litigated licensing proceeding.

The 10,000 year-period was picked because on the one hand, it would be long enough to allow you to compare sites and media without being, basically, masked by the engineered barriers. They looked at significantly longer periods and concluded that the uncertainties and the predictions were just too great to be useful out to those periods. But they did endorse DOE's inclusion of 100,000 years as a point at which to do evaluations for comparing sites. Not for regulating them, but for doing comparisons.

They adopted a standard of proof they refer to as reasonable expectation, which recognizes that you can't have unequivocal proof of compliance of something like this for those long time periods.

They established protection requirements. One of them is an individual protection requirement to, basically, limit the dose to any individual near the repository. And that's 24 millirem.

And then they established some quantitative requirements with respect to protecting groundwater, and it might be a drinking water resource near the repository.

The compliance requirements were less stringent. It was only to apply for the first 1,000 years and assume that the repository was not disturbed and didn't have to use a detailed performance assessment.

The assurance requirements are designed to compensate for the uncertainties in these long-term mathematical projections. There are requirements for:

Multiple-barrier systems. They could not rely on perpetual institutional control to prevent releases;

Preferred to be located in places where there weren't resources that would attract drilling for exploratory drilling, and;

Should not preclude removal of the wastes within a reasonable time after emplacement. Now this, basically this retrievability requirement, is for safety reasons. It's not to preserve access to the spent fuel for recovery for reprocessing, which is an issue, the concept. It's purely a safety issue.

And basically this was not to be

applicable to NRC-licensed repositories. NRC was to come up with its own requirements like this. So, let's look at what NRC did.

The Nuclear Waste Policy Act specified a couple of aspects of the NRC standard:

(1) Was that it had to provide for multiple-barriers, and;

(2) It laid out three stages of licensing construction, operation and decommissioning.

Now, what's happened on reactor licensing since then is that he construction and licensing two steps has been merged into one, but it's still this way for the repository.

The key thing I want to focus on that are mentioned in the NRC standard is the individual barrier requirements. These are requirements that NRC included that had to be met in addition to compliance with EPA standard.

They required almost complete containment in the waste packages themselves for a period of 300 to a 1,000 years.

They required a minimum release rate from the engineered barrier system after 1,000 and specified a groundwater travel time minimum of a 1,000 years from the repository to the accessible environment to allow radionuclides to decay.

It also allowed for other values that could be approved by the NRC.

The purpose was to compensate for the uncertainties that were inherent in these long-term calculations. And NRC had some concerns at that point the state-of-the-art on this kind of analysis.

There were a couple of other provisions in the NRC just worth mentioning in passing:

They had criteria related to specific aspects of the site that might be favorable or unfavorable to disposal, but they weren't go/no-go criteria. They were just things to be analyzed in the course of the licensing processing.

They adopted reasonable assurance as the standard of proof; that's the standard NRC term in licensing proceedings. But they made it clear that the purpose was the same as reasonable expectation as to recognize you can't have complete proof in the normal sense of the term for these long time periods.

They included a retrievability requirement, again for safety reasons not to retain access to spent fuel.

Now, let's briefly talk about the siting guidelines that DOE came up. This was a set of guidelines that was to govern a process that was to start with comparisons of multiple sites and wind up with selecting a single site.

I won't go into the details. I want to talk about the key issue that came up, and I think it's going to come up again if we get into the siting criteria again, is use of "qualitative" versus "quantitative" disqualifying conditions about sites. And what I mean is something like a site cannot be located closer than ten miles for a fault that's been active in the last million years, something like that. The specified quantities of certain aspects of the site.

The argument in favor of that, or a big one, is that you need something very specific and clear to avoid subjectivity and to give confidence this is a fair and open process. The counter argument is that you can wind up ruling out the site that would be perfectly good, that you could do a perfectly acceptable repository at.

In the event the guidelines that were adopted emphasized the qualitative conditions for screening, but at the end of the day the final site selection was based on actual performance assessment based on the data from site characterization to tell whether it would meet the regulatory requirements.

Now, not surprisingly, there was the lawsuits. And what was then in 1987 a court vacated the disposal parts because of some issues related to the protection requirements rather than the fundamental containment requirement. They upheld the 10,000 year performance period as reasonable. They upheld the reasonable expectation standard of proof against charges that it was just too subjective. And the court said, "Look, it would irrational to require things that science can't do." And they also upheld the idea that you can have a zone around the repository in which you don't meet the standards.

So, that put the cat among the canaries, as it were and they were back with all the issues back on the table being table with a lot of things going on, a lot of people getting their oars into the water on it.

Some of the key issues were old familiar ones:

(1) Would that quantitative probabilistic standard work? Was 10,000 years just too long or too short, or just right;

Were the release limits too stringent, and the particular issue I'm going to talk about in a minute was with respect to carbon-14 at an unsaturated zone site, read Yucca Mountain;

There were questions about the NRC's quantitative individual barrier requirements and whether it was necessary, whether it would impose unnecessary costs;

There were questions about probabilistic treatment of human intrusion, which I mentioned. That there was going to be an all new performance assessment. Well, what they were learning from WIPP performance assessments was that it was looking like the assumptions that were made about how many bore holes, and I think even how big they were, in exploratory drilling over a 10,000 year period were going to drive the compliance determination. And that seemed like a little odd.

And then finally, there were concerns about what the public perceptions might be of changing the standard in midstream.

One thing I want to call your attention you. I think you have gotten summaries of it, was this report from the National Academies, Tom Isaacs was involved in it, called "Rethinking High Level Radioactive Waste Management." And I just want to call out a couple of the points they made. They weighed in on some of these issues.

They were concerned about over-emphasis on the use of these quantitative calculations to make detailed long-term performance predictions. They thought that could lead to some problems.

They were concerned about

establishing these very detailed regulations early in the process before you had all the data about the sites that you were going to be investigating, and they thought that you could wind up with standards you couldn't meet.

And they recommended a flexible approach that focused on the ultimate performance goal and then would allow some adaptation as you moved around.

Now what happened was by 1992 there was some impatience in Congress. They wanted to move on Yucca Mountain, they wanted movement on WIPP and both were held up by the lack of standards. So, we wound up with two pieces of legislation, which I'll talk about, one of which set us off with Yucca Mountain and the other set us off on a path with WIPP and everything else. And so I'll talk about the WIPP and everything else path first with the WIPP Land Withdrawal Act. And it basically told EPA to go back and fix the parts that had been remanded by the court, come back in a year with a standard, and that standard would not apply to Yucca Mountain. Well, they didn't say "Yucca Mountain." but the word meant Yucca Mountain.

They made EPA the agency to determine compliance. Prior to that it had been DOE because this was a defense DOE site.

They required compliance recertification every five years. This wasn't going to be a one shot and then it's done decision.

And they exempted WIPP from some of the hazardous waste disposal requirements, but left them subject to the mixed waste requirements that were implemented by the state, which by the way gave the state a regulatory authority over WIPP that they didn't otherwise have, which I think was important to the state.

So what happened to WIPP? Well, it worked basically. They got the rule out in a year. They changed the dose limit to 15 millirem, which one of the issues, and they bumped the compliance period on the two protection standards up to 10,000 years to match the other 10,000 year standard. Came out with an implementing rule. And basically, they certified WIPP in '98. WIPP got a RCRA certification from the state. It was recertified in 2006. And I think DOE has submitted the next recertification already, I think. So that process is working fine.

Now let's look at the Yucca Mountain path. Not nearly so smooth.

The Energy Policy Act told EPA t come up with a site-specific standard for Yucca Mountain that had a health-based standard based on dose to individuals. And it was to be based on consistent with recommendations from the National Academy. Now, I have to say this is really emotional territory I think for a lot of people and I need to explain what happened here.

This goes back to the point about

the standard being too stringent for an unsaturated zone site. The EPA standards, the release quantities were calculated looking at generic repositories in the saturated zone. Carbon-14 comes out, I think, as carbon dioxide and goes in, will dissolve into the water. And their analysis was based on that and they came up with a limit. In an unsaturated zone site which they did not analyze for the standard in determining what was feasible with a repository, it goes into the atmosphere. Because there's no water to stop it, it comes out as gas, it just goes up in the atmosphere, distributes itself around the whole world but in a quantity that violated the quantity that EPA determined.

At the same time, the doses that it produces, the individual doses, would be very, very small because its distributed throughout the whole atmosphere, and very far below any, for example the 15 millirem protection limit. But it dosed a lot of people. It was referred to at the time, I think, as "micro-doses to mega-people" was kind of the issue. And it didn't mean that you couldn't do a repository in an unsaturated zone, but it meant that it was going to take a very long waste package just to contain just the carbon-14 while it decayed. It's a 5,000 year half-life. And at the time in the debates DOE estimated it was going to cost, I think, $5 billion, something like that for a waste package just to keep the carbon-14 and meet that standard.

And that was talked about a lot on the floor of the Senate in the debates. The congressional judgment was that wasn't a good idea. The told EPA to just come with a standard that was based on dose, and based on analyses of what was reasonable levels of health protection. And then they asked the Academy to weigh in on the subject.

So on one hand there was a technical argument that you could say well this was the kind of technical adjustment that the Academy was thinking about of needing to fix something that was a standard that was too rigid and it was set before you had all the data. On the other hand, it's absolutely clear that people who were concerned about the Yucca Mountain choice would basically see this as simply cutting the regulations to fit the site: Changing the rules and supporting the predetermined decision.

So, the law put three questions to the Academy:

(1) Does a dose standard make sense?

The other two were related to that concern about human intrusion and what its impact would have. So they asked:

(1) Can you assume that if you have post-closure oversight of the repository, you can prevent it and can you supportable predictions of what human intrusion would be? But at the same time the Act, and people don't

really note this a lot, it mandated perpetual oversight of the Yucca Mountain site and it directed NRC to assume that that will work except depending on what the Academy said.

So, in 1985 the Academy came out with its report. They said, yes, a dose-based standard will work provided, and we're right back to this mini-dose problem, you will accept that the risks from these very low doses are negligible.

On the other two questions they said no. No, you can't assume in the 10,000 period you could block human intrusion. And no, you can't predict how much intrusion there's going to be. So then they made the recommendations and finding.

The big one was this one: They said you should regulate at the time of peak dose, which at that time was understood to be well past 100,000 years at Yucca Mountain. They said there was no scientific reason to stop the performance assessment at 10,000 years. The only reason to stop it would be out to the limits of geologic stability of the site, which they thought was about a million years. They said regulate based on a risk standard rather than dose, they recommended analyzing human intrusion not by trying to predict how much there would be, but just by specifying a scenario for intrusion and then analyzing it and seeing if the results were acceptable. And then they said the individual barrier requirements really were not necessary and could be counterproductive.

So, EPA came out with a final rule through a standard rulemaking process. A final rule in 2001. Adopted 15 millirem annual dose. They included the groundwater standard from the previous rule. They put in a specification that compliance could be measured as far as 18 kilometers from the repository versus, I think it had been 5 kilometers usually. It's one of those cases, it was based on analysis of the specific characteristics of the Yucca Mountain site. So in that sense, it is a site-specific requirement. On the other hand, it is clearly seen by critics as just gerrymandering the compliance system to approve the site. But that's the real risk of a flexible site-specific approach.

It retained the 10,000 year period despite the Academy's recommendation. They still felt that these long-term projections were not a useful basis for a regulatory decision. They told DOE to go ahead and do a peak dose projection, but it into the EIS so people who basically would there would see it, but it's not a regulatory test. They reaffirmed reasonable exception and they adopted the idea of a stylized approach to human intrusion.

NRC decided not to change their earlier regulation Part 60, the generic one, and they came out with a special one for Yucca Mountain. They dropped their quantitative barriers requirements, as the Academy had observed, but they pointed out that the methodology of performance assessment had evolved so well since they originally put them in, that they no longer felt the need for those quantitative requirements to give confidence. They still did require that there be a demonstration that multiple barriers are contributing to isolation, but there's no standard for each one of them. They included the retrievability requirement, again. Adopted EPA's reasonable expectation standard of proof for post-closure to avoid the confusion. And they gave guidance about how that would be implemented in the license.

DOE did the same thing that NRC did. Was they left the existing guidelines in place and came up with a special one for Yucca Mountain suitability. Got rid of all the comparative parts of the regulation. And they focused the determination on the analysis of the total system performance, not analysis of individual site characteristics. And that was actually used for the recommendation in 2002.

Naturally, once the recommendation was done and affirmed by the Congress, there were multiple lawsuits against a lot of the provisions in the regulation which were described there. The key one is the court rejected all of them except one, and that was the contention that the 10,000 standard was not consistent with the Academy's recommendation that they regulate to the time of peak dose. And they said the Energy Policy Act said you had to be consistent with the Academy recommendation. And the court looked at it and said "You're right." And basically vacated that portion of EPA's and NRC's standard and said "Go back and either fix it or get Congress to change the requirement that you have to be consistent with the Academy's recommendation."

So, they fixed it. Basically they proposed a revision in 2005. Came out with a final in 2008. I will skip over the fun time that was had in going from the proposal to the final.

They basically changed the regulatory time frame. But the way they did it was a two tier approach. They kept the 15 millirem for 10,000 years and then added a 100 millirem level for the period from 10,000 after the time of peak dose.

NRC then adopted that, incorporated it into its standards. They added some specifications with regard to how to treat climate change. And I point this out because what happens when you go to a million year standard is now you got to take into account glaciation, really major changes in climate. And it seemed inappropriate to expect the applicant to have to make the predictions of exactly what that would be. So the regulator specified that.

And they also said that the technical basis for the performance projection out to the million years, for 10,000 was sufficient for the one out to a million years. So they didn't have to go do a whole new technical basis.

So, what happened? We're done. That is what the license application shows compliance with. The process is moving along, but it's still pending the withdraw. And as I said, there are lawsuits pending. So if it does proceed, we'll be back in court on provisions of those regulations.

So, where are we? It turned out, this was an unprecedented job for the regulators. I have a lot of sympathy for them. The process was really bumpy, complex, convoluted, left the repository designers without clear standards for a long period of time, and we've evolved two different sets of regulations. One is just unique to Yucca Mountain, and that is the path where most of the regulatory thinking and development has happened, it's on the one that is now unique to Yucca Mountain. And we have one that's in use at WIPP, and potentially applicable to the other repositories.

And the bottom line is I think any new repository siting process may require further evolution and we should draw on the lessons from these two experiences. And the lessons, both with regard to the substance of the regulation but maybe equally importantly to the process we use them next time to come with whatever we're going to use.

Done.

CHAIR LASH: Thank you, Tom. That was amazingly fast and comprehensive.

And for those of us who haven't lived this process through the last 30 years, very informative. And I appreciate it.

DR. COTTON: And now we will find out how long I have. I have some questions --

CHAIR LASH: We actually have a few minutes for questions.

DR. COTTON: Oh, good.

CHAIR LASH: Members with a question? Allison?

MEMBER MacFARLANE: Tom, that was great.

I just want to hear a little bit more of your wisdom here and what do you think are some of the most important lessons taken from their experience, and how would you apply them going forward to a whole new system?

DR. COTTON: Exactly. That's for the other folks.

As I went through this and looked at it and then put together that horrible viewgraph, I think it's the process problem we really have to think about. They had multiple things going on in parallel. There was even an effort, I remember in that '87 to '92 period when somebody from the TRB had recommended to the Advisory Committee on Nuclear Waste that we consider a negotiated rulemaking to corral all of these arguments, get people to try to come up with one integrated set of agreements about what to do. And I think trying to avoid a repetition of that kind of process would be a really good thing to do.

MEMBER PETERSON: Tom, the 1995 National Academy study also included essentially a statement that EPA could adopt a standard that would be consistent with its approach to regulating other hazardous materials, which really chemicals. And that, of course, raises a whole big set of issues because the way we regulate chemicals does not really take into account long-term potential hazard. So how do we deal with societal question of the fact that we regulate nuclear waste in a very specific way, yet if you don't do something similar for chemicals, then you could have chemicals swamping the long-term hazards for people?

DR. COTTON: I don't think I'll touch that one with a ten foot pole. But I will observe, I do remember a symposium at MIT where they brought together the people dealing with hazardous waste regulation and management and the people dealing with nuclear waste. And the nuclear waste people were talking about how do you provide markers to indicate to future civilizations 10,000 years from now that there's a repository, and they were going through all of this. And after that, a fellow who was working on hazardous waste stood up and said "This is astonishing to me." I mean this just seemed crazy to them because they're thinking about 60 years, you know really short-term. Graphically there's a dramatically different approach, but how you bridge that gap I don't know. It would be a good thing for the discussion later. But I don't have an answer.

CHAIR LASH: I have a quick follow-up question to Per's. There's something I don't understand there. And then a longer question.

The follow-up question: A lot of

the hazardous wastes that are regulated in a way entirely different, don't actually have half-lives.

DR. COTTON: Correct.

CHAIR LASH: So what is the justification for taking a short-term approach? If they don't have a half-life, then they never mature, especially heavy metals, those things remain toxic in perpetuity. But we regulate them very differently.

DR. COTTON: We're just used to them.

Actually, the one place, and the EPA can talk about this, I think in the land disposal limitations that if you inject or dispose of certain toxic materials, you have to show that there's no migration from the disposal site. And that's there's no migration and they've adopted, I think, 10,000 years sort of as the limit. But that was kind of ratcheted back from the high level waste

10,000 year period.

CHAIR LASH: Tom, I have a very naive question. You were very clear that part of the difficulty here was the two-track process. There was a general regulatory process and then there was the effort to create a set of regulations that fit Yucca Mountain. And without any imputation of bad faith, you were very clear that people were doing the best that they could with the situation they had.

If our recommendations move back toward a saturated site, does that mean that this 20 years of work for Yucca Mountain is irrelevant?

DR. COTTON: No. I think there's a lot of the thinking was not just Yucca Mountain-specific. There were aspects of it that were very specific to the unique site, like the 18 kilometer boundary. There were things that having to do with the unsaturated site. But I think a lot of the regulatory thinking would be applicable they'll need to think through.

For example, NRC's evolution of thinking about barriers and they've got through a risk-informed approach to regulation. And they never went back and fixed Part 60 after they got focused on Yucca Mountain. So there's a lot of things that need to be brought in from that experience.

CHAIR LASH: Senator, do you have anything?

MEMBER BAILEY: Tom, thank you so much for that very clear and comprehensive presentation.

On the side of being a little bit naive, I want to talk about three areas really. And you can probably do them very quickly.

On the issue of retrievability --

DR. COTTON: Right.

MEMBER BAILEY: -- versus I know Per sent us something versus reversibility.

And I'm not sure necessarily the differences there.

The issue as it relates to tectonic activity or fault lines where the sites are located: Who exactly does that analysis?

And in looking at DOE and the number of sites, I noticed in your article that you wrote for a book that we had an opportunity to look at before this, talked about that initially there were a number of sites looked at and it pared down to maybe two sites, possible.

DR. COTTON: It was three.

MEMBER BAILEY: Or three. Okay. You know that better than I.

And the fact that we did not continue to look at a second site, I'd like to talk a little bit about that.

And then also looking at EPA, NRC, DOE how do you prevent it from being purely political? You talk about that in your article. And -

DR. COTTON: Carefully.

MEMBER BAILEY: Okay.

DR. COTTON: I talked about it very carefully.

MEMBER BAILEY: I'm talking advantage of you, thought.

DR. COTTON: Okay.

MEMBER BAILEY: Okay. Go ahead.

DR. COTTON: Well let me say, okay, retrievability, there are a couple of concepts. There's retrievability for safety reasons. It doesn't have to be easy and EPA said it doesn't have to be done easily, it just has to be done. And they said basically any mined repository could meet that standard.

There's, you can use another word, recoverability which is the ability to get at -- or ready retrievability, which is the ability to get it out easily. And that's what you talk about if you want to put in spent fuel and then get it back out again because you want to use it. And that's more demanding, particularly like in a salt site. The salt creeps in, it's harder to maintain that kind of retrievability.

And then I think maybe the reversibility concept there is more one of how the whole program has an ability to stop and go back and undo a decision. It's not so such much a repository, but it's how the program.

With respect to the tectonic thing. I was just using that as an example. But right now the way things would be set up is that that's the sort of thing that will be addressed in siting in general guidelines for siting of repositories. Okay.

On the second site, you know the decision in 1986 that stopped basically work on the second repository. There were supposed to be two repositories originally and two processes going on in parallel. And then that was halted in '86 because the Department had concluded that -- at least the rational was that they didn't need the second repository so soon. And then that scrambled the politics of the agreement in the Nuclear Waste Policy Act and that led to the '87 amendments.

The EPA/NRC/DOE thing, that's where I come back to the process and I throw it back to the people who were involved to talk about how there might be a way to get a credible process and is not perceived as being torqued by political considerations.

CHAIR LASH: Any further questions?

Tom, again, thank you very much. Very, very helpful.

Our next speaker is Timothy McCartin of the Nuclear Regulatory Commission. Tim serves as the Senior Advisor for Performance Assessment in the Division of High Level Waste Repository. He'll speak to us about the NRC approach toward regulations for a deep geologic repository.

And thank you. I think Tom has

set it up beautifully for you. We'd like you to be fairly brief. You can tell, you'll be deluged with questions as soon as you finish.

MR. McCARTIN: Okay. And just a procedure question: When you said five minutes, I originally was told ten. I will try to scale back to five if you'd like me to.

CHAIR LASH: No, no. I misspoke.

MR. McCARTIN: Okay.

Tom, I think you made off with the clicker.

CHAIR LASH: It's just typical of the process that we always change the rules after people start.

MR. McCARTIN: And on behalf of the NRC, I'd like to express our appreciation for giving us the opportunity to give our perspective on the regulations. Today I'll talk to the two pertinent regulations we have with respect to geologic disposal: 10 CFR Part 60 which is our regulation for all sites other than Yucca Mountain, and 10 CFR Part 63 which is our regulation for Yucca Mountain.

Having said that, I need to provide at least a small disclaimer. That we are currently in the process of reviewing DOE's license application for Yucca Mountain. I will talk to Part 63, but none of my comments should be interpreted as any indication of a decision, a view with respect to the acceptability of DOE's license application for Yucca Mountain.

And with that, I think Tom actually did go through the roles. I think just very briefly, EPA sets the standards for the releases off the site. The Department of Energy is responsible for designing, constructing and operating the repository if they are granted a construction authorization. And ultimately the burden of proof is on the Department of Energy to show that they comply with NRC's regulations.

NRC is an independent regulatory agency. We do not report to the President, such as EPA and DOE. We take that independence very fiercely within the staff. Our job is to a safety review: That's it. And that's what we are in the process of doing.

We set the regulations.

We make our license decisions based on the application: That whatever applicant applies to the NRC, we use their information.

We do ask what we call RAIs, Requests for Additional Information of applicants when they submit applications. But we base it on what the applicant provides to us.

And just as important, if a license is granted, there's inspection and oversight that the NRC continues to provide that oversight to the licensed facility.

Let's go first to NRC's generic regulations. And I'll just touch on a few of the key points with respects to the Part 60 regulations, many of which are also in Part 63.

First, as Tom mentioned, this phased approach. There's one license application but there are multiple decisions along the way at the appropriate time. Three of those decisions are: At a construction authorization phase; an operation stage which is the license to receive radioactive material at the repository, and; finally a closure stage. Throughout that process it's continual learning.

Now we do not substitute. At the construction authorization phase we have to have sufficient information to know that the repository will be safe. But there is a recognition that information will continue to come in during construction, you will learn more things. As repository drifts are excavated, you learn more things. And that information in our regulations there's ways to factor in that information at: One prior to the license to receive and possess, and at the time of closure.

Part 60 does have the multiple barrier requirement, those quantitative limits, which in the late '70s when they were first developed I will say NRC had never conducted a performance assessment for geologic disposal. There was uncertainty, so they came up with three particular values. I think the easiest way to look at it:

There was a waste package lifetime to ensure that the waste was contained during that period when the waste was the hottest and estimating the releases would be the most uncertain;

Then once packages failed, the release rates should be sufficiently low, that was the release rate part of it, and;

Then ultimately the groundwater travel time that for whatever releases, they should take a long time to get where there might be contact with humans.

That was the basis between those three subsystem criteria. Over time the Commission, there was never acceptance of those. It was difficult to implement and there were discussions going on. However, as I'll talk about for 63, when we went to revise Part 63 we did opt to leave Part 60 in place. That was done for efficiency purposes. We acknowledged in 1999 when we published the initial proposal for Part 63 that the Commission always understood they would given enough time to revise Part 60 if it needed to be used in the future. And so it was put off to the side, but there was a recognition that some of these warts, if you will, were left there.

With respect to the phased approach, let's for the same of argument say that's a 100 years from this time of construction to the time of closure. That's a fairly long time. The regulations require what's called a performance confirmation program. The Department of Energy would be needed to conduct a continue to challenge the basis for which the safety decision was made and continue to look at those properties, parameters, characteristics and challenge them over that 100 year period. All that information would be factored into the final decision to close the facility. That's where the retrievability requirement comes in with respect to the NRC perspective.

If there wasn't a retrievability requirement, let's say over this 100 years at the time of closure you finish your performance confirmation program and you really don't have confidence in safety any longer. If you couldn't remove the material, it would be kind of a worthless decision: It's not safe, but we can't get it out. And so hence, these two requirements: Performance conformation program and retrievability somewhat go hand-in-hand. So at the final decision the Commission would make to close the facility, it's a meaningful decision in that you could retrieve the waste if you no longer have confidence in the safety.

There is the program for oversight after permanent closure. It isn't relied on to provide safety, but there are requirements for continued oversight of the facility. That would be done by the Department of Energy. At the end of the day there comes a point where NRC after closure would turn over regulation of oversight of the repository to the Department of Energy so there'd be just one Government agency responsible for safety at that time.

The post-closure period, as was mentioned, is 10,000 years and EPA's post-closure standards are incorporated into Part 60. However, the standards are not the current standards at 191 today. As I said, we've left in it place. We would have to incorporate the current standards that are at 191. They're not there today in NRC's regulations.

In terms of our regulations for Yucca Mountain, as was mentioned, it's a different kind of way of estimating and looking at compliance with an overall safety measure, the dose limit. It relies on a performance assessment.

As I said, the Part 60 regulations were developed really in the late '70s. This was first proposed in the late '90s. So there was almost 20 years of performance assessment experience that had been gained at that time, and consistent with the NAS recommendations and EPA standards there's requirements for the performance assessment to be conducted to show compliance with the dose limit. Some of that:

The characteristics of the biosphere, that was the NAS recommendation that they said it was not fair to have the applicant try to come up with this biosphere, it would be more appropriate for the regulatory to come up with some of these characteristics that define how the calculation would be done. And it's those attributes of the system that are difficult to defend, if you will, in a adjudicatory hearing. It's more appropriate for a regulation such as where people live, what their diet is, et cetera; trying to estimate that for hundreds of years, let alone thousands and millions of years it's better done in the regulations.

Multiple barriers. We did remove the quantitative subsystem requirements. We did not remove a requirement for multiple barriers. It's done within the context of the performance assessment. The performance assessment clearly is relying on different attributes of the system, be it a waste package, waste form, flow of water, transport of radionuclides, solubility of radionuclides. There's a lot of attributes in the performance assessment, the characteristics of those barriers are what's required in the regulations. DOE has to explain them and defend them consistent with how they've estimated the 15 millirem dose in the performance assessment.

Okay. I will go very quick.

EPA's post-closure standards. There's the dose limit for individual protection consistent with the Academy recommendations. There's also a stylized calculation for evaluating human intrusion, and the separate limits for the protection of groundwater.

The compliance period is through the period of geologic stability, which is a million years.

Finally, what would we do tomorrow if, indeed, we are no longer working with the Yucca Mountain site? Considerations would be for:

Revising Part 60, which was put on the shelf back in 1999 with the recognition we would be given the time to revise it;

I think, as was mentioned, the Commission has adopted risk-informed performance-based approaches to regulation. In that sense, I think the quantitative subsystem requirements would be removed. We would use the performance assessment similar to Part 63;

We certainly have to conform the current Part 60 to the current 191 that EPA has that we do not have that current to date, recognizing of course that there would be three standards. Integrated release, the individual protection limit and the groundwater requirements that all represent different levels of risk.

And these would be the kinds of things we have to look at when we revise Part 60 in the future.

Thank you. I'll be happy to answer any questions.

CHAIR LASH: Thank you very much. We appreciate that.

Questions from Commissioners?

Per?

MEMBER PETERSON: I'd like to get, I think the really important question that would be one of the areas where a transition to risk-informed approach might be made, which is on the question of retrievability requirements. And, of course, the point behind retrievability is to reduce risks or that you might decide you need to reverse what you've done, or to mitigate. And the big concern I have it's just like with safety systems for reactors. You can add a safety system that causes the accident, which is sort of a perverse thing to have done. You didn't reduce risk, you actually increased risk by mandating that you had to have a safety system that then can actually initiate an accident.

The issue with retrievability requirements is that if you don't implement them properly, you could actually be forced to reverse thing because you picked a site or you engineered the system in a way that it doesn't perform well because you did it so that you could reverse it, right?

So what I'd like to know is the current standards. First, in terms of retrievability, humans can mine virtually anything out of anyplace. So it's really a spectrum of difficulty. How does the current standards, how do they set sort of what is retrievable versus not retrievable, given that it's actually just going to be really a spectrum of difficulties to be able to do that?

MR. McCARTIN: Right. And NRC's current regulations do not provide a lot of detail with respect to that. The discussion we've had over the years about retrievable is that:

(1) From NRC's perspective, it's one done for safety, that you now have lost confidence in the ability of the repository to perform its safety function. And it would be an unusual situation. And the regulations are

not intended to make retrievability easy, but you don't want the capability rendered impossible or impractical.

You're right. What makes it not retrievable? And I think that the primary thing would be the condition of the waste package, I think would be a large part of understanding is it truly retrievable. But, you know, there aren't any rigid requirements.

MEMBER PETERSON: Right. So then the second piece of the overall risk is this question of how do you make the decision. And so it seems to me that your performance confirmation, does that defer until you've emplaced everything into the repository? Or, wouldn't it make more sense to have intermediate steps where you learn from experience so that you have off-ramps because it's much less expensive to reverse if you do it early, then if you emplace large amounts of material? Again, we're thinking about this being a better approach as to try to minimize risks of high costs to reverse.

MR. McCARTIN: Yes. Well, that would be more the Department's choice of how they wanted to develop the repository.

In terms of NRC's perspective, it's what we're interested in that the performance confirmation program exists. Because recognizing, let's say approximately 100 years from the start of construction until a decision for closure, that's a very long time period. And the prudent thing to do is continue to conduct experiments, observations, tests that challenge the basis you had for the safety decision. It's not replacing it or deferring the safety decision. You have to have enough confidence. But continue to challenge those bases.

You know, there's no question that you would expect a project that long, after 20 years of excavating drifts and emplacing waste, they're going to revise some things, they're going to do things differently, they're going to suggest changes.

MEMBER PETERSON: Yes.

MR. McCARTIN: That's all part of the NRC process. The Department is free to submit amendments, suggest changes, et cetera.

So I don't know if that's getting quite to your concern. But from our perspective it just is it safe? And if economically it makes more sense for the Department to conduct, say, a ten year pilot program before they go into full, that's the Department's decision. Our focus is safety.

CHAIR LASH: Vicky?

MEMBER BAILEY: Tim, thank you.

I see that you're also on the panel next.

MR. McCARTIN: Correct.

MEMBER BAILEY: And I also was looking to see if there was another NRC representative this afternoon. So this question may not be specific to what you do, according to your title, but at what point is there public involvement in your process?

MR. McCARTIN: Well, certainly through our hearing process.

MEMBER BAILEY: And can you explain that? Can you kind of detail that for me a little bit? What's the process for that?

MR. McCARTIN: Well the first step in the process is, certainly, our regulations. And we go out for public comment and people are allowed to comment on the regulations and there is public involvement in deciding on the regulations.

MEMBER BAILEY: Is there notice of that? Is there a time period for that?

MR. McCARTIN: Sure.

MEMBER BAILEY: Is the notice only in a specific area? How is this done? Because I know the lawyers get it, I know that. But how does the public get it?

MR. McCARTIN: Well, in terms of Part 63 where we noticed in the Federal Register notice and we went out to Nevada and had public meetings in Nevada to seek public comment and explain the regulation, what it meant. We've had meetings in Nevada with the local units of governments, the affected Indian tribes with respect to their participation.

The hearing process for NRC is a formal adjudicatory process. And you have to be allowed in as a party, so you'll have to show that there's an affect on your, there's a potential for harm to be in the party you have to have, and you need to have an accepted contention: You have to submit a contention and be accepted.

MEMBER BAILEY: What's a contention?

MR. McCARTIN: A contention is something, people would look at the DOE license application and say that they disagreed with a part of that application and they believe it isn't accurate.

MEMBER BAILEY: So I'm a citizen's

group. How do I involve myself in this process?

MR. McCARTIN: Well, you --

MEMBER BAILEY: I'm not a lawyer.

MR. McCARTIN: Right. You can submit a contention to the hearing and to be a party in the hearing. Now some groups are automatically in. Obviously, the State of Nevada, they're considered a party to the hearing and others. But there are other groups that submit contentions or they can team up with other groups and submit contentions. But you do have to submit a contention if you want to be a party to the hearing.

MEMBER BAILEY: Okay. In full disclosure, I'm a former State Commissioner and former FERC Commissioner so I know their process. I'm actually giving you an opportunity just to state for the record. Because this is something that we will be considering as we look at how to make decisions on certain of these questions. So that's why I'm asking you specifically.

MR. McCARTIN: Sure. And certainly the NRC has a website for the Division of High-Level Waste Repository Safety, which is doing this, that a member of the public can go on there, see what's being done, provide comments to the staff. There are other forums. I was referring more if you want to be a formal party to the hearing where you have the ability to call witnesses and cross-examine witnesses. But it is a fairly formal adjudicatory hearing.

MEMBER BAILEY: So formal sometimes can be intimidating, but do you feel that it is transparent?

MR. McCARTIN: Well, anyone can attend the hearings and observe. There are transcripts. They are sometimes simulcast or put on the web for people to view.

Transparent sometimes depends. I think some of the contentions are very technical in nature and require a certain degree of understanding of that issue that depending on one's background may or may not be considered transparent.

MEMBER BAILEY: Okay. Thank you, Tim.

CHAIR LASH: Allison?

MEMBER MacFARLANE: Okay. I will skip my retrievability question and move right on to performance assessment.

So, you said that between the late '70s and the '90s there was great advances in performance assessment experience.

MR. McCARTIN: Yes.

MEMBER MacFARLANE: And that's why performance assessment was required to evaluate the repository. This performance assessment experience, what was it on? Was it on complex earth systems, which is what you're evaluating in the repository?

MR. McCARTIN: Yes.

MEMBER MacFARLANE: It was? Oh.

MR. McCARTIN: Well, now it depends on what you mean by complex. Now I will say I start --

MEMBER MacFARLANE: Almost any earthy system is complex.

MR. McCARTIN: Okay. I joined the NRC in 1981 to begin part of that process of developing the first computer codes for the development. We started with the SWIFT code that the USGS developed for single-leak injection. And there were certain flow codes we've done. There was work at the University of Arizona in unsaturated and saturated flow. There was a number of programs that have developed and we continue to use that capability in international benchmarking exercises; INTRAVAL was the last one for validating transport codes for waste management applications.

There's been a number of reports over the last 20 years that --

MEMBER MacFARLANE: So you believe

you can validate these assessments?

MR. McCARTIN: The word "validate" was used, but it's validate for the purpose. And we are not in the business of saying we are predicting the future. But we believe we have --

MEMBER MacFARLANE: But that you are in the business of predicting the future because you're supposed to be coming up with a specific number to meet --

MR. McCARTIN: We are not predicting the future. We are judging the safety of a repository: There is a difference. And what we're saying is we have the tools and techniques to evaluate the processes between waste package lifetime, degradation of the fuel, solubilities, transport of the radionuclides to be confident with reasonable expectation. We will never have complete assurance, but reasonable expectation that we believe this system is safe.

Will it act exactly the way that, say, someone is estimating it? You know, the odds of that are low. We hope it actually behaves much better.

CHAIR LASH: Senator?

CHAIR HAGEL: Thank you, Tim.

From your perspective is there anything that you would add to or particularly emphasize from Tom's cogent presentation and chronology this morning?

MR. McCARTIN: I guess in summary, the only thing at least from my perspective, is that most of the regulations and standards are in place. That I look at, you know certainly from an NRC perspective, the phased licensing approach, retrievability, performance confirmation. There's a lot of things in place.

What the most appropriate performance measure, which is one part of it has been the more debatable subject, and that's the one that I think will be -- you know, between the performance measure and the time period, those are the two things that continue to get, say, debate as compared to most of the pieces are fairly stable.

CHAIR HAGEL: Thank you.

CHAIR LASH: Thank you very much. We appreciate it. And appreciate the comprehensive nature of the presentation.

Our next witness, and the last witness before the break, is Jonathan Edwards, the Director of the Radiation Protection Division at EPA.

I do want to say one thing before you start. I neglected to mention at the beginning of our proceedings, this like all of the meetings of the Committee and the Subcommittees is being webcast. And also, members of the public who want to participate in our public comment session at the end of the day should sign up.

Tim, where's the sign-up list.

MR. FRAZIER: The sign-up list is

right out front. See Nicole out there and you can sign up.

CHAIR LASH: Thank you.

Mr. Edwards, thank you.

MR. EDWARDS: Good morning, Chairman and members of the Commission.

My name is Jonathan Edwards. I am the Director of the Radiation Protection Division at the Environment Protection Agency.

On behalf of the EPA and Administrator Lisa Jackson, I would like to thank the Subcommittee for the opportunity to provide information on the Agency's program for establishing radiation protection standards.

Previous meetings of the Subcommittee and the full Commission have demonstrated there is significant interest in this topic. We hope that our experience will serve to inform the Commission's recommendations as they relate to the disposal of spent nuclear fuel and high level waste.

However, as a regulatory agency tasked with specific responsibilities in this area, EPA does not believe that it is appropriate to offer formal recommendations regarding the form and content of future regulatory standards. What I mean by this is that, obviously, EPA as a regulatory agency and values its independence and credibility, looks at our role in this process as a very clinical, detached, professional setting of the standards and evaluation much like a sport referee or umpire would maintain for vested interest in the success or failure of a team or the outcome of a game.

So I would like to say is you should not take any statements that I'm making today or that my colleagues make today as advocating for or against Yucca Mountain or any other site.

All right. I would like to begin by describing EPA's overall authorities for establishing radiation protection standards.

Reorganization Plan No. 3 of 1970 which created the Environmental Protection Agency transferred certain functions of the Atomic Energy Commission under the Atomic Energy Act, and most notably the function of establishing generally applicable standards for protection of the general environment. That's Section 2(a)(6). It's important to understand two aspects of this broad authority.

First, the general environment is considered to lie "outside the boundaries of locations under the control of persons possessing and using radioactive material."

Second, this authority does not extend to the implementation or enforcement of the standards which typically falls to the U.S. Nuclear Regulatory Commission or the Department of Energy. These agencies are responsible for licensing or otherwise approving the use of radioactive material, as well as for overseeing the operational aspects of any facility under their respective jurisdictions.

EPA has issued standards using this general authority beginning with standards applicable to the uranium fuel cycle in 40 CFR Part 190, which was issued in 1977. 40 CFR Part 190 covers activities related to electrical power generation from the milling of uranium or through the extended long-term storage and reprocessing of used fuel. It does not cover transportation or disposal activities.

EPA has also issued standards pursuant to congressional directions such as those required under the Uranium Mills Tailings Radiation Control Act, that was 1978, and we refer to that as UMTRCA, a fun acronym. It always gets a laugh at briefings with our senior management.

I would now like to discuss generally the chronology of EPA standard setting efforts.

Regarding spent nuclear fuel, the Nuclear Waste Policy Act of 1982 directed EPA to "promulgate generally applicable standards for protection of the general environment from off site releases from radioactive material in repositories." That's Section 121. This particular provision directed EPA to use authority granted under other provisions of the law and did not confer new authority to the Administrator.

It is also important to understand that under the division of responsibilities laid out under this Act, EPA has no role in characterizing or selecting the site, or in approving the facility to operate.

EPA issued generally applicable standards for the management and disposal of spent nuclear fuel, high level waste and transuranic radioactive waste in 1985 as 40 CFR Part 191, as you've heard Tom talk about this morning. These standards were challenged before the Court of Appeals for the First

Circuit which remanded portions to EPA for further consideration in 1987. And you'll see what the court's findings were there. I won't go over them in detail since Tom touched upon those already.

In 1992 Congress passed two additional statutes that changed our obligations regarding these standards. The WIPP Land Withdrawal Act revised standards to address the portions of 40 CFR 191 that were remanded by the First Circuit and then applied them to the Waste Isolation Pilot Plant. EPA issued revised standards in 1993.

The Land Withdrawal Act also designated EPA to implement and enforce these standards for the WIPP, which is unique in giving the Agency responsibilities beyond standard setting. EPA issued certification criteria in 1996 and approved the facility for operation in 1998. WIPP and the Department of Energy was able to begin operation of the facility in 1999. As required by the Land

Withdrawal Act, the Department of Energy must apply for recertification every five years. EPA issued that first recertification decision in 2006 and is currently reviewing the second recertification application.

Finally, the Land Withdrawal Act specifically stated that 40 CFR 191 would not apply to the proposed repository at Yucca Mountain.

The Energy Policy Act of 1992 directed EPA to establish public health and safety standards applicable to the Yucca Mountain repository. I'd like to point out the difference in statutory language used in the Energy Policy Act as compared to the Nuclear Waste Policy Act.

As you know, the language in the enabling legislation has a significant influence on the actions of regulatory agencies, so it may be useful to see the differences here as the Commission develops it recommendations.

As noted earlier, the Nuclear Waste Policy Act directed EPA to establish standards for protection of the general environment from off site releases, which provides fairly broad discretion to the Agency. By contrast, the Energy Policy Act specifies that EPA standards for Yucca Mountain are to be "public health and safety standards for protection of the public," thus EPA's standards for Yucca Mountain were required to specifically protect public health and safety.

In addition, the Energy Policy Act specifically requires that EPA standards prescribe the maximum annually effective dose equivalent to individual members of the public. The Energy Policy Act is thus, much more prescriptive regarding exactly how EPA standards are to protect public health and safety.

Equally important, the Energy Policy Act required EPA to contract with the

National Academy of Sciences for a study and to issue standards that were "based upon and consistent with the findings and recommendation of the NAS." I highlight this provision because raised one of the more difficult questions facing both regulators and implementers of geological disposal, which is the regulatory compliance period.

The Commission heard testimony at the May meeting regarding the lengthy history of the NAS in evaluating issues related to geologic disposal. The National Academy of Sciences issued its report in 1995, and EPA followed with proposed standards in 1999. And then final standards in the year 2001.

EPA standards were challenged on several counts before the Court of Appeals for the District of Columbia Court. And in 2004 the Court rules in EPA's favor on all counts except one. The Court found that the compliance period established by EPA was not based upon and consistent with the recommendation of the National Academy of Sciences panel. The NAS recommended that a compliance standard applicable to individual dose apply at the time of peak risk; whenever that occurs within the limits imposed by long-term suitability of the geologic environment.

NAS concluded that the long-term suitability of the Yucca Mountain site would be on the order of one million years and, thus it would be feasible to project future exposures for compliance purposes for that period of time. NAS did, however, indicate that EPA may have valid policy reasons for not strictly adopting the NAS recommendation.

EPA's concerns regarding the increased uncertainty in projecting exposures for periods as long as one million years led it to establish a 10,000 year compliance period, the same as 40 CFR 191. However, EPA also required that DOE perform projections to the time of peak dose and place them in the Environmental Impact Statement to ensure that the full record was available to the NRC and the public. EPA viewed this approach as consistent with the intent of the NAS recommendation that long-term projections not be neglected as well as with its statements on its policy considerations.

The D.C. Court disagreed with this and concluded that EPA's approach was not consistent with the NAS technical recommendation regardless of its policy justification. The Court vacated the 10,000 year compliance period and remanded the rule to EPA for further consideration. EPA determined that its policy concerns regarding uncertainty in future projections could be adequately addressed by retaining the existing compliance limit for the first 10,000 years and then applying a different compliance limit for the period beyond that and up to one millions years with some additional conforming changes to accommodate this extended time period.

EPA proposed such an approach in 2005 and issued its final amended standards in 2008. These standards have been challenged and the case is currently stayed pending resolution of DOE's petition to withdraw the license application now undergoing the NRC process.

So in conclusion, with the decision to no longer pursue Yucca Mountain as the site of the repository, EPA is aware that legislation will be necessary to adopt a new course. At present, 40 CFR Part 191 would apply to any future repository developed under the general framework of the Nuclear Waste Policy Act. EPA has no intention of revising this regulation prior to issuance of recommendations from the Blue Ribbon Commission.

This concludes my statement. I'd be happy to answer any questions that you may have. Thank you.

CHAIR LASH: Thanks very much.

Vicky, maybe we'll start at this end this time. No questions? Okay.

Allison? Per?

MEMBER PETERSON: Thank you. This is very helpful information.

One issue that we face with geologic disposal of radioactive materials is the fact that some of these materials may also have chemically hazardous components associated with them too. And in the U.S. our approach to regulating the disposal of chemically hazardous materials is substantially different from that for radioactive materials. And in general, you can correct me if I'm mischaracterizing things, but we permit shallow land disposal of chemically hazardous materials at hazard levels that if they were radioactive, we would require them to be replaced into a geologic disposal. The issue is that therefore, things that we require around chemically hazardous materials can complicate significantly disposal into a geologic repository, perhaps without adding any value because a geologic repository will provide far better isolation than shallow land disposal can.

And so how do we treat this issue that once you go into geologic disposal, the chemical hazards associated with waste really should be handled in a way that is consistent with the fact you're getting far better long-term isolation because it's going in with the radioactive waste into geologic disposal? How do we rework this?

MR. EDWARDS: That's a great question.

Obviously, the strict hazardous waste disposal regulatory scheme is covered under the Resource Conservation and Recovery Act, RCRA Act. And the sub-title C part of RCRA deals with the requirements, the designs for these hazardous waste materials for the chemical disposal.

And you're right, they're not the

deep geological sites that we see examined and looked at for radiological high level waste and spent nuclear fuel. But they do have fairly strict non-migratory requirements around those particular landfills. And modeling that does take them out for several periods, certainly for the first thousand years and out to even 10,000 years. But sort of the reconciliation between the way we deal with risk assessment and risk management and regulation of chemicals and radiological elements is an area that the agency's been interested in for a while. In fact, about ten years ago we contracted a study with the Environmental Law Institute to take a specific look at this. And it was important in the sense of each of the different risk assessors and risk managers understanding better the processes.

I can't say that there's an easy answer, though, for the question you've posed. What I'd say is EPA would continue to seek input from scientists, technical experts on this particular issue. It certainly would involve environmental groups and the public and whatnot in this kind of debate. But at this point there's no easy answer for that particular question.

CHAIR LASH: I have two policy level questions for you. It seems highly likely that the Commission's recommendations will require that Congress go back and reopen the Nuclear Waste Policy Act. In light of that, and in light of the 30 years experience that the Agency now has in trying to develop a set of regulations, do you have thoughts about guidance that you would like to have from Congress that would make this process easier?

MR. EDWARDS: Well, certainly it's obvious with most folks that some difficulties over the last few decades deal with wrestling with this very complex and technical issue, and the need to weigh and balance a lot of different scientific expertise that's offered and recommendations. And, of course, accommodate the interests of the public and environmental groups, state and local jurisdictions, the tribes and all that. So, it's obviously a very difficult process to go through.

I think against drawing back from Yucca Mountain and speaking generally, success could be seen in basically four different approaches, I think.

First, the fact that you would go into it with existing environmental standards in place very early up in the process. We do have the advantage now of looking at 40 CFR 191 as the standing applicable regulation which has proven to be an effective regulation since the Waste Isolation Pilot Plant is run under that, there's a facility at the Nevada Test Site that is under that regulation. And so it's proven to be a workable, successful regulation.

So I think knowing up front what the environmental standards are so that the site investigators, the site characterizers, the site selection, the system design all the way up and through construction operation, closure and post-closure are informed very early on on what environmental standards they'll be held to and what will be required.

The second item I'd say is the importance in the process of a public involvement; the opportunity very, very early on and frequently during the process for state and local jurisdictions, for the effected citizens, for national interests to be heard in a public process.

Third, ideally it'd be a nice situation to have multiple sites, or several sites that you could look at and go through and do the technical evaluation and look at the merits of each particular site, and then the country could make its decisions based on looking at several of those different sites.

And then lastly, I would say that -- and I know the Commission probably already appreciates this, but I would highlight that within the legislative language the more binding the roles of the different functions in that language, and there could be attentions behind that, because it's binding on the back end or when the Agency or agencies go out through the Administrative Procedures Act soliciting comment and input during the regulations. So people should not interpret this as showing a lack of appreciate, for example, for the National Academy of Sciences or other advisory groups. But just understanding that the more specific you get with the rules up front in the legislation about what has to be complied it when you get down to the procedures that we go through as far as public notification, soliciting comment, weighing and balancing the particular comments the Agency becomes more restricted in our ability to respond to those things through the Administrative Policy Act.

So again, this is not to question Congress' intentions when they write those particular laws, but I'd like to just highlight that as a particular thing to consider.

CHAIR LASH: One other policy question, then. You may not want to get into this. But listening to Tom's presentation about the complexity of the process and to some of Per's and Allison's questions, it strikes me that the division of responsibility between EPA and NRC, which is basically at the boundary of the site, is unusual. It wouldn't apply in the Clean Air Act. In the Clean Air Act you would promulgate regulations that affected the operation of the facility that created the risk, not just the risk at the boundary. And that creates some of the complexity we've seen.

Not speaking for your Administrator, not speaking for the Agency but recognizing we have to think about that and how to resolve that complexity, do you have any guidelines for us as we approach those issues?

MR. EDWARDS: Well, as you know the long which set up the Waste Isolation Pilot Plant designated to EPA the authority to determine the compliance criteria and go through the certification process and recertification process. It was not easy, but EPA was able to work closely with DOE and resolve items as we go along, as well as collecting public input and scientific input, and travel input along the way. So that's gone well.

And you look at the timing in the '90s, too. We were able to move fairly efficiently into the final resolution of 191 into the 194 role, which is the compliance criteria and then into approval from just the Land Withdrawal Act and Energy Policy Act of '92 into approval of DOE's site in 1998 and then operation in 1999. So we've learned a lot from that, and it went well. But that's not to say that we don't have a lot of respect for our NRC colleagues, and they have a large staff that has a lot of experience and expertise in this area. And we've worked well with them over the years and with the Yucca Mountain rule, too.

So, we would follow, obviously, whatever the enabling legislation is in this area. So you've got sort of two examples you can look at: The WIPP, Waste Isolation Pilot Plant and the roles that were there and the Yucca Mountain scheme.

But again, one last point I would say is that in being the regulator in the sense of compliance criteria, development and certification and recertification that also has given us insight and informed us in our abilities to write regulations, too. So that has been sort of a positive feedback loop.

But, again, we would follow the

intent of Congress and the legislation.

CHAIR LASH: Per, do you want to follow-up?

MEMBER PETERSON: A quick follow on. Could you characterize -- I mean, you actually mentioned this. But there's now been experience from the licensing, construction, operation of WIPP. How valuable is that? And then there's also conjecture sometimes about changing the mission for WIPP and such. But it seems to me that it provides also opportunity to gain experience with closing a repository, which is also a technically complex thing to do.

So maybe to describe a little bit what have we learned from WIPP and does that put us in a better place to develop standards and to move forward with developing new disposal facilities?

MR. EDWARDS: Yes, I think the WIPP would be a very good case study for folks to consider and look at. Obviously, it's been operating now for 11 years. After going through the very difficult site selection and characterization process, and the site design and development, and then moving into construction and operation it's been operating for 11 years. And it's operating with a fairly safe track record. That's not to say that EPA is here advocating for the WIPP, but certainly the process has gone well.

I would say that some of the advantages that WIPP process had for EPA is that, again, since 191 was out there and we were going through the updated remanded portions, fairly early on the WIPP was able to understand what kind of environmental standards it would have to meet. And then also learned the criticality of getting in very early and talking with the local groups and, obviously, the state government and affected tribes.

One of the advantages I think the WIPP site had is generally they had local support for the facility. And that the state government was not necessarily advocating for it, but was somewhat neutral in the process. So that was an additional factor in our experiences at the WIPP.

But I think I'd wrap up by saying that it's taught us the absolute necessity of being very, very close in and talking to the regulated party, DOE, very frequently to understand every step along the way. You know, the parameters they're looking when they add, and the different approaches they use in their performance assessments; all the different factors they submitted in their certification and recertification package. And that's not to say that we, as the expression is, go tribal with them. But we have a lot of very, very productive conversations very frequently.

In fact, just off the top of my head, we meet with the DOE management, senior level management around the WIPP at least three to four times a year, sometimes even more frequently, to talk through these issues. These are the activities that EPA does around the WIPP, are posted on the web, there's opportunities to meet with us when we go out to Nevada, we set up stakeholder meetings most of the trips that we go out there. So, again, there's these practices that contribute to the success of what we're doing.

CHAIR LASH: Thank you very much. We appreciate your joining us here this morning.

We are going to take a coffee break. It's scheduled to end at 10:15. We're running a little behind, but let's start again at 10:20.

(Whereupon, at 10:07 a.m. the above-entitled matter went off the record and resumed at 10:22 a.m.)

MR. FRAZIER: All right. We should go ahead and get started.

CHAIR HAGEL: Thank you.

Welcome to our panelists this morning.

This panel that I will introduce will provide a range of perspectives regarding the regulations for deep geological repositories.

With us we have Dr. Mark Peters. Dr. Peters, thank you. Who is Deputy Director for Programs at the Argonne National Laboratory.

Dr. Robert Budnitz, Staff Scientist at the Lawrence Berkeley National Laboratory. Doctor, thank you.

Dr. Warner North, President and Principal, NorthWorks, Inc; Consulting Professor, Stanford University.

Dr. William Murphy, Professor at the Department of Geological and Environmental Sciences at the California State University. Thank you.

Daniel Schultheisz of the Office of Radiation and Indoor Air, Radiation

Protection Division at the EPA.

And our last panelist who is our old friend and familiar as of an hour ago to this room, Tim McCartin from the NRC who will participate in the discussion after each of you have an opportunity to make presentations.

Thank you again, each of you.

Dr. Peters, I'll ask you to begin.

DR. PETERS: Thank you, Senator. It's a pleasure to be here.

So, I've put together some slides. I guess the luxury of being first, probably good and bad both. I'm going to actually go through each question and just provide a quick perspective on each one. Like you say, hopefully it'll -- some of it's going to be a little bit repetitive because what I heard this morning, I actually agree with some of what I heard this morning.

So, first of all, let's start with sort of an introduction. And this follows on the discussion you started having with Tom during his presentation.

There's the existing generic set, the 10 CFR 60 and 191 regs that are general or generic. And then you also have the site-specific effort. I do totally agree with Tom. There is things in the site-specific regulations that are of broader applicability that can be brought into the general set when we go forward and update the regs. I'm of the opinion you've absolutely got to go update the regulatory basis to allow us to move forward in whatever direction we go.

I'd also say, recognizing this is a Disposal Subcommittee and I know you have a much broader charter, the disposal piece is a very important part of the fuel cycle, but there's a lot of other parts of the fuel cycle. And I know you're talking about the regulatory basis for all pieces. I could imagine, actually, an integrated regulatory basis. That may be a very difficult thing to do in policy space, but technically I think it would allow us to have much more flexibility to make decisions going down to the road.

To the specific questions, first on time frame. Again, we heard this a bit from the speakers this mornings.

There's evaluating behavior of future humans on the time scale of one million years. To me, it's just not possible.

I also don't think when you get out to a million year time frames to have quantitative demonstrations of compliance are also not defensible, in my view, technically. All the uncertainties, among other things, the uncertainties become so large it's very difficult to support a rational decision making process.

I do think quantitative demonstration of compliance is important. I think few to several thousands of years -- notice I say few to several thousands. You can argue is it a thousand, is 5,000 is it 10,000. We heard this morning about why

10,000 made sense in terms of discriminating between sites, et cetera, et cetera. I'll also remind you that internationally there's strong precedent for that 10,000 year limit, not only in the U.S. basis but also in other countries' regulatory basis, and also in what the IAEA and the NEA do. So, there is a sound basis out there for that number. I think we can debate about whether it would be a little shorter. But in terms of going out to a million years, I'm trained as an earth scientist and so we're not about predicting the future, we're about understanding the past. But I do think that you can think about in a qualitative -- I'll call it a qualitative sense about the stability of a site, what the evidence from the site tells you about how it might perform over time; how it's performed in the past and how it might perform forward in a qualitative matter. So as opposed to having a quantitative dose standard out to a million years, I would go for much more of an argument that the regulatory requires the license to go through a qualitative demonstration of why the site still makes sense.

That could be somewhat subjective, and so the regulations will have to be carefully worded. But I do think that that is incumbent upon the licensee to do that.

That, to me, isn't as strong in the current regulatory basis as it needs to be.

In terms of how you demonstrate compliance, I'm not an expert in performance assessment. I'm actually an experimentalist. I did field testing and lab testing, but I've spent a lot of time thinking about the science of performance assessment. And do find the approach that's taken with features, events and processes it's a sound process. And I think it's an important part of what we need to do to demonstrate compliance. It needs to be underpinned by experiments and process models. But I would also, and the second bullet sort of gets to what I was alluding to previously, there's other way of supporting the safety case that aren't just a quantitative performance assessment. So we need to bring those other multiple lines of evidence in, much more into the regulatory framework than we do today.

Like we already talked about, as we evolved from the generic set to the site-specific set, that's where we limit it to a more risk-informed performance-based approached. And I think that's sound.

Without subsystem performance criteria, Tim talked about that, I think that's something that needs to be brought into the general set going forward.

And finally, continuing to describe both the multi-barrier concept, defense-in-depth concept needs to absolutely to be preserved. We don't want to get into the situation where we're licensing engineering around a bad site, that's for sure going forward.

What about retrievability? We already heard that it encompasses safety, particularly from the regulator's perspective and also resource recovery. I don't see retrievability just going way. I don't see us just throwing it away. I think Per actually was headed in the right direction. I think it needs to be a flexibility framework. We can't be in a situation where we're actually picking a site because it's retrievable but it doesn't maintain long-term waste isolation like we need. And this is, I think as Tim said, the requirements right now are fairly general. In order to get a flexible approach to retrievability it will require more detailed thought and the regulations have to be very carefully thought through. But I think it could be fit into staging also as you go forward.

What about international experience? I've already alluded to this.

There's extensive experience. You've got the IAEA, the NEA and then you've got county-specific efforts. You've probably seen tabulations of all that's gone on in regulatory in terms of establishing regulatory frameworks for high level waste disposal and spent fuel disposal. So I think we should rely on that going forward. I think we have, but I think we can even rely on it more, and that's in many areas of staging, or adaptive management, demonstration of compliance. PA is an accepted approach to part of the way we demonstrate compliance international. Level of protection, which I'm not going to talk too much right now anyway. And then also time frames.

What about staging? So the statutory structure of the NWPA framework as well as the regulations have some forms of staging in it vis-…-vis two-stage licensing. Just for example, at Yucca Mountain construction authorization followed by license to receive and possess, ultimately followed by a license to close. So there's pieces there, although I would argue that that's not really embracing adaptive management in the way you hear people like Tom Isaacs talk about, or the Academy talk about it in 2003. So I think it's important as we go back to these generic regulations to ensure that we actually absolutely incorporate learn-as-you-go and staging adaptive management in the way that it's really meant. And that would include how you interact with the regulator through that process. Not the public, of course, but also the regulator.

What about other geologic repositories, other concepts, and how do you do it? Do you need, I'll call it, concept-specific regulations as opposed to site-specific regulations?

An example that was given was bore holes, and that's probably a good one. That's kind of a good one to talk through. I would argue, and it's not so different than the site-specific argument.

I would much rather see us try to develop a flexible set of regulations that would allow us to think about a range of media and concepts. That allows us to compare between alternatives. Also keep that public confidence. I think if you go down starting setting concept-specific regulations like you did with site-specific, I think you start to perhaps lose that public confidence that we really need going forward in kind of a staging approach. And then it also optimizes, I think, the way you go about screening, selecting and ultimately licensing a site.

We heard this, I think, a bit in the Q&As this morning. We really need to setup this framework before we embark on the program. You don't want to get into a situation like we already went through where you're back -- it's all my words -- we're back fitting regulations as the process plays out.

So you'd like as much as you could to have that up-front.

What about other regulatory issues? I'm not going to touch the dual reg with RCRA, at least in my comments. We can talk about that during the Q&As.

I did want to plant the seed about waste classification. And this is, actually, important fuel cycle more broadly. The current waste classification system as its articulated in the regs and the statutory framework is source-based rather than risk-based. And there's a lot of activity going on right now at the NRC, both in the high level waste space, low level waste space. DOE's looking at their own regulations. The IAEA has a very nice safety guide out there that articulates the need for a risk-based approach to waste classification. So I would actually argue that that should be on the table as part of this. And I'm a strong advocate for a risk-based approach to classification because

I think once we go down the path of down selecting to a fuel cycle, this will really allow us to develop an optimized system for how we actually dispose of the waste streams that come out of whatever fuel cycle we embark on.

I believe that's it for me.

CHAIR HAGEL: Dr. Peters, thank you.

Dr. Budnitz?

DR. BUDNITZ: Why do you run? Because I only have ten minutes.

My name is Bob Budnitz. I'm an employee of the University of California's Lawrence Berkeley National Laboratory. It's a DOE lab, and hence I work for DOE, except I don't. I'm here on my own time. DOE isn't paying me today. University of California isn't paying me today. So what I'm about to say doesn't represent at all, necessarily, any position except Bob Budnitz's.

Secondly, you should know that

what I basically do for a living is reactor stuff. I've been in the waste business for 30 years, but it's a small fraction. I'm a reactor guy. Almost all the research I'm doing at the Lawrence Berkeley Laboratory today is funded through DOE, but by NRC. I need to tell you that because when I say something nice about NRC, you have to know they're my sponsor. I'm unabashed, but I need to tell you that.

Now in ten minutes I can only say Mark did great; he said 13 things. I'm only going to say three things, maybe two.

The first has to do with analyzability. I am firmly convinced today that for the purposes of demonstrating compliance with a sensible regulation that deep repositories of the kind that are discussed all around the world can be analyzed for those purposes. And I know that Allison MacFarlane and I disagree about that. I want to tell you Bob Budnitz's opinion that Allison is in a minority in that view. I'm saying that straight to her, and I told her in the break I would.

The vast majority of people who have worked in this business for a long time believe that we can predict the future. Heck, I can't predict day after tomorrow, but we have certain scientific methods. It is the opinion of the vast majority, which I share, for the purpose of demonstrating compliance with a sensible standard, and no standard for a period time I'm going to talk about in a minute, that analyzability is here. We can do it. We do it. This is internationally understood. Overseas people are doing it. And that is, in fact, my view and I know Allison disagrees. And I'm telling you what I think the community thinks about that, and there are other members of the community can talk about what they think.

Now, the problem is how far in the future. I am firmly convinced that it is easy to do a 1,000 years. Heck, anybody that doesn't have a canister that lasted a 1,000 years shouldn't be allowed. By the way, that would allow you to put it under Central Park or under Golden Gate Park, which we don't want. But in fact, a 1,000 years is easy. Do it with a canister.

Ten thousand years using the interaction between the engineered system and the, of course, the environmental conditions. I believe that eminently doable against a sensible regulation. And if you ask me what I think about the period of performance, I think and have thought for 30 years since the Science Advisory Board of EPA that I was on recommended this, that a 1,000 years is fine in terms of how long we need to protect our progeny against this stuff considering that we're putting stuff in San Francisco Bay now that's going to get out in a 100 years, or 500. But I understand 10,000, I'm not going to argue with that because, in fact: 10,000 enables you to discriminate a good from a bad site; 10,000 isn't hard to do; 10,000 isn't expensive to do, we can do that analysis. However, a million years? Ridiculous. Preposterous. Let me describe.

In way less than a million years, if the past is a predicate for the future, the whole northern U.S. is going to be under hundreds of feet of ice. There will be no New England where I was raised. There's no Chicago. And this regulation would say you can't put something someplace because it's a few millirem above some standard half a million years from now and you have to invest extra money to make that true. Crazy. That's crazy as a matter of public policy to me.

And we're not spending even $10, never minding enough, to plan for that. And as Allison said to me in the break, how about Florida being under water in 200 years? Who is planning for that? And yet this regulation we have now -- you can finish that sentence.

I just think it's preposterous.

The analyses is doable with conditions. I mean, uncertainties get big. There's a whole lot. But it just doesn't make any sense as a public policy.

Next point -- and I just think that's way beyond.

Next point, and I don't have a lot of time here so I'm cut and go straight to the point. In my view, the idea that we have three agencies, federal agencies, setting the regulatory scheme for this is nuts: EPA, generally applicable standards; NRC to write the regulations against which a repository has to meet; DOE setting the site standards, Part 960 or 963, whatever. I don't understand where it came from. I lived it, but I don't understand the public policy purpose for having three agencies. It doesn't make any public policy sense.

One agency should be charged with setting the regulations and with enforcing the way we do with most everything else.

By the way, in some schemes we have states, but I don't think the states should play in regulation here. We have federal preemption for a reason.

It ought to be one agency. And I don't mind telling you that my favorite is the NRC. First, the NRC with its Commission system has an independence from the political process that is not true at EPA where the Administrator reports to the White House. It's not true of DOE where the Secretary is a Cabinet member, they come and go without terms.

The EPA and the NRC have technical competence, as does DOE. After all, everybody working there are feds. They're presumably on her majesty's service, and I trust their capability and their motivation, and their good intentions but in fact, having three agencies is crazy.

Now let me tell you something

about the NRC. Not just in the waste area, but all the way through. For decades they have demonstrated a technical competence and an independence, and a non-politicized approach which is very precious. And if you want to try to -- you recommend, or the Congress decides to put that someplace, the country would be fortunate if wherever it's put could establish that combination over the years. We've already got it. Have a new agency or a new place? It would be really hard to establish the independence and the technical competence, and the follow-through and all the things the NRC has demonstrated over the years.

By the way, some people don't like them because they make decisions they don't like. People that hope no reactors should ever run don't like them because they get up and put their clothes on and they run. But their reputation is stellar, in my view. Of course, I've told you they're supporting me so

I don't mind saying that. But I think that if you think hard about what the public policy purposes of having any other agency monkeying around in this business, you'll recommend that that be eliminated.

One last point, because I only have another minute.

Way back, I was the Director of the NRC's Office of Research at a time when we had $200 million, which today would be $500. Of course, the budget is now 20 percent of that because of things that have happened. That was in 1980. And I've been involved with them ever since, off and on, and they support some of my research. And it is my belief that the technical competence of the NRC's Office of Research supplemented by the technical competence in the regulatory offices like NMSS that Tim is in and the reactor people, is such a strong resource that the tragedy is they haven't been supported as well by the Congress as they should be. And part of that is because, if you don't mind my saying, because they're rate recovery business put the NRC's budget in a rate base and the reactor people went and said "Lower their research budget," which was half of the budget, "so our fees would go down." You don't mind me saying, it's candid, it's what happened.

So the NRC's Office of Research went down from here, to here, to here, to here, to here. And if you look at the research that Brian Sheron, who was here yesterday, I suppose, can support, the amount of research just counting noses and with inflation, is less than 20 percent of the amount I could support 30 years ago when I was its Director. The other 80 percent is gone. What a loss.

It's not very much money, a couple hundred million. It's a huge increase in the confidence of the Government, and therefore our society, to understand these issues. Okay? I say that with all due respect. I told you they support me.

Now, a couple of other things I want to say. I've been involved from the beginning. When I was the Director of Research and the Deputy before that when Part 60 was under consideration in 1979 and '80, I was the Director of Research at the top of the Agency; there are only three statutory offices, I had one of them, when we were debating what Part 60 should have in it. And a couple of years later when EPA came out with a draft 191, there was a Science Advisory Board Subcommittee that I was on which advised the Administrator of EPA about that. They didn't follow our recommendations. I was on that Academy Committee. I was on a review committee for a decade with Tom Cotton and Tom Pigford and others looking at WIPP. I've been involved in this thing off and on for, I don't know, 30 years with all sorts -- I've advised EPA about their 197 standard. Even though I'm a reactor guy, I've been involved for a long,

long time. And I want to tell you, good hard working people working very, very diligently with the best interests of the public in mind have in many instances been stifled by the clumsiness of this cockeyed scheme that Congress put in place. Okay?

By the way, it was historical. In the EPA enabling legislation they inherited the old FRC, Federal Radiation Council guidelines about generally applicable. So they got it. Meanwhile, it had been in the AEC, but they took it to them. And then when it came to AEC splitting, they never got it back to NRC. It's nuts. It's history.

DOE's siting thing, Part 63 later changed. Came from the time when there were going to be nine sites and they had to compare them. But, you know, that should have been all the way a regulatory, not the developer's scheme. It just doesn't make any sense. And yet we wrestled with it. And most of the clumsy intellectual work that came out was a direct result of the fact that politics and industry, and the like -- can't go against that, but I'm just telling you. Have lead to this stifling of what good hard working people have been trying to do to come up with sensible regulations.

Okay. I'm done.

CHAIR HAGEL: Dr. Budnitz, thank you for your mushy commentary. We appreciate your --

DR. BUDNITZ: We're even.

CHAIR HAGEL: I know that Allison will probably have something to say later on.

DR. BUDNITZ: She and I have known each other for a long while.

CHAIR HAGEL: You have fulfilled every expectation we had already about our panel. So, thank you.

DR. BUDNITZ: Am I done?

CHAIR HAGEL: Well, I don't think so. You're probably not. But right now you're done.

DR. BUDNITZ: I'm fine. Thanks.

CHAIR HAGEL: But we'll get back to you. Yes. Yes. Thank you. Thank you.

Dr. North, you may assume the podium, or sit there, or dance, or whatever you'd like. Welcome.

DR. NORTH: I think I will sit here and I will not dance, and I will not sing.

I thank the Commission for inviting me to appear here. I appear here as an individual. And what I will say, I say on behalf of myself rather than any organization with which I am now or in the past have been associated.

I have put up the six questions that were posed. I'm going to speak generally about these, especially the first two in ten minutes. Given the complexity of the regulatory situation and its history that you have heard, I cannot possibly go into detail. But I would like to make some points about major themes, and I will do that within my ten minutes.

I had the honor in 1999 with an international conference leading to the 2001 National Academy report "Disposition of High Level Waste and Spent Nuclear Fuel." We started with an international conference involving about 200 people, I think a dozen of which are participating in this meeting today. We had 17 countries represented. And then a group of us chartered by the Academy, 12 representing seven countries, put together this report.

I'd like us to reflect what does the cover picture represent? I suspect maybe one of you on the Commission might have a good guess. It's a picture to illustrate geology and a major point in the geology.

In the front piece of the report there is a quote that goes with the cover art, and as Chairman one of the few things that a chair can do unilaterally within the National

Academy system is choose the cover art and explain what it represents.

So, the movie the "Gladiator" had just been playing and I looked up some history of Marcus Aurelius, and here is the quote. "Time is a sort of river of passing events, as strong as its current."

Well, does modern science and our understanding of geology endure much of what we understand has been developed in the last 50 to 100 years, or does it get swept away? Now this was said 2000 years ago.

When we look at this landscape created by glaciers, the last of which was about 11,000 years ago, I think it gives us a sense of geological time versus human time.

At our 1999 workshop I thought one of the best lines was: "What can you trust: rocks or people?" In geology we've learned to understand what happens with rocks and water moving through them as events occur over time scales of the order of a million years.

Predicting how people will behave, even on a time scale of a year or a decade, certainly for a century or a millennium, is extremely hard and we have very little basis on which to make such predictions.

Now let me turn to performance assessment, which is the area of my expertise. I'm trained in risk and decision analysis.

In this report there is very extension discussion of what is performance assessment and how does it relate, not just to the situation in the United States, but all the various countries that are trying to develop repositories as a long-term solution for high level waste. The report concluded that geological disposal is the only long-term solution and we very carefully used the term "disposition" to mean active management before a repository was sealed.

Now there are many themes in modeling and performance assessment, and this will get into the Budnitz/Commission

MacFarlane debate, et cetera. In my limited time I will give you one quote written in the first report of the Nuclear Waste Technical Review Board when I was an initial member of this organization, and we wrote our first report to the Secretary of Energy and the Congress on performance assessment.

I will note a few themes which I've highlighted here. First of all, you can't just do it by data collection. It involves models and expert judgment. It is an extremely process to try to make an assessment of what I will call the safety case for a repository.

We criticized the Department of Energy in this statement because we didn't see enough about peer review. Our organization was, I believe, set up at the instigation of your fellow Commissioner Phil Sharp when he was serving in Congress. And I feel reflecting on my own experience with it for several years and its history ever since, which my colleague can discuss next, that this institution was a very valuable addition to the overall process.

So, we need peer review. And we need to be able to deal with the controversies, how the public sees the acceptability of a nuclear waste repository or a storage site.

There is a great deal that has been written on social trust and credibility. You will hear some of this in the second panel today. I've listed a few things which I think would be extremely useful background for you if you haven't read them, including Chapter 5 of this report.

I will now go to the six questions. In my judgment, with respect to Yucca Mountain in particular and to a much lesser extent on other sites, I believe the present regulations are adequate and is a decision criterion for the application for a construction license. I believe that the

Nuclear Regulatory Commission is extremely sophisticated. And I think you've heard from my colleague, Dr. Budnitz, on that. I support that. The state of this art has gone far enough that I think a reasonable decision can be made on that license application. I hope that decision process goes to a conclusion because I think to the extent it identifies problems, it would be a very useful learning exercise even if Yucca Mountain does not go forward.

Point Number Two: I believe that relying on regulations and compliance with the regulation is inadequate for having the enduring consensus among the public and the political leadership that we'll need over a time scale of the order of many decades to a century for the process of selecting a site, getting a construction license and placing waste, and then the final decision to seal the repository and stop active management.

Now with respect to other points,

I favor flexibility very strongly, and therefore I favor retrievability. And I favor a phased approach to developing a repository with adaptive management and many decision points. Details are laid out in this report, and many other documents.

I will conclude my ten minute presentation, I think I'm still on time, with this quote from the 2001 report. "Measured against the frequency of changes in government leadership in democratic societies, the time necessary for implementing the high level waste policy is extremely long. For a policy to remain place over this period, it must have broad and enduring public support."

Think about regulating our airline industry to achieve the kind of exemplary safety record that they have achieved. That's been done with extreme diligence to learning and adapting, and re-engineering both the human side and technical side. I would submit we need a similar process. Extreme diligence in getting good science and engineering, transparency involving the interested and affected parties in the decision process, and in understanding the basis for decisions. And doing this is an evolving way with the science over the long time period involved.

Thank you very much.

CHAIR HAGEL: Dr. North, Thank you.

Dr. Murphy?

DR. MURPHY: Thank you.

I've probably given thousands of lectures, and I've never read one. But given the circumstances today, I'm going to read this. It's unique in that regard.

I appreciate this invitation and the opportunity to share my ideas with the Commission.

I'm a geochemist and a Professor geological and environmental sciences at California State University, Chico. I've worked on problems of geologic disposal of high level nuclear waste for about 25 years. And I advocate permanent geologic disposal as a feasible and proper solution to the problem of high level nuclear waste.

I'm currently a member of the U.S. Waste Technical Review Board, which is supporting my participation here. I'm very grateful for that support. And I'm very pleased to be on that Board. It's been very rewarding for me. But I want to make it clear that the opinions I express here are entirely my own and don't necessarily represent any agency.

I'm also a technical administrative judge on the Atomic Safety and Licensing Board Panel of the U.S. Nuclear Regulatory Commission. But in that role I've been separated from anything having to do with high level waste because of my long involvement in high level waste. And certainly I don't represent them here.

Given my limited time, I'll turn

immediately to provide some personal comments related to the questions that you posed.

The first comments are on time. The time frame for permanent geologic disposal and its regulation has to be considered objectively in relation to the half-lives of the radio nuclides. And I'll take two, for example, that are particularly notorious with regard to their geochemical transport characteristics: Iodine-129 with a half-life of 16 million years and neptunium in the five-valent state, neptunium-237 with a half-life of 2 million years. These are objective times that have to be considered.

Geologic systems are relatively well understood on time scale on million year time scale. And a million year time frame is realistic, in my view, for technical evaluations of geologic stability and for evaluations of geologic isolation of nuclear waste.

On the other hand, a million years

is a completely unrealistic human time scale. Our species has only existed for, perhaps, 100,000 years. So, it's unrealistic, and nevertheless I think it's amazing not necessarily incredible, but amazing and certainly unprecedented that ultimately the principal isolation mechanism for the proposed Yucca Mountain repository was the engineered Alloy 22 container. That's amazing.

I've been interested in studies of natural analogue systems; natural systems that are analogous to repository systems, mostly for Yucca Mountain. But I think the Cigar Lake uranium deposit in particular, which is in Saskatchewan is especially interesting to illustrate my geologic perspective.

This uranium deposit is described as the world's richest uranium deposit. The primary mineralization is uraninite, which has the crystal structure and chemical composition essentially of spent fuel. It's very similar to spent fuel.

And the deposition of that mineral occurred 1.3 billion years ago. It's presently about 430 meters below the ground surface. And according to the literature, I'm not an expert at Cigar Lake particularly, but according to the literature there is no surface geochemical or radiometric manifestation of this richest uranium deposit at the earth's surface, 400 meters. It's an area that's very far north. It's been glaciated repeatedly. And this kind of observation makes me as a geologist comfortable with the idea of a billion years of geologic isolation, which is obviously far more than regulatory concerns need to take into account.

So on the issue of compliance, I thin compliance relates to public confidence: Confidence in safety. Compliance needs to be based on confidence.

From a technical perspective, confidence in performance or safety of a geologic disposal of waste can be achieved through multiple lines of technical evaluation that tend to converge on the same conclusion. That's a scientific process. There's lots of lines of reasoning: Site characterization, for instance geological stability, engineering design and assessment, laboratory and fuel scale assessment, theoretical modeling, performance assessment modeling including performance assessments and natural analogue studies. When the composite of these multiple lines of reasoning come to comparable conclusions, then my confidence is increased. My confidence is increased when multiple lines of evaluation tend to make the site look safer as understanding increases with time.

I lose confidence in the system if the trend seems to be that the more we know about the system, the worse it looks.

My sense of confidence is also diminished as political or economic interest supersede technical and health interests, which is a pattern that seems to be impossible to avoid in the nuclear waste management field.

Retrievability must be considered in my mind in the context of the individual geologic or engineered system. Retrievability may be relatively impractical for certain system like deep bore hole disposal or sub-seabed disposal which might otherwise prove to be very technically credible systems for geologic disposals of nuclear waste.

In recognition of inevitable social instability of the time scale of the hazard of high level waste, retrievability is a potentially hazard feature of a repository. In my mind, a good geologic repository should disappear, literally. It should become invisible to society for the benefit of future societies.

The concept of retrievability for the purpose of maintaining access to a potential resource has to be considered completely separately from the notion of retrievability for the purpose of judging the safety of the system.

In the present state of high level waste management in the U.S. I thin that geologic site selection needs reconsideration. I think there are many potentially excellent sites. And the often asked question: What's the best site is really an inappropriate question. We don't need the best site. We only need one that's good enough and to have confidence that it's good enough.

With regard to regulations concerning siting, there were requirements developed by EPA and NRC and DOE. For example, EPA required comparative performance assessments for long times to be part of the site selection process. NRC required a balancing of favorable and potentially adverse conditions in evaluating the sites. And the DOE listed disqualifying features. But all of this went by the wayside in 1987 in the

Amendments Act which derailed the site selection process.

All these siting regulations were abandoned in the aftermath of the Nuclear Waste Policy Amendments Act of '87. And there's a lot of international guidance, I think for instance from IAEA on siting guidelines.

And that's the end of my comments. Thank you very much.

CHAIR HAGEL: Dr. Murphy, thank you, sir.

MR. SCHULTHEISZ: Thank you for the promotion, Senator.

I have to state categorically before I begin that I have no opinions of my own. I'm representing the Environmental Protection Agency. So anything that I say can't be attributed to me directly.

I'm only going to focus on a couple of the question, those that were most important for the EPA as we considered developing the standards and particularly the Yucca Mountain standards over the past few years.

So, first, just in general why are regulations are necessary? Why are we having this discussion? And the primary purpose of geologic disposal, as has been mentioned a couple of times here, I think is to contain the waste and isolate the radio nuclides from the biosphere for long periods of times. The regulations provide the framework for developing a robust disposal system, one that can respond in a variety of situations, potential scenarios.

So as we regulators as EPA's job, we see that our purpose is to devise a reasonable test of the disposal system to see how to evaluate the containment and isolation capability of the site, and the engineered barriers that are integrated into the site characteristics. So the standards that we develop basically provide performance objectives against which to evaluate the site's isolation and containment capabilities. We're really not about predicting environmental impacts or future health effects. It's really everything is geared towards an evaluation of whether the site has met this test for the period of time and under the conditions that we've prescribed.

So in general, there are several different types of standards that have been used here in the U.S. and international. Projections of risk or dose to a designated receptor is probably the most common. It is the most explainable, and people understand it better and can relate it to other standards. So it is one that is frequently used.

The movement of radio nuclides into the accessible environment from the repository over a period of time is another one that we've used in the containment requirements discussed this morning by Tom Cotton.

Concentration of radio nuclides in an environmental media is yet a third way of looking at the containment and the isolation ability of the repository such as our groundwater protection standards.

One of the difficulties is that these latter two types of standards aren't directly related to impacts to humans, estimations of public health effects or public health goals. And so they are sometimes harder to explain as to how they determine safety.

So the question of how long standards should be applied is obviously one that has generated the most strongly held opinions and expressions of disbelief that you've heard today. But in general there's growing acceptance that periods up to one million years have to be looked at in some way. There's really no consensus as to how to do that, whether it's apply quantitative standards, look at it more qualitatively. In the Yucca Mountain rulemaking in 2001 we took the approach of a quantitative standard up to 10,000 years and beyond that the projections had to be done and placed in the record, but there was no compliance standard applicable to that. And the D.C. Circuit Court of Appeals did not agree with that approach, that it met the statutory requirements that we were operating under.

The problem with that is that there are, as you've heard, significant uncertainties in projection dose and risk over periods of time approaching a million years. So this becomes increasingly problematic in terms of what the standard means, what the projections mean and how they relate to the capabilities of the site.

There have been some suggestions that indicators relying solely on the geologic capabilities may be more predictable, and therefore more useful in showing compliance such as containment requirements, which is one of the reasons why we established those in

1985 as the primary protection requirement. And in 1982 it was, in fact, the only requirement that we proposed. We did not propose individual dose standard at that time. We thought that the geologic projections would be more defensible and less uncertain then trying to deal with what happens when the radio nuclides reach the biosphere.

So as far as EPA standards are concerned, we have two end points that we could look at:

The 10,000 year standards in the Part 191 generally applicable rulemaking. Was upheld by the First Circuit in 1987. It was challenged and was upheld. On the other hand;

The one million year standard that we established in 2008 for Yucca Mountain in Part 197 is a site-specific based on site-specific direction from Congress and a site-specific recommendation from the NAS. And as such, it really has no legal applicability to any other site.

And a key question here is the question of intergenerational equity. What is our obligation to future generations? How long does that apply? What necessary to carry out that obligation?

In general, those obligations are to minimize the burden on future generations and to minimize the impact on future generations to the extent that we can. But the extent that we can applies not only in terms of time, but also in resources that we have to invest to try to reach some standard of protection for people in the very far future. And so the question really is: What is it in our power to achieve over these time frames that we're discussing? There is no question we have these obligations, but what really can we achieve?

In terms of demonstrating compliance, performance assessment generating results that are compared to quantitative standards in terms of risk or dose. They can generate the numbers. We can compare the numbers. That's fine. But, a regulatory judgment, as I thin we've heard several times before, can't simply rely on the comparison of a generated number to a standard and say pass/fail, up/down, hit or miss. It's much more complicated then that. Foresight may be able to engineer compliance for 10,000 years through applications of all sorts of enhanced materials.

At the same time, if you're looking at a million year time period, in the year 900,000 if you've exceeded this standard by a few millirem, is that unsafe and how do you reach the judgment that that's really unsafe?

We cannot prove that these projections are correct. So what EPA has done, as you heard this morning, we require a reasonable expectation that the standards will be met based on the full record before the implementing agency, which in the case of

Yucca Mountain is the NRC.

So, in terms of performance assessment that's really the tip of the iceberg in terms of everything that has to be considered in reaching a regulatory judgment about the capabilities of the site and disposal system including site characteristics, history and stability, the conceptual site model, field and laboratory studies involving the chemistry, geochemistry, materials that you are using in the engineered barriers, natural analogues studies, was mentioned here, the mathematical models how complex they are, how they get simplified to try to implement to a regulatory requirement; a reasonable expectation that covers all of these and many more things.

And as I say, in the far future the meaning of the projections in terms of dose and risk is increasingly questionable. You're running into large scale geologic climatic variation that you need to try to account for. And so we have this one simplifying assumption, which is that human behavior in the future will be the same as it is today. The level of the technology will be the same. The level of medical knowledge will be the same.

One thing we can say about this is it is almost certainly wrong: We can pretty much say that's the truth, but we can't say what will be right.

So, the NAS in their advice to us said there's no scientific basis for distinguishing one future from another, so use today's society as a basis for looking at the standard.

So in this case, dose and risk provides a benchmark. It's not a prediction. It's not really a calculation of health effects, even though that's the metric, that's the language we have to talk in some ways. It really cannot be viewed in that same light.

So, looking internationally what

can we learn from others? There are a handful of countries that have standards that they have issued. Nobody has implemented them. The Yucca Mountain license application is still the only one that has been submitted.

The Swedish regulatory authority anticipates that we'll get an application either by the end of this year or early next year. And they are the closest to being implementing of any of the sites.

So here there's a variety, these are just general metrics that are used by these countries, a variety of dose risk, time frames, several thousand years up to a million years.

10,000 years in the case of France with calculations considered thereafter.

Germany uses lifetime risk for a million years or annual dose depending on how you want to do it.

The U.K. is very up-front. They've established a risk guidance level.

They say that it's really not appropriate to establish a standard or a constraint. We'll use a guidance level and we'll decide whether that's good enough. And they actually used the words "good enough" without really describing it.

So all of these other countries, they emphasized the increased uncertainty and the use of supplemental or qualitative information.

Over very long times there's an implied if not an explicit flexibility in how the standard is interpreted over very long times.

They address unlikely or disruptive scenarios in a separate analysis; sometimes there's no standard applied.

They apply a critical group, some sort of approach. A high end group of people who hare highly exposed but not the most exposed person. It's a little unclear as to whether Germany is using that or not, but they do talk about individuals associated with the repository.

And the standards that EPA has issued, both in Part 191 and Part 187, take conceptually similar approaches to this.

And just as a last slide, the references here. Really the best way to understand how EPA has done this over the years and the extent of our thinking in trying to respond to these issues is in the regulatory record. The Federal Register notices for the proposed and final rules and then the detailed responses to comments that we submitted on both Yucca Mountain rule makings go into it. But a lot of detail about the international standards, about the thinking, our thinking about applying the standard as a quantitative limit for 10,000 or a million years. So I would encourage the Subcommittee to look at those and see how EPA has really drawn out its reasoning over the past almost 30 years now.

And that concludes my presentation.

CHAIR LASH: (Off microphone question.)

MR. SCHULTHEISZ: Yes. There's a section in the 2008 response to comments that goes into some details on the international standards.

Now I'll point out that several of these were issued within the last year. The U.K., Germany and Switzerland all issue their standards in 2009. The Swiss standards were an update of the previous standards, and didn't change all that much. But there are some that we did not address because they came out after our standards.

CHAIR LASH: Thank you very much, Mr. Schultheisz.

So. we've particularly structured this because we wanted to have the opportunity to direct questions to all of you, and also to hear your interaction with one another.

Mr. McCartin, we'd assumed that your statement earlier would be your statement. Did you want to --

MR. McCARTIN: I had a few remarks I was going to make.

CHAIR LASH: Okay.

MR. McCARTIN: But I don't have slides.

CHAIR LASH: Let's give you a few minutes to make a few remarks. But we want to have a chance to get interaction between you and us.

MR. McCARTIN: Okay. Briefly, I guess there's three quick topics I'd like to talk to, and well let me narrow it to two: Performance assessment and public acceptability of regulations.

And I'll say with performance assessment, as I said before, I started in NRC in 1981 as the beginning of implementation of a performance assessment capability at NRC. In that capacity I was made the technical lead for developing the Yucca Mountain regulations. And the key to the regulatory improvements, as I will call that, in increasing the efficiency and effectiveness of NRC's regulations of geologic disposal, what you saw was the use of performance assessment to focus on those items most important to safety.

The previous regulations, Part 60 had a number of prescriptive requirements. Did that make it safe? Well, they were requirements. You had to meet those. And there was always debate. And at the time they were promulgated, it was felt that that was the best that could be done. However, with the emergence of performance assessment you saw Part 63 move, based on the NAS recommendations, let's look at the performance assessment as an overall compliance measure.

As Dan was suggesting, this is not oh, does it meet 15 millirem and we're done? No. It is far more than that.

What appropriately in my mind from

an efficiency and effectiveness standpoint, what that performance assessment does is you now develop an understanding of how the repository will behave. DOE has to identify the barriers important to waste isolation. Well, what are the things you're counting on? This performance assessment is a way to encapsulate those things that are important to performance.

Previously, as I saw over the last almost 30 years now at NRC, if you went to a geochemist, the problem was a geochemical problem. If you went to a hydrologist, it is a hydrology problem. If you went to a materials person, it was a materials problem.

What the performance assessment does is integrate all this thinking to the end-product of dose. Well, what really are we relying on? What's significant? And so the performance assessment provides that integration.

Absolutely critical to the

performance assessment is the discussions, the support from all the other scientists and all the other disciplines do you agree. From a geochemistry standpoint you look at all the factors, all the complexities; it's really the pH that's driving this.

You can narrow things down. The repository has no moving parts. If you are at a good site, there should be a limited number of things that you're relying on and you have high confidence in to get you to safety. I believe that that's what the changes that resulted in Part 63 was take the benefit of let's focus on those things are most important to performance. The performance assessment is a way to encapsulate this. But trust me, there's all kinds of supporting information.

If you say something, there's a simplified model in the performance assessment. There can be laboratory experiments, field experiments, all kinds of research that has gone on to support why that's supportable. That information then gets taken to our hearing where it needs to be defended. And that's where people can cross-examine.

And that to me is how for regulations in the future I believe the performance assessment in Part 63 represents a significant efficiency and effectiveness in ensuring public health and safety over the other regulations.

In terms of public acceptability we have struggles how to best work with this. And there is no easy answer.

There is one suggestion I have heard that one could go out to the community, wherever it is, of the effected people. Explain the performance assessment, the kinds of scenarios, the kinds of features we're looking at in this site and talk through that in as transparent a way as we can and get suggestions from the effected.

Well, did you consider this? Did

you consider that? And factor those suggestions into the performance assessment is a way of possibly getting some acceptable from the people that are most effected. And that's something I know Janet Cocher at NRC has led the public outreach. We're constantly looking at ways to provide more acceptance. That is very, very important to us, but it is a very difficult thing with the complexity of this.

And I guess the last thing is, NRC's independence. And since 1981 I don't know how many performance assessment calculations I've done; hundreds, thousands. But I can say unequivocally that I have never, ever been asked to change a number, to make a number easy on DOE, or to alter the results. The emphasis is always on is this defendable.

CHAIR LASH: I think you're answering a question that wasn't actually asked.

MR. McCARTIN: Okay.

CHAIR LASH: I suspect the

performance assessment issue, being deeply perspicacious, is going to come up again in the next few minutes.

Let me make a couple of requests of the panel and also to my colleagues. We do want to get interaction among you. I also want to make sure my fellow Commissioners get chances to answer questions. So let's try not to have all six of you respond to every single question, but if you have something urgent, you've just heard another member of the panel say something and you have a one minute intervention, just let me know that but stick to the quick response so we can keep things moving.

And to my colleagues, it's clear that we will have some discussion about the role and value of performance assessment, but let's make sure we get to the whole set of questions, not just that one.

Allison, do you want to start off since the issue's kind of on the table in front of us?

MEMBER MacFARLANE: Sure. Thanks very much.

I thank you all for your presentations. I enjoyed them.

Seeing how Bob singled me out, let me make a short statement here. I am not a minority of one. There are many other earth scientists, especially but not solely, who have written critiques, very good critiques of performance assessment. So, you should be aware of that.

And performance assessment, of course, we keep focusing on it here because this is how the U.S. has been deciding whether a site, the Yucca Mountain site in particular, is meeting the standards that were established. So that's why we keep coming back to it. So it's important.

And although the last two speakers may disagree with this, I think in the U.S. it's become at least in terms of the public perception, and in the way that especially the Department of Energy has talked about their project, it's been the sole way that this situation is being evaluated. And I do think that that's a problem.

I want to remind the panel, just for the record, that performance assessments were developed to evaluate nuclear power plants totally engineered systems that were expected to last a period of decades. And they are now being applied to complex earth systems that will last, and these predictions are being drawn out, for hundreds of thousands to millions of years. These are apples and oranges. Okay? That's one of the problems.

To do a performance assessment I am constantly told by you guys that you need o know all the features, events and processes that will occur over the time evaluated. And the Department of Energy has claimed that it does know all these features, events and processes, and this is where I have a problem.

Because I know specifically that they do not have a lot of information.

Like they say kinetic and thermodynamic information on the mineral phases that are relevant information on the future impacts of climate change over even the next few hundred years, for instance. And I could go on and on, and on. All right. But I won't.

So, you know and in place of lack of information what's being asked for is expert judgment. Okay? Expert judgment is qualitative, but you're pretending that it's quantitative. Okay? And then there's a conflation of qualitative and quantitative judgment. And I find that I've seen some of you who really support performance assessment say that the results of these mock performance assessment models are data. You're conflating model results with data. Models are models. They are not reality.

And, in fact, Mr. McCartin just

said "with performance assessment now we have an understanding of how the repository will behave." Okay? Those are your words. That means you think that the performance assessment has given you absolute truth. It has not. It is a model, and a bad one, an opaque model. You can't make it transparent to the public because none of you can fully understand it on your own, all the parts of it.

So, this was not supposed to be a lecture. But anyway, Bob made it that way.

But I do have questions, and so maybe some of, not all of you I suppose, might want to respond to that. But I tend to think that Bill Murphy made a good point when he said "we're better off using multiple lines of evidence."

But let me ask a couple of specific -- well, actually respond to that and maybe we'll ask specific questions later. Go ahead.

DR. BUDNITZ: Well, I kind of think we're going to agree on almost everything except the judgment about how the decision is framed, and therefore answered.

Of course a performance assessment is not a prediction. Of course a performance assessment is not a realistic description. Of course a performance assessment has major uncertainties. But the key to performance assessment is that it enables a focused sensitivity analysis to be done about the things that matter and the things that don't matter.

As an example, and Rod Ewing and I have been friends and colleagues for 30 years and he's a mineral phase guy of the international stature, we don't understand the mineral phases that would occur inside the canister at Yucca Mountain were the water to get in there and the uranium change. Okay? We don't.

\ A lot of work needed to be done.

I actually was in the Yucca Mountain project trying to support some of that for a couple years until the Administration changed and it got killed. But we still don't understand that.

It turns out the results for the purposes of making a decision don't depend on that very much. In fact, they hardly depend on it. The reason they don't depend on it has to do with science.

And the point here is you don't have to understand everything to be able to make a decision if it doesn't depend on it, or depends on it only a little

Second point: Reactors are an engineered system. I've spent my whole life doing reactor analysis, which is what I really do. We license reactors, we run them. We have confidence that the analysis makes them safe enough because we understand them. But in fact, no one today can do a thoroughly correct thermal hydraulic analysis of a pressurized water reactor or a boiling water reactor in normal operation, never minding during transients. And yet we run them and we have confidence. Why? Because we've done enough analysis to know that the things we need to know we know, the things that we're still uncertain about don't matter enough to affect things. Even for an engineered system.

Same thing with aircraft. Neither the Government nor Boeing, nor Airbus understands the true accurate description of those aircraft that I, by the way, am going home on tonight. Why do we have confidence? Because we can bound it.

MEMBER MacFARLANE: Bob, can I just interrupt you

DR. BUDNITZ: Of course.

MEMBER MacFARLANE: And say the reason that you have confidence is not just not that you can bound it, it's that you can do it. You can run the experiment.

DR. BUDNITZ: Ah, now I'm saying

not so.

MEMBER MacFARLANE: And you can see whether it performs as you --

DR. BUDNITZ: Not so.

MEMBER MacFARLANE: Let me finish.

As you predict or not. You will not be able to do that with a repository.

DR. BUDNITZ: But we can't do that for a reactor either. We've not had a meltdown, and yet we understand them enough.

MEMBER MacFARLANE: Yes, you have. You've had multiple meltdowns.

DR. BUDNITZ: No, no, no. It's not true. The scenarios that worry us -- let me just go on because this a crucial point.

The TSPA is not the decision criteria. It informs the decision. The regulations that EPA wrote in 1991 that they reiterated again, the regulations that NRC wrote in Part 60 that they reiterated again, of all the policies of every country, go read them, say the analysis informs a decision by people who sit, think and stare. And that seems to me to be an essential element of public policy.

And my judgment is, and you can differ and we can differ honorably, that the analysis we do is adequate to inform that decision in the context of the regulations that were written. And if you don't think so, fine. But I don't think they're accurate. I don't think that they're predictions. But I think they're adequate for that purpose.

If you don't agree, fine. But that's the decision or the judgment that I have made and that I think is very strongly held, not by -- of course you're not alone. Not by everybody, but by a vast majority.

And then just to cite one example. The Academy put together a committee of a dozen or 15 people. We all said that in the report: 15 to zero. Maybe it was 13, I don't remember the number.

MEMBER MacFARLANE: Well, if you

don't invite a critic, you know you're going to --

DR. BUDNITZ: I'm not going to argue that.

MEMBER MacFARLANE: -- get agreement.

DR. BUDNITZ: I'm not going to argue that.

MEMBER MacFARLANE: And we don't have any critics any here, unfortunately, presenting to us.

I do have a question associated with this. I'm sorry, I forgot to put this to you.

Those of you who do support performance assessments seem to be really adhering to the idea that we desperately need a quantitative way to evaluate this, and I don't know why.

DR. BUDNITZ: I don't either. Boy, I don't either. It informs judgment.

CHAIR LASH: Can I interrupt this

dialogue? I know that Dr. North wanted to make a comment. I'll urge him not to set off the entire debate, because I suspect there are other issues that other Commissioners want to raise.

DR. NORTH: I'm going to note that what is called performance assessment in this context, in many other context is called risk analysis or risk assessment. And the question comes down to: Is something we are about to do acceptably safe? That might be drilling in the Gulf of Mexico or it might be landing a spacecraft on another planet where we contaminate it with life from this planet. And I actually worked that problem as leader of a group for the NASA for Project Viking, a landing that occurred in 1976. And I'll call it performance assessment, and I'll tell a 30 second version of the story because I think it's illustrative of how we get insight about complex systems.

Our Vikings spacecraft had about

20,000 live microbes on it. The issue was would one of them, at least, be able to find an environment on Mars where it could reproduce. My colleagues and I did over a period of nearly a year a quantitative analysis of this working with the many specialties involved.

We got a quantitative answer: Six chances in a million to compare to NASA's regulatory standard of one chance in 10,000. But we were able to essentially throw the analysis away because the insight was that the number was low because the ultraviolet flux through Mars' thin atmosphere was such that a particle that would be able to float from the location of the spacecraft to some other location would have to be so small as to be not shielded by the ultraviolet light.

So in the wake of our analysis, to my knowledge, the National Academy of Sciences and others who have looked at this advising NASA have not considered there was a need for further analysis. We figured out a way of looking at the problem, combining understanding from different fields of science where the question acceptably safe was viewed as not needing a quantitative analysis. Yet, when we were brought in nobody had the insights that our analysis produced.

So, I will assert that the proper role of performance assessment is to generate an insight on what is important for safety. I have concerns myself about getting too far into the numerology. But as somebody who works in this field, numbers allow precise calculations and we learn from that. Therefore, I would assert we should use the numbers but we should not take the results too seriously. View this as a way of exploring, not a way of calculating precise numbers.

And to support this, I would reference the Lewis report on Reactor Safety written, in large part, by my colleague to the left which makes this point in considerable detail in the reactor context. 1978.

CHAIR LASH: Other -0

MEMBER PETERSON: Actually, let me offer just a couple of observations and possibly instigate a question on this specific area. And then I'd like to move to the topic of retrievability, which I think is also important for us to dig into.

I'm going to ask in just a moment is Yucca Mountain particularly complicated to analyze, perhaps, compared to some other potential geologic site which could contribute to our problems? The analogy being that we're currently also concerned that carbon omissions into the atmosphere could perturb climate. We have modeling efforts, we have a variety of qualitative arguments. It's a very specific problem that we're stuck with trying to predict and it's essentially a similar set of issues that we face in terms of trying to inform public policy about what to do about carbon dioxide. And if you think about it, you're running into a lot of thing, and a part is because it's a really hard system to analyze.

So, would we be better off with reducing -- I mean if you followed some deterministic criteria, maybe this is not such a contiguous issue if you're dealing with a system that is more analyzable than Yucca Mountain. So I'd like to just get some opinions about is it likely that other geologic media and sites that we might consider could be more easily analyzed than Yucca Mountain has been?

CHAIR LASH: Dr. Peters, would you like to start?

DR. PETERS: Yes, I'll take a crack at it. Yes and no.

Actually, you know my experience is with Yucca Mountain, that's where I grew up in this field so I've got a perspective on Yucca Mountain. I don't know as much about other media in terms of the details of getting in the testing. But I would say it introduced a set of complexity and uncertainties that are more than you would see in other media is my answer.

I'm just thinking off the top of my head. But you added an unsaturated zone, and when we really dug into the unsaturated zone it got very complex, and when you think about what's going on inside that drift, things got very complex.

I'm not saying that the application that was submitted won't necessarily hold water, because I was a part of developing it. But if it's a very complex site, and whereas if you go to salt for example, you look -- as Per's not even listening.

So as you got to salt, it's got a much simpler safety case, I would argue. If you got a saturated zone site, you don't have the UZ to play in as much, other than just recharge; perhaps it's a simpler safety case.

So, there's probably some truth, Per, to where you're headed.

MEMBER PETERSON: Also we do know from natural analogues that there are places where materials like uranium tend to want to stay stable for long periods of time. And it's not in an oxidizing, unsaturated media, if I'm correct.

But, Warner, if you could --

DR. NORTH: Well, I will share my experience. In 1985 I was a consultant to the Board of Radioactive Waste Management when they reviewed DOE's multi-attribute analysis of five candidate sites with Tom Isaacs as the leader of the DOE effort.

I think between now and then we've learned that performance assessment which seemed relatively straightforward when you were doing it without not too much information gets a lot more complicated when you have a site that's proposed for licensing.

I've also had the advantages as an

initial member of the Nuclear Waste Technical Review Board of traveling to Europe and to Japan to look at their programs. I must say the system proposed for use in Sweden and Finland of using granite crystalline rock and using a container which is very resistant to corrosion in the geochemical conditions in that rock would seem to be a simpler system. But then you get into issues such as the next ice age in Sweden, will be shear such that the weight of the ice causes a fracture that cuts your container in half.

So, I think until you get into it it's hard to tell.

CHAIR LASH: Did you have some other questions, Per? MEMBER PETERSON: Yes, I had a set of questions that I'd like to shift over that relate to retrievability. And what I'd like to do is to note that we're going to have some sort of requirements around retrievability for a repository. The question that I'd like to entertain is can we be more specific about why from a societal perspective we want retrievability? And then to engineer the system to meet the societal goal as opposed to having a more prescriptive and deterministic requirement it should be retrievability that may not efficiently actually serve the society goal.

To think what societal goals might look like, an analogous problem that we're now dealing with is the cleanup of high level waste in tanks at Hanford and Savannah River. So what happened, of course, is that at Hanford we had the early generation of high level waste, carbon steel underground tanks were constructed and built, which is better than what the Russians did, of course. But in order to have some level of chemical compatibility the waste was neutralized greatly increasing the volume in generating slug and such, put into the tanks. You still had corrosion. And as a consequence, the cleanup has been protracted and difficult.

Now a question would be: Well that made sense to do a little bit because if you did just for the few years, at least the overall effort to reverse that would be tractable. In fact, we're already pretty much reversed that at West Valley, which was a small amount. But why did we keep going down that path instead of switching to acidic waste and stainless steel tanks, in which case we'd already be done cleaning up tank waste, largely?

Is this correct sort of view? And then that gets to the question of: What's our societal goal with respect to reversal?

I think we want to keep the mortgage that we might build up reasonable so that if you do determine you need to reverse, you have a reasonable amount of effort to do that?

I mean, Warner, I think maybe you've thought about these topics, and others.

CHAIR LASH: Per, I take it your

question is not so much a technical question about what should have been done there, but the political question about why we couldn't change course when we had sufficient knowledge?

MEMBER PETERSON: Right. I guess I need to be more specific in trying to phrase the question from here.

The question is: Is the societal goal that we're trying to achieve is to not create a big reversal effort or to minimize the risk that future society would be faced with a huge effort to try to reverse something as opposed as just making sure that it would be reversible if you wanted to, but not thinking about the cost and difficulty of doing that?

DR. NORTH: I will take a short at this. I was a study looking at the largest risks from the weapons complex some years ago. And subsequent to that I served as an advisor to the head of Fluor Hanford for a couple of years on some of the activities there to remove some of the most dangerous materials. I didn't work on the tanks, per se.

There is a book called "On the Homefront" which documents the history of Hanford and the releases that have occurred, and I will call it the lack of performance assessment in due diligence as that site was operated during periods of the Cold War. I won't try to explain the behavior of the people that made the decisions. It is my judgment that the problem with the high level waste in the tanks could have been foreseen, and might have been foreseen, but that knowledge was not used and acted upon. They went ahead with it.

So, all this is by way of saying I think we need transparency. I think we need performance assessment or risk analysis, or something like it to try to anticipate what may fail and why, and do a best effort on that and communicate it to those who might be effected.

Now with respect to retrievability, it seems to me there is the issue for future societies that uranium and plutonium might be valuable for energy use. And then there is the issue of if we dispose of waste in some way, and I'll think of some deep borehole technology, and then we find out there is a path from where we put it down that deep hole such that the radioactivity might be released into the accessible environment, then we've got a problem similar to those tanks at Hanford. And we ought to try to avoid that.

MEMBER PETERSON: So then, in terms of thinking this from the perspective of risk, though, let's say that the probability that a borehole might leak is going to be substantially less than the probability that Yucca Mountain might leak.

DR. NORTH: But I want to see where did that probability calculation come from. What expert judgment, what use of models, what physical principles, et cetera. If it's just a number, I've learned to be very skeptical of those.

MEMBER PETERSON: Okay. Well then I'd just ask for expert opinion as to the probability that Yucca Mountain might leak versus a deep borehole might leak from people who looked at the two technologies. And just a qualitative comparison.

DR. NORTH: Again, let's think about it in terms of what's the level of the investigation. It is a number off-the-top-of-your-head; I think the probability is one in a 100 or is this after very serious review of all the applicable science and doing the calculations?

On our Mars example, for example, we went into a lot of detail about the Martian atmosphere and about the way UV sterilizes microorganisms and which kind, and how do you know, and so forth to put this case together. It was not a set of off-the-top-of-the-head judgments. And it stood up to review by people like Joshua Lederberg and Carl Sagan, who were pretty smart about the biological aspects.

MEMBER PETERSON: I agree. Actually, you need to make decisions based on substantial analysis. But my question would be should one try to minimize the risk that you'd be faced with reversal in a way that looks at both the probability that you might in the future learn that the system is not going to perform well? And can you evaluate that risk?

And then also through how you phase the emplacement of waste, say, try to learn during an initial phase and have an off ramp as opposed to just continuing to do the same thing like we did at Savannah River and Hanford, even when you began to probably realize that you were generating a big mortgage by continuing down that path?

CHAIR LASH: I think that Dr. Peters wanted also to respond.

DR. PETERS: You kept going and now I've got another thought.

CHAIR LASH: Okay. Well, cover both.

DR. PETERS: Well, I want to go back to boreholes. You know this, but your questions about boreholes, it all depends on what you're putting down there, first of all. You know that.

MEMBER PETERSON: Yes.

DR. PETERS: Is it cesium-strontium capsules or is it spent fuel? You know, those are two dramatically different things.

And also, as you well know, the uncertainties associated with a field of boreholes if you're thinking about trying to understand geologically what's on down there if you've got a field of boreholes that you're trying to waste down, think about being able to understand geology between those boreholes, the uncertainties that are associated with that.

So it's not a panacea like I hear some talk about: Well, let's just put it all down deep boreholes. I think we need to hesitate from going that direction. I don't think it's what I hear from; that's the first point.

MEMBER PETERSON: Okay. I apologize. To operationalize this then, for example if one in your waste classification criteria were to categorize material by the likelihood that you might want to retrieve them and start with the stuff that you believe you're unlikely you want to retrieve, you would reduce risk of being faced with a big reversal bill, right?

DR. PETERS: Yes, sir. So I think you're on the right track. So I think when you think about retrievability in the context of staging and adaptive management --

MEMBER PETERSON: Yes.

DR. PETERS: -- I think you

separate safety and resource recovery first of all, because they're at different phases in the decision process.

MEMBER PETERSON: And to operationalize that you would say well why don't we focus initial disposal on, say, cesium-strontium followed by high level waste, then with a serious decision point there, potential disposal of spent fuel, right?

DR. PETERS: That's a scenario, yes.

MEMBER PETERSON: That would maybe allow you to go to sites that have lower or more expensive retrievability? You can retrieve at infinite expense, infinitely difficult material?

CHAIR LASH: Per, can we move on? I know Vicky has some questions. Allison has another round of questions. I have an easy and naive one.

Vicky?

MEMBER BAILEY: Mine will probably

be easy. Just a quick question.

The capacity of boreholes, is that the same as we might see in permanent other geological? Can I have an answer to that? What's the capacity difference here that we're talking about?

DR. PETERS: I don't have the numbers off the top of my head. There's reports on it. But in general, you drill a lot of boreholes, you can put a lot of stuff down it. But in terms of putting a lot of spent fuel down a borehole, like if we were to go that direction --

MEMBER BAILEY: Right.

DR. PETERS: -- that to me is a bit more hard to imagine. You really need something mined, a mined repository, in my mind.

MEMBER BAILEY: Okay.

DR. PETERS: This is a personal opinion.

MEMBER BAILEY: Yes.

DR. PETERS: I see boreholes for specialized waste streams, I'll call it.

MEMBER BAILEY: Okay. Any other comments on that? Go ahead, Dr. Murphy?

DR. MURPHY: I've seen reports recently that our conventional estimates of high level or high activity wastes would require about a 1,000 boreholes.

MEMBER MacFARLANE: Yes. That's for the existing stockpile of spent fuel.

MEMBER BAILEY: Not for future, but current capacity. I'm sorry, I should have been more specific. Okay. All right.

Actually, I want to go to Dr. Peters. Your responses on the regulatory changes and also on other regulatory issues, and Dr. Budnitz obviously mentioned from the standpoint of his views, he argued for a singled regulator. And I guess I want to ask Dr. Peters, is that where you were going with your thoughts on more appropriate interactions with the regulator? And how important during this staged process what can we do to do public acceptability?

DR. PETERS: I actually didn't even go there on the two regulators versus one. If I'm implied it. Thank you, there's three. So you've got DOE, NRC and EPA. And I didn't even want to imply that I was going after that one. Bob went after it, for sure.

MEMBER BAILEY: So I'm giving you a chance to.

DR. PETERS: Yes, I'm going to go after it now.

I personally think that we could do a much better job of simplifying it. So I would argue for a not so different than the WIPP model where you have one agency focused on developing the regs and the compliance, et cetera. So, I like that model.

I'm not going to pick a winner, like Bob did.

MEMBER BAILEY: Okay.

DR. PETERS: I'll let the Congress

decide who the winner is on that.

MEMBER BAILEY: Okay. Bob?

DR. BUDNITZ: I just want to chime in that. There is a very important pubic policy purpose for multiple clumsy process. The Founding Fathers did it with how we enact laws, and that's an extremely valuable thing. They made it clumsy in order to assure against quick one decision, off you go. And that has served the Republic well over more than two centuries.

And I thin the federal system with its state and federal roles is another example of that, quite separate from the way we enact federal laws.

In this case these are all federal agencies. And I said I don't understand the pubic policy purpose for multiple federal. If someone can tell me. Except the purpose of making it clumsy, and I understand it. But except for that, trying to make it slow and clumsy and so on and if you're opposed to anything going on, you love clumsy processes; you can sue 75 different times on different things. But if they're all feds working as federal employees do to try to advance what Congress told them is their mission and to try to advance the sensible public policy, I don't understand it. I mean, it's as simple as that. Okay.

MEMBER BAILEY: And back to Dr. Peters, on your risk-based versus source-based approach can you talk to me a little bit more about why you favor one over the other?

DR. PETERS: Well, I think it's similar to kind of the way we go with risk-based regulation overall.

But let's back up. So if you look at the regulatory and statutory framework now, what I mean by source-based is anything that was derived from reprocessing as being high level waste, quite frankly just to simple. There's details in there that people in this room could talk to better than I, but that in and of itself is a restrictive classification in that some of the waste streams that come from reprocessing aren't, in fact, high level waste there.

So if you truly look at it from a risk perspective, then some of the waste stream could be handled as low level waste, for example, which could or could not be handled in a different disposal environment. But I think we're basically looking if you retrieve this source, you're not really looking at the risks and the health effects. So it's really an old way of looking at what now we're already going to risk-informed performance-based regulations overall anyway. So to me, the waste classification system eventually needs to catch up; that's my perspective.

MEMBER BAILEY: Any other comments on it? All right. Thank you.

CHAIR LASH: So I'm going to ask one questions. I hope several of you will respond. It follows up on Vicky's questions a moment ago. And then I'll come back and start with the second round with Allison and Per.

I found it very helpful, Dr Budnitz, your explicit conclusion:

(a) That we need to unify the regulatory process. It doesn't make sense to have multiple agencies for public policy reasons;

(b) Recommend that a specific agency, and;

þ In the course of recommending a specific agency, you essentially articulated some criteria. You recommend NRC because it is independent, has the expertise, and essentially has a culture of considering these issues that you thought was useful.

DR. BUDNITZ: And a process.

CHAIR LASH: Yes. And I'd like to divide that into several pieces, and make sure I get input from others on the panel as well on this.

Would you recommend that the process be unified regardless of the choice of agencies?

DR. BUDNITZ: Yes.

CHAIR LASH: And secondly, do you think that those criteria could be -- it's essentially balancing the criteria. And I had the sense that you thought independence was most important. And then after you've answered that, I'd like to hear from any others.

DR. BUDNITZ: In that sense I think I can correct myself.

CHAIR LASH: Okay.

DR. BUDNITZ: I think the most important is that the Nuclear Regulatory Commission has demonstrated a long record of very high technical competence and they've shown it in how they've gone about both establishing the regulations for Yucca Mountain and the interaction over a decade with the applicant, the DOE and its contractors, and how they've gone about this review.

If you look carefully at how EPA went about certifying WIPP, you will find no impugning of their motivations, of course. That process was far less detailed, intense, technical and drawn-out.

Now I'm not arguing. WIPP's a great site. I was on the applicant's side for that, namely Sandia employed me and some others for a decade to help them review the technical basis for what they put in. So in that process, I was actually on the side of the applicant.

But when I watched the regulator do what they did, and they did a good job, but they didn't muster the resources that I would have hoped. They didn't ask as many or many rounds, or as much detail, okay? Again, I'm not impugning.

But the thing that really troubled me was, and I'll say this as directly as I can, the single most important thing EPA does is air pollution. There' was an office, it was called Air and Radiation Programs.

CHAIR LASH: And Noise. Air noise.

DR. BUDNITZ: Oh, excuse me. And air was 99.999. And if you were running that office, radiation was down here somewhere. I'm not saying they didn't do a good job. But Nuclear Regulatory Commission had -- I'm talking about the WIPP process without impugning any of the motivations and the fine work of the staff, they didn't the resources, they didn't ask for them, they didn't get them so they didn't do it. What they did was, you know WIPP turned out to be a wonderful site. It turned out the analysis was very robust, so it went through. And I'm happy about that.

But if I asked that to happen in the Office of Air and Radiation at EPA today, air is still going to be more important.

And so I find that structurally an

issue. That has not to do with the competence, but with the resources that they brought or they could bring, or that political processes would allow them to bring. Okay?

CHAIR LASH: So, having gotten an even more clear response from Budnitz, I wonder whether anybody else has any other views, particularly on other criteria that might be important?

MR. McCARTIN: Well, it terms of the two regulators or one, if you will, I think the roles of EPA and NRC are defined well. While we don't always agree, we have over the years with the Yucca Mountain regulations we've had a lot of interactions. I think it's resulted in better standards and regulations.

I don't know if it's that clunky. I think there are a lot of reasons why things have taken so long for Yucca Mountain. They aren't necessarily problems with EPA and NRC.

The one thing I guess I would

caution is that there are other requirements that NRC is responsible for in Part 60 or 63 that I think are somewhat unique to NRC's licensing approach. And we have safeguards materials, things of that nature, security that if it was just the post-closure standard it would be one thing, but with spent fuel and other items that will be there, there are some unique aspects that I think NRC at this time is the right agency for that particular material.

But, you know, I'd be interested what Dan wants to say. But I've felt the interactions have helped the process.

CHAIR LASH: Thank you.

Mr. Schultheisz?

MR. SCHULTHEISZ: Yes. I would have to agree with Jim about the interactions in the Yucca Mountain process. And we actually left some certain decisions in the 2008 for the beyond 10,000 year standards to NRC to determine; the long-term climate characteristics. And so there's a lot of interaction there, there's a lot of expertise that NRC has.

And I will not disagree that their program is much better resourced than the radiation program at the EPA, and probably will always remain so. You know, that's part of their fundamental mission is dealing with all aspects of the nuclear fuel cycle, and that is just other than the standard setting part of it, that is not really an EPA mission critical function.

And so I can't disagree that we had a much smaller team involved in certifying and now recertifying the WIPP probably than NRC would have been able to bring to bear. We did not do independent performance assessments. NRC did. We did not do a lot of other independent research, as NRC did.

Of course, you could argue that Yucca Mountain, the spent fuel high level waste program is going to demand far more resources than the DOE defense TRU program would in any case, and that may be a legitimate issue.

But I do agree with Tim that the agencies have become I think much smoother at working together over the past decade or so.

CHAIR LASH: Anybody else? Dr. North?

DR. NORTH: I would urge the Disposal Subcommittee to think more broadly as you are going to do this afternoon with the institutional panel.

There is the task of setting regulation, and then there is the task of evaluating a license application such as NRC is now doing. I would urge those tasks to be separated.

And I would urge consideration of outside review groups, including committees of the National Academy of Sciences who repeatedly review WIPP, Bob Neill I hope will talk about his group and their activities in

WIPP this afternoon. It isn't just a matter of a federal regulatory agency. It's a debate to try to get out what is the best science and are we making decisions properly given what we know about the science.

So having information and skepticism come in from a variety of other parties seems to me something that is very much needed to be encouraged rather than there is a project manager, which might be a federal agency like DOE, and then there is a regulatory authority which might be EPA, NRC or some combination. I think it should be more broad then that.

CHAIR LASH: As a lawyer coming to this kind of problem, I think I would expect that there would be a proposer, a disposer and a rulemaker and that those are very separate functions and should be kept separate. I understand that that's somewhat of an oversimplification in this context.

Dr. Budnitz and then we'll move on

to Allison.

DR. BUDNITZ: I just want to disagree with Warner. But I want to start out by saying that Warner and I studied freshman physics together. I was a sophomore and he was a freshman in 1959 or '58, so we kind of know each other for a couple of years.

I respectfully want to disagree with Warner about something. You know, I'm a reactor guy, in the reactor the Nuclear Regulatory Commission is constantly modifying the regulations as cases and details come up in the context of some broader, but then they modify details, either guidance or regulation, because the thing they wrote nine years ago or even two years, or 14 years ago doesn't fit the case. And they have to do that. And so they have varies processes for either modest changing the guidance or sometimes changing the regulations all the way to the Federal Register and the Administrative Procedures Act, or sometimes it's at a lower level.

Now if you got to go to another agency to do that, that's clumsy and I don't understand the public policy purpose of that. In fact, it actually gets in the way because one of the things you want to do if an issue arises is to make sure the regulator in a prompt and useful way provides the right guidance or regulation, as it may be, to the applicant who is trying to adjust what they found to the case and still maintain safety and security and environmental protection. And I'm really worried about the implementation phase, and I've been worried about this for the longest time.

Imagine Yucca Mountain was going ahead and they're nine years into it, and they're emplacing and they find something. Going back to another agency, boy, is that clumsy. I just don't see it as satisfying the purpose. Okay?

And that's down in the details, not just setting standards which I could understand a little, although even that I don't.

CHAIR LASH: Allison, you've been waiting patiently.

MEMBER MacFARLANE: Okay. Great. So although Bob and I violently disagree on something, we violently agree on others.

DR. BUDNITZ: You bet.

MEMBER MacFARLANE: That's right.

And because you have lots and lots of experience here and I respect all of that, I would like to hear from you on a couple of questions and also maybe Bill Murphy and Warner as well. And this question isn't one that you were asked, but because you're sitting there I want you to answer it.

What agency or entity do you think should manage the characterization site selection, that kind of thing, of this whole process?

And then I want to ask you all about waste classification and whether you are satisfied with it or not, and how you would change it?

So, Bob, yes.

DR. BUDNITZ: You're asking me?

Well, as far as I'm concerned, the logic is the applicant does everything needed to support the application for permission using and following the guidance set down by the regulator as to what is necessary.

MEMBER MacFARLANE: Yes. So who should that applicant be if it were up to you?

DR. BUDNITZ: Well if it was up to me, well first of all the applicant today is a federal agency.

MEMBER MacFARLANE: Right.

DR. BUDNITZ: If I was rewriting the regulation?

MEMBER MacFARLANE: Yes.

DR. BUDNITZ: I think that --

MEMBER MacFARLANE: You mean the law. If you were rewriting the law.

DR. BUDNITZ: Excuse me. Yes. If

I was rewriting the law, I'm not sure -- and I haven't thought a lot about this because I'm actually trying to be engineer. About whether the model of an independent agency like TVA makes more sense then letting it be in the Cabinet, a part of a Cabinet office. I haven't thought that through. I understand the arguments pro and con, but I haven't thought through them and I just don't want to go there. But I understand there's pros and cons there.

MEMBER MacFARLANE: Okay.

DR. BUDNITZ: To me, though, the essential thing is that the applicant, whoever it is, must be responsible for developing the whole case fitting within the guidelines laid down by the regulator as to what the case is.

MEMBER MacFARLANE: Do you not see that to be the case right now?

DR. BUDNITZ: Oh, it's the case now. It's the case now. You bet.

MEMBER MacFARLANE: Right.

DR. BUDNITZ: And it, if you don't mind my saying, worked at WIPP and it worked at Yucca Mountain to that stage, yes.

MEMBER MacFARLANE: Okay. And waste classification?

DR. BUDNITZ: The idiocy of the current system, and that's a strong word but I'm going to use it, is that certain wastes that look identical, this one and this one, are regulated differently just because of their source.

MEMBER MacFARLANE: Yes.

DR. BUDNITZ: That's a historical artifact that goes back to the '50s. Excuse me. Goes back to the original Atomic Energy Act, which was in the '40s. And has been maintained because of its historical inability to just -- it's just inertia, and it doesn't make sense.

MEMBER MacFARLANE: Yes.

DR. BUDNITZ: For example, as perhaps you know, we have some wastes that are regulated highly and another identical waste isn't regulated at all by anybody. Why? Because one's an NARM and one's NORM, and ones raffinate -- I mean, where'd that come from? It came from history. That don't make any sense.

If you don't know what NARM and NORM are, I'll give you a lecture later.

MEMBER MacFARLANE: Okay.

DR. BUDNITZ: Okay. But the idea that we should regulate waste streams based on their characteristics has impeccable logic. And the idea of regulating by the source of their material doesn't make sense to me. How's that?

MEMBER MacFARLANE: Okay. Warner, go ahead.

DR. NORTH: I'd commend to you the chapter reviewing international programs in this report and the recent report by Dan Metlay for Nuclear Waste Technical Review Board on the international programs. It seems to me that there are a number of models being used outside the United States that have some real virtues to them. I was particularly interested in and impressed with SKB as the applicant in Sweden and SKI as the regulatory oversight agency.

It seems to me that you want an applicant that is both very highly motivated, has access to the best science and the best engineering, and also has a very strong motivation to reach out into the communities where a repository or storage site might be located and develop a relationship with those communities.

It seems to me SKB has done that job very well. I don't know a lot about it, but I would urge you to investigate.

MEMBER MacFARLANE: And the waste classification?

DR. NORTH: This is with respect to the Swedish repository program.

MEMBER MacFARLANE: Right. I know.

I know. But what do you think about the current waste classification system? And if you don't like it, how should it be changed?

DR. NORTH: I think I'm going to leave that for other people.

MEMBER MacFARLANE: Okay. Bill?

DR. MURPHY: First of all, I can't comment on waste classification. It's not something I've studied or have expert judgment about.

One question I think you posed was who should do site characterization.

MEMBER MacFARLANE: Yes.

DR. MURPHY: And I think that's an excellent question.

I think that it gives me an opportunity to say something I wanted to say earlier in response to the question whether or not Yucca Mountain was more complicated than other potential sites.

I've worked on several sites, and I've studied many others, and they're all complicated. That's the nature of the system.

Many of the fundamental assumptions about the WIPP site, which was purported to be simple before they built it, were completely wrong: The permeability, the creep rate, the amount of water that's there.

MEMBER MacFARLANE: Yes.

DR. MURPHY: Very fundamental things about the WIPP site that were believed before they did site characterization turned out to be wrong.

Many of the things that are thought about Yucca Mountain before site characterization turned out to be wrong. And people still sometimes say it's a dry site. That's absurd. It's ten percent water above the water table. And I think a problem that we faced in the case of Yucca Mountain was that the site was selected before it was well characterized. Site characterization is essential and it's hard. It's complicated. The systems are inherently complicated. It doesn't mean that they're impossible.

We've learned a great deal about Yucca Mountain. The entire science of groundwater flow in fractured unsaturated rock has changed because of Yucca Mountain. So it's not that there isn't expertise adequate to address the hard problems, but it needs to be done and preferably before decisions are made.

MEMBER MacFARLANE: Yes. And who should do that?

DR. MURPHY: I don't know who should do it. But I know in the case of Yucca Mountain there was really excellent work done by the people at Los Alamos on site characterization. There was really excellent work done by the USGS on site characterization. There were excellent work sponsored by the NRC Research Office for a while. And so there were a lot of players. Livermore did some work on site characterizations. So the National Labs were, I think, principally the agencies where the expertise was.

CHAIR LASH: Per, do you have additional questions?

MEMBER PETERSON: Yes. The first thing I'd like to do is to go back just shortly to retrievability and look at the two different reasons why one might want to retrieve. Because one is that you want to get the material back out because you've determined that it might have some value. And then the other is that you determined that there's something about the performance of the system is not going to be acceptable and you want to try to fix that.

For the first, I guess, Mark, you expressed a lot of discomfort with putting spent fuel into boreholes. Is that because you would believe that you could get into the performance problem or into a resource recovery problem?

DR. PETERS: Well, it was partly

because it was both. It was partly resource recovery problem, but also because it's the shear number of boreholes and the complications of getting spent fuel down a borehole. There's other operational, but there's the shear volume. To me if you're going to dispose of spent fuel, there's perfectly good media. You could go out and build a nice mined repository that operationally is much easier to deal with. That's just kind of intuition on it. But resource recovery is a part of it, correct, likewise.

MEMBER PETERSON: Okay. On the case of the performance problems, the other alternative if you discover them is to mitigate, right? So to what extent can we have some judgment about how much we should rely on the possibility to mitigate potential problems versus retrieve, going back again to the fact that it's possible that by selecting a site and engineering to enhance retrievability you might in the end actually get worse performance and therefore, end up more likely to retrieve it because of what you've done?

Tim?

MR. McCARTIN: Certainly the intent of NRC regulations is not to make the site less safe. And so we would look very dimly on retrievability designs that look like they were making it less safe. So we would certainly not try to do something like that and not have a licensee feel they had to do that.

In terms of mitigation, our regulations have the provisions that it's expected that different conditions will be encountered. When DOE encounters that, they have to analyze it and see what they might do. You know, if it changes the safety significantly, they need to come back to the NRC and we need to evaluate that and see what the next step is.

Clearly, any decision to retrieve safety purposes will carry with it a fair amount, I would assume, public debate and discussion and, hopefully, be transparent what's done, whether there's other conditions that can be relied on so it doesn't need to be retrieved or it needs to be retrieved. The intent, at least from a safety standpoint, is not to make the site less safe.

The same thing has been said with performance confirmation testing. What are you going to do to confirm? Well, there's a lot of things you might want to do. You wouldn't do things that make it less safe.

MEMBER PETERSON: Warner, and then one other question.

DR. NORTH: I'd like to tell a story about the early days of the Nuclear Waste Technical Review Board with respect to retrievability.

The original plan for spent fuel at Yucca Mountain was to emplace it vertically down a shaft and put it in boreholes. My Chairman, Don U. Deere looked at this in his first months as the Chair of the Nuclear Waste Technical Review Board and thought this was a crazy idea.

You could come in from the side with essentially a horizontal tunnel where you could take these very heavy waste containers and you could move them around much more easily, and you will avoid a great many problems in terms of the safety issues of putting a very heavy thing down a shaft and getting it emplaced properly.

So, I would urge that we think about this not just as a regulatory issue, but as a good management and operations and safety issue of how the operator is able to emplace and then maybe move around or even retrieve the waste materials and how that can be done in a way that doesn't lead to a lot of worker exposure to radiation or the potential for old fashioned industrial accident, et cetera.

CHAIR LASH: Did you have another question, Per?

MEMBER PETERSON: Actually, no.

CHAIR LASH: Vicky, any more?

Oh, did you want to add something, Dr. Budnitz?

DR. BUDNITZ: Yes. I had a comment about Per's.

At Yucca Mountain when the final analysis that was submitted was done, the risks of those doses to the receptor on the surface were really quite low. But one of the dominant risks turned out to be from earthquakes. Even though of these very low doses, a lot of it was from earthquakes, large earthquakes out in the future that were not sure to happen in any given year, but were sure to happen over millennia sooner or later. And that analysis was one in which I was particularly participating during the few years I was at Livermore, because what I do in reactors is a lot of that stuff: Seismic.

And we ended up with a good deal of uncertainty about how it would actually behave. But the bounding analysis we did, which was I think very robust, convinced us that that particular repository was actually very nicely chosen and designed against that phenomena.

We now believe that earthquakes way larger than the earth can probably sustain will, nevertheless, not compromise the overall performance. So if someone says "What about earthquakes," because there are earthquakes in that area. You can't say there aren't. Of course there are. Those earthquakes that we understand might happen over the millennia, or even hundreds of millennia, turnout in the analysis not to compromise the overall criteria. And that's wonderful.

Now, that isn't necessarily something anybody knew going in. I'm talking about back in the '80s, nobody knew that. In fact, we didn't figure it out until the middle

2000s, which is really a comeuppance when you think that had it come out otherwise, we would have been very, very unhappy.

If the earthquakes by themselves would have compromised what was otherwise absent earthquakes a good site design combination, there probably would have had to been an awful lot of work to figure out what to do. It probably might have been done, but it was very hard.

Now that tells you something, and you got to be humble about this. One of the problems we have is that retrievability is there in case our children or their children learn something, science or engineering, that we didn't know or have a different perspective on it which forces them to say you know, they were doing the best they could our grandparents, but we don't think that's good enough. To me, that's the fundamental thing.

This resource recovery thing, I understand that, but it just doesn't wash with me. We're talking about safety here. And it seems to me that with that in mind, again the Yucca Mountain site is particularly suited for that in a way that salt is not.

By the way, salt you can recover it, okay, but boy is it hard compared to a mined thing that's there for a couple hundred years and you don't have to do anything. You can go back in.

And I don't know how to balance that. Let me describe. This is a crucial point. We have as a fundamental principle in our society that we've enunciated throughout this process around the world the issue about equity across generations.

On the one hand, the generation that made the waste ought to pay for its disposal. All right. On the other hand, we want our grandchildren to be able -- you can finish the sentence. On the one hand we want them to pay. On the other hand, will our grandchildren have to pay a lot because of an error we inadvertently made? That's a judgment which is only to be confronted in the event that some mistake is found and which will tear your hair out all the way along.

So it comes down in the end it's a policy call that somebody has to make. And who is the place that makes it? In our regulations today it's the five Commissioners at NRC who make that call.

And by the way, if it was EPA, it would be the Administrator. Okay?

Now, that's not only appropriate, it's the way we do things here. All right. And I like that way because it seems to me that these intergenerational equity things are something you can't write into a regulation, and you can't even give much guidance except the words. But they do come down to a judgment, depending on the site, the waste and the design, which I don't see how to foresee even except just a trust that the decision maker will do it right.

CHAIR LASH: I have one last question that actually flows from that. It's about the boundary between expertise and social values. And it comes up with respect to the question of length of time in which you assess risk. And I find your arguments about a million years quite persuasive, but I think we will face this question in other areas than just whether it's a thousand, ten thousand or a million years. And I was very struck by the testimony we heard from Elizabeth Dowdeswell who managed the Canadian process. And as I understood what she was saying, they essentially turned the whole analysis upside down. Rather than having a group of experts come with a proposal and the public respond it, they had the public say what are the values that are most important and then went back to the experts and said how could you achieve a result that adheres to these values.

And this is a difficult issue. How do we take advantage of the enormous expert capacity that we see here that you have at NRC, and at the same time recognize where there are areas where really it's the public values that have to come first and that will shape whether the outcome is legitimate and maintainable.

So, I just welcome comments from any of you on what the right boundary is and what kind of process we can design to accommodate it.

DR. NORTH: Tom Isaacs and Lee Merkhofer, who consulted for the Canadians, and I had a class about a year and a half ago where we compared the Canadian process with our knowledge of the process in the United States.

I think there's a lot to be said for having a bottom process involving the public to get them to understand the nature of the problem before we go out prescribing technical solutions. My thoughts on the matter reflect two National Academy studies that I've been a part of. One in 1996 called "Understanding Risk," and another in 2008 called "Public Participation In Environment Assessment and Decision Making." These are both referenced in my one page statement. And I would be delighted to talk at length about them, but I'm restraining myself right now.

CHAIR LASH: I've relied on them both.

Any other comments?

DR. PETERS: I guess one plea. I agree with you, but to me whatever comes out the end of this process, hopefully, new policy I would like the policy to prescribe that process as opposed to just saying "Tell the Government to go do it," if I may.

CHAIR LASH: Right.

DR. PETERS: Because I can imagine, you can imagine. And, you know you may say that's micromanagement, but actually I think that's a very, very complicated question and I think that there needs to be some level of guidance provided to the Government about how exactly to engage the public in the right way.

DR. BUDNITZ: But, just to defend what's what, the Administrative Procedure Act, APA, was followed by EPA when they adopted the first 191. And I want to tell you, the EPA went through 25 or 30 drafts of that thing between, you know A and Z. And I may be the only person on the planet that's got all of them in a box in the basement. I was pretty much involved at that time. And there was constant interaction with the public of the time, 1980/'81/'82.

Tom Cotton is nodding, because he was part of it at OTA at the time, and others in the room. To get this feedback about the 10,000 years and the level of protection, and you remember this thing about how many deaths there were going to be over the ten millennia. It wasn't as if that process failed in the sense that anybody, and lots did, could chime in, and they did. It wouldn't be accurate to say that that process of adopting 191 in 1981 was done absent public interaction.

Then, of course, NRC did Part 64, same process.

Now, if you didn't chime in, well okay you got a chance later because as Tom Cotton showed, there were nine different times when everything was being revisited so you had plenty of chance to get in there. I don't think that the APA, properly implemented, is a flawed process for enabling public participation.

And by the way, of course the public also includes the people who sued, the people who had standing in hearings. Sometimes the standing was denied because they couldn't show it. There's a whole lot of things, you know legal and technical.

It seems to me we had a process that worked in principle. Why didn't it work in practice? It broke down when one site was picked. That's where it broke down. Okay. One site was picked, absent the full information.

CHAIR LASH: That is Congress broke the rules?

DR. BUDNITZ: Wait, wait. No. Congress makes the rules.

CHAIR LASH: I understand. But the social understanding was of a different process.

DR. BUDNITZ: There was a compact which Congress embedded in the EPA. Everybody understand this? And which didn't happen for a reason in 1987 that we can revisit.

By the way, the second repository program OCRD that was going to find a repository in hard rock in the east was also eliminated in '86. It's all part of that same sort of political thing. There was a compact in which there was going to be a second repository east of the Rockies, and some of you remember that. I was actually part of that process, too. It was awful.

And so if you're going to try to put a process in place that's different then that, it will like this process always be subject to override, just as if you don't mind my saying, just as the cancellation of the Yucca Mountain thing, if you don't mind my saying, was in Budnitz' view extra legal.

Now, you know, okay, it' extra legal. I mean, by the way, Budnitz' stuff isn't extra legal, but the policies are extra legal. But it happened. Okay? I'm grown up, right? You can't do anything about that, Jonathan Lash, as best I can tell except just hope that we'll work together.

MEMBER PETERSON: Jonathan, can I have one more question?

CHAIR LASH: Per?

MEMBER PETERSON: I have one additional question. To make an informed decision about whether a site is sufficiently suitable that if you pursue it, you have a reasonably good expectation that you can be successful to meet regulatory criteria and license and construct a site, one needs to collect some information that likely depends on the specific characteristics of the geologic media and stuff. Is there someplace one can go to get some idea of what specific information do you really need to have collected to be able to make an adequately informed decision? Because I don't want to get a specific technical answer, but at least is there someplace to go to get that information? Is it just boreholes? Do you actually have to mine out into the material or at what level do you have enough information?

DR. NORTH: I can't address how much information is adequate. But I would say that an organization that had that problem should definitely go around the world and visit all the other nuclear waste repository programs. Because a great deal of geological exploration and inputs into performance assessment have been done in many national programs across a wide range of types of site.

MEMBER PETERSON: But is there someplace I can go to find out what things would you need to do to get to the point of being able to make a informed decision?

DR. BUDNITZ: Yes.

DR. NORTH: Yes.

MEMBER PETERSON: If the answer is yes, that's good.

DR. BUDNITZ: Yes. The second repository program, OCRD, the Office of Crystalline Repository Development, which was looking at all these sites in the east from 1981 or '82 until it was canceled in '86, and I was in the thick of that, and Bill maybe ran it at Battelle Columbus, had a carefully thought out and public process determination of just those things. And it's all in the record. It was very carefully -- they had huge public meetings; 500 people showed up in Atlanta for three days. And all of those things.

Remember, they had 27 different sites in all different media all over the east; the east, Midwest, southeast and so on. And they had public input from people in a zillion states; 20 of them and their agencies.

And it was all carefully thought out. It's still in the record. I've got copies of it. And it remains a very valid logic for site investigation and criteria.

CHAIR LASH: And go to the European. Go to a couple of the European programs, I would argue to.

MEMBER PETERSON: And then the next element is how much time is it likely to take once you say I want to get information about a specific place that there's reason to believe might be reasonably good? How long does it take to collect the information needed to make that informed decision? Is it one year, is it five, is it 50?

CHAIR LASH: Tim and then, Mark,

you were hesitating around a response. And then we'll wrap up.

MR. McCARTIN: Yes. I mean at the initial stage, I think first of all you need to know what you're going to dispose of. Because the nature of your source term will have a dramatic effect on what you need and what you're interested in in the natural system.

Ultimately, I think everyone looks at where does the water go. I think you have to understand where the water goes. You've got waste, you've got water and then the types of disruptive events that might effect things; that's your initial look. And then you start doing some of the site investigations.

I think back to Hanford, Hanford the only thing you could say that there was a work going on. The more information that was collected consistent with what Bill Murphy was saying, you got more uncertainties.

If I have a single borehole, I

have a very simple model that is true. You start collecting more. But I think ultimately the water is what removes the waste and takes it somewhere where you might not want it.

MEMBER BAILEY: Tim --

DR. PETERS: I usually take the bait on stuff like this. There's too many qualifications: It's not one and it's 50, it's ten.

MEMBER PETERSON: If it is tens, then we've got a big policy problem. I think, you know just the willingness to try to do this over again --

DR. PETERS: I understand. I understand.

MEMBER PETERSON: -- becomes unappetizing if it's going to take a really long time.

DR. PETERS: Well, if you think we can go out there and do this in two to five years, I think that's not -- my perspective is that's hard to imagine for all the reasons we've been talking. When you go out and actually start studying something, you learn how complex it really is. And so we need to do this right this time. And so you've got to take the time to do it right. And so we do have a policy challenge because you have to give us the time and the cover.

I use "you" collectively. We need the time to do it right.

CHAIR LASH: Vicky had a follow-up.

MEMBER BAILEY: Yes, just real quick.

Tim, and others, I keep hearing about it depends on the type of waste. Civilian waste, defense waster, military. Tell me what are you saying when you say "it depends on the type of waste."

MR. McCARTIN: Well, certainly well the half-life and the quantities and types of things. I mean, if you have a lot of plutonium, you're interested in certain things. If you have removed the plutonium and you're interested in other nuclides, you may have different concerns at a particular site.

MEMBER BAILEY: So that will make a difference whether it's a mined repository or boreholes? Are we talking used fuel, spent fuel? We talking military?

You know, we're here to look at all of it. If I'm into reprocessing, am I going to --

MR. McCARTIN: Right. But the acceptability of a particular site can depend on the type of waste that you're going to dispose of. That's all I was trying to say.

MEMBER BAILEY: Would you see multiple sites if we had two or three and we said, well at one site we're doing one thing and at another site we're doing something else? Help me understand what you're saying.

MR. McCARTIN: Yes. Well --

MEMBER BAILEY: If I'm to get it right, is that what Dr. Peters says?

MR. McCARTIN: Well, as he was suggesting with the strontium and cesium for deep boreholes, it's pretty good for that. Maybe it requires more characterization, more understanding for input of plutonium down that borehole. And I think that's all the --

MEMBER BAILEY: Is there an issue as it relates to water surface levels, other issues that I have to think about depending on the type of waste?

I don't mean to pinpoint Tim.

DR. NORTH: What may give you one issue with respect to Yucca Mountain if you emplace spent fuel, which has not been cooled for a long period of time, you are injecting a lot of heat into the rock formations next to where the place has been placed. That heat may drive off water. And the water goes away in the rock and with the heat it may dissolve some chemicals in the rock that change the corrosiveness of the water.

So, it isn't just about

understanding the repository, it's understanding the repository as a system which has, for example, heat going into it that is not anything that that type of nature would have experienced.

In Yucca Mountain this became a design variable: How hot do you want to get the rock? And there were discussions about we want to go well above the boiling point of water or we want to spread the waste out more so that you wouldn't have that level of heating occur in the rock in the early years.

And then as part of the performance assessment you have to say what are the consequences of various levels of heat? Do you get corrosive water that might come down on the canister and cause the canister to erode faster than would have happened under natural situations? In other words, you don't have a natural system, you have a system which has been changed.

CHAIR LASH: I would like to thank

you all. This has really been a fabulous exchange, enormously useful for us. Thank you very much for your patience with some of our questions, which are things that you probably dealt with when you were undergraduates 40 years ago. But in any case, it's been a very session.

Fifty, yes.

We will reconvene in one hour. So ten minutes later than scheduled. And I'll see you all in an hour.

(Whereupon, at 12:38 p.m. the above-entitled matter went off the record and resumed at 1:39 p.m.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

1:39 p.m.

MR. FRAZIER: Okay, if I could get your attention, we are going to resume the meeting and start the afternoon session. So without further ado, I will turn it over to Senator Hagel.

CHAIR HAGEL: Thank you, Tim. Good afternoon and we again thank our distinguished panelists.

We, this afternoon, will turn to other aspects of the regulatory institutional system that will be needed to make the system effective and publicly acceptable. We will ask our next panel to advise us on these issues.

With us for this panel this afternoon we have Robert Neill, Director Emeritus of the New Mexico Environmental Evaluation Group. Welcome.

Dr. Michael Voegele. Is that correct? Voegele. As I said, Dr. Michael

Voegele, independent consultant and former chief scientist for the Yucca Mountain project and we appreciate you being here.

Steve Frishman, Technical Consultant to the State of Nevada Agency for Nuclear Projects. Steve, good to see you again. Thank you.

Dr. Hank Jenkins-Smith, Professor and Associate Director at the Center for Applied Social Research at the University of Oklahoma. Nice to have you. Thank you. I just spoke to your president about two hours ago, Senator Boren, and he wishes you well and says don't embarrass him.

(Laughter.)

CHAIR HAGEL: No, he didn't say that. He spoke very glowingly of you and how fortunate we are to have you. So, thank you.

And Dr. Roger Kasperson, research professor and distinguished scientist, Clark University, thank you as well.

Let's being with Mr. Neill. Thank

you.

MR. NEILL: Thank you, Mr. Chairman.

CHAIR HAGEL: And you all know the rules and ten minutes, and so on. Okay.

MR. NEILL: Thank you. In 1978, New Mexico had a number of concerns about the proposed transuranic waste facility by DOE but lacked the resources to address them. DOE offered to fund an independent technical evaluation and the state accepted. I set the group up. I was the director for 22 years, retiring a year after WIPP opened in the year 2000.

Now the punch line is that it is absolutely vital that a state have an ability to do a detailed technical evaluation of a proposed repository. Well what are some of the essential elements for a state review?

Well one, obviously is objectivity. You don't want people on the staff that are either violently pro nor anti on it. It is sort of obvious.

Independent. It is essential that the work not be subject to political approval. And as a matter of fact, when a governor of New Mexico intervened on EEG and didn't like some of the answers we were coming up with and felt perhaps we were being a little too hard on DOE, both Senator Domenici and Senator Bingaman intervened to assign the group from state government to New Mexico Tech. And I will always be eternally appreciative to both those gentlemen for their efforts to ensure the credibility of the work that was being done.

Also, you need to have people that are really confident, senior knowledgeable staff. Virtually everyone I hired had a graduate degree of some type in different disciplines. Also multi-disciplinary is obvious but it is important to note that the key issue here is the potential radiation exposure to people from one of these facilities. Therefore, it is essential that the leadership be vested in radiological health or radiation protection, or health physics, whatever you want to call it.

We decided from the very beginning that we wouldn't just write a nasty letter to DOE or so but we would publish our reports. And over the course of the time we published 80 reports, put out 500 copies on the street and this was really good. So if we were raising an issue, DOE couldn't just blow it off or ignore it and people would say well how about that, DOE, is this reasonable or is this unreasonable?

Presentations at public and professional meetings are essential and also it is necessary to keep the legislature and the congress fully informed. I probably testified 50 times before the state legislature and the congress over the course of my work there.

We also had formal field trips

where we had people of diverse views present their views and we wrote them up in a detailed report, which was published. We encouraged the staff to have key roles in the professional societies. As a result of this, I was fortunate in being asked to be a member of a number of committees at the National Academy of Sciences, DOE, EPA, and also OTA, when we had that and the Aspen Institute.

Long story short, we determined that DOE had met the EPA standards and recommended disposal. And part of the success of WIPP at the risk of sounding immoderate is public confidence from the EEG evaluation of the impact on public health.

Two things that are, in general, lacking at times in here was candor and humility in saying what the uncertainties in protections of potential disruptions over 10,000 years, whether they are manmade or naturally occurring destructions. And the example I would use is that all our mothers are very, very proud of the work that we have done and, you know, I really trust this totally but when you start telling your own mother what people are going to be eating 10,000 years from now or what the potential root of exposure of these materials coming back to the biosphere, you know, your own mother may have some questions as to the validity of those assumptions.

Now what is WIPP, again? It is a nineteen billion dollars repository and the critical radionuclide is plutonium-239 for WIPP. It is the long-lived, 24,000-year one. And a reminder that the contact handle transuranic waste is respirable. There are no limits on the respirability. It is soluble. It is not fused in an insoluble matrix. And it is contained in the 55 gallon carbon steel vented drum. The isolation is essentially based on the containment in the salt beds.

The absence of engineered barriers are when we proposed the legislation it was required that engineered barriers be included. The amendment was modified before it was passed to say that engineered barriers shall be used if necessary to show compliance with the standards. And since they were able to do the calculations without the engineered barriers, none were included, although we have a magnesium oxide but that is not one important.

Two important things on this slide is that the public acceptance is far greater for activities involving the defense of our country. This is known intuitively, whether you call it patriotism or what have you but there is a greater receptivity and acceptance of those types of activities.

And I might mention you ought to point out that on high-level waste, ten percent of the inventory is defense-related.

Secondly, on the hazards of the radwaste, the states do not regulate either high-level waste nor transuranic waste. DOE does. The responsibility was given to them by the Congress but the states do regulate the non-radiological components.

Now in the case of WIPP, the question was raised this morning, they are trivial exposures from the non-rad components. And the agreement that the state has with DOE is that nothing in this agreement shall relate to the radiological constituents in the waste.

Now, on lessons unlearned on waste disposal, it is essential that we plan, evaluate, and plan some more to avoid this changed-our-mind syndrome. There are a dozen examples in the paper published earlier this year.

One other thing which is important is consistency in disposing of materials. DOE was able to dispose of the transuranic waste in shallow land burial prior to 1970 and did so. And that was legally correct. Since then, we now have new standards requiring deep geologic disposal and the material that, for example, at Los Alamos, is under three feet or six feet of dirt. This is acceptable because it is legally correct.

There is a paper published in the UNM Law School Journal earlier last month by my daughter and myself, as a matter of fact, urging DOE to dig up these materials and put them in WIPP for consistencies sake.

A 1957 NAS report was cited frequently here last meeting but it didn't mention the fact that they said, hey, you ought to resolve the major technical concerns before you authorize construction. Those words of wisdom sort of went down the tube. And don't use the screening technique of identifying the criteria that is desirable for a site, where you have five, and then you narrow it to three, and then one. We don't use that in choosing a spouse where we list the criteria that we want in a repository is equally a serious decision for it.

At national meetings, there are

any number of papers that are presented but we always talk about the transparency and openness. You never see papers presented saying how we really messed up. We spent these funds unwisely. They really didn't get -- On the low-level waste sites, six of the first ten had to be closed because they leaked. Oak Ridge had the open pits where the rainfall was less than the evaporation. Now it is true most years. Some years it wasn't and we had a real mess on our hands.

So, on the regulatory standards it is essential that one resolves jurisdictional disputes between the agencies promptly. You cannot evaluate any performance without a yardstick to do so. I think it is unconscionable that the two regulatory agencies, NRC and EPA spent over two years at loggerheads arguing about what their respective roles were. And I would recommend that the Commission take steps to try to adjudicate those kinds of things promptly.

Probabilistic analyses are essential and the public understands that fully. You don't need deterministic ones.

Lastly, predicting a dose from the materials becoming back to the biosphere, resuspended and inhaled as is ingestion from diet over one million years, that is a meaningless exercise and those standards must be revisited.

By the way, most of the NRC and EPA standards are salvageable. There is no reason to go back and reinvent the wheel from scratch.

And before we had EPA standards, Sandia did the calculations on WIPP of calculating max doses at 1.6 million years. So I just throw that in to be fair on it, even though I am opposed to the one million year criteria.

Asking Congress to solve technical regulatory problems should go out the window. If DOE wanted to bring waste to WIPP for experiments, you have got Congress to approve that and they said take that a step further. Not only do the experiments, you have got to do them before you bring waste for disposal. The experiments were without merit and had to be cancelled. The law then had to be changed. Also, the EPA required 10,000 year analyses. Congress then asked NAS to take a shot at it and came up with a million years.

And I think the moral of the story here is don't ask Congress to do the work that we want to do.

Now, it is important to provide a perspective on this which is sometimes lacking. This illustrates the total U.S. population exposure; that in two decades, the medical radiation exposure to our population went up by a factor of 7.3. As a matter of fact, the nuclear exposure went down by a factor of 0.2 but one is 9,000 times greater than the other. I mean, it is as though we have a bookkeeping system where we account for the pennies and don't bother to count the $100 bills. This is a report by the NCRP last year; 160. It is a very reputable group. And the reason why the public is seemingly accepting of this is that the public believes that the benefits of the early detection outweigh any risks of the radiation exposure. Mind now that medical is 50 percent of the total population exposure that we have. It is an enormous number and I would submit that it is terribly important that the Commission urge all the principles to not only do risk analyses which are vital but do benefit analyses as well. What are the benefits of some of the high-level waste, whether it is energy independence, whether it is solving problems with some of the defense high-level waste and things of that type?

So this is extremely important and we need to put them all into perspective. You know, that thousands of people die each year from starvation in Africa. Food irradiation can increase the shelf life by months. There is no electricity. The food spoils. People have to shop every day. And this is an example of the beneficial aspects of ionizing radiation.

CHAIR HAGEL: Mr. Neill, could you wind up?

MR. NEILL: Yes, sir.

CHAIR HAGEL: And then we will get all of your panelists there ten minutes and then we will get the questions. Thank you.

MR. NEILL: Yes, sir. Twelve seconds.

Ten million has been spent to date and we have collected twenty-two billion from ratepayers. Yucca was expected to cost ninety-seven billion. The new one will be greater than that. And the future funding is going to be far more difficult to obtain and I would recommend that the Commission consider trying to get those funds collected and that they be put in a separate account, rather than the general treasury.

Thank you.

CHAIR HAGEL: Mr. Neill, thank you very much. Dr. Voegele?

MR. VOEGELE: As the person who doesn't really belong on this panel, I will try not to dig myself into too deep of a hole. The questions that you asked are rather broad and it would take far more than ten minutes to do them justice.

I have chosen to take a small bite of the apple and I am reacting in particular to the statement about avoiding extended out-of-sequence confusing process of regulatory development.

I am going to examine selected aspects of the regulations that are traceable to policy that I will try to identify that really complicated the disposal program or caused concerns related to what is normally caused as changing the regulations to fit the site.

I want to point out that the regulations themselves do not lead to the abandonment of Yucca Mountain. Those regulations are difficult but they are understandable. They are clumsy and proscriptive but the Department of Energy was able to prepare and docket a license application. So I am going to present some observations about why I believe the regulations and to evolve and maybe a lesson learned that is a little different from you were expecting. There is perspective in my points that I think you have to expect that is going to happen in the future as well.

As to the social part of this, I personally don't think the public involvement in the program was meaningful -- The Yucca Mountain program was meaningful. I do think it was meaningful in the WIPP program and that is why I don't think anybody was satisfied by it. And it is very easy to try to write that off as part of the difference between working within a peer democracy and a constitutional democracy but I prefer to look at it as an issue that we were dealing with some very well intentioned goals that were just poorly implemented in terms of involving the public.

So we will go from here. The policy basis I want to talk about involve the interagency review group in 1979, which is a source of the position the country adopted to solve the waste disposal problem within the current generation's lifetime. And I want to make it very clear that I agree with that goal but I don't necessarily agree with the way it was implemented. I don't think that you had to solve something. You had to make something happen within 30 years and lock the door and walk away and never think about it again. I believe it is perfectly legitimate to talk about finding a way to solve that problem and maybe passing onto the future generations an opportunity to become involved, if it is necessary. There we go with the public involvement.

I want to mention a couple of things about the Nuclear Waste Policy Act as a precursor to these comments. It did cause us to have three federal agencies involved and that led to some complexity that I am going to talk about in a minute. One thing I want to point out here as an example of public involvement is the Nuclear Waste Policy Act required the Department of Energy to create environmental assessments for looking at selecting the sites to go forward for characterization. And in developing the citing guidelines for the environmental assessments, the Department of Energy believed they were involving the public but they ended up with a set of regulations that could not be printed within the amount of space that a real environmental assessment would allocate to addressing those types of concerns. So it is a situation where the Department was trying to address the congressional perspective of involving the public but created something that he public couldn't deal with in the way the public was used to dealing with it.

I want to talk a bit about the National Research Council's report in 1990. You heard about that this morning and I am going to focus on a couple of different aspects of that and I am going to talk about why the National Academy's Board of Radioactive Waste Management believed we were on a path to failure with the complexity of the regulatory structure we had at that time.

A little bit on the regulations. You heard a lot from Dr. Cotton this morning and I just want to highlight a couple of things he said and add a few extra perspectives.

40 C.F.R. 191 originally was a release standard and its own science advisory board had suggested to the Environmental Protection Agency that that was not the proper way to do this and the environmental

protection agency responded and suggested that if we went with the dose-based standard, it would encourage looking for sites which would actually disperse the waste and the EPA didn't want that. And please feel free to forward to 2008 when we actually have that type of standard today, but nonetheless, that was an issue in screening.

Another issue that the EPA was dealing with was rather than having a full risk-based regulation, they based a regulation on what they believe was technically achievable. In fact, there is a quote and I don't have it with me that something to the effect that if we did not believe that repositories were capable of performing so well, we might have made a different standards.

Finally, I will emphasize what Dr. Budnitz talked about. The Science Board disagreed with them and one particular thing they disagreed with was not only the level of the standard but the probability that was used for the screening criteria and that is still haunting us today.

The Nuclear Regulatory Commission, in developing their Rule 10 C.F.R. Part 60 dealt with subsystem performance objectives. Mr. McCartin talked about that this morning and that was a way to address uncertainty. A point that I want to really emphasize and this is building on the solving it within a single generation's lifetime, is the reasonable assurance finding that the finding that the Nuclear Regulatory Commission makes to say that we believe that this can be done safely is done before construction begins. And that is also true of 10 C.F.R. Part 63. That is not conducive to setting up a program that we will talk about a little bit later on that gives people an opportunity to learn from experience such as was done with WIPP during the recertification processes.

I wanted to mention that the

Nuclear Regulatory Commissions have never had sole reliance on the natural barrier system. And you will often hear people criticizing those regulations and that is not true. There has never been sole reliance on the natural barrier system. And the point that I want to leave you with specifically, and this sets you up for some of my next viewgraphs, in 1985, the Nuclear Regulatory Commission amended 10 C.F.R. Part 60 to allow disposal of the unsaturated zone. That gives you a real glimpse into what those regulations were at that time; not just we are going to add something. This is to allow disposal in the unsaturated zone.

So you are looking at Yucca Mountain being an unsaturated zone site. We did not even in the NRC's mind have a regulation that allowed disposal in the unsaturated zone.

Moving on to the Department of Energy citing guidelines. My principle comment there, again, they were not required to be promulgated as a rule and DOE went through a rule making process and created something that was so large, it ended up with a 6,000-page environmental assessment, including the comment responses, as opposed to 150 pages as an average member of the public might have expected for such a document.

Nuclear Regulatory concurrence was required. Commission concurrence was required on those citing guidelines. And again, I am going to come back to that in just a minute, why that is crucial.

The Nuclear Waste Policy Act itself had some guidance to the Department of Energy about screening. And this is where the disqualifying condition concept came from 10 C.F.R. 960 and those led to expectations as well on the part of people. And I am going to try to conclude with a perspective on the difficulty in dealing with a simple to understand regulation that can be strictly enforced, as opposed to one which really deals with risks to mankind.

We mentioned this earlier this morning. The Environmental Protection Agency remand in 1987 was procedural. It was not technical and the Energy Policy Act of 1992 was meant to be a remedy for that.

Now the Nuclear Waste Policy Act amendment created some regulatory issues as well. One of them is the Department of Energy had not amended its citing guidelines when the NRC amended its rule to allow disposal in the unsaturated zone because it wanted to compare all sites equally. It did not want two different sets of criteria for comparing one site for another. That left DOE after the Waste Policy Act was amended with a single site that did not match the siting guidelines.

You can begin to understand whey we had to change the rules to fit the site. DOE put themselves in a pretty bad position. This is not quite so important. The

Environmental Protection Agency began with a saturated zone focus and I think Tom talked about that this morning with a carbon-14 issue, the gaseous versus solid. But again, EPA did not have specific criteria to address unsaturated disposal issues.

And this was said this morning as well and I will just reiterate it because I believe it as well. There was a lot of public frustration following what was seen as reneging on a commitment that was made to pass the Nuclear Waste Policy Act. Those of you who many people have had the privilege of hearing me speak about the Yucca Mountain site and one thing I have never said is Yucca Mountain was selected fairly.

Now I want to talk about the Board on Radioactive Waste Management statements on how they affected U.S. policy. And I am sure you are all familiar with the statement that said the program is unique in its rigid schedule, its insistence on defining technical requirements in advance for every part of the multi-barrier system. The part that sometimes gets lost, we are up to yellow already, you started me earlier, is that the encouraging expectation of absolute certainty about the safety of the repository program is a scientific trap that can't be done for 10,000 years.

And I will close with the bottom point there. A policy that promises to anticipate every conceivable problem or assumes that science will shortly provide all the answers is bound to fail.

So lessons learned. Changing the rules to fit the site was necessary, technically but I don't think you could have found a worse thing to do institutionally. We just had to change those regulations because they didn't fit the site and yet everybody believed that that was bad.

More than lip service is needed to involve the public. The public wants rules that are simple and strict. Nevada's argument that it had to give up the veto to be able to negotiate with the Department of Energy, that is vital. I have said this in shorthand, hundreds of concerns that the NRC staff did not consider acceptable, I meant that to mean that in a different environment, many of those things might have been able to have been worked out before they became contentions.

So very, very quickly I will try to wrap this up. The path forward has to have trust, has to deal with the uncertainty, has to deal with time. There must be real public involvement with this. The responsibilities must be real. I believe the state needs a role of responsibility and I believe there needs to be a compensation package.

So my last viewgraph is for my last 30 seconds. Twenty-one years after the remand, we basically ended up with the international consensus regulatory position of how you should be doing that, although their screen probability is still too low. I believe there were important lessons to be learned from WIPP. The public involvement and the re-certification approach I think is key. It is something I think we would like to see in a new program. And I think we need to remember the large first-of-a-kind engineering projects will benefit from proceeding in stages.

Thank you.

CHAIR HAGEL: Dr. Voegele, thank you.

Mr. Frishman.

MR. FRISHMAN: Thank you. I first have to say that while I am a technical consultant to the State of Nevada, what you hear from me today is from me after 30 years of experience, having gone through the regulatory process, as well as the entire Nuclear Waste Policy Act process, even from before it was written. And I have spent the entire time working from the perspective of the state first of Texas and then of Nevada. So I have seen this from a very different direction from almost everybody else you have been hearing from.

I want to go directly to your question about how can needed regulations be developed in a coordinated, consistent and timely manner? And instead of going through the litany of all things good, I decided that it might be more interesting to just intuitively see what kind of a process could possibly look. And I started out thinking well, do we try to invent something that is absolutely novel? Do we try to work with systems that are there already that can be modified and maybe overcome some of the difficulties, such as long periods of time that it took both EPA and NRC to get regulations straight but on different paths. But some of that having to do with major debates within their own agencies and some of it having to do with debates between the agencies. So how do you address something like that?

I also went through, I think, all of the processes from both of those agencies and from DOE in developing their regulations and guidelines and they all had different personalities. They all treated people differently. They all said how proud they were of their dealing with the public and as Mike has observed as well, they were talking at the public. They weren't getting involvement and they weren't, in terms of anything effective that the public could actually do. You know, it is come and listen, we will tell you. And I remember even one instance where, and I will get back to this point in a minute, where NRC and EPA staff people actually sat on the same stage in Denver and they wanted to talk to the representatives from the various effected states. But the talk turned out to be a demand session on the part of those two agency staffs were tell us what you don't like about our regulations. And this was before the regulations were even final and that was a rather bruising day for everybody and we gave back some bruises that were well-deserved.

So trying to put together a scheme and try to preserve what may be good and see if we can side-step what may not be so good, it occurred to me that there is a combination of things that might actually suggest it could be successful, starting with putting together an expert panel of EPA expertise staff, NRC staff, and experts from the public, and diverse experts from the public, people from the fields that know about radiation, people from the fields who know about environment, and on and on with that list. Diversity is the important point.

Have this panel put together a nationwide inquiry, maybe starting out following the pattern that EPA has seemed to move into when it is proposing regulations, and that is pose some sort of large-scale questions but make it very clear that these are only example questions. People can talk about whatever they need to talk about in terms of what they thing regulations should be.

And while that crystalline rock program over 20 years ago convened large groups of people and listened to people, or tried to listen to people, or said they listened to people, in this one I think it really needs to be a discussion where the public is able to say what concerns them about the safety of high-level waste disposal in the context of today's circumstances.

We certainly shouldn't ignore the path but I think people think differently now from what they did 20 years ago about radioactive waste, in some cases regression and in some cases progress. I don't want to judge either right now.

But I think a national inquiry,

what got me thinking about that was the apparent benefits that came from the one in Canada on a broader scale but this would be primarily dealing with regulation. And this panel then produces a report that literally doesn't make, necessarily even make recommendations. It just records what they heard and organizes it.

And one of the things that has always been a rub is that too many people in the meetings that we are used to are told that what they are saying is out of scope, which means it is going to ignored for sure by the people who are writing the regulations.

Well, with a regulation such as this, there should be a NEPA evaluation of the regulations. So therefore, the scope should be wide opened because the information gained is not only to write the regulation but to write the NEPA evaluation of the regulation.

So once the report is done and the report should be probably issued in draft form so people can see what the panel did here and how they organized it and if they feel they want to make recommendations, that is fine, but I don't think it is mandatory.

Once that is written, then that becomes the guide for writing the regulation. And while I don't intend to say anything that sounds like I am agreeing with Bob Budnitz, but I think it should be a single regulation and I think it should be, even though I am not beholden to anybody, I think it should be written by the Nuclear Regulatory Commission and I think it should be written with the assistance and advice of EPA, the panel members who were there and heard it all.

And also, at least with the oversight of the public members of that panel, so that they can see that the regulation is one or way or another faithful to what the panel heard.

I think this will go a long way. And what got me sort of thinking of going in this direction is that I first was a little curious when you said that the theme of today was going to be regulation and I started thinking, well, why would you start there. And it occurred to me there is a really good reason for starting there. And that said, if there is no confidence in the regulation itself, there is no confidence in anything that falls from there. So unless the people believe that the regulations are in fact aimed at their safety and I think they need to have the assurance that it is generic, generic meaning everyone is equally saved, then from there, you may have the chance of devising a program that could flow from at least a feeling that people are being protected in this really complex area.

And so that would leave us with a process that I think as I said sort of was inspired in part by the Canadian process. It also, think, has a couple of other advantages. It takes what I see as the good of both APA, Administrative Procedures Act, review and comment rulemaking, and the good of a negotiated rulemaking because those discussions with the public and with a knowledgeable panel who can sort of try to pull out of the public what they think the public is really concerned about and really interested in, I think that sort of brings out or takes advantage of some of the good of negotiated rulemaking.

At one point there was even a suggestion, everybody was so frustrated, there was a suggestion that there be a negotiated rulemaking for the high-level waste program. And we were all I still believe, correctly, scared to hell. It would have been a bulldozer job. We didn't have enough in common to negotiate anything.

So but in this case, I think if the people believe that the panel is serious about we are trying to figure out what you want in the way of safety, that still will be technically competent and still will satisfy the regulatory needs that we know we have, then move on from there.

I suggested the NRC primarily because they have a structure in place and they have a structure that while for the hearing portion is really close to the public. The public organizations and individuals don't stand a chance in that system but organizations do who can afford it and states do. So inviting states and local governments and tribes in early, so that they actually feel that they have some ownership on the regulation, will then maybe encourage them later to play or to do whatever they can to be involved in a hearing if it comes to that later. But I think we have to recognize that it is out of the public's hands once it gets docketed, once an application is docketed.

And I don't know what more can be done about that, other than the agency still has to deal with an environmental impact statement to go with a regulator's decision and the public should be encouraged to come back into that, rather than being forced to write contentions on a NEPA document which NEPA never intended to have happen.

Thank you.

CHAIR HAGEL: Mr. Frishman, thank you. Now to Senator Boren's favorite Oklahoma professor --

(Laughter.)

CHAIR HAGEL: -- Dr. Jenkins-Smith.

MR. JENKINS-SMITH: That is a scary proposition. It really is.

My name is Hank Jenkins-Smith. I am a professor of public policy. I will be talking today about a synthesis of work that I have been doing for the last 25 years at Oklahoma, Texas A & M University and the University of New Mexico. This work was sponsored over a long period of time by all those universities, by Sandia National Lab, by

National Science Foundation and other organizations. I will be synthesizing that today.

Let me just start by saying that I believe that we start out with a structural credibility deficit that is really a combination of the way we have designed our policies concerned with used nuclear fuel and the way our institutions are structured. The history, particularly at Yucca Mountain but elsewhere, has been one of relative inflexibility with how we have defined those institutions. They have been built initially with a particular objective that trapped the policy debate in particular ways.

The policy designs can be built that reflect public concerns in a way that can really increase the prospects for public support. There is no guarantees in this game but you can design the initial policy in a fashion that either pushes you down a road of greater contention or that provides the prospects for greater support.

And the last issue I want to get to here is that the regulatory process interacts with the level of controversy associated with the policy over time. And that changes the way that the technical communities that are involved can engage in this process, which creates a different type of organizational challenge.

Used nuclear fuel management raises a bunch of interesting kinds of problems. We begin right now at a point where there is substantial support for nuclear energy, for increasing the share of U.S. energy supply that comes from nuclear power plants. What is intriguing about that is that that change in perspective has come about largely because of changes in the perceived benefits of having independent supply within the United States that assures a large base. It is not because people have seen the risks of things nuclear as diminishing over time.

So it is a benefit-cost calculation on the part of the public and we have tracked how that has evolved over time but it isn't because the risks seem to have gone away. The challenge for the management of used nuclear fuel and the potential for recycling or disposal is that when we focus on that piece of the policy process, we are really looking from the public standpoint at the costs and not the benefits. We have isolated a piece of what is seen as generally a beneficial direction for U.S. policy but for purposes of talking to the proposed host communities, we have isolated all the bad parts. And that frames the way the policy debate can happen in that community in an unfortunate fashion. It generates a lot more opposition than support.

Let me preface this by saying there is the institutional aspect of this and I will get to the public support in just a moment. With federalism, the way it is designed in the United States and particularly with the supremacy clause in the Constitution, we have an interesting game theory problem when you are negotiating between federal agencies or federal entities and states. And that is, that the states, as a player in the negotiation, are always put in the position of knowing that the other party can change the rules because Congress can and there is a long track record that states can refer to showing that in fact the federal government, Congress can change the rules.

And so it is difficult from the position -- if you were put in the position of being a representative of that state, say a governor or a state level official, and you are negotiating for the future well-being of your citizens, you are having to place an awful lot of trust in the hands of an entity that has a track record of changing the rules.

I urge you all, if you haven't read it yet to look t the letter written in

1982 by the governor of Wyoming in response to the attempt to negotiate a monitored retrievable storage site in the state and he vetoed the continuation of an evaluation process simply saying that governors can't assure the well-being of their future citizens. Now that is an institutional arrangement issue that has to do with the entities that are doing the negotiating.

And governors, these are not governors that tend to be opposed to federal policies. We are talking Utah, Wyoming, Nevada. These are people who are put in a nearly untenable position from a standpoint of really simple rules about how negotiation happens. I anticipate that that problem won't go away, as long as we have that institutional design in place.

Let's talk about policy design for the moment. I think of policy design as the broad parameters in which people begin to think about the benefits and the costs and the processes for handling a major public issue. Now policies themselves come in bundles of attributes. If we were thinking about the nuclear energy process generally and we included the whole cycle, we would have energy production with its implications for energy security, for jobs, for economic development, along with the waste cycle and everything else that is involved.

You can see here that in these combinations of attributes, we are dealing with process issues, numbers of disposal sites, the regional distribution of those sites, criteria for selection, process issues such as who gets a say, how you frame the policy itself and what venues are employed for doing that. The facility design aspect which interacts with all of these things and is usually seen as an outcome of the former process has to do with questions of retrievability, depth, there are a variety of different strategies from Greenpeace's advocacy of having an aboveground pyramid, sarcophagi to deep bore hole. So you can think in terms of many variations in design.

But there are also extra storage kinds of attributes associated with the facility. Many of the European designs encompass a research facility associated with a prospective disposal facility, particularly if you are envisioning long time periods for investigation of a site, the potential for treating the materials as a resource, potential for future design and building of reprocessing facilities at a site, and other attributes of the policy.

My point here is that if you think about what you are asking a host community to engage in or if you are thinking about asking a nation to engage in a discussion about siting these facilities, the things that can be involved are not restricted by some magical prior. Now, in the U.S. case, we have generally, as the Yucca Mountain process indicates, we have talked about design chiefly as a disposal facility, as a place that we are going to take waste, designate it as such, permanently place it, observe it for a while and then close a facility.

That is a way of designing a policy. Note what it is doing though is that it is isolating specific aspects of the policy and not focusing on others. Now, we have done a lot of experiments at the University of Oklahoma on what it is that leads to acceptance or not of respective repositories. One of the issues is retrievability and we have focused on this qualitatively and quantitatively. And I am showing you here when we ask people how they would prefer to see a repository as a retrievable site or as a non-retrievable site, you get a substantial majority that would like to see retrievability, in large part because they see the future development of knowledge and capacity as something that future generations ought to be able to bring to bear on the problem and precluding that discourages them.

In focus groups when you raise this kind of question with an average cross-section of lay citizens, you often get laughed at if you try to tell people that they ought to, we ought to just seal it for fear of future generations. So as a preconception, this is a very significant concern.

When you look at bundling of attributes with a repository, we have looked at how people's preferences or support for a repository would change if you bundled it with a laboratory or if you bundled it with a reprocessing facility. And depending on where you start, you get some really interesting changes here.

Focus on the oppose columns on the upper chart there. It is a research laboratory. If you are going to make a mine-like geologic repository of the sort that Yucca Mountain was envisioned to be, if you pose the question broadly, you get a fraction that oppose it, half of those who oppose the policy initially say their support would substantially increase in the event that it was coupled with a laboratory. That is similar numbers for deep bore hole.

Similar kinds of changes occur when you ask about adding a repository to the process. These are attributes of design that have significant implications for public support for a repository. You frame these issues differently, you start out with less of a deficit, in the policy debate that ensues, people are able to talk about benefits of the site, as opposed to just minimizing the costs of the site. Structurally, that is a very different debate.

And I am going to stop here because I am out of time but I can also raise the other issues on technical credibility later. So I will end.

CHAIR HAGEL: Doctor, thank you.

Mr. Kasperson.

MR. KASPERSON: I would be remiss in citing this if I didn't register the concern coming out in my community of social scientists about the way the Commission has been established and is carrying out its functions. And I think that there is a fairly deep concern about whether the requisite expertise that the Commission vitally needs is necessary.

In ten minutes I am going to try to do something that I know is impossible. There are probably 50 to 100 books that have been written on the social science aspects of nuclear waste disposal and probably a thousand peer reviewed articles. And in ten minutes I won't get to say very much about all of that but I am going to try to make a few essential points with encouragement for the Commission to identify these as major issues that it is facing in designing a new approach to radioactive waste disposal and to really dig into those issues, however that is done.

Okay. That said, I think that it is pretty well understood and it is not just the finding of social scientists but here, for example, is a statement from the National Academy of Sciences, from its Board of Radioactive Waste Management. Here is another one that we recently published two weeks ago or something in Science magazine indicating the kinds of concerns that are out there. So I tried to make the case today that while you gave us a set of questions that were focused on regulation, we don't think that those are really the basic problems that you are facing. And the problems are issues that are underlying the regulatory system and I will try to say something about what I think they are.

All right. So what are the fundamental problems that we are talking about? Well, we see four of them that we think we are talking about a deep uncertainty problem here. We have already heard about the need for effective public involvement. By the way, extremely difficult to do. And you are not going to get answers here from me. It is one of the areas that I think you really ought to dig into deeply.

Fairness in both process and results is going to be essential but very difficult to achieve in the design of the new system. And perhaps most pervasive and already spoken to by several members on this panel, this whole process that you are about to generate and initiate must move forward under conditions of high social distrust. And I want to make the argument with you if you think you are going to regain social trust, think again because it is not going to be possible within the time frame that it necessary. And proceeding under conditions of high social distrust as opposed to high social trust is a whole different matter about the design of the processes and how that may effectively be done.

So, deep uncertainty is a major problem and it has a number of aspects. As we know, the long time frames we have already heard about the difficulties in making the traditional proof of safety that we would do in most environmental and risk regulations. The Academy has concluded that the physical and chemical phenomena that control the site and the repository really make it very difficult to predict what future events and future risks will be.

And we know that we are going to put down a system some place that is going to interact with human systems. And basically, major components of those human systems I will argue are essentially unknowable. So they contribute to the deep uncertainty that is involved with the problem.

We also know it will be, as we have already head from the panel a first-of-a-kind facility, which will make the risks and uncertainties highly site-specific.

And the implication of all of this is that the understanding of risk and uncertainty will be, as we have heard, evolutionary in nature and it will develop with the progress of science and experience and you are not going to have it by doing a nice, neat, risk assessment at the beginning of the process. It just doesn't work that way. And so you are going to have to deal with a very different kind of problem than problems that -- I have worked in the risk analysis field, I have for a long time, and I would say it is an abuse of risk assessment to try to throw risk assessment at this kind of a problem. We can talk about that.

All right. How to achieve effective public involvement and collaboration? Tough question. You know, if you talk to federal agencies here in Washington, they will all tell you that of course risk communication has to be two-way and then try to find anybody who does it. And it hasn't worked very well in the risk communication efforts, I would argue, surrounding Yucca Mountain. And we are going to have to do some hard thinking about what real two-way risk communication, particularly including the listening function to people or what I put it is not the outreach but the in-reach function connected with risk communication. That is essential. It doesn't normally occur. Everybody acknowledges risk communication is two-way and it never happens and we are going to need to figure out, it is going to be a major imperative in this particular case.

And so we need to, I am going to skip over some of this, but we need to get started very early. We have a series of guidelines about how you can undertake stakeholder participation and try to do a good job and it is very difficult. It involves baseline studies and public perception and things like that, a monitoring system of how concerns change over time with events and new information and so forth and so on.

I am going to jump forward. I am not going to walk you through this. I just want to indicate that in the social sciences, we have tried to create some very complicated analytic frameworks, just as we have with the technical aspects of the program. And I would be worried if you haven't seen any of these because they are an essential part of where the information analysis comes from of some of the major problems that you have to deal with.

Okay, let's go on. Fairness will be an absolutely essential element of this process, as several panel speakers have spoken to already. And those kinds of fairness we should keep in mind are just not the fairness of the ultimate regulation or how many sites or how the sites are selected but the whole process, the whole procedural aspect of how the regulatory system and how the disposal process is developed. And is that process going to be fair? Is it going to be dominated by a few leads in Washington? How is it going to be done exactly?

And judgments about the fairness of the process will begin at this point, that people will be looking at the entire process of the development of the disposal program. So we have to stop worrying about it now, today and that should continue on through the process.

Okay, word about social trusts, since I am short on time. I would say over the past 25 years we have done about as bad a job as we could have done on the social trust question in this area. And we have succeeded in losing the trust of the principal stakeholders in publics who have to be involved in decision making in the management of waste.

And we also know, and I will just show one little figure, here is some work from

Paul Slovic in Oregon in which Paul is famous for his group sitting people down and doing paper and pencil exercises and he had them rate what a whole series of different trust building activities are located at the top of this, top half of this diagram, versus activities and events and so forth that may lose trust.

The interesting thing about this, I mean it is very interesting to see what in the composition of these two, but notice that the lines on the top that the trust building things are all relatively short, brief lines and the lines on the bottom are really big lines, by comparison. And Paul is making sort of an experimental point out of psychology that the effects that we have on people, once trust is lost it is extremely difficult to regain it.

And let me just finish then with one final -- So what does all this mean for regulatory systems? This I know the

Commission is very concerned about, which is that we really need to have an explicit recognition that we are dealing with a deep uncertainty problem and that is a deep issue. That is a profound issue and it means that we are going to do something. We are going to manage this problem in a very different way than we have said about managing it in the past. And there are implications for the burden of proof and who should bear it and who bears the matter of removing uncertainties. Is that the risk bearers, the host publics and so forth or is it the managers of the system? And fairness is going to be an absolutely crucial issue.

Thank you.

CHAIR HAGEL: Mr. Kasperson, thank you. We particularly appreciate your resounding vote of confidence.

(Laughter.)

CHAIR HAGEL: To the five panelists, we are grateful. Thank you. Now, your work is not yet complete. We would like to have a round of questions. So if you are agreeable, we will start with who has a question?

Allison, we will start with you.

MEMBER MAC FARLANE: Sure. I have lots of questions but I will just start with a couple for Dr. Kasperson. Thank you for coming. And clearly we have a lot to learn here and I know you guys have written a lot about this. So I am quite aware of that. And this is really the fundamental, you have touched on what I think are the fundamental issues associated with nuclear waste disposal.

So a couple of questions, then. And maybe you will think this one is irrelevant but I am always fascinated and we sort of touched on this this morning but we as a society, as a culture, don't seem to have much of a problem with disposing of things like arsenic and lead, and heavy metals but we do have this enormous problem with stuff that will disappear eventually. So that is one question.

Another is do you think that the original Nuclear Waste Policy Act, before it was amended, was considered fair by the public? And then finally in terms of trust, could an agency like the Department of Energy regain trust in any kind of reasonable time period?

MR. KASPERSON: Well, let me take a shot at those three questions and maybe my colleagues here would like to jump in on this as well.

First of all, we do think that really a number of those other problems like lead in the environment and so forth, which has very long half lives and so forth, is a very serious problem that doesn't get the same attention.

We know from studies that have been made that nuclear materials are highly dreaded and it is sort of interesting to try to figure out why when you put things underground people are extraordinarily concerned. Even when we were experimenting with state programs with low-level waste, we found out and we were talking about surface and near-surface facilities, people were very concerned about putting anything in the ground. So that is one issue.

The second issue is nuclear materials and regular nuclides, themselves, that there seems to be a very strong set of fears, in particular, connected with those and that has turned up in lots of experimental results and so forth and there is lots of speculation about why that might be.

A second point about, I am forgetting your second point, but social trust, I think, was the third.

MEMBER MAC FARLANE: The third, Nuclear Waste Policy Act, the original wasn't fair.

MR. KASPERSON: Yes, I guess my

own deal is I don't think by and large the public knew enough about that Act to really make a decision of fairness but I think that the architects of that act went to a lot of trouble to try to develop an architecture of fairness in the number of repositories and where they would be located and those kinds of things.

Some of that was lost in the amendments that subsequently occurred which destroyed. And then when we chose the site before we did the technical work, that was not a help either. So I think that the whole process of implementation of the Act lost a lot of the initial value of the architecture there.

On the social trust question and maybe my colleagues will agree or disagree, but I think DOE has a really hard job to operate under. And what I would probably, if I were advising the Department of Energy, what I would say is act in a way that really deserves trust and merits trust and assume that it is not going to exist. And you are not going to be able to rebuild it in the time frame that you are going to need to make decisions.

And so I think a decision process which assumes distrust, rather than trust, is a very different kind of process. And one guide is really realistic to what we are facing.

MR. JENKINS-SMITH: If I could just weigh in just slightly on that question and I will go in reverse order, I think we need to be careful not to over generalize. I mean, the case of WIPP is really interesting. I am sure it is all Bob Neill's fault that the WIPP process worked out the way it did but in the late 1980s, the New Mexico public was two to one opposed to the waste isolation pilot plan and the public imagery that was associated with it at that point was very much tied to nuclear disasters. I do remember the bumper stickers that said Three Mile Island, Chernobyl, WIPP, and all of the discussion that went on there. But that policy process that spanned the latter half of the eighties, all the way up to 1999, when the truck started rolling, was a fascinating one. The University of Mexico sponsored a time series survey in which we measured twice a year what the New Mexico public thought of the risks and the support for that facility. And there was a gradual rise that was punctuated in a couple of cases.

When EPA approved the facility, there was an uptick in public trust. When the trucks actually got there, there was a substantial uptick in trust. By the year 2001, the substantial majority of the public supported the operation of that facility. And I say that not because I think that this demonstrates great trust. It simply says that there are more than one set of processes that can be employed that might get you to a successfully opened repository. There are many publics. I think we ought to be careful about how we use that term.

MEMBER MAC FARLANE: Yes. No, I agree.

Just briefly, then Steve can jump in. Do you think then based on your little history of what happened in New Mexico, do you think the opening of a repository in Sweden or Finland might have any impact on what happens here?

MR. JENKINS-SMITH: Yes, I do. I think that the more successful examples there are -- I mean, keep in mind that what happens in the course of a policy debates is that there are a number of major considerations. Think of them as dimensions of concern by the public. One might be safety. One might be economic costs, something like that. The issues that are out there that are brought into the debate are going to be those that reflect on those dimensions of concern.

So to the extent that there are successful sites out there, yes, that is going to be part of the debate but only if the debate is set up in such a way that there are people who really want to bring all the issues to bear. Again, if it is an issue that is defined only about minimizing risk, then the primary discussion is going to be what those threats are. And it is going to be very, I mean, when you talk about very small risks and what scientists understand are ten to the minus six, the risk, there is a very lumpy bottom end to the public's notion of likelihood and that is going to substantially shape the kinds of issues that are brought to bear.

So if you don't have reasons for people to say positively you should do this, well you can have a lot of evidence. It is simply not going to resonate much in a public debate.

MR. FRISHMAN: I just want to get

to your question of whether the Nuclear Waste Policy Act was fair. We knew at the time of its writing which states were most likely going to have the potentially acceptable sites. And so most of the jockeying that went one was among and between those states versus all of the states that were afraid they might get it because the deals that have already been sort of cut would break down. So the intent was that it be fair. And the champion of that intent was Congressman Mo Udall and he beat up a lot of people in the course of trying to be fair.

And in the end, I think the fact that the repository capacity we knew was going to be exceeded for the first repository and we had to have a second, that is an indication of the knowledge that it was unfair.

CHAIR HAGEL: Per.

MEMBER PETERSON: Actually, it is interesting, Steve, that you just raised this question of capacity because that was my first question. I have got a couple of questions and actually I was hoping, Hank, that you might be able to help me with something.

Statutory capacity limits seem to be a frequent feature of the laws that bring into effect disposal systems. And in the case of trying to drive the system so that you will have multiple disposal sites, I am curious about this because at least my thinking on it is that the major issues associated with repositories are inter-generational equity problems. And I don't understand the logic behind punishing people in multiple places a thousand years in the future to generate equity when it is our actions that have created the problem.

On the other hand, you do have a whole bunch of reasons to try to reach interregional equity for the current generation but there are other ways to do that, such as minimizing transportation distances by geographically disbursing say interim storage facilities, by transferring wealth from generators to those who have the responsibility for disposal and such.

If one were to work on that, do you think that it is still politically necessary or socially necessary to have statutory limits on capacity for disposal facilities or should we just go technical?

MR. JENKINS-SMITH: I think that is a question that would be really interesting to investigate but the history of these kinds of limits, actually in the WIPP case, it had to do with the type of waste that was to go into the site because there was a period of time when they were investigating putting high-level waste reactor waste in the repository and that led to a substantial political backlash and therefore the conditions that this only be transuranics.

And that issue, the cap has largely been seen as a way of making sure that current generations are spreading the risk, rather than as an intergenerational issue, I think. But it really bears on the question of whether the host community desires to undertake that activity.

I would posit that if you had a host community in the United States that really wanted to host that facility that had cooperation from the state level, that there wouldn't be the pressure on limits that you see when you are setting it as an a priori issue. That what happens is that when we are looking prospectively at who is going to bear the burden, the limits become an issue.

MEMBER PETERSON: I understand. I have another question that relates to what I thought was a very intriguing point that you made.

You showed that there can be significant changes in the level of support for facilities for disposal and, I presume, for storage as well. If they are coupled with extra storage attributes such as research or reprocessing, what is striking is that it seems that the increase in support is quite similar between the two. But of course, those have very large different implications in terms of what you are doing with the fuel cycle, which also has very important independent set of policy dimensions that we have a different subcommittee that is working on.

So one thought on that because you can construct policies that couple either reprocessing or research with these sorts of activities, one of the things that differentiates reprocessing is that very likely what is going to happen is that you will have a transfer of wealth from waste generators to these communities and that may contribute in some ways to acceptance because of the fact that it shows some interregional distribution of benefits and risk or transfers of benefits and risk.

Would it be helpful if you go the

research route to pay for that research from fees that would be charged to the waste generators, as opposed to from taxpayer fees? Would that assist in further increasing the feeling that there is some stronger basis of equity because the people who are making the problem are also paying for the work to create a solution and transferring wealth. Would that be something that also would be helpful from the perspective of generating local and state acceptance?

MR. JENKINS-SMITH: I suspect that it would. I have to say I don't have any experimental evidence on that issue. But the key underlying driver in this as we have teased it out in focus groups and seen it in the data is when people think that the facility is not only a purveyor of risk but is actively engaged in trying to see how minimize those risks or better manage them in the future, it really does a lot to offset the dread that we know is attached to things nuclear.

I suspect that if you attach that even further to the idea that those who are benefiting from nuclear energy or paying their mil and that mil is going to support that research itself, that that connection would probably help. I would have to actually empirically investigate that to know the answers definitely.

MEMBER PETERSON: Dr. Kasperson, could you maybe comment on this question also?

MR. KASPERSON: Well, I think I didn't emphasize it in my presentation but I think there ought to be as much risk reduction and so forth as we can reasonably achieve and we ought to try to make as fair a system as we can make but there will probably be come residual risks and unfairness. I think that should be compensated for.

And I guess my own view about the compensation would be you could do it like the French do it, which is to build schools and so forth in the facility.

My own view about that is that it ought to be sort of a negotiation in which the host community gets a right to try to indicate what its preferences would be for different kinds of compensation but the compensation level should probably be determined nationally for the disposal facility.

MEMBER PETERSON: So then another attribute of having that compensation include either research or reprocessing, probably even more so for research is that it also implies that you have a local base of people who are scientifically and technically knowledgeable and credentialed who live in the community. Well of course, New Mexico has two major national labs with this sort of expertise.

To what extent might that also contribute to building or facilitating a higher level of trust? Both Hank and Roger.

MR. KASPERSON: Well, one comment that I would make is that first of all, there frequently is a surprising level of expertise that may exist in the community, if you are not looking for large numbers of people. But the other option would be to provide resources so that the local community can higher its own technical experts, so we know how to carry on its negotiation.

MEMBER PETERSON: Exactly. In fact, Roger Neill spoke to the value of doing that. Maybe so I don't take too much time, I would like to move to a different question for Michael.

You noted that in the licensing process, the regulatory process, you are concerned about the fact that currently the determination of reasonable assurance occurs before construction is done. Correct?

MR. VOEGELE: Correct.

MEMBER PETERSON: So, I would be interested in the technology of deep bore holes. One of the reasons that it is interesting is because technically it has a very, very different set of characteristics from a conventional mined repository, the most fundamental being that they are like small modular reactors or something like that. In other words, you build one in a few years. You fill it. You close it. You get the experience of the entire lifecycle up through decommissioning in a short period of time. And you would do one initially as a demonstration before building additional ones. Thus, reasonable assurance determination could occur from having done the complete lifecycle of the disposal facility before you would expand and do additional work.

So clearly, this means that bore holes are different and therefore may not fit with the current regulatory framework in this way. Could you comment on this specifically as well as other ways that they may not fit or things you might need to do, such that bore holes might become an option if that is what one might want to do.

CHAIR HAGEL: Excuse me. May I interrupt just a moment? I know one of our panelists has to leave on time to catch an international flight. So we are going to try to stay on track here.

And please go forward, Michael, and answer Per's question. Try to keep it --

MR. VOEGELE: Very quickly.

CHAIR HAGEL: -- summary version. Then I am going to take the prerogative of the chair and ask the co-chair for one last question and then we will get you all on your way and one of the distinguished members of the panel will be off and running to wherever you are going. Thank you.

MR. VOEGELE: The Nuclear Waste Policy Act had actual provisions about how to do the licensing in stages for a repository system. That would not apply, at least readily apply to a bore hole system. And the only thing I know that is comparable to a bore hole disposal system would be a no-migration variance petition under something like RCRA, which I think I forgot who mentioned it this morning. It may have been Tom, historically has been done with the 10,000-year assumption and it just kind of traces back to the repository program anyway.

But what I suggested about and I believe the National Academy has written more than one report on stage development, internationally people have adopted a safety case process where there are step-wise decisions reviewed with the public about how to take the next step forward. I don't know how to do that readily with a bore hole program. I think you basically have to do as much research as you can and make an assumption before you start putting that material down. If you are going to be down one or two miles burying this material, it is very difficult to understand what the analogue to a performance confirmation program would be.

I don't see the current regulations being readily adaptable to bore hole disposal and I don't see them being an easy solution to them, either.

CHAIR HAGEL: Thank you. Thank you. Jonathan?

CHAIR LASH: We have at least absorbed the point that you were making, Dr. Kasperson, that the problem here is first of all process more than technology. That doesn't mean that we understand what the solutions are.

And I want to pick up on something that Professor Jenkins-Smith said and use it to pose a hypothetical to the two of you and try to dig a little bit into how you solve the problem.

I believe you said when you asked people about the level of assurance of future human intervention from a deep geologic repository, how much assurance they would have, 60 percent left at the prospect that there could be some long-term assurance that people wouldn't subsequently invade that space.

And frankly that reflects my own visceral reaction and yet we see rules being set up premised on the idea that we can somehow answer that question through the technological design of a site.

And I think that in a normal public process in which a public entity is coming to the public and asks that question and gets laughed at, there are two responses. One is, we really have to work harder to education them that we are right. And the second is maybe we can tweak the rules to show that we are right.

And I am interested in how you construct the process that can respond by saying, that is right and we will build a process premised on the understanding that we all know controlling something for 100,000 years is preposterous and how do you build that into the process so that the public values become the driving force, rather than the problem to be overcome.

MR. JENKINS-SMITH: Well, I think that the way that one could do this would be by opening up what it is we think that the policy is designed to do. And one option is to think about fuel cycle facilities that have a number of functions that would include determining which kinds of materials could be disposed of and disposing of those in a fashion that would be, could be reversible. Actually, it is an interesting term, this whole reversibility debate.

In Finland, in France, and more recently in the UK, this is a big issue. And in Finland, the whole question of public approval of their repository turned on the question of whether the repository would be designed in a way that you would retrieve the material. In France, the reversibility issue is a much bigger deal because they are talking about changing the direction of policy on the basis of future learning.

But the concern that is raised isn't that we are trying to plan for a 10,000-year horizon. It is that we are assuming that we will get there in an uninterrupted fashion. And people look backward a hundred years and they think about what the technological capabilities and the level of concern that those generations had for how they were handling materials for the present period of time. And they even think about the type of changes that have occurred in recent memory with the technologies that they employ.

And I think they see difference in kind in capacity. I mean one interesting thing is how far deep bore hole, as an option, has come since the Yucca Mountain process started, in terms of the sort of technological assurance that we could do this kind of thing.

So options don't hold still and people are aware of this. And I think that

that is one of the primary concerns that underlies a Yucca Mountain-style approach, which is permanent disposal, permanent ceiling, treating it as a waste, which is an interesting kind of categorical change and moving on.

CHAIR LASH: Can I interrupt for one moment? You gave me a very articulate answer to a question that I didn't ask.

MR. JENKINS-SMITH: That is what professors do.

(Laughter.)

CHAIR LASH: I thought that was what politicians did.

(Laughter.)

CHAIR LASH: You are articulating a plausible solution to the problem that we can't control the future sufficiently but I was asking, how do we design the process so that it responds to that public concern and says, that is legitimate, we will change our goals, our parameters, rather than you just don't understand because you don't have a Ph.D.

MR. JENKINS-SMITH: The WIPP case is a good example of this. And I am sure that Bob Neill can tell you a whole lot more detailed stories than I can.

But I was involved in the transportation side or watching closely and there were multiple instances in which concerns that were raised did in fact lead to programmatic change.

And in fact, I remember at one point talking with the woman who was running most of that program for the Department of Energy. Her name was Judith Holm, who always struck me as a stellar public employee. But what she did was she started keeping a record of the kind of changes that were being made. And when she engaged the public in these communities, she could explain many of the types of changes that had in fact taken place.

The audience, chiefly for her,

were precisely the kind of people who communicate that well. She was working with the emergency responders in rural communities all along that transport route. And so when she would do the staged accidents that they were doing for learning purposes, she would be able to communicate this to much of the community or that subset of the community that everybody else in the local community turns to for reassurance about exactly this kind of problem.

And I can't attribute causality but I do know that when we measure over a substantial period of time in New Mexico public fear about transport, that the fear drops as you get closer to the route, which is exactly the reverse of what the NIMBY-type literature leads you to expect. But there was some amazing success in that program.

And I would urge you to talk to Judith Holm about some of the extraordinary work that she and her team did in that particular case because she figured out who to talk to and did a really good job of explaining how the program had in fact changed.

CHAIR HAGEL: Gentlemen, we are going to bring this to an end because, as I said, one of you has to catch a plane and maybe more of you but we are grateful for your good work, your answers, and your availability.

On a personal note, I am sorry that we have besmirched the reputation of professors by the co-chairman's recent comment but nonetheless, we move forward.

We will take a short break. We will be back in ten minutes. Thank you.

(Whereupon, the above-entitled matter went off the record at 3:06 p.m. and resumed at 3:24 p.m.)

CHAIR LASH: So, we're back and we feel surrounded. I hope it feels comforting to be surrounded by this many centuries of expertise.

(Laughter.)

CHAIR LASH: Those of us who have come to the issue relatively recently don't carry the baggage of 30 years of its not having gotten done. Our purpose in asking you to participate in this round table is, in particular, to hear interaction among you.

So we will certainly start with some questions from the panel members but we would be eager to have you not only jump in but to jump in to ask one another questions. You have all heard all of the discussion today and surely there have been times when you had to bite your tongue right through not to say something. So, we would like to give you that chance to jump in.

Vicky, since you did not get to ask a question in the last session, do you want to start us off this afternoon?

MEMBER BAILEY: Okay. Boy the pressure is on. Right? Actually, I will.

The two things that I was wanting to hear more discussion on, the issue of sufficiency of regulation. I think in Dr. Voegele's -- Is he still here? Someone left. Okay. He talked about that. And you talked about a new set of regulations.

Our earlier panel felt that the regulations in place were sufficient. I would like to hear a little bit more about that. And then on the issue of voluntary host sites, once again this is not a siting Commission but I am trying to understand the issues as it relates to disposal, storage, repository areas, how we should look at this, how we should view this, what are the advantages. Is it totally foolish for us to even think that?

I think once again, Dr. Voegele's presentation, you talked about, you mentioned voluntary host sites and that you didn't think that they were a possibility and more than a bribe. And maybe you can tell me what you meant by bribe would be needed but your conclusion was that that would not be a possibility. So I open that up to the entire panel. I think that is something we seriously need to hear about if it is foolish to think that because obviously, Nevada thought that they were given very bad treatment, a very negative taste in their mouth as to how this process was done. They felt they were the site of last resorts, I guess when they were first starting this process. There were several sites in line but they ended up being the sole site. And that was just negative from thereon out. So, Dr. Voegele.

MR. VOEGELE: I get to start. Right?

MEMBER BAILEY: You get to start.

MR. VOEGELE: Let me just start out by saying that I had, you can insert whatever word you want, I will use privilege. I am not ashamed of it. I worked on every document the Department of Energy ever did to address any of the regulatory requirements or the legal requirements for this program over a period of almost 35 years. And I understand those silly regulations. So I am not as uncomfortable with them as somebody who would pick up those books and start reading it. I don't have a problem with the sufficiency of the regulatory structure, other than I believe it is too prescriptive and very difficult to understand. My bigger issues are in terms of the process in which those regulations are implemented and it is going to go right to the second part of this as well.

I don't believe that the public was given a fair opportunity to participate in that process. I think those things which were given to them which were meant to be public involvement were not what they looked like they should have been on the surface. Is that a fair statement? I mean, do I need to be Hank Jenkins-Smith and go for a long time with that?

It is just that -- Let me give you

-- Here is my best example. Okay? Here is my best example for you. We did an Environmental Impact Statement for the Yucca Mountain site. That Environmental Impact Statement was part of the Nuclear Waste Policy Act and that was the document that was going to identify how one site was selected from three sites. Peel back the onion skin one little bit and you will understand that Congress, when it passed the nuclear waste policy act, took a whole bunch of things off the table that the public would expect to deal with in Environmental Impact Statements.

The need for a repository, alternatives for a repository, they are already off the table. And now you have amended the Nuclear Waste Policy Act and you have taken a document which was meant to justify selection of one site from three and you have already picked the one site. What is left for the Environmental Impact Statement? It is not a meaningful public Environmental

Impact Statement. That is the kind of thing that I am talking about.

Now when I talked about their not being a willing volunteer, it is in the exact same context. Why would a state that didn't have a responsible role in determining whether or not this was going to go forward. Let's say you had a state that was willing to step up and say I would like to participate in this process but in return for that, I don't want 20 million dollars a year. I want a seat on a Nuclear Regulatory Commission. I want oversight responsibility. I want to my own site characterization program.

Now, could all of those things have been done under the Nuclear Waste Policy Act? Perhaps but they weren't. And that is what I was talking about.

And he didn't hit me in the ear so I guess I am not too far off.

MEMBER BAILEY: All right. Point/counterpoint. Go ahead.

CHAIR LASH: Hank, you wanted to jump in?

MR. JENKINS-SMITH: Unless Steve needs to get there first.

On the issue of compensation and the voluntary nature of the process and I think the jury is out on that right now but compensation is a tricky issue that has to be understood in an interesting way.

I think that when you talk to people about whether they would accept a repository, the things that are germane to that issue are the parts of the problem that don't normally get there. If they are going to say to their children, yes, I support having this thing come in here, they have to have some sort of story they can tell about why that repository is actually good, as well as risky.

And in my work, the thing that resonates most with people is if they can say, yes, I signed on to that because I think that this facility is going to engage in activities that make sure that the risks to future generations are smaller, that it is not monetary compensation that gets you to the point where you can start thinking acceptance. So it is those other dimensions of the policy issue that we were talking about earlier, I think, that are crucial for making something initially worth talking about.

Once you get it to the point that it is worth talking about, then you can talk about compensation. If somebody starts out opposed, however, offering money tends to make them even more opposed because it is seen as blood money. In fact, it is seen as a confirmation that all of the awful things that they initially believed must really be bad or you wouldn't be offering them money to take it.

MEMBER BAILEY: So why was WIPP different?

MR. JENKINS-SMITH: WIPP was an

interesting case from a number of perspectives. One, it was initiated by the local community elites in southeastern New Mexico. It never had a split or it never had significant opposition at the state level officials. In part, that was because the materials that were being handled at that facility came from within the state. So there was material at Los Alamos that was going to go down there. The state had also a long history of involvement in the nuclear weapons complex. And for that reason, handling those materials was seen as a legitimate kind of an activity or continuation for the state.

But note that it was still highly sensitive. As soon as we started talking about adding other kinds of wastes to that repository, given that it was all about handling and disposing of these materials, it started to blow up. You would have much more significant state-level opposition and you would have had a much more difficult time garnering public approval, had there been champions opposing the site in state office and if you had elections that were fought on the basis of who could be most successful at opposing the facility.

And so one of the things that is important to understand at this stage is the way the policy is designed is going to frame the path that the public discussion takes and that is going to condition a great deal of public support. It doesn't guarantee it. You know, but you can certainly undermine the prospects greatly by designing a policy where it is all about how we can make a bad thing least bad, which is what we do when we minimize a risk.

MEMBER BAILEY: Steve?

MR. FRISHMAN: Well, I think you can see that in Nevada's reactions over the years, where the people of Nevada were extremely accepting of the Nevada Test Site. And it is because, as it was explained to me, it is because they thought they were serving the national interest and in a way that was protecting them from something that they wanted to be protected from.

In 1977, GAO suggested to the Department that they start looking for sites at atomic energy defense facilities because they were relying on that. And I think the department, or at least some decision makers in government were genuinely surprised to find out that Nevada didn't want to get dumped on because we saw absolutely nothing in it for us. But the opposite was true for years and years and it was a great misperception on the part of the government to try to dump on us.

MR. NEILL: Now, I think the state may very well volunteer for a proposed repository in the same way that when an economic situation may be grim, people do volunteer to have the state prison located in the -- As a matter of fact, in Santa Fe they requested the state prison over the university because it would have a more stable population.

(Laughter.)

MR. NEILL: The original mission of WIPP in the Draft Environmental Impact Statement included spent fuel and that was pulled by DOE because the House Armed Services Committee had said that if we include the high-level waste, that will include NRC jurisdiction and we don't want the NRC in the act. So that was taken out and WIPP was then confined only to the transuranic waste.

Now a lot of the discussion I have heard today really relates to the biological risks. I don't know explicitly whether it is risk, dose, dose-based, risk-based, but it is essential to include all of the other factors of advantages as well as disadvantages. And there are some disadvantages.

There is nothing to be ashamed of to say if this repository goes ahead, we are probably talking 120 billion dollars of which, what 25 percent would be spent locally, 50 within the state, 25 percent elsewhere. There are jobs. There are other things involved. I haven't heard any mention for the national good, whether it is for patriotism to get rid of some of the defense wastes and some of the other factors. And we have to, I think it is essential to do not just risk analyses of such a proposition but to do the benefit analyses as well, including all the, as Congress says, the social, economic, political, all these factors together and addressing it.

CHAIR LASH: Other comments?

MR. McCARTIN: Yes and Steve may want to comment on this. I mean, I think public support for a repository, no matter where it is, is always going to be a challenging thing to understand what should you do. What is the right approach? And even within the State of Nevada, there is Nye County who in all the meetings we have been at with Nye County, they neither support nor are against the repository. They have remained neutral and just say they want to see the safety case put forward and make their judge there. And so Nye County is the county that Yucca Mountain actually resides in.

It is interesting. I don't think you can characterize one single view but it is very complex. I will say that. And what it would be interesting to have Nye County do, have them explain what led them to this neutral position, which seems to be in contrast to the state.

CHAIR LASH: Are there other comments?

MR. NEILL: Just a very quick one. Mike can tell you the Citizens Advisory Board for Nevada Test Site published inventory of attitudes of the offsite population and you end up with a bimodal distribution. There were some people that are clearly opposed to having a high-level waste facility there but there also were people that supported the facility as well. So this issue of how do you inventory or gauge public involvement, you can use a few bumper stickers and things like that but you really, it is a little bit more complex, as one would say. There is a huge spectrum of views.

MEMBER BAILEY: Let me go a little bit further on this issue of public trust. Dr. Kasperson?

CHAIR LASH: He's gone.

MEMBER BAILEY: Oh, he's gone.

CHAIR LASH: Oh, here he is.

MEMBER BAILEY: I thought that was him. Sorry. See, I'm already seeing things.

The issue of public trust, which you said will be very difficult, if we think we are going to regain that, think again.

So, I would like to hear from others. You know, one of the comments I made at the first Commission meeting was that there obviously isn't a crisis as it relates to the scientific issues, the science and the technology that we are looking at here, but there is, in my mind, a crisis of confidence and I have heard that repeatedly throughout our hearings, throughout our discussions.

You know, if I manage to put in place a process for public involvement, you know, how prescriptive do you think that needs to be? Is it more restrictive, as I think I heard Director Edwards I think from EPA say something to the effect that that might be not a good thing for us to be too prescriptive?

I guess the issue of public trust, I would like to hear comments on that. If I do things to make it seem like we really give credence to the fact that we want public involvement, we want to hear from them, but at the end of the day, someone has to balance the issues, whether it is Congress, whether it is the NRC, whether it is DOE, EPA, someone has to balance all the issues and somebody is not going to be happy. But what can I do to say that we are sincere as it relates to the issue of building public trust and confidence in the process?

MR. KASPERSON: The position that I have taken on that and when I occasionally talk with people in government about this or in corporation, I say, you know, I think you ought to behave in ways and you ought to be concerned with trying to develop social trust and do the kinds of things that may help to win some of that support but you need to understand that it is probably a long process.

And Paul Slovic in his work has sort of argued that you can lose trust in a single and then it may take 10 or 20 subsequent acts on the other side to rebuild that lost trust.

And so my own view about that is act in ways to deserve the trust and try to rebuild it. Try to behave in really responsible ways. It is complicated, by the way, because there are different dimensions to trust as we know. So, just to give an example, if you have an emerging study and the study is not there yet, do you hold it back until you are really more sure of the result? That helps to build competence, which is one major dimension of trust. On the other hand, you are not being forthcoming with it. So it is pretty hard to win on both of those. I mean, you interfere with one dimension and you win on another dimension.

So I think the trust is, so my own view is well, do the best you can and try to rebuild trust in an effective way because it probably is the most precious resource of all the things that we are talking about that is related to fairness and so forth.

But I think if you just realize the realities that the trust has really been lost and it is probably going to be very difficult to rebuild and it is going to take a long time. Then you build a management and decision system that puts much more reliance upon the other parties than it does -- the experts can't do things here and assume that they are going to be trusted because they won't be. And people want to put more of the power in their own hands. So you need to design a different kind of process, I think, in regulation and decision making and so forth. So anything that doesn't have significant sharing of power with the people who are going to host a repository and so forth, I think is probably in for a tough ride.

CHAIR LASH: Could I ask a follow-up question? Would the creation of a new independent Nuclear Waste Management Authority responsible for proposing and managing a site make any difference?

MR. KASPERSON: Well, I think it would help, personally. I think DOE has a really tough road to sled here because of its history. And I mean, I remember when I first decided to look at these things in the 1970s, I think there was a proposal at that time that the Commission be an independent commission responsible for radioactive waste and a number of countries have gone in that direction. And I think that is one possibility that ought to be looked at.

MR. BUDNITZ: I have a related angle that I think is very important for the long haul. The nation needs a long-term sustained, government funded research endeavor that engages scholars, scientists, engineers, social scientists, a whole spectrum of people in research and creating new knowledge and consolidating knowledge we have on all of the subjects you have heard about today and you probably have been hearing about for the last, what, three or four months. The fact is, it doesn't exist. And it doesn't exist because the mechanism for brining it about, which exists, was defeated by the political process. It is easy to explain.

The Department of Energy, through the waste fund and Yucca Mountain and so on, had such a thing. I ran it for two years, until it was killed because of a political exigency. And no one stood up and said we need that over the long haul. That is one example.

The Nuclear Regulatory Commission had, for the longest time, a sustained effort in the Office of Research and in NMSS, the office that does the regulation, but it was too narrow because the mission of that agency is to do the research to expand the knowledge to enable them to do regulation. Very important but not prominent.

And no one wanted to go with a ten-foot pole near the social sciences. In 2002, I proposed I was newly at DOE and I was running what was to become the new science and technology, the R&D program and I proposed the science and technology effort, a component of that in social sciences.

And Dan Madia is here and I remember we had a bunch of discussion with a bunch of social scientists. Perhaps Roger wasn't involved but others were. We came up with a program that wasn't going to be very expensive and it got killed.

It got killed because people said if the Department, which is the proponent, does social science research, it is going to look like we are manipulating public opinion. Well, okay, but the courage to sit down, carry out, and sustain a science effort, an engineering effort, a social science effort, and some combination of people that know about regulation, so that a cadre of scholars with decades by 30 years later of experience and funding and interaction provides the expertise in 2040 that you see here in 2010. Some of us are here in 2010 because it started in the '80s with us but we are scientists and engineers. Luckily, a few social scientists were supported elsewhere, Roger being among them but way short of what is needed and without the sustaining commitment. And it seems to me that quite separate from whatever happens, because whatever happens is going to take years. Right? Getting that started now, I don't know who, NSF maybe? I don't know who but some place that would provide the community of interest that would grow and become as expert as you will need in 2030. You are not going to get it if you don't do it and it ain't going on now. In fact, what little there was collapsed with the collapse you know about last year. Okay?

MR. JENKINS-SMITH: You know, there is a downside to the social science involvement, though, Robert.

MR. BUDNITZ: Of course there is.

MR. JENKINS-SMITH: I think that social scientists may be in part implicated in this because so much of it was tangled up with advocacy.

MR. BUDNITZ: That's fair.

MR. JENKINS-SMITH: And it is difficult for agency managers who are making many of those kinds of choices to talk about funding when the funding appeared to be going for advocacy purposes. And that is something that social scientists have to sort out.

MR. BUDNITZ: So let me try to describe. When the science and technology effort within Yucca Mountain, RW was proposed by me in 2002, and at the highest level of the Department, right up to the Secretary's level, they said no. It looks like advocacy. I said, let's give a couple million to the NSF and let them decide, using their processes, which scholars should carry out which research and it will be grants, no control grants. Right? No, we are going -- I don't have to. It was just --

(Laughter.)

MR. BUDNITZ: It seems to me that the Congress as a matter of policy, could, do you mind my saying should, make that one of the imperatives of the long ten and twenty year need that the nation needs. And we can fund it in a way that avoids these, shall I say, things you have said. I know how to do it.

MR. FRISHMAN: Let me point out though that it is interesting to hear Bob's explanation of why the highest levels in DOE didn't want to do it. Meaning, get involved in supporting working the social sciences. The perception within the Department, I think correctly because we recognize it, too, is that we they didn't want to appear to be starting a ministry of propaganda.

But in fact, we weren't assuming that. We figured if they tried to do that, we could deal with it. What we saw was that it was a direct effort to continue something that they had started years ago and that is, they refused to consider any aspect of stigma and perception of risk. And we saw this as a mechanism to shore that up.

MR. BUDNITZ: But that was, of course, if you don't mind my saying, a piece of the sort of research that we thought social science experts could --

MR. FRISHMAN: Well, that is what we wanted done and we saw that reaction from the Department as a means to make sure that they cemented in what we had been told for years and years and that is, we are not allowed to consider it and neither are you.

MR. BUDNITZ: Steve, I am going to have to argue that case. I joined the Department for two years, 2004 --

MR. FRISHMAN: No, I am trying to explain the difference in perception of --

MEMBER MAC FARLANE: Let me interrupt you guys.

MR. BUDNITZ: And I saw that stigma right away. So we had to find a way around it and I suggest you guys find a way around it.

MEMBER MAC FARLANE: Let me interrupt you guys just to say that I think that that is a good idea, Bob. And speaking as a person who has tried to get funding from the federal government for nuclear waste research and I know this is true on the science side and on the social science side, there is no where to go if you are an independent researcher. There is no where to go, which is pathetic. It means that they don't. You know, you don't want the research to be done. And the DOE, maybe it has done a lot of research. Hardly any of it was published in the peer review literature.

And so, from a scientific viewpoint, that is useless. It is not adequate.

Can I ask a question? Okay, so just to go back to a previous thread because we have all these experts here. For a disposal process to work, one thing, you know, and I think we will think more about the whole process for siting and a repository or whatever it is going to be, you know, there are many aspects to it but something that has been discussed today and I would like to hear more about from you guys is how to, or the best way that you think to include public involvement. And in particular, are there good examples out there where this has been done? Examples from the U.S. Examples from other countries.

And I understand, Roger, all your concerns that this is really complicated and everything. I am not looking for an easy answer but I think we need to address this issue and we don't have a lot of time. So, I would appreciate any advice.

MR. BUDNITZ: I have one good example, which I could cite from the Department of Energy. In 1982, with the Act, the country decided that there were going to be, as it turned out, nine sites in the West, the South, the Southeast, for the first repository. And in order for equity, there was to be a second repository in the Northeast or the North or perhaps in the middle of the country and a second repository program was begun in 1982 and went on for four or five years and, in fact, was finally killed just before the decision about Yucca Mountain, you know, that just picked one.

The second repository program, which I was deeply involved, Bill Madia at Bettelle Columbus ran it and he had an advisory committee that I chaired from start to finish of that, of various people, has a record that you can get, and you should go hear from Bill Madia or somebody that he will tell you about, of a wonderful start at full public involvement thought through carefully. There were 22 sites. We had a bunch of public meetings. People came. State officials came. I said this earlier but there is more to say. And they had consultation from various social scientists, as well as lawyers and the like.

And they were just at the stage of getting to the hard stuff when the plug got pulled. But the record that they accumulated of thinking and there were reports and meetings, and lessons learned from them is all there for you to learn from. And I think it would be a terrible shame that you are going to possibly not take advantage of that because it is sitting there for you and it was all killed in 1986.

CHAIR LASH: Roger, did you want to respond to that also?

MR. KASPERSON: Well, I am sitting here thinking what would be a helpful response to try to make to that.

I think one good starting point would be you know the National Academy of Sciences just came out with a report the end of last year, which has been in process, I think for about three years on public participation. Were you on that one?

MR. NORTH: Yes, I was on that. It is dated 2008 and the name is Public Participation in Environmental Assessment and Decision Making. And I guess I would think I want to say how much of a generic problem this is through the federal government. We are looking at this issue here now but I have been involved in reviews at the Department of Homeland Security and the climate research program and renewable energy and so forth. And this is an issue in all of them.

I mean, all those reviews have found major deficiencies in this area. And first of all, it seems to me that that Academy report would be a good starting point from which you might derive a set of criteria and so forth. But there is a cadre of people out there, including people like Warner and others who worked on that report, who have thought a lot and are experts on the question of public participation. And I would like to see a group convened and given the task of designing and doing just what you are saying, designing a national program, which I assume would probably be a tiered program that needs to begin immediately, if you will, and carry through.

And I think that people in corporations and in government agencies and so forth will tell you time and time again that what we do with public participation and outreach and risk communication is you look at your budget at the end of your process of doing your report and if there is any scraps left over, you run a little public participation program.

A serious program would begin on day one and be a critical part of the development of that study and would make the study better through the public participation. But we don't do that anyway in the federal government, that I am aware of. Maybe an exception would be NOAA and its research program as a place where I see most interesting work going on in public participation. But I do think that there is a national capability. It is not a PR problem. It is a problem for people who work seriously on the question of public participation and stakeholder involvement. And I think it needs to exist at multiple tiers because I think some of the critical stakeholders are state officials and utilities and so forth. There is a different kind of process when you actually get into the citing situation. So, you hold public participation. You need a public participation program for that. You need one at the national level. These things should all be peer reviewed. There is a community of people out there. And I think you might actually -- and it needs to be invested in. It needs to take time and it needs to take money. And it needs to be just as serious as all the technology and science stuff that we do and that will be first when that happens.

CHAIR LASH: I see three of panelists who want to add something and then I know Per has a question. And we will probably end with the thread that you set off.

Bob, I saw your hand up, and Warner, and then Hank.

MR. NEILL: Thank you. The Nuclear Waste Policy Act required DOE to do the planning for a second repository. The Department said, you know, it would be a lot easier, I think, to get the inventory of the first one increased, then to go through all the machinations for a second repository. And that was logical and we agreed. The only trouble is when the first one went down the tubes, there is no back up. So the moral is, don't put all the eggs in one basket again, whatever you do.

CHAIR LASH: Warner.

MR. NORTH: I am going to expand a little bit on some of the things Roger said. I would like to make the point that Roger was involved early in the 1970s, I believe, in the Swedish program, setting it up with the considerations of social science and public involvement. As a spectator, I thought that was a really useful contribution in orienting their national program. France is a case study of how they started off with the technical people running it and ran into very serious problems, such that they had to reformulate the whole program.

I would like to comment that the 2008 report that I worked on, I might add over five years, we were disappointed in the amount of literature out there, especially where you could test public involvement in a program versus no public involvement.

Now a lot of anecdotes and a lot of stories but very little, shall we say, controlled clinical research. There have been a number of areas where the federal government has started off to do a lot in this area but then given politics and people's concerns, it is not continued. Climate alteration is one of these. There was a big exercise in this area which was stopped and I think much valuable opportunity involving people at a local level on what does climate alteration mean to you and what might be done about it that this wasn't pursued by the government as it might have done.

Now, I will add a little anecdote of my own. I was involved in a Superfund site. There were a whole bunch of these that EPA has had to deal with. I was brought in as a consultant to the responsible party, in this case VEPCO, Virginia Electric and Power, an electric utility. The first thing I suggested we do is have a meeting over lunch between the leaders of the environmental group and representatives of the utility. And we were able to start a dialogue on the basis of some apologies from the utility for past performance, get some local experts from the university to review the analysis, and in relatively short order, we were able to get a Superfund site turned into a public park with great enthusiasm on all sides.

I thought the process was very

straightforward. You get people to talk to each other, exchange information and you figure out that there is a way to do it very well. It costs a little bit more money. And if everybody is satisfied that you can proceed in this direction, you can turn a noxious facility into something that the local community takes great pride in.

I have to say, this was never documented. It was used by EPA administrator Lee Thomas in testimony. I have talked to him and to a number of his staff trying to find that testimony. I was never successful.

So, that is another point I want to add. I think if we look at our history, a lot of prisons have cited. A lot of environmental messes have been cleaned up, often with public involvement, sometimes done with skillful leadership and not documented in the social science literature.

CHAIR LASH: Hank you had a comment? Just before you do, do you know a book called Leadership Without Easy Answers, Ron Heifetz book --

MR. JENKINS-SMITH: Yes.

CHAIR LASH: -- in which he documented the Tacoma smelter case?

MR. JENKINS-SMITH: Yes.

CHAIR LASH: I would be interested in your reactions to that.

MR. JENKINS-SMITH: It is a good case. I want to take a slightly different angle. We have been talking about public participation and involvement and that is a huge category. It involves many things and it has different objectives that are implicit within it that you have to take into account, before you start thinking about appropriate directions to go here.

But public involvement has to differ substantially, depending on what it is that is being engaged. If you are engaging simply garnering public acceptance of something that is a net bad, it is a different story than it is if there are benefits to be had. And I think that one of the things that is unfortunately not systematically researched, is the degree to which different mechanisms work differently when you have different policy designs at stake.

But there is another aspect to this that I urge the commission to be somewhat attentive to and that is, the fact that when you are getting close to the question of representation when you are dealing with public involvement. There isn't one public. And as much of Roger's work points out in the social amplification of risk, one of the things that happens is that there are interested parties who are, for ideological or material interest reasons, deeply engaged in an issue like this and have big stakes in the outcome and will do everything they can to effect the course of policy events. And they may not at all represent the broader public. We tend to treat them as the public because they are the ones who show up at the hearings. They are the ones who intervene in the processes. But that is not the public in the sense that we think of it when we are thinking about politics and we are thinking about representatives processes.

And there have been some very serious efforts to try to engage a representative public in these kinds of things that involve citizen juries where you actually do random selection of members of the public or some sort of representative stratification and engage in discussions and there are conferences that, on an annual basis have attempted to do this. The problem is is that you change the people who are engaged in those processes so they no longer represent the public from which they were drawn if you engage them too deeply.

So the dilemmas we face are interesting. And I will end up with another anecdote like Warner likes to do, that drives this home.

I once was involved, this was the case of trying to arrive at public consensus about incineration of nerve agents at the various depots that we have across the United States, and there was a very active infrastructure of interest groups that engaged this issues at all the different sites and that had been put on site-specific advisory boards and given all sorts of representational involvement. And I came across a county commissioner at one of these events and he was spitting mad because he had to stand for election and he had to go on the basis of his record and get reelected to represent his county. And then he gets to an issue that is a major issue for his county and there are all these people who purport to represent the public, in his view, who don't, who had a seat and he didn't. He was furious.

And this is what happens when you overlay one kind of representational system in the name of public involvement in an already structured system in which we have elections and people have to stand for them and all kinds of rules like that. Just be careful. Be careful. That is all I'm saying.

CHAIR LASH: Per.

MEMBER PETERSON: In addition to being a member of the Disposal Subcommittee, I also am a co-chair for the Reactor and Fuel Cycle Technology Subcommittee. And there are some linkages between disposal and fuel cycles that I would like to explore with just a couple of questions starting from the two slides, Hank, that you showed earlier on implications of design options, co-locating research laboratories or reprocessing facilities with repositories and then retrievable versus permanent disposal and opinions about those two things from the perspective of the parallel activities that might be under way with research on advanced reactor fuel cycle technologies and/or reprocessing.

So the first question I would have would be would one expect to see similar response in terms of public support, if one were to co-locate research laboratories or reprocessing facilities with centralized storage. I would assume that you would have somewhat of a similar response but this important because we have a variety of different types of infrastructure that may be needed for a system to work. And certainly we know that storage is a big part of how you go forward. So that would be one part of the question.

The second is that I note that when you find the 69 percent preference for retrievable storage, that is with respect to the storage of used nuclear fuel.

MR. JENKINS-SMITH: Correct.

MEMBER PETERSON: And my question would be if one were to prioritize initially taking defense high-level wastes from the defense sites that currently have those materials for disposal and defer the question about disposal of spent fuel until you have had time to do additional work and research and stuff to make a more informed decision about whether it actually merits disposal or not, to what extent would that possibly change this current 69 percent desire to see the stuff be put in retrievable storage.

In other words, is this being driven by people's perception that you are throwing away something that you shouldn't or is this because they think that throwing it away might be unsafe and you are going to have to reverse that process?

MR. JENKINS-SMITH: It is both of them with respect to used nuclear fuel. Note that between the research and safety and new learning versus the resource, the learning for safety purposes is the bigger jolt and it has a bigger effect on increasing support for the repository.

So I think it would have a substantial effect, particularly in a policy debate when you are talking about something that is indeed a waste, for which the prospect of treating it as a resource is remote, that it would, that that part of the justification for retrieval would be moot for most of the public.

MEMBER PETERSON: Oh, actually, quick, it is also likely or not likely that you would see similar sorts of statistics with respect to coupling research or reprocessing activities with centralized storage facilities as well.

MR. JENKINS-SMITH: Yes, it would be. It is a fairly, for most people, the idea of long-term storage and disposal are pretty close to one another but the reaction would be roughly the same.

MEMBER PETERSON: Okay.

CHAIR LASH: Vicky has one follow-up question.

MEMBER BAILEY: Not on this subject. On a different subject but back to a question that I asked on regulation.

Steve, I wanted to pursue a little bit further and maybe the other panelists can comment, you made some recommendations on a regulatory panel, as such, in your comments. And I don't think I gave you a chance to discuss that.

But I would also like to hear some input from others because obviously we have heard, you know, there are those who think we just need one regulator and there are different views about the issue of how to develop regulation for a new repository process.

MR. FRISHMAN: Well, I was looking at what we know to be deep and well-resourced expertise in both NRC and EPA on this subject. They certainly should be, after the years they have spent. So I was looking at taking advantage of that and also taking advantage of their knowledge in the actual writing of regulation but then forcing them to do something that they rarely if ever do, which is work together as equals in developing information and add to them the people who are or some people from multi-disciplines who are experts and considered public.

I have done a funny thing here where I have said there is public and there is government but I hope you understand what I am saying and find some of those people and take advantage of their expertise in terms of being able to better grasp what their interest and concerns are at their level of expertise but also would have the sensitivity to help bring the interests and concerns of the not-so-elite public to the table. And I think their main job would be, this is why I mentioned the way EPA often does proposed rules now where they pose a set of questions. And they certainly are not the only questions. AS I said, everything is in scope but they can start that discussion by having an informed list of questions.

And in my one-pager, I put out a few of the areas. And there are lots more. Just about everything that was talked about this morning is fair game.

But part of the purpose of the expert public is to do everything you can to bring out what it is the main general public is interested in, concerned in, and will either lead to improved confidence or lower confidence, depending on how well that group works.

MEMBER BAILEY: Could I hear from some of the other panelists? I know Bob, you have talked about the NRC and Warner, you have talked about --

MR. NORTH: I would just like to know, Steve, that the process you have proposed is quite consistent with what is described in the 2008 report on how one might want to proceed.

Starting with a framing of the problem involving people that are expert but also involving people representing the public and having iteration back and forth where the expert scientists carry out analysis and provide their insights to the public representatives. The public representatives react to that. And then as you go toward conclusion you have some fundamental value issues that may appear and that is a point for wider discussion among the public. Or you may find that there are some crucial technical issues. That is an invitation for more intense work by the experts and the analysts.

So the process needs to go back and forth and iterate toward a conclusion.

CHAIR LASH: Tim, did you want to comment? Then we will wrap up.

MR. McCARTIN: Yes. In terms of I think EPA and ourselves, we have worked better over the past few years together with respect to Yucca Mountain. There are certain things in the regulations that are EPA's jurisdiction and some that are NRC. And so it is difficult. I think we talk to each other but sometimes we will have different views but ultimately, there are some things that are EPA's call, some things that are NRC's. And the process is worked reasonable.

Now, in terms of public input, we have tried. And I realize in terms of you always can be a better listener. We have had numerous public meetings. We have gotten a lot of input. I can promise you there are three or four of us at the NRC that have read more than once every single comment that we got with respect to the Yucca Mountain regulations. We have put forward statements of consideration when we finalized the regulation, responding, we felt faithfully to every single comment we received. We do tend to group things and so people might not see it but how many people read the Federal Register?

I do sympathize with the public

that is out there. You know, I don't think I have looked at the Federal Register on any routine basis. Is there a way for us to interact with some of the people we interact with at those public meetings? We get their input. Very simple input sometimes. Very useful. But we never get back to them. We write our Federal Register notice. And so I think some people they are not going to see, their name or their specific comment. It might be lumped together with others. And even if they read the Federal Register or they might not notice it, it would be useful to -- We have tried to go back to communities more than once. And so they get the dialogue going.

But there is, I think we -- Starting in '99 was our first public meetings in Nevada. Some people would say they weren't very good. I am a glass half-full person and so I think we learned a lot from those meetings but we went out as technical people to explain our regulations. It didn't work with the people. We have done a lot of work since then and I would like to think we have done better but it is a challenge. If we fail, it is we really don't get back to some of the people that I think provide very valuable input to us.

And I will say I have repeated this story to the interns at NRC that very first meeting and why I feel the first meetings in Nevada with respect to our standard were successful. There was one woman in Caliente who stepped forward to the microphone. And she remembered as a little girl that she was out on the playground, Caliente is downwind from the Nevada Test Site, and saw little flakes come from the sky. And they were told to go inside. They were left with little burn marks on their arms. They were downwind from the Test Site. One of the shots ended up there. She looked us straight in the eyed. She had two brothers that had died of cancer already. She looked at us and said, we are counting on you to protect us.

That kind of information from the public -- She could not clarify our job better than that. We talked to her after the meeting. But those are the kind of people that are out there and she didn't ask us to deny the application. She didn't ask us to approve it. We are counting on you to protect us.

And so I think there things out there. There are the public out there. Those are the people we need to talk to in addition to the people, that same meeting someone called me a liar. We need to talk to that person and understand why are you calling me a liar. And over time, we built up and that person doesn't call me a liar anymore, I will say. But that personal getting back to people, I think that is how you gradually build up trust. And you are absolutely right.

The people who are at the meetings, do they represent a good cross-section? I don't know but that is the starting point, getting those people that they feel they can talk to us and they will get an answer back from us. And I think they talk to their neighbors and gradually, hopefully, that is how trust in the process builds up.

CHAIR LASH: Thank you, Tim, and to all twelve of you, we really appreciate your agreeing to spend an entire day with us and participate in both your panels and this round table.

We are still at the sponge stage trying to absorb as much as we can but pretty soon we have to move on to sorting it out and beginning to frame a response. And we will look forward to ongoing interaction. I am wanting to take to heart what you just said, Tim. I mean, we have the same kind of responsibility to all of you who have taken so much time with us to respond and let you know how much you have influenced us and how we have decided to move forward in the way that we do.

We have -- The members of the roundtable, thank you very much and you can step down.

We have one more phase, which is public comment. Do we want to reorganize the room or stay organized as we are?

MR. FRAZIER: What we can do is either move the podium back out --

CHAIR LASH: Okay.

MR. FRAZIER: -- and take a few moments to do that or we can have the public sit over there where Tim is and we will make Tim move.

CHAIR LASH: On Tim's lap?

MR. FRAZIER: Judy would like to sit on your lap. Let the record reflect.

CHAIR LASH: We have two people who have signed up to speak to us. We are looking forward to welcoming Judy Treichel back who has spoken to us before and Mary Olson.

Judy why don't we just let people get out of the way and then we will invite you forward.

You have been with us often so you know that we will invite you to speak for five minutes but we are glad you are here. And there is a lot of material for you to respond to today.

MS. TREICHEL: Yes, there definitely is. First, and mine is always haphazard because I take notes as I go along. So it doesn't fit -- This isn't a prepared presentation. Judy Treichel, Nevada Nuclear Waste Task Force.

In response to Tim and talking to the public all the time, it wasn't that big a deal because they were there because they were going to do Yucca Mountain. So, if you really liked Yucca Mountain, you felt like you had something to contribute but if you had any reservations about Yucca Mountain, you were just getting the joy of being able to sit in front of a microphone.

And for Tim, I would say, you know, he said he couldn't tell if they were making any impression on people, that they explained their regulations. Yes, they did. Ad nauseam. We heard exactly what the regulations were over and over. But if he had wanted a gauge, what he would have done is told us what changed because we talked. What difference did we make? And that is where we would have felt like we were having a two-way conversation with NRC.

I would say that you have got to get away from making this statement all the time, "make it publicly acceptable." That means you have already made it. And then the next step is making it publicly acceptable. It is too late. You have got to start with the public going in and as somebody said, frame the conversation, decide where everybody starts by already agreeing. Is there nuclear waste? Yes, we all agree there is nuclear waste.

And then you can start up from that point where you keep having people and then when you start to get places where you don't agree, you can kind of figure out how you need to blend it. But with Yucca Mountain there was so much already over and done with, that none of that ever happened. And I think people have to be in on the making of the regulations. It has to be bottoms up like they are talking about in Canada. I don't know if that will always work but it started right.

And I am not sure that you get a volunteer, even if you have multiple sites but you should have multiple sites and you should tell people what kind of thing you are looking for. And if there are people who really want to engage some place, I would never discourage anybody. I was vehement about it not being

Nevada. But because the public didn't want it, the officials didn't want it, we had already had testing, we had real experiences like the lady with the stuff on the arms and whatever. So it has to really begin at the beginning.

And the public is definitely not involved in the current licensing process. You can't be. You have to have an attorney. You have to have all sorts of expertise and a lot of stuff that takes a lot of money.

The last thing I would say is there have been questions all day about how do you start developing trust. Where does trust come from? Well, I will tell you where it doesn't come from and it doesn't come from what DOE is doing right now. They have already started up. They are already relooking at nuclear waste and they are doing it with what I call secret meetings and anonymous communication. You don't know who you are talking to when you get an email that just says nuclear energy. And when there are other agencies that are invited to participate and some agencies that ask if they can participate, and they all get together in the public or any member of the public like myself is absolutely refused, that is ridiculous. And that is how they are staring up now.

So it is already wrong and it is already going in the wrong direction. So that is what I would say.

CHAIR LASH: Thank you for being with us. Mary Olson?

MS. OLSON: Mary Olson, Nuclear Information and Resource Service and I do represent the engaged public. We have a lot of engaged public and they are very interested in what this commission is up to. And I would say that they echo many of the concerns that Judy Treichel just raised.

I want to tag the fact that that Nuclear Information Resource Service was a party in the challenge to the EPA's Yucca

Mountain standard. We were one of the groups that brought that suit and w certainly had a front row set in the 1990s Nuclear Waste Policy process, a very close working relationship with both the administration and a lot of congress.

I want to tell you that sitting here today, it finally became clear to me that the Commission is repeating a mistake already. I understand this is a big complex issue, you have a lot of people in a short time but by breaking into topical subcommittees, you are preventing the very thing that our community does, which is when we do a risk-benefit analysis, and believe me we do, we do it for the whole system from the generation of the waste, its cradle, to its grave.

And so I want to challenge the VRC to consider starting with problem definition. What is your goal? Our goal is isolation of this waste from the biosphere. The irradiated fuel from commercial nuclear power has 95 percent, more than 95 percent of the radiological burden that we are all worried out. So I said yesterday, if it wasn't radioactive we wouldn't be here. You know, it is the ionizing radiation that makes the issue. Right?

So 95 percent of the problem, the goal needs to be isolating it from the biosphere. If that is not your goal, you need to be transparent about it, then you need to state what your goal is.

Okay, so assuming we share that goal, we look at it this way. The stuff is somewhere now. It could be handled better. We would like to be spread out, hardened. We like it to be monitored. We like the local communities to be more involved.

But it is being stored now on licensed sites. So given that fact, then you look at any steps further. And from our perspective, transportation is very risky. It is not secure, compared to the local site where it is now. It is not certain. The regulation transport allows up to two years and it is a single shipment, two years in transit. It passes through very dense populations if something were to happen and the routine radiation exposures are, by definition, higher than leaving it where it is. So you are increasing the risk just to move it. So you better be moving it for a good reason. And our goal is isolation from the environment. So if you are moving it to a site that is going to leak, that is not a repository that is a dump and we are going to oppose it.

If you are moving it to reprocess it, quite frankly, that is not isolation from the environment either. We are going to oppose it.

And you know, I am not saying we are the be all and end all. I am not saying we have all the power in the world. I am telling you our thinking process and why your committee isn't able to do that thinking process because you have cut it into pieces that don't reflect the whole system.

So I hope at some point you are going to be gathering yourselves together and really doing that.

So finally I just want to say that you know, we want to work with a positive future. And I have had the unique opportunity after 20 years in my job of stepping into an advocacy role. I did it with the Commission, the five commissioners at the Nuclear Regulatory Commission in June, advocating for hardened onsite storage. We will continue to advocate for that. I think you have very, very strong support over 200 groups signed on to the statement that is posted on your own website because we submitted it and I am constantly using your site to give you more hits when I refer other people to it.

And you know, we are ready to join hands and say let's do this well. Let's do this well. And so then the next thing I want to say is that I think there is much more diversity in our community about the need for repository program. I think there is support for the discussion of a repository program. I am not going to say my organization is endorsing it. It is not. But if there is one, you have got to start with clear rules and then you have got to be willing to reject a site that doesn't meet those rules. And we have been dancing in the streets ever since Yucca Mountain was -- You know, there has never been a clear statement as to exactly why but from our perspective in 1998, we had the data to show that site was going to leak and not meet the site suitability guidelines in statute. And it caused us deep shame in our government that there was not the courage to acknowledge that and reject the site at that time.

So you know, yes, absolutely Yucca Mountain should be off the table and absolutely we should have a scientifically credible process. So I am going to take it one step further. It needs to not only be a standard, it needs to a viable strategy. And it really scares me to hear that five years is too long for this process. It is probably going to take five to ten years to even get a viable strategy in hand. Then, you go looking for the site.

You go looking for a site before you have a good standard and a viable strategy, it ain't going to work. And there is, I think, interest in it working.

CHAIR LASH: Thank you. It was -- You covered a lot and it was clear and unequivocal. We appreciate it. Keep putting stuff on our website and keep coming back to talk to us.

MS. OLSON: I live in North Carolina. I will see you in South Carolina.

CHAIR HAGEL: Jonathan, may I --

CHAIR LASH: Please.

CHAIR HAGEL: -- make a comment? And I appreciate both Judy and Mary's thoughts but I really have no standing to contribute what I am about to say because I am not one of the two co-chairs, although you and I share co-chairmanship of this subcommittee.

I think it is important to reflect a little bit on what Mary said because she brings out some important points. Now in the absence of our commission co-chairmen, I would offer this. Her terminology reflect on the whole system. It is important and it is accurate. And I want to assure her, at least from this Commissioner, that we are doing that. The three subcommittees essentially were put together, structured so that we could have some management and organizational structure over so many very important and complicated parts. That is why we have these hearings.

I also want to note that many members, Per being one and I think Vicky another, Susan Eisenhower on this subcommittee another, serve on more than one subcommittee.

Another point I want to make is that the subcommittees will start blending and start working together once we have some information that we all believe, all members of the commission, that is relevant and important and focused on the objective of the Commission, at least the tasks that we were given by the Secretary. So it is not without not only an awareness but an actual practicality we are doing these things. We are, in fact doing essentially everything I heard Mary talk about. And I think she is right, the points that she makes.

So I would offer that with, of course, no standing, but that has never stopped me. But thank you.

CHAIR LASH: Do any of the members of the panel want to make any closing comments for this afternoon? Vicky?

(No response.)

CHAIR LASH: Well then I just want to thank the panelists for being such engaged participants. We will begin a process tomorrow of trying to decide how to actually move forward to sort through some of what we are hearing and also decide what further information we want to gather, what kinds of meetings do we want to have in the future.

To all of the interested public who have joined us at this meeting and past meetings, we really appreciate your being with us and hope to see you at our future meetings. Keep the pressure on.

(Whereupon, at 4:34 p.m., the above-entitled matter went off the record.)

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