BLUE RIBBON COMMISSION ON AMERICA'S
NUCLEAR FUTURE

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DISPOSAL SUBCOMMITTEE
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MEETING
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THURSDAY, NOVEMBER 4, 2010

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The Subcommittee convened at 8:30 a.m. in the Carlton Ballroom at the St. Regis Hotel, 923 Sixteenth Street, Northwest, Washington, D.C., Chuck Hagel and Jonathan Lash, Co-Chairs, presiding.

MEMBERS PRESENT:
CHUCK HAGEL, Chair
JONATHAN LASH, Chair

MARK AYERS
PER PETERSON

ALSO PRESENT:
TIM FRAZIER, Designated Federal Official
JOHN KOTEK, BRC Staff Director

GEORGE DIALS, B&W Technical Services Group
LAKE BARRETT, L. Barrett Consulting
JOHN GREEVES, formerly of the US NRC
R.D. ANDERSON, formerly of Sandia National Laboratories
LINDA LEHMAN, Contractor to US DOE

ROBERT ANDREWS, Intera, Inc.
W. GARY GATES, Omaha Public Power District

PUBLIC COMMENTERS:

STEVE FRISHMAN

JUDY TREICHEL

ALEX PAVLAK

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

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

8:29 a.m.

Call to Order

MR. FRAZIER: All right. If we could get everybody to move to their seats, we're going to try to get started here really quickly. I'd like to take this opportunity to welcome you to the -- wow, is this really loud -- welcome you to the -- it could be me, I have had my coffee this morning -- welcome you to the Disposal Subcommittee of the Blue Ribbon Commission on America's Nuclear Future.

My name's Tim Frazier. I am the Designated Federal Officer for the Commission, and without further ado, Senator Hagel, when you give me the high sign, we'll turn it over to you.

Opening Comments

CHAIR HAGEL: Tim, thank you as always and good morning. Thank you. We want to thank all of our panelists this morning, those who continue to contribute to our

efforts. I think everyone knows that this Subcommittee was formed to address the matter of how the U.S. can go about establishing one or more disposal sites for high-level nuclear waste, in a manner that is technically, politically and socially acceptable.

Our last meetings have covered the issues of the need for disposal facilities, alternative approaches for the disposal process, to develop a disposal system or systems, and essential elements of technically credible, workable, and publicly acceptable regulations for disposal and institutional systems needed for the regulations to work well.

Last month, the Subcommittee held several meetings abroad in Finland and Sweden. As I think most people already know, these two countries successfully finished site selection processes for final repositories, and appeared to have achieved a high degree of public acceptance.

Our goal was to learn from their experience. We had a number of very productive meetings and site visits, where we had a chance to communicate with federal and local government officials, scientists, engineers, environmentalists and local public representatives.

A summary of these meetings will be posted on the website later this month, and I want to thank my co-chairman, Jonathan Lash, and the members of the Subcommittee who participated in that effort. It took a lot of time and attention and discipline, and I think it was very productive.

The purpose of today's meeting is to explore lessons learned from previous site evaluation processes, and to hear a utility perspective on the implementation of the Nuclear Waste Policy Act. As always, we have an impressive collection of experts who can share their experiences and perspectives on this issue.

We would like to remind our invited panelists that they are to keep their formal presentations, if they can, to ten minutes or less, and that the remainder of the allotted time will be spent on questions and a conversation and discussion with Subcommittee members.

We are webcasting this meeting, as we have done for all Commission meetings. We want people who aren't able to get to our meeting locations to be able to follow our proceedings. The video archive for this meeting will be posted on the Commission website.

At the end of today's morning session, we will hear from any member of the audience who wishes to speak. A sign-up sheet for the public comment period is available now, and will be open for sign-ups until noon.

Of course, the amount of time allotted to each speaker will depend on the number of people who wish to speak. We

appreciate the time and efforts, again, of our speakers, and have put into their presentations that the analysis and their own expertise and perspectives that we know will significantly contribute to our efforts, not only this morning but our overall objective.

Also, I wanted to mention that it is the last Subcommittee meeting for this year, for this Subcommittee. This Subcommittee will be taking time to process the received information that we've gleaned over the last six months, and we'll have additional hearings, if necessary, while continuing to receive public comments and input.

With that, I will open the floor to the commissioners for any statement or comment they wish to make, before we move next to our item on the agenda, and that is to hear from our panelists. At this point, I will ask my distinguished co-chairman, Jonathan Lash, for any additions he would like to make.

CHAIR LASH: Thank you and good morning. Just two brief points. First of all, we continue to be astonished and deeply grateful at the willingness of experts from across the country to come and talk with us and help us through this task.

We have found universal willingness to come give us your thoughts, and help a Commission that started from pretty much zero to move ahead on this topic. I noticed one thing as we were traveling in Finland and Sweden, two countries which are really quite close to reaching a consensus on a solution to waste disposal.

In Sweden, we visited the facility they have constructed, that is a purely experimental facility to test their waste solutions, 450 meters deep in granitic rock, in which they've dug demonstration drifts and begun testing.

Their solutions and, despite the fact that in terms of the success of their

process, they've gotten much further than we have, it was quite remarkable the extent to which the decisions taken by the United States, the views expressed by this Commission, the input of U.S. experts like yourselves, carries enormous importance.

They attach great weight to what we decide and what we do, and it adds to our sense of responsibility in addressing this. So I think we have a chance to reach an urgent solution for a problem the United States faces, but also help the world move forward. So we appreciate your participating in that very much.

Per, I don't know if you have anything to add?

MEMBER PETERSON: No, thank you.

CHAIR HAGEL: Thank you. Now before we turn to our panelists, let me ask John Kotek, who is the BRC staff director, to give a Subcommittee rundown of the Commission papers that have been requested so far to

assist this Subcommittee in its work. John Kotek.

MR. KOTEK: Yes. As much as anything, this is sort of an advertisement. The Commission has asked for papers to be completed by some outside experts, where we've found areas where we needed some help.

So for example, we have had papers prepared on federal commitments related to waste, and also on options for geologic disposal. You'll see we reached out to the law firm of Van Ness, Feldman and then Dr. Chris Whipple, who's well known to many of the folks in this room, I'm sure.

Those papers are available right now on the Commission website. I just wanted to make sure people knew they were there. If you look on the website, there's a tab that says "Commission Papers." Click on that. You can see what's been provided to us.

We're more than happy, always eager to receive comment on any of those. So

again, for folks who are interested, go have a look, and if you think there's something there that needs to be commented on, we'd love to hear it.

Next slide, please. Can I get the next slide? We've got other ones, a longer list of ones that are going to be coming down the path.

I won't read them all to you here, but what I can do is have a list, post it on the website, of kind of what's coming. But you'll see that we're trying to get some outside help exploring a broad range of issues that are before the Commission.

Again, these will be posted on the Commission website. They're not the work of the Commission, they're the work of outside experts that we've asked to provide us advice in specific areas, and we would love to hear thoughts from anybody who has something else to offer in those areas.

So we'll get this list on the

website in the next several days, so you know what's coming, and again, appreciate any thoughts you have to offer. That was what we wanted to accomplish here. Thank you.

CHAIR HAGEL: John, thank you. Now to our panel. The panel discussion is focused on, will be focused on lessons learned from past site evaluation processes.

In particular, we have asked our speakers this morning to focus on two specific questions. What were the drivers behind the scope of scientific work and the associated cost and time required of the WIPP and Yucca Mountain sites?

Second, how can a future site evaluation process be designed to allow the many necessary and sometimes conflicting goals for site evaluation to be met, to be met in a credible way within a reasonable time and at a reasonable cost?

We have with this us this morning Dr. George Dials, Executive Vice President,

B&W Technical Services Group. Welcome. Mr. Lake Barrett, former Acting Director, Office of Civilian Radioactive Waste Management of the U.S. Department of Energy, and now owner of his own consulting company, L. Barrett Consulting.

Mr. John Greeves, former Director, Division of Waste Management at the NRC. Thank you. Dr. Rip Anderson, retired scientist at Sandia National Laboratories; Dr. Linda Lehman, contractor to the U.S. Department of Energy for Performance Assessment, former consultant to the state of Nevada; and Dr. Robert Andrews, principal scientist at Intera, Inc.

To each of you again, thank you very much. We look forward to your comments and to the exchange, and we will begin with Mr. Dials.

Panel Discussion

MR. DIALS: Thank you, Senator and members of the Subcommittee. I'm honored to

be here. I sort of felt boxed in the corner there with my old colleague, Lake Barrett. But Lake used to be my DOE boss when I was the president of the M&O contractor in Yucca Mountain, that's not a position I'm unaccustomed to.

I am honored to be here. I know we have a few minutes, but I am very pleased to talk about lessons learned from two national repository programs, both of which I'm honored to have had some small role in. I was a member of the Senior Executive Service, and actually I was able to form and staff the Carlsbad area office.

It's now called the Carlsbad Field Office, when it was decided we really needed to pull together the various and disparate organizations trying to get the WIPP licensed and opened, and required a lot of people to move to Carlsbad, New Mexico.

Several of their wives have yet to forgive me for that action, but it was

essential in that program. Then I was also honored after I left DOE service to be chosen to be the president of the M&O contract team, to run the final couple of years of TRW's role in the Yucca Mountain project, and Lake and I worked very closely together.

I do want to talk about lessons learned on these two programs, because they have some great similarities in terms of timescales of concern and in terms of the technical and organizational aspects, timescales in terms of identifying and picking acceptable sites, and then moving forward through site evaluation to the review of regulatory and licensing requirements, and then licensing programs.

They're quite different, though, in terms of ownership of the problem, in the sense of who really had control and owned the waste, and what were the mandates for dealing with, on the WIPP program, the defense-related transuranic waste, for example, and on Yucca

Mountain, it's the used nuclear fuel and the high-level waste.

They're different in terms of the sort of stability of the regulatory environment in which they were being evaluated. There was lots of concern and angst when it was decided, under the WIPP Land Withdrawal Act and others, that the EPA would actually be the regulator for determining if WIPP met the compliance requirements and could open, rather than the NRC.

But that was one of the signature events that occurred, that enabled the WIPP program to move forward under a stable regulatory program and meet compliance requirements that were both stringent and well-defined.

So the programs are different in the sense that one has been successful in terms of its ultimate objective, that is, in getting a licensed and operating repository open that's permanently disposing of a waste

form that we felt problematic, and that's the WIPP program.

The Yucca Mountain program unfortunately has become the victim of primarily political decision-making. There was no technical, rationalized technical basis for the decision not to move forward with Yucca Mountain, and I'm sure other speakers here who have been intimately involved will speak to that.

I wanted to emphasize a couple of points in the time I have, of areas where we should look for the lessons learned, and I have a few viewgraphs that will help me do that, and our technical staff are very accomplished. They did indicate with an R and an F which direction we need to go, and I appreciate that assistance.

I would like to say that, finally, on both of the programs I've been involved in, the successes that we've had, and there have been great successes both in WIPP and Yucca

Mountain, are attributable to the hundreds and thousands of dedicated professionals, many of them who have spent their life working on those programs.

There have been many scientific, technical, administrative, communication, public outreach successes, and there are lessons to be learned of great value for moving forward with government programs in both WIPP and Yucca Mountain. There have been failures in both programs, and as a senior manager in both programs, I will take responsibility for my part in some of those failures.

But the failures in these programs, particularly Yucca Mountain in my opinion, are failures at the very senior management level, where we lost focus on our primary objective of solving the problem and removing high-level waste from the environment.

That was the simple objective of

both of these programs, and at their genesis, they were combined. If you go back and read the history of it, the WIPP site was sited initially to dispose of all of the nuclear waste in the United States.

After some deliberations, it was decided that the program should be divided, because of their different timescales of concern. That is, the actinides remain radioactive for hundreds of thousands of years, whereas the fission products are tens of thousands of years.

And there were those who thought, including my thesis advisor at the time, Dr. David Rose at MIT, that if you separate them into long-scale and sort of intermediate-scale timescales of concern, you would actually be able to solve the most serious problem in terms of health and safety risk to the public, that is, the used nuclear fuel piece, much more quickly and readily than the hundreds of thousands of years problem.

Now it didn't quite work that way, but that was the concept. So there's a lessons learned when we look at the programs in that context. We need a rationalized approach and I think there are lessons learned in looking at both these programs, in a comparative sense with the steps that were taken to how the programs were rationalized.

You can't just talk about solving one piece of this problem without looking at the whole picture, and that's basically what we suggest here, that not all of these pieces are going to be dealt with at one time, and you don't have to have the solution for every technical aspect of it to move forward with a solution to the immediate problem.

The immediate problem with transuranic waste at one time was that we had transuranic waste at over 23 sites around the country, posing some risk to the public, and we decided to communicate this in simple terms.

That is, if you define how many people are at risk, what can you do to reduce the risk? So if we took a 50-mile radius circle and drew it around each of the sites, and found that there were 53 million people at some risk and undefined, because we weren't sure how much of the risk was real or not, compared to what we were trying to do, is to move it to one site half a mile underground, with a 50-mile radius circle with 60,000 people.

The public understood that there was some great improvement in comparative risk. If you did that with used nuclear fuel you'd find that there's probably over 100 sites where you have high nuclear fuel high-level waste. I haven't drawn those 50-mile radius circles, but if I did, I would -- I'll just make a wild guess.

There's probably over 150 million people at some risk to ultimate exposure and potential health and safety impacts, if we

left it there and something bad happens over the next 100 years. So we need to do something about that.

So you look at it in a holistic sense, and the very important part is ultimately, no matter how you look at this problem, the international community, Finland, Sweden and other countries you visited, the National Academy of Sciences, the International Atomic Energy Agency, the OECD NEA, all the deliberative bodies of the world who have looked at this problem, say we ultimately need a repository, a disposal site.

So the Disposal Subcommittee has a very critical part to play in this as to formulating how do we get, in the United States, to the selection of a disposal site and the implementation of the programs to get there?

One of the things we need to do is get a rational regulatory period of timescale framework to do the evaluation, rationalized

as to apply the principles of scientific management for desired result.

There's a variant of that. If you have children, you will know the variant: the variant when your children come say, the dog ate my homework or the computer crashed or whatever, the car rolled down the street and hit a building.

The variant is to provide a plausible but untrue reason for conduct. We had that variant operative very visibly in the last several months on the Yucca Mountain program. My colleague, Lake Barrett, wrote one of the best letters to the editor addressing the variant behavior that's happened on Yucca Mountain. It was published in Energy Daily recently.

I liked it so much I asked him to autograph it for me. I wish I could have written it. As timescales are concerned, a million years isn't credible, ladies and gentlemen. It isn't credible to the public,

it isn't credible to the politicians who try to make the decisions, the policymakers, the management team. It isn't credible.

You know, look at all the significant events that have happened here in a fairly short time, compared to a million years. We need a credible regulatory framework. I know I'm out of time. We need to think about sites. You're going to be ultimately thinking about sites because we need disposal decisions to be made in site evaluation.

I just picked this one out because there's a heck of a lot of bedded salt around, and we've already had an example, a pure example of a repository that's gone through a very detailed and rigorous compliance assessment, that was peer-reviewed by expert groups in the United States.

It's also the first program peer-reviewed by a combined OECD NEA, IAEA peer group, and passed muster in terms of, it met

the requirements in salt. That's not the only formation or geological structure surrounded by it. If I put one up of granite, there'd be lots of granite sites around too. Oh, I missed one.

CHAIR HAGEL: Mr. Dials, could you wrap up here in about 60 seconds?

MR. DIALS: I will.

CHAIR HAGEL: Then we can get back to anything else you need.

MR. DIALS: You need peer reviews, you need credible peer reviews, you need peers who are truly peers, who are not involved in the management, who do not benefit financially or any other way from the programs, but they need to review the scientific/technical programs.

Peer reviews were conducted both at WIPP and Yucca Mountain. The National Labs played a role. That needs to continue. Finally, you need a transparent decision-making plan that the public, the politicians,

the policymakers, the opposition groups are bought into and it's published and advertised.

On this plan, which was a five-year plan for the WIPP program that I used and carried around in my inside pocket, and Senator, every time I briefed Senator Domenici you can be sure he pulled his out and said okay, where are we, all the opposition groups pulled theirs out and said, when's the next public outreach meeting?

There were 47 public outreach meetings, pre-identified, prescheduled on this chart. You need some framework that the public, broadly speaking, can understand, value and participate in. Thank you very much. I look forward to answering your question.

CHAIR HAGEL: Mr. Dials, thank you very, very much. Let's now turn to Mr. Barrett.

MR. BARRETT: Thank you, Mr. Chairman. I believe the main site evaluation

driver is a relentless societal demand for a virtual zero-risk, zero-uncertainty, near-utopian repository.

This was instigated by those who did not want a solution to radioactive waste, those that were opposed to whatever particular site was being considered, and well-meaning bureaucrats and academics, who either intentionally or unintentionally fostered unrealistic, overly-expensive and time-consuming demands.

For Yucca Mountain, this started with a dead-right, blue-sky National Academy report that basically required a million year standard, just like George described a moment ago.

The EPA, under political pressure, piled on with traditional ultra-low-risk dose requirements, additional inappropriate resource protection requirements like the drinking water protection standard, and all of these initial overly-protective standards in

turn is implemented by the ultra-stringent and demanding NRC adjudicatory, regulatory implementation process, that in itself has cost over half a billion dollars alone.

Additional jaw-bone requirements from the Nuclear Waste Technical Review Board added further burdens in the name of "helpful perfection." Taken altogether, this NAS, EPA, NRC, NWTRB gauntlet was so demanding that it makes it extremely difficult for any real site to succeed.

This is not to say the task is impossible for a high-performing site. Despite all these overly-protective near-perfection requirements, it appears that after over $7 billion and 30 years of analysis, the proposed repository at the Yucca Mountain site can achieve all these super-safe requirements.

In my view, the obvious least-cost, least-time solution that is safe for the American people is to continue and improve with a Yucca Mountain monitored, reversible,

hybrid storage repository facility.

If Yucca Mountain is not to be used, costs and time for another site evaluation could be reduced if the near-perfection requirements can be reduced, and the implementing organization is empowered to more effectively meet the challenges than the DOE was.

Unfortunately, given the anti-nuclear waste rhetoric and fears over so many decades, it will be politically challenging to reduce existing requirements.

In my view, previous nuclear safety requirements are like an irreversible ratchet. They never loosen. The Yucca Mountain site evaluation cost and schedule experience may well be the good old days when compared to any new, real repository site evaluation.

However, an existing site like WIPP is a possibility, but reversibility, natural resource potential exploration and

erosion out to a million years will be challenging evaluation issues that should not be underestimated.

Remember, the grass always looks greener when viewed from across the street, but it's not so green when you stand on top of it and look at it. Managing a politically sensitive, open, transparent, complex state-of-the art science program like this, in a very highly regulated environment and contentious political environment, within a large catch-all civil service organization like DOE, is not easy for many, many reasons.

A direct executive agency branch like the DOE is about the worse place to do it, with constantly changing bosses who have dominating political electioneering responsibilities.

Actions going back as far as the 1986 termination of the second repository program, the Fiscal Year '96 Congressional budgetary redirection, the Nevada primaries of

2004 and 2008, and the current Nevada Senate election situation, provide ample proof of this.

In addition, there is very limited authority granted to DOE OCRWM office, to meet the many challenges in a timely, effective manner. Budget competition and many other DOE internal rules make it very difficult to implement a program like this.

In my view, a focused government-chartered, private-public entity would be a much better management structure to effectively evaluate any new repository site, to establish an integrated storage facility, hopefully in conjunction with advanced nuclear R&D initiatives, or finishing with a statutorily designated but much enhanced Yucca Mountain facility.

Now I would like to, in my remaining time, put this in context with some schedules. Can I have the first slide please? Well, next slide. Next slide, please. I want

to quickly go through and show you the site evaluation process.

The first beginning, this is generic for what happened at Yucca Mountain. I believe it would be generic for any new site that you look at. The first period is policy development period. Back in 1978, the IRG was sort of like you. That led four years later to policy being written, the Nuclear Waste Policy Act.

Next slide, please. Then you go into preliminary siting. In the case of Yucca Mountain, this was cut short, as you know, by the '87 amendment. Next slide. Then there's a detailed site characterization period.

For Yucca Mountain, this took 15 years, and I'll come into some of the lessons learned, why I believe that should be closer to seven years if we did this again.

Next slide. Then you start into the facility licensing part. The first phase would be for the applicant, whoever that is,

to submit a license application. In the case of Yucca that took six years, and in my view that should have been only three.

Next slide. Then the regulatory organization has to make a decision. That is nominally a four-year process, per the Nuclear Waste Policy Act. The NRC is halfway through that. They've suspended that review at the moment, but if that were allowed to continue, that would have been 2012.

Next slide, please. Then the nominal eight years' construction, and you'd be looking at operation in the 2020 timeframe. So it's been 42 years from the start to the finish, with site evaluation being the longest, at 15 years.

Next slide, please. Site characterization lessons learned. 15 years, took that long because of many different delays for many different reasons. First, there was the state permits, and this gets into the social science part of it, where they

delayed this for several years.

Then we had the budget reduction changes, some from the new Republican Congress in '94. Then we had internal Congressional appropriations for many years, where that was cut back. The management of betterments and the standards were always changing during Yucca Mountain.

The EPA standards and everything else was changing. It's very hard to have moving targets and keep the focus with a chart like George showed earlier, which he had for WIPP, and we have similar charts for Yucca Mountain.

The one I would like to talk about the most is the management challenge for cultural integration. To do a project like this, it takes -- you have to meld together and integrate very distinct, different, cultural groups of people who don't work well together naturally.

The first is world-class academic

earth scientists. These folks are in academic institutions, really good people, but they don't necessarily work well with a bunch of mundane other groups. But you have to have world-class, state-of-the-art science.

Then you have the nuclear engineering type of people who come out of the reactor world primarily. They don't necessarily work so well with some of the others. They have their view on how it ought to be.

Then you have the underground people, be they miners running tunnel bore machines, deep borehole figures if you want to do deep borehole disposal, the reality of that world, the very practical, we call it "mud-and-boots" world.

These all have to work together in a highly regulated Nuclear Regulatory Commission culture, which these folks don't understand, don't particularly like, and they will buck it. Following the stringent NRC

requirements is very critical, and it's a big job for any organization to do that, especially difficult within the DOE world.

If it's private, I think you'd do much better. Ward Sproat did a wonderful job of pulling together the license application in 2008. But this is something that you ought to keep in mind as we go forward. It has to be done.

Of course, there's political delays. I won't talk about that. Management continuity, Ward Sproat talked to you about that and he's absolutely right. You can't go changing bosses every couple of years. I was the longest-serving director, and I was only an acting director, and that's not the way it should be.

Next slide, please. As far as program restructuring, I think this is really absolutely mandatory for success in the future. I think we need to implement an organization that would be a public-private

corporate new entity. This would minimize -- you're never going to eliminate political interference. You can minimize it though.

It needs to be empowered. I think you've heard about that and talked about it. It needs to have funding, it needs to have management capability to hire and fire and control various contractors at various times. Management continuity, and most importantly, to work with the host entities, be they the states, be they the local. Next slide please.

I'm not going to go through this in detail, but this is very similar phases. If we were to go forward, it shows you starting in 2010, and I put guesses on dates. But there are a few differences here.

One I put in green, the second phase really is, we should establish the regulatory criteria before we get into site evaluation. You've had meetings about that before. So we need to not have the standards changing while we're doing the work.

Then I split the work into three parts. The regulatory part on the second line, and the bottom line is the technical. Those are kind of standard. But a key thing for the future going forward is host relationships.

We've got to have a better relationship with the host. You saw that in the Nordic countries. Well, I'll tell you, they have no states, and if we had no states and we weren't the United States of America, we would have had this done. But setting that aside.

But constant interchange between the host and the regulatory world, the technical implementing world at all times, with host agreements that evolve and are phased as it goes forward.

I believe that would be the formula for success, once you start operation of the continuous science and technology improvement through value engineering and

advances in science.

And if this were to go forward on what I believe a reasonable schedule would be, with a faster site characterization of seven years, licensing prep of three years, we're talking about operating around 2044.

Now that's kind of a significant date, because that is 100 years after we started making high-level waste at Hanford at the end of World War II.

My personal view, 100 years is a long time, and I think it ought to be faster than that for the children, for reasons George talked about, the number is around existing sites, it's 165 million people, all right, and these are the headwaters of rivers and lakes and places, and that's not what we should be leaving for the grandkids. Thank you very much.

CHAIR HAGEL: Mr. Barrett, thank you. Mr. Greeves.

MR. GREEVES: Good morning,

Chairman and Committee. Thank you for inviting me. If you would please, start my slides. I just have a few to keep a focus. Ten minutes isn't a long time.

I started my waste management career with the Nuclear Regulatory Commission in 1980 at the NRC. I actually worked with Lake Barrett, Linda Lehman, and in many ways the other people on the panel over the years.

In that timeframe, in the early 80s, we were reviewing multiple sites, and by the middle of the 80s, we had narrowed it down to three, the Nevada test site, the Basalt Waste Isolation project up at Hanford, and the Salt Project in Texas.

We actually were working on what was called "site characterization reports" and as a young engineer, I was working on the site characterization report for the Hanford project, which was completed.

As many speakers have told you today and previously, it takes a credible

technical and societal decision process to be successful with deep geologic repositories.

In my view, the U.S. program has failed regarding the societal decision process at Yucca Mountain. However, the U.S. has succeeded in implementing a credible technical and societal decision process at the WIPP facility. Overly-prescriptive regulations can drive the cost and schedule of these types of facilities.

Noted in the remarks that I provided, the adaptive stage management process, as suggested by the National Academy of Science and others, should be followed.

I believe it helped Sweden and Finland and even WIPP gain public trust in the selection, characterization and development of a deep geologic repository. WIPP also profited from a demonstration approach, where they took contact-handled waste for the better part of a decade, and then, only then, started handling remote-handled waste.

The next slide is just questions that you teed up, so if you could, just go to my third slide. So with only ten minutes, what I've chosen to do is highlight a few of what I think are key drivers. They're not the only drivers associated with the repository siting process.

Earlier remarks, the program was making progress narrowing down from three sites, and then precipitously chose one. This is quite contrary to the adaptive stage management approach. I believe you've been briefed on this and have papers, and really, it virtually made it impossible achieving societal acceptance at that one accepted site.

Other countries, including Sweden and Finland, chose a different path. They've been more successful following the adaptive stage management approach, and I currently consult for some aboriginal people in Canada, and they are quite voiceful about seeking assurance that this adaptive approach will be

followed in the DGR in Canada. I believe you've had speakers from Canada that have addressed this.

Other speakers have articulated that regulatory standards were not in place. Having worked there, I was part of that process, and those standards were not in place and they continued to evolve for the better part of ten years. This is a serious problem in this type of an endeavor.

Performing regulatory reviews. Some of the times when Lake Barrett would submit us a report, we knew the standards were a bit of a moving target, but we had to implement what was on the books at the time. It's very hard to do that, for both the proponent and the regulatory staff to implement, with the standards not in place.

In looking at standards with other countries, the U.S. system seems to be much more prescriptive. I've worked on both Part 60, Part 61, which is low-level waste, and

Part 63 over my career. Such prescriptive approaches make it difficult to get consensus on what those standards are.

They make it difficult to determine what the design acceptance is for various components, and it's also difficult to conduct transparent reviews with all of these standards. My experience for over ten years, working with the IAEA is that other countries use much less prescriptive approaches.

Regarding management control, there was constant turnover within the director level. Lake, as an acting Director, was a bit of continuity and I did at least enjoy that, the years that I was responsible for the program, and also the contractor, the management that ran the contractor also changed periodically. Basically ran about a four-year cycle where you had a new team.

It was difficult for that team to instill and maintain a nuclear safety culture with such turnover. Each new Director came up

with a new idea to address design changes and safety culture issues.

This was a source of repeated quality problems, and people in the field, like Barrett described, just were not following their internal procedures, which was a large part of the problems that I had to deal with when I was at the NRC.

Last slide, number four. So with that, what can you benefit in terms of the future? Setting standards prior to siting sessions is just mandatory. You just cannot proceed with this evolution process.

It's clearly necessary to follow, to set these standards and it's important to set the technical and the societal expectations that will take decades to implement.

Standards need to be succinct, understandable and implementable. You're going to likely need a clean sheet of paper. Having worked on 10 CFR Part 60, which is

still on the books, it has a very complex and prescriptive approach to it. I don't see how you can just pick that back up.

For example, there's three subsystem component standards in there that -- each in their own right. We had to hire a contractor and staff to develop an understanding of how to implement those standards, one on groundwater travel time, another one on substantially complete containment. What is substantially complete containment? Then the third one was the engineered barrier system, which required a release-rate calculation.

Coming up with the models to meet those substandard systems didn't always integrate very well with the overall systems performance assessment.

So like I said, I think you're going to need to start out with a clean sheet of paper and take the lessons learned we've all been afforded over the years, and what's

going on there nationally.

Experience shows that use of a safety case analysis under the adaptive stage management approach can be effective. I would also use -- I would also recommend using such risk-informed techniques to manage the use of resources, not just the technical part, but the management of the resources.

Also, the what-is-enough question. The scientists like Barrett talked about all have a better idea on how to run tests, do research. Well, what's the payoff? There are risk techniques available that you can use to evaluate. Do I need to put another hole in and what data do I need to gather from that hole? There are techniques that can help you answer those questions.

Carrying two sites is expensive, but prematurely investing in one site and then not getting societal acceptance is obviously a big mistake that we've run into. When you have to retrack on something like that, it's

much more expensive. Geologic repositories are best characterized at depth.

Apparently, you went to Sweden, you saw this. It's, I think, mandatory that you get down. You really don't understand what's going on with the geology with boreholes alone. For example, we didn't learn about the chlorine-36 issue at Yucca Mountain until DOE went down there and opened up those repositories in full-scale drifts. So doing that is quite important.

I believe the experience at WIPP shows how beneficial it is to start out on a small scale, build confidence as you go. Repository development is clearly a decades-long process, a process that demonstrates disposal of DOE's high-level waste glass and the commercial fuel that we currently have. It's not a candidate for recycle.

Doing a demonstration process on that, I think, would be quite useful, and also the high-level waste glass that DOE is

producing is growing, and there is no disposition path in sight for that material.

The last item, the need for sustained management and budget control has been addressed by numerous speakers. Inconsistent funding has clearly been a problem for both the proponent and the regulator at Yucca Mountain.

It's hard to keep talented people when your budget is uneven, the country is invested in the Southwest Research Institute, in that talent pool, and that talent pool, I think, now is in jeopardy based on what's going on.

Apparently, WIPP has not suffered from similar problems over the past decade of operation. Most of my experience has been with the Yucca Mountain process and international, but I, from a distance, have observed a number of positive aspects associated with its development.

So I tried to keep to ten minutes,

and I'd be pleased to hear what the other speakers have to say. Thank you for your time.

CHAIR HAGEL: Mr. Greeves, thank you. Dr. Anderson.

DR. ANDERSON: Thank you, Mr. Chairman. Sorry. I was asked to address whether performance assessment could be used as a tool for folks in science, and it indeed was at the WIPP site and at others as well. The bigger question, however, I think is should probabilistic risk assessment be used on large programs, and I think the answer to that right up front is that it's the only way that you can optimize the research, shorten the time scale and save the money.

I think that the discussions of how the science of performance assessment has developed over time is very critical. I'm only going to point out that the sub-seabed program, which I managed for about 11 years, set up the procedures for probabilistic risk

assessment, and the WIPP program which, George, you told me to get busy and focus on, in effect optimized those procedures that were used at WIPP, and then we used them at an INEL program, which looked at a different waste and a different geologic formation, and then again for the disposal of nuclear submarines, decommissioned nuclear submarines, the reactor vessels from them in the ocean.

In all the cases, the probabilistic assessment project that was -- the science that was developed indeed worked there. What I'd like to do, if I may, is to have the second view graph.

This is in effect the performance assessment flow diagram that everybody has used, sometimes acceptably, sometimes not very acceptably, and -- is there a pointer or would it be better if I just got up to point out different areas? Do I have to be near a speaker?

CHAIR LASH: You've got to stay

near a microphone.

CHAIR HAGEL: We need a microphone, though, next to you. If you want to go over to the podium, it might be easier.

DR. ANDERSON: Okay.

CHAIR HAGEL: There's a microphone there.

CHAIR LASH: I think there's a pointer up there. The trigger is on the bottom for the raising point.

DR. ANDERSON: Okay. Let's see if we can --

CHAIR HAGEL: And you need to turn your mic on by the way there.

DR. ANDERSON: Okay.

CHAIR HAGEL: There you go. Thank you.

DR. ANDERSON: And the pointer is --

CHAIR LASH: Under your index finger.

DR. ANDERSON: Okay. The first

thing that you must do is develop a FEP list. This FEP list must be very, very complete, and as George indicated earlier, WIPP was very deeply involved in developing FEP list for different geologic formations. Why is this so very important?

CHAIR LASH: What's a FEP list?

DR. ANDERSON: Thank you. Feature, Event or Process. Anything that happens at the repository site. What this does is give the management of the program an idea of how big the scope of the work is that will have to be addressed.

This FEP list -- Feature, Event or Process -- then, is addressed individually, and those that are found to be important are screened in -- oh, thank you -- are screened in, and as they're screened in, then the physics codes are developed to in effect allow you to do the calculations.

Those that are screened out, because either from regulation, from low

probability or low consequence, are put into the library and left.

So the only ones that are important are the ones that are left in. Physics codes are developed from each one of the FEPs, and then that code, whatever it may be, a sensitivity and uncertainty analysis run on that.

What that does is identify the most sensitive parameter or parameters, and allow you then to focus back to generating the raw data on only those parameters which carry the most uncertainty. For example, a code might have 20 parameters that are important, or 20 parameters that are in the code.

But when you do this uncertainty analysis, you find that all of the uncertainty lives in maybe five of those parameters. So in essence, rather than doing research on 20 parameters, you only have to do research on five of them.

Then when you do each individual

subcode for each FEP, then you start combining the codes, doing a similar sensitivity uncertainty analysis on that, and what you find is that, indeed, there are very few parameters that are found to be -- to carry most of the uncertainty. So you decrease the amount of research needed again.

What you also find, in many cases, is some of the FEP subroutines are unimportant, and those could be -- no more research is needed to be done on those as well. So what you have done here is decrease the amount of research that you need to get for raw data, and you have also decreased the amount of computer power you need to run those analyses.

Now how do you be involved with the individual scientists, because the scientist almost invariably is going to try to pre-op the situation.

What you do at the beginning development of the code is that you involve

the scientist, the lead scientist, in that activity by identifying all of the parameters and all of the equations that are needed for that subcode, and then do the uncertainty analysis.

He sees indeed that there are a number of datasets that are important, but most of them are not, and there's no way that he can argue then that his data is the most important data, if it's already gone through the uncertainty analysis.

Likewise, where the subroutines, when you find a subroutine that doesn't carry very much of the uncertainty, you streamline the process and finally you end up with the analysis that goes into the final regulation, as well as guidance back to the management on the individual FEPs.

What happens if you have increased complexity, say, of the geologic formation or of the waste forms? The uncertainty sensitivity analysis, the importance of that

increases. The more complex, the more you need this uncertainty analysis.

The complexity of the geologic formation and the complexity of the waste form, the more complex, the less transparent it is and the less defensible it is.

Now, one very important step across all of this is that you only make abstractions for those parameters and those subroutines that do not carry much of the uncertainty. If it carries a high amount of uncertainty, don't do abstractions -- abstractions meaning calculations, excuse me, calculations off to the side, where you put the data into a lookup table and make that analysis.

Okay. Could I have the next slide? How did we apply this to WIPP? Next slide. Okay. Do I need to control it? All right. Okay. We've got something in the middle of it. What we did on WIPP, for example, with a SECOFL, we did the --

developed the subroutine and do the sensitivity analysis.

We found that there were very few of the parameters in the SECOFL that were important. Likewise with the SECOFL transport, and I'm sorry, I don't know how to get that out of the way.

But overall, what we ended up doing with WIPP is the area in blue is the models, the subroutines that did all the calculations to produce the CCDF, to produce the show of compliance.

SANTOS, which was the -- a very complex code that showed the closing of the repository from where the waste was put in until it had collapsed on the waste form, we found that there was almost no, no uncertainty in that subroutine.

So it sat outside of the box of the calculations, and only was called upon as a data set when it was drastically needed.

Next slide. Oh, I got it. Okay.

Here we go. I went through my old history and pulled out a presentation that I gave to the National Academy of Science WIPP panel about at the end of the WIPP program, and what this was is how the PA process matured over the time that I was involved.

Pre-1989, we did not do any probabilistic analysis. In 1989, we had -- we were sampling on 12 parameters. In 1990, we were sampling on 29, and I'm not going to go through the rest of this because of the time.

Next slide. In 1991, we were 45. 1992, we were 55. In the end, we were 56 parameters that we were sampling on at that point in time. This in effect was the amount that was sampled over that time, where there was almost 5,000 parameters in the total of the program.

So we had cut down the program from a huge number down to a sampling of like 56 at this point in time. As far as how do you use performance assessment and risk

assessment for site evaluation, all else being equal, choose the simple, most predictable uniform geology that you can find. Thank you.

CHAIR HAGEL: Dr. Anderson, thank you very much. Dr. Lehman.

DR. LEHMAN: Good morning, and I'd like to thank the chairman and the Commission for inviting me here to speak about some of the issues with Yucca Mountain that we experienced during my time as a state of Nevada contractor.

Before we get started, I'd like to say that the views that I'm expressing today are not those of the state of Nevada. They are my personal views, and nor are they representative of any of my past or current employers.

Today, I was going to speak about the legislation and the funding that developed the state oversight regulatory environment, and some experiences while I was at the NRC at

Hanford, but because of the time constraints, I'm going to skip over this and go right into the state oversight of Yucca Mountain during the site characterization phases.

Then I'd like to end up with a new approach, which I think is very promising, for technical interaction that's being put forth by the DOE Environmental Management office, and their Office of Compliance.

Oops. I somehow got too far. Well, I think my slides are not in order here, but that's all right. What I was going to start out saying is that after the Waste Policy Act was developed, the states, tribes and local governments were given oversight and review authority.

In a way, this put quite a burden onto the DOE, because now they had to show and convince, basically, state regulators or state stakeholders, that this very highly technical -- these technical issues had to be communicated to a largely, to a lay audience,

and this was not an easy feat.

Early on in the site characterization process, the state technical experts started having disagreements with the Yucca Mountain project on technical interpretation of data.

They brought forth two issues to the DOE. One was on volcanism. This approach started developing with the University of Nevada at Las Vegas with Dr. Gene Smith. It turned out to be quite a lengthy argument over volcanism.

The second issue, which I'm going to talk about today, was put forth on the groundwater flow field. We had very different, differences of opinion on how that performed. Sorry about that.

The original groundwater flow field that was developed by the DOE and the USGS was one of matrix flow. It had flow moving from the west part of the mountain block to the east part of the mountain block,

discharging into the Fortymile Wash.

The state conceptualization was quite a bit different. We've envisioned it to be a structurally controlled flow field, where water was basically moving down faults and fractures. We used temperature data to help us determine that that movement was along the faults.

I will put this up here, and I will try to use this pointer, and see if I'm successful in doing this. What this is, I know it's hard to see, but it's a topographic map of Yucca Mountain area, and superimposed over that, this very fine line here, if you can see, is what we used to call "the porkchop," or the area where the repository was to be located on the mountain block.

Over that, we have major fault zones, which are shown here in the dark lines, and on top of that, what we call the potentiometric surface, which is the elevation, basically, of the water table under

the site. As I was saying, the DOE models early on were taking flow, moving across the block from east to west and discharging here.

The state had a different interpretation altogether. It started out, our first indication was some geochemistry data that was done at the water table surface by a researcher at University of Nevada-Las Vegas -- at Reno, sorry -- Nancy Matuska.

She determined that the chemistry of the water on the east side of the block was quite different than the chemistry on the west side of the block, and also different from that in the center of the block, which indicated that this was not a uniform flow field that went across the block.

Our second indication, the state did some research on water table oscillations, which resulted from earthquakes, and found that this separate flow field was supported by that data, because we had different frequencies on this side of the block, yet had

another frequency on that side of the block, and yet a third frequency on the center of the block.

So again, that did not support an uniform flow field across the site. We also then looked at temperature data, and this dark arrow along here is what we determined was the flow path based on chemistry, because it was colder water coming down, and it was actually a plume that followed exactly this outline of the Ghost Dance Fault.

So we urged the Yucca Mountain Project to use both temperature and the potentiometric surface data to calibrate against both of those and solve for both of those before they determined an actual flow path on which to base their dose calculations.

At first, they were very resistant to this idea and did not accept that proposition at first. It's my feeling that had they accepted that alternative conceptual model, that more relevant data could have been

gathered earlier in the program.

So site characterization phase began at Yucca Mountain without consideration of the structurally controlled fault system, and -- in their flow model. And, as I said, despite our comments and our comments on the site characterization plan, the state's ideas were largely ignored for a very long time.

Later developments, as John Greeves mentioned in the '95-'96 time period, when chlorine-36 was discovered in the fractures following the tunnel boring machine through the mountain, DOE could no longer ignore the prospect of fracture flow at the site.

The DOE and the USGS did set about trying to verify --

CHAIR LASH: I'm sorry, I have to interrupt you. I can't understand that statement, since I'm not a geologist and I don't know the significance of chlorine-36.

DR. LEHMAN: Okay, sorry. The

significance of the chlorine-36 -- it's created from exploding the bombs. It's a bomb tracer, basically, and as the tunnel machine moved through Yucca Mountain, Los Alamos researchers followed behind that machine and took samples of water that was dripping into the ceiling.

That was water contained bomb pulse, chlorine-36, which indicated that it had reached the repository horizon in less than 50 years, which was not consistent with the models at the time that the project was using.

So that basically forced them to look at the fracture flow model. The DOE went back in and tried to verify this later. They did some remapping and they did tunnel sampling. However, because the tunnel ventilation system had been in effect for several years, all of that water that was coming in the fractures had evaporated.

The approach they took was a more

systematic regularly-spaced sampling along the tunnels walls, and that study did not show chlorine-36. My response to all of this was that they were both right, because if they were sampling the matrix they shouldn't have seen it, and when they were sampling the fractures they did.

In the end, the last few models that DOE created for the Yucca Mountain site, did have the faults and fracture zones included in those models.

While they were very much more complicated than the models that I did for the site, the flow paths that resulted were much more similar. In fact, they had a more southerly flow path as opposed to the easterly flow path that they started with.

So I believe that they were being very defensive of their early models, and that was actually costly to them, because they did eventually have to go in and try to characterize the site in terms of fractures,

and that led to a lot of uncertainty in the data set, that they went into licensing.

Now I just want to mention as a very positive aspect, the Department of Energy EM has had for years, trying to close their high-level waste tanks and develop disposal facilities, and under DOE orders that also requires a performance assessment.

So after years of doing these performance assessments in a vacuum, and then throwing them over the fence to the state regulators, we found that that didn't work, because, for example, at Hanford, on a sea area tank farm, we had about 1,000 page performance assessment which went over to the Department of Ecology.

We got back about 1,500 comments on why things were not right, and they didn't understand largely what we had done. So the Department decided, and the Office of Compliance decided a new approach was necessary.

This approach, we call it the scoping process, was largely due to the efforts of Mr. Marty Letourneau, Bill Levitan, Tom Crandall, Linda Suttora, which are currently at DOE Office of Compliance.

Much of the work is educational. The way they start out is they offer -- they develop a swim lane chart, what we call swim lanes, and each swim lane belongs to each regulator.

For example, the Department of Ecology would have one swim lane. The NRC would be in another swim lane. Each swim lane addresses only the decisions that need to be made by that regulator. So the Department of Ecology has no say in really what NRC's decision are, and vice versa.

What they did was they brought all of the regulators that were involved in the process together. They tried this at Savannah River site first. So then they went over exactly what was going to be in the

performance assessment.

Everyone got to ask the questions that they needed to make their decisions, and in the end, while it took about a year and a half to go through this scoping, when they actually wrote the performance assessment, everyone had the data they needed, the information they needed, and they were actually able to get through the whole process of review in record time.

So that really saved a lot of money and a lot of time for the Department. But more importantly, it resulted in a more informed state regulator and stakeholder community, and in the end they were very supportive of the closure projects.

So in conclusion, I would like to hold up the Office of Compliance model to follow for any future site investigations that the Department might undertake. Thank you.

CHAIR HAGEL: Dr. Lehman, thank you.

DR. LEHMAN: You're welcome.

CHAIR HAGEL: Dr. Andrews.

DR. ANDREWS: Yes. If it's okay, I'll stay here and if you can have my first couple of slides, if that's possible. But in the meantime, I'll say I'm Bob Andrews. I work for Intera right now. I'm probably all three of Lake's bullets.

I was an academic geologist, then went into consulting and contracting work. I was underground and doing surface-based testing at a number of sites, mostly in Europe, in Switzerland, and then worked for a utility doing regulatory work in support of Yucca Mountain.

For Yucca Mountain, I led the performance assessment activities, which Dr. Anderson talked about for WIPP, in the mid-90's into the 2004/2005 time frame and then transitioned that to Sandia, so they could complete the work.

If I could have -- just go through

to the third slide, because the second slide is just the questions that you posed to us. Trying to answer the first question on the drivers affecting the required scope of work, the first one up there clearly is the regulations.

Early on in the mid-80's, late 80's, early 90's, the regulations were pretty unclear. Dr. Greeves has already talked about, the three subsystem performance metrics which are only metrics, they're only criteria. There weren't requirements per se, and not quite uninterpretable but almost uninterpretable from an implementation perspective.

I think NRC also realized that and Congress finally realized that in the early 90's, and then went off with the National Academy of Sciences panel that led to finally the Yucca Mountain standards being developed in the late 90's.

But changing regulatory criteria

expectations were the major driver in affecting the science that was performed, because early on, the criteria were essentially to go out and do good science and investigate this site amongst many other sites initially, and then just this site.

But it was go do good scientists -- go do good science. So you had good scientists doing good science, and questioning each other on the science they were performing.

Most of that science was done by the national labs and the USGS for one good reason, and that is that -- because those same institutions had been investigating that same real estate since the mid-50's, early 50's, late 40's, for very obvious reasons, that 900 underground nuclear tests were performed in that exact same real estate for this nation.

Those tests stopped in 1992. So even while this process was going on, underground nuclear testing was going on, and

the science associated with underground nuclear testing and the geology, hydrology, geochemistry and the residual contamination that's left from underground nuclear testing was still being investigated by those scientists, and they carried over that knowledge base to Yucca Mountain, just 20 miles to the southwest.

The second issue that's been alluded to here is the -- that goes along with the regulatory requirements -- is this is nuclear waste, and nuclear waste and nuclear materials have very, very special quality assurance requirements.

Those quality assurance requirements and expectations, driven from what's called the quality assurance requirements document from a DOE perspective, which flows out of the regulations, are sometimes in conflict with the scientists and the science.

The scientists are generally not

used to working under a controlled nuclear culture, safety culture, at their labs, or the USGS for that matter.

So taking that culture of nuclear culture and nuclear safety culture and quality culture, and trying to embed it amongst the national labs and the USGS was a challenge, and led to a lot of rework in some cases, because they sometimes quite frankly didn't get it. So that led to a significant amount of the effort during that time period.

But it wasn't just regulatory. There were technical drivers as well. The design, as you might know, changed significantly throughout the process, including the last design. There was a design change -- the last before the final license application went in. That was a DOE decision to make it streamlined, simpler, safer from cradle to grave, if you will.

Perhaps a good decision, but affected by the science and affected the

analysis and it affected the cost and schedule associated with doing the work. But there were prior design changes to that, led by various decision-making processes within the Department.

Performance assessment, in fact, as Rip said, can be a major contributor. Understanding what's important, determining what's important, testing what's important, leaving aside what's less important and not focusing your dollars and effort on that, is a very useful tool and finally came to be used at Yucca Mountain towards the early 90's, mid-90's and on into the late 90's. But early on, it was not used as an evaluator criteria for Yucca Mountain.

The regulators and other stakeholders, including the state -- a very major stakeholder -- did affect the science that was undertaken at Yucca Mountain. A good example would be the regulator coming up with 293 questions after the site evaluation, what

they called "key technical issues", that they felt needed to be evaluated.

Many of those questions were not particularly risk-informed. They were not particularly performance-based, but they were questions the regulator felt needed to be answered.

Many of those questions in fact were developed by DOE scientists in discussions with the regulator, saying "wouldn't it be good if we did X."

Well, of course. You know, if a DOE scientist says "wouldn't it be good if we did X," the regulator's not going to say "no, don't do X". So go do X and spend the money and time and resources to do X. Scientists can always find a little bit more that they could do and want to do, and that certainly happened in the Yucca Mountain project.

Technical reviews, there were a number of technical reviews, external technical reviews such as the Nuclear Waste

Technical Review Board. They certainly drove aspects of the science. They would say on innumerable occasions that they were not particularly risk-informed or performance-based, nor in fact, they would say, did they care about the regulations.

They cared about the science. So there was some science performed, not directly supporting the regulatory basis or the license application or the site evaluation, but performed because an external group, in this case the Nuclear Waste Technical Review Board, thought that would be a good scientific endeavor to go through.

And this was science. So it's not surprising that there would be unexpected results when you do science. One of those unexpected results, and I was going to use in fact the same example that Linda used, was the chlorine-36 example.

Discovered in the mid-90's, this bomb pulse indicating that the water got to

the repository horizon much faster than any scientist looking at Yucca Mountain had guessed or evaluated up to that time period, which was kind of a mind switch for the scientists.

About that same time, the USGS -- there was a big rainfall year in about '94 or '95 -- and the USGS scientist charged with evaluating how water percolates through the mountain determined that maybe more water was percolating through the mountain than they thought up until that time.

Even though they'd been studying Nevada test site since the early 50's, and the amount of water that moves through underground nuclear test explosion areas since the early 50's. So this was a mind shift that occurred, you know, in the early 90's, mid-90's, that affected a lot of ongoing work, affected a lot of the analyses models, the design, et cetera.

Just sticking on the chlorine-36 issue, you might think, oh well, the Los

Alamos scientists proved, you know, that water go to the repository horizon in 50 years. Well in fact not.

USGS disagreed; Lawrence Livermore National Lab disagreed; and in fact, after 15 years of additional research, the answer is still unknown, whether Los Alamos' information is correct, verified, adequate or whether in fact another interpretation favored by other scientists, USGS and Livermore, is in fact more correct, which is there is no bomb pulse, chlorine-36, at repository horizons.

So after 15 years of study, the answer is still in the final document inconclusive about which one is correct. Of course, there are some management issues, in terms of what direction the project should go to minimize risk, to minimize public perception of risk, and those did affect the ongoing work.

Going on to your next question, the goal of any future site evaluations, I

think you first have to define what is that goal, and I wrote down what my definition of that goal would be: would be to characterize the relevant and significant natural and engineered features, events and processes that affect the ability of the diverse engineered and natural barriers, wherever the site is, to meet the performance objective of protecting human health in the environment.

All sites will have both engineered and natural features. They will all have different processes.

They will all have different events that could act on them to affect the performance, and the ability to characterize those in a meaningful way, and to reduce the uncertainty or evaluate the uncertainty in those features, events and processes is key.

I agree with several of the other speakers that the credibility of that process can be obtained by the objective review of both pre-licensing during the evaluation

phase, and licensing by these independent reviewers. Whether -- who they are paid for, that's somewhat immaterial. But they have to be independent from the ongoing work.

Going on to the design of the future site evaluation process, which I think was your second question, the first one I agreed wholeheartedly with -- I think Dr. Greeves said that we have to have right up front transparent and implementable regulatory objectives.

They have to be specified. We can't be having 15 years of guessing what are the metrics that we're trying to meet and we're trying to achieve. Of course, all stakeholders involved -- are involved in identifying those objectives.

The second one, having lived through QA issues for 15 to 20 years, is having a stable QA program. The QA requirements document went through 20 iterations at Yucca Mountain. I think it's on

Version 21 right now.

That seems to be unacceptable and seems to imply that you can't get the requirements down so everybody understands them. If we can't get the requirements down, then how do we communicate those requirements to the scientists and engineers who are actually going to be performing the work to those requirements.

It also means having a stable staff that knows how to implement those requirements, and the ability to train and to identify appropriate roles and responsibilities for those staff, as they implement those requirements.

Having some design and initial site information is useful to generate an initial safety case, because a safety case and the initial performance assessments can help you drive and focus the program, as Rip mentioned.

I agree with Linda. It's good

being last, so you can agree with people and you don't have to say who you disagree with -- that the involvement of stakeholders in the performance assessment is a very useful activity.

I think DOE has been doing that quite successfully over the last few years in South Carolina, because there is waste in South Carolina that's going to stay in South Carolina, and the performance assessments for those waste sites are being iteratively done with direct support from stakeholders.

I think they're taking that "lessons learned" if you will, and applying it now, as Linda said, up at Hanford, I think, in also a very successful way, where all people can get together and say okay, who do we agree we're trying to protect? What's our performance metric? What are our levels of protection that we're going after?

Finally, this is science in some ways, but science can be controlled. Science

can be controlled from a quality perspective, as I mentioned earlier with respect to quality assurance, and it can be controlled with respect to simply scheduled cost accountability performance.

That's very difficult to do with some of the scientists, as you can imagine, because they're not generally used to working under quality controls or schedule cost controls.

It's just something that you're going to have to keep struggling with, with respect to in particular the national labs and USGS, if those are the institutions that are going to continue in that vein.

CHAIR LASH: I suspect our questions will come back to this last point. I know many of us having questions about reducing the costs. Are you basically --

DR. ANDREWS: I am done. Yes, thank you.

CHAIR LASH: Good. Thank you very

much, and thank you to all six of you. That was extremely informative. We appreciate it very much. I know that my colleagues are full of questions. Mark, do you have a question you want to --

MEMBER AYERS: Not yet. I need to go through my notes.

CHAIR LASH: Okay. Per?

MEMBER PETERSON: Yes. I do have questions. So I'd like to start out -- ne of the things that I found striking was a general consensus, first of all, of the importance of having some continuity and stability of management, to make this type of program successful, or this type of activity successful.

The other major element was the discussion, and I think fairly broad consensus about the importance of the standards that would be applied. So I'd like to focus a bit on standards and then how they're used.

My experience comes from reactor

development, and there's been a very large evolution on how we regulate the licensing of reactors, and in fact large improvements, I think, over time.

One of the things that strikes me is, you know, looking at repository standards, this tendency for the older ones to be prescriptive and deterministic. Even the statute does that.

I mean looking here at the Nuclear Waste Policy Act, it actually specifies that "The maximum size permitted for borings or excavations during site characterization shall not exceed a diameter of six inches." You know, having the statute be that prescriptive clearly is problematic.

What I'd like to do is to have members of the panel comment about what the most important characteristics of a good standard would be, and then also to provide recommendations on how one might get a new standard, and in particular what entity might

be best at doing that.

Would it be another National Academy study focused on something that would be more site-independent, EPA, NRC -- how to tackle that problem, since clearly the standards question is very important, and who'd ever like to start off, I'd just like to hear about that.

MR. GREEVES: Thank you for, well raising a number of questions, and one of which was the standard. This prescriptiveness issue is a problem, when you put things like six inches and anybody that's familiar with Part 60, which actually is a requirement; it's not guidance, it's not --

You have to do it. You pick up 10 C.F.R. Part 60, you have to do those three subsystem performance objectives. Each in its own right created a cottage industry of analysts that chased each of the -- and I was part of that. I've learned a lot since then. I'm wiser. I've looked at what's happening

internationally, and so I think there's a way to get there.

Having the National Academy do another study? I don't think so. I think there's enough wisdom within the current regulatory bodies, if they get legislation that sets up expectations at a high level, and they're told do it right, be safe and basically follow the ICRP recommendations: .3 millisieverts. That's the dose to the public.

You have to -- and that's for normal operations. You can do that. Internationally, that standard is out there. The IAEA puts it in their documents, and you also have to account for an off-normal performance, and some other standard about background and some levels near background.

But more prescriptive than that, and you set up the dynamic that I was part of, that takes 15 years to implement, only to get to where we are now.

So I think there's enough wisdom

out there already, with the good and bad experiences we've had in this country and internationally, to write such a standard. I think the regulatory agencies could do that without further studies.

CHAIR LASH: Just could you back up from standards to site selection criteria?

MR. GREEVES: Site selection criteria. I don't profess to be an expert on that. What I would -- site selection, and I'm speaking for myself. I've done this, I've done some things wrong and I've seen some things done right.

I think that the sites, you know, the best site is the enemy of one that's good enough. So don't, you know, set people off to find "what is the best site." I think a process that first to have a standard, an implementable standard; then look for multiple sites and, in parallel, use this adaptive stage management process to --

It truly is as much a societal

process as it is a technical process, very unlike reactors. So you have to go down both those roads and if you can find a site that has societal acceptance and meets a reasonable standard, that's the goal.

My experience is telling me you probably have to carry at least two sites along for a while. It's expensive; your question talked about the conflicts. One of those conflicts is, you know, how much can I carry? I think experience is carry at least two sites, maybe different geologic media along, and as I said in my presentation, make it a demonstration.

You know, this business of setting 70,000 metric tons for Yucca Mountain, that's overly-prescriptive, and I think the WIPP experience showed that using a demonstration builds confidence and allows us to show that the standard is met, perfect those tools, and I don't really want to comment on site selection criteria because they become

actually a trap.

You write too many of those down -- and I think there are good sites out there, and maybe somebody else at the table's more expert at site selection criteria.

CHAIR LASH: Mr. Barrett looks like he's on the edge of his chair.

MR. BARRETT: Well no. I agree, I think, with what John just basically said here. I mean I think site selection is very different than the site standard, because to me it goes like this: any site has to be safe and meet the requirements for safety and environmental protection over a period of time that's appropriate.

To select the site -- that's what is a science safety line that must be met no matter what, where you are. Then there's the social side of it, the institutional side. It has to be a site that can work socially as well, and there are different tracks.

So you don't want to preclude

sites, you know, due to an overly-prescriptive site selection point of view. I think a flaw of the '82 Act was science was going to tell us the best site. That's not going to happen. There is no such thing.

So it's a safe site that is socially acceptable is the goal, and you're going to have the criteria, as John said, what is the criteria for a safe site, because you have to meet both. So safety is necessary but not sufficient, you know, as you do it.

I think this is a risk -- it needs to be risk-informed. I fully support the performance assessment, but this is going to be a risk-informed political decision. That was said at one of your other meetings. I think that's absolutely, absolutely true.

One of the things on Per's question is who's going to regulate it? It is a very critical up front policy question, and there is a very different culture between EPA regulations and NRC regulations. They evolved

from different places, they act very differently.

What happened in the case of Yucca, we had the worst of both. We had the EPA, in my view, will set a more policy-related standard, being sort of the way they are, but their implementation of it is not as rigorous and engineering-focused like the NRC does.

The NRC evolved, as Per said, out of reactor licensing. Very engineered, pumps and valves, and probabilistic, that kind of thing. EPA is a little more policy world about we're going to protect the ground water or not, and this kind of thing. But their implementation and in case of WIPP was not the rigidity of the NRC quality assurance that a reactor core design ends up with.

So we had the EPA setting this sort of standard that was overly-aggressive, and the NRC implementing that with an adjudicatory process that was almost proof

beyond a reasonable doubt, okay, which is a very, very strict way to do it, and it was the worst of all.

If the NRC was setting the standard and EPA was implementing it, we would have had this done, okay, at half the price and half the time. That would be my view. So you need, as the nation goes forward, if we're going to look for a new site, you need to kind of decide that up front, who's going to do it, and in my view, the way we have it -- give it all the NRC or give it all to EPA, okay.

I think George brought home WIPP very well, but he had one set to do it under and it was the WIPP, was the EPA approach.

CHAIR LASH: Mr. Dials.

MR. DIALS: Yes, I believe it's critically important that we begin with the end in mind, and that's an over-used phrase. It's a very simple supposition we began with, at the genesis of the waste disposal programs.

As I said in my presentation, it's

in my written comments, at their beginning, they were combined. It's very interesting. The radionuclides don't seem to know which program they're in, and they react in a very predictable scientific manner, in terms of half-lifes and migrations through geological structures and ground water and so forth.

A tremendous scientific work's been done. But in the site selection evaluation, we should begin with that simple evaluation in mind. The goal is to remove the hazardous material from the biosphere, so that it poses no safety or health threat to the public or the environment, now and for the predictable future.

The problem comes when we try to prescribe the make-up of the site and the type of geological structure, and the type of engineering design barriers, both active and passive barriers that need to be implemented, and we got caught up in that, both at WIPP and Yucca Mountain.

Fortunately at WIPP, we had a demonstration project going on, so some of the prescribed techniques early on really didn't prevail.

It found out they, one, were not necessary, or they were not productive. With Yucca Mountain, it seemed to be much more prescriptive, that it needed to be largely because the selection of the site was prescriptive.

We mandated the site. We didn't really go through an evaluation and selected in a site selection process. That was a great mistake, because fundamentally we want to come down to one, and the genre of this problem is, and I believe he coined the phrase that I heard in 1971 when I was studying with Dr. Rose at MIT, and he was very interested in the nuclear waste disposal problem, but also in other problems.

He coined the phrase called "sociotechnological problems." In fact, I

took an elective course that he taught called "Sociotechnological Problems and Solutions," which was quite interesting because we formulated the problem and then we tried to creatively, over a year's time, come up with approaches to them.

Nuclear waste was one of those. This genre of problem is not conducive to merely prescriptive, scientific or technical solutions. It embodies social, political, ethical, moral, public evaluations that are complex in nature, but essential to allow an ultimate solution.

We have to -- one of the lessons learned, I think, in the comparative reviews of WIPP and Yucca Mountain, that we were much more successful, and I do think, John, we used the adaptive method, the decision-making process at WIPP and we didn't do that Yucca Mountain.

If you travel around Europe, you will find in countries where they're doing

that have been most successful. Those where they didn't do that have not had successful programs. So I think there are lessons learned that certainly would be beneficial as we go forward to address the disposal issue.

CHAIR LASH: Thank you. Did you have additional questions, Per?

MEMBER PETERSON: Yes. To follow-up in just a little bit more detail on this question of standards, I think that we're very much interested in the time line over which you could move through a process, and so Lake, you had mentioned that you thought that regulatory criteria might be established within a five year time period.

Is that a conservative estimate or might it be longer? What's the frame, what's the time frame in which one should have sufficient confidence you know what the standard is, recognizing that you may have some adjudication and other things, so that you could make reasonable decisions to move

towards site characterization and selection?

MR. BARRETT: I used the five years because my realistic estimate, from when it says "go, you know, you people are to do a standard," to when a standard is issued that can be used by the implementing organization, whomever that may be.

I assume it would probably be an EPA standard. EPA does take years to go through it. They have a process. They first have to evaluate it and do their work. They put a proposal out, they get comments, they have to address it, and it is a multi-year process right there.

Then if you have NRC implementing it like we had before, they go through almost the parallel, parallel but a little bit of series. They overlap a bit.

But nonetheless, if you look at history on these standards, it's been five years from start to finish or longer if you have litigation that goes with it and remands,

and if not every I is dotted and T is crossed, back it goes to square one.

So I think five years, if you look at the history -- and your staff can give you sort of a history -- I bet it's always been five years or more.

CHAIR LASH: Thank you. Mark, did you have a question?

MEMBER AYERS: Yes sir, thank you. Mr. Dials, you made the statement that the framework -- we need a framework that the public can understand and participate in, and that's been a topic of conversation all along.

You know, I really -- every time I hear that, I become more perplexed, because I'm inclined to think that the public or the social aspect, they cannot understand the science aspect of the process we go through in order to come up with the site selection.

Doesn't it really boil down to trust and confidence, because the public is never going to understand the technical aspect

of all this. I mean I've been sitting through these meetings, and I'm trying hard, and I'm a long ways from it.

MR. DIALS: Well, I appreciate that, Mark, and I agree with you in this context. The public will never in general understand the scientific details of, for example, what Rip Anderson was talking through, the system prioritization method we went through, that I had the opportunity to mandate and oversee, to decide which of all those questions the scientists want to ask really had some impact on the performance and the safety performance of the WIPP site.

Scientists are truth-seekers, and they understand the details and they want all the nitty-gritty details. You could explain that to the public until you're blue in the face and they would come away, as we might be, perplexed with what he really said.

This is no offense to him, because we've had this discussion over years, saying

why are we doing this and what does it mean. The public does, however, understand these relative risk assessment things. They do understand, for example, if you said a radiation exposure requirement, you say well, this is ten times lower than the radiation you got when you got your chest X-ray last week. They do understand that.

MEMBER PETERSON: Right.

MR. DIALS: And you've got to put it into comparative terms they appreciate. For example, the WIPP site and at Yucca Mountain we started doing this, is how many people, where's the material now, and if there's a risk of exposure or health benefits or health effects of safety risk, we think it's much greater with where the material is now, sitting on the surface in whatever storage configuration it is, or in pools of nuclear reactors or in barrels at the nuclear weapons facilities where the transuranic waste was.

So we crafted this descriptive methodology, comparative methodology to say well, 50 mile radius circles around all those sites, you have so many millions of people. Now do you want to leave it there, or do you want us to move it someplace where it's in a safer configuration, and there are fewer people potentially exposed?

They do understand that. We used that very effectively, for example, with the -- and I can remember giving the presentations to the Native American groups, the Pueblos around Los Alamos, who at first were opposing the transportation of the transuranic wastes on Trupaks through their reservations.

And they have the right and the ability. They could almost, they could, certainly through protest, stop you or slow you down.

We finally got them to understand that where the material was sitting up on the mesa at Los Alamos, just to give you a

specific example, there was much more potential risk to them than what we were trying to do, driving it through their pueblo to take it down and bury it half a mile underground 250 miles away.

They finally, they did get that, and when they got it it was liberating for us, because they quit opposing the transportation through their pueblo.

So you have to get it to terms where the public can understand these complex issues. They would never believe, for example, and that's why I said it's incredible, that you're going to guarantee the isolation of anything for a million years.

I don't believe it; do you? So why have a standard that's ridiculous, that's not credible and nobody will believe. Have one that you can document, demonstrate and communicate with them about it, that ends up being credible and acceptable. Ultimately, that's what it requires to get through the

licensing process.

MEMBER AYERS: Thank you. Also, Mr. Barrett you indicated or said the cost in time for another site could be reduced with the lessons learned from Yucca Mountain, and I guess that begs the question, and I'm not being smart when I say that, but haven't we learned enough lessons in 42 years to do this right now?

MR. BARRETT: We know what the challenges are after 42 years, you know, how you develop a standard. In many ways, what you're wrestling with is not terribly different that what the IRG wrestled with in 1978. If we have the answer, like who's going to do the standard. Is it a million years, is it 10,000 years, is it 1,000 years?

If you have the answers to those, I believe a new organization that can start afresh, not have to carry DOE baggage, okay, and not have to carry 1987 political decisions, has a better opportunity to do this

in a much better, more cost-effective and timely way.

That's not an easy thing to do, in my view. I wish I could tell you oh yes, it was just one mistake I made back in 1992, and that's the answer and if we'd fix that, we're all set. If life was that simple, we wouldn't be here.

MEMBER AYERS: Okay. Then one last question. None of you mentioned any standards or requirements, et cetera, on occupational safety and health. Some of you mentioned changing standards, which by implication are public health, environmental and technical, for example, corrosion of containers.

Did occupational safety and health standards change at the same rate for workers doing the work of site exploration, development and for future workers during operations?

MR. BARRETT: I'll start with that

one. No. We had DOE and all our contractor teams had, you know, very stringent, you know, OSHA health and safety aspects through the entire program from beginning to this current day. The work, the lost time workers and all of that time were an exemplary performance.

So those didn't change. You would find there's always issues when you're doing anything. For example, when you're underground, you know, you have to be very, very careful and we were.

I mean if you looked at the English Chunnel, 30 workers were killed in building those. When we did the 7-1/2 miles at Yucca Mountain, we had a very good record.

Now was it perfect? No. We had issues of zeolite and workers would take their masks off sometimes, and so we spent millions and millions of dollars dealing with that, to make sure the workers were protected. But the standards, I don't believe, we really the issue.

You'd find in such an open and transparent program, where we showed all our data to everybody, those who opposed the Yucca Mountain would seize on it and make press releases and TV ads, especially in front of elections, about how the workers were being harmed and this was DOE who killed us when we did, caused cancer and weapons testing and blah blah blah, all of those kind of things would ripple.

So that if you watched TV in Las Vegas and watched what the politicians said, you got a different perception that was not the, what I believe was an exemplary workforce safety program.

MR. DIALS: Could I add to that? As having been both in the DOE and responsible for a site, we implemented a rigorous occupational safety program at WIPP. In fact, we had the first volunteer protection program, Star Site, in the Department of Energy. Then as the M&O contractor at Yucca Mountain, we

had a tremendous emphasis, as Lake was the acting director when I was out there running the program, tremendous emphasis on occupational safety and implemented the integrated safety management systems and had the OSHA folks come in and began the VPP programs.

So an inordinate focus on the occupational safety is embodied in all these programs, and I think one of the lessons to carry forward with that is to continue that sort of focus, because the M&O, the DOE, of course, are motivated to maintain good safety standards, and M&O contractors are motivated and rewarded for maintaining excellent safety standards.

So that part of the program is very robust and I think worthy of note from other industries, come to our sites to see how we execute the programs.

MEMBER AYERS: Thanks.

DR. LEHMAN: If I might just add

to that a little bit, I think this is getting at part of the problem, at least in terms of public perception. The standards are not consistent between like CERCLA sites, DOE sites. For example, the standard for worker dose is at Hanford is like 5 REM per year they can have.

Yet for Yucca Mountain, it was 25 millirems. For CERCLA sites, it's 15 millirems, and the ground water piece of the dose is down to four millirem. So there's a big disparity on what the public thinks is safe.

It's safe -- five REM is safe for a worker to be exposed to it, but yet we can't go over four millirems in the ground water standard for a high level waste repository or any other disposal facility that we might site, here or on DOE sites.

So I think that disparity needs to be explained. Lots of states, at least out at Hanford, the state says "Oh, you can't even be

within 70 percent of that four percent, four millirem standard, or else you have to take some action." I think these standards are very low and in the public opinion, they don't understand that such a small dose is really safe.

MEMBER AYERS: Well, it becomes very confusing, as you say, for not just the public, but for the three million construction workers that I represent, trying to determine, you know, "What is the safe dose for me?"

DR. LEHMAN: Exactly.

CHAIR LASH: Senator?

CHAIR HAGEL: Jonathan, thank you, and thank you all again for your contributions. Let me go back to Dr. Anderson. You had your hand up on one of Per's questions, I think, and we maybe glossed over you very quickly. Did you want to come back to that and make a point.

DR. ANDERSON: Yes, if I may please. It seems to me like we have a perfect

storm situation that occurred at the Yucca Mountain.

We have a regulator that is terribly prescriptive; we have a geologic formation that is terribly complex, although I think it's totally acceptable, and the combination of infinitely complex geology and totally prescriptive NRC made a situation that was almost impossible to be successful in.

On the flip side of that, you had WIPP, with not such a prescriptive regulation, EPA, and you had a geologic formation that was totally uniform and predictable, which meant that the demonstration of success could be accomplished at a very much lower cost in time and schedule.

If we look at that, saying that NRC will probably be the regulator in the future, then the drive should be on site qualifications to the most simple geological formation that you can, all else being equal. What I mean by that is all the politics and

the acceptance of the people near the site being equal, you need to look for a simple geology.

CHAIR LASH: Senator, questions.

CHAIR HAGEL: Thank you. Let me use, Mr. Greeves, your fourth slide, which I thought was a really excellent six bullet point summary of answering the question on the future site evaluation process and so on.

Using that as kind of the model or the base, I would ask each of you are there additional points you want to make here, as you have listened to the conversation and each other, and as we've kind of drilled down in certain areas, and maybe we have not focused enough on some areas that you think are important that we've not touched upon?

So I would use your conclusive comments here on that slide of Mr. Greeves. If you'd like to define any more of those six points in any more detail, and we recognize that limiting each of you to ten minutes is

difficult. But in the interest of hearing from all of you, we had to do that.

But here's an opportunity to come back to some areas, if you think we've not spent enough time in an area.

MR. FRAZIER: We're bringing the slide up.

CHAIR HAGEL: Okay, and we'll start with -- thank you. And we'll start with your Slide No. 4, Mr. Greeves, on your six points. Thank you.

MR. GREEVES: Okay. While we're bringing it up, I only had ten minutes and I've tried and am pleased that you picked on it.

These were kind of the ones that I had some views on, and the only one that hasn't actually been discussed much here was the -- in detail was the management and budget controls. So I would just add, I've been to a number of your meetings, watched them on the presentations.

And you know, this concept of having an administration department agency run a program like this and be torqued every four years is just, in my view, unacceptable. Some sort of a fed corp, that's a term people have used, I think would stand a better chance.

You've been to Sweden. The way it's developed there is continuity. I spent ten years at the IAEA and I saw the same people all the time, both the regulator -- one regulator, not two, and saw the developer, and I, you know, admired that type of an approach.

So that's the one thing of the list of six items that hasn't received much attention here today. I spoke to all the six and I'll just open the microphone to the rest --

CHAIR LASH: Since you brought put that question and responded before you got to your slide, so we did see that in Sweden and in Finland, especially in Sweden. But in fact, it was not a fed corp; it's a private

corp.

MR. GREEVES: Terminology, choose what you want. But consistency in that process. Do not subject to either budget process, which we're witnessing now, or administrative change. It's you know, some of the speakers talked about combining the EPA approach with the NRC approach. We were set up for failure.

I think there's a way to come up with a standard in less than five years. It's out there. You don't have to do another study. It's just going to take assigning that responsibility to one entity, not two, and separately creating another entity to pursue the program, like you saw in Sweden.

I think it's essential -- I agree with those six points. But you cannot be successful without the public acceptance part of this. You have to have the sociopolitical aspect in here.

In Sweden and Finland and others,

they have very active public involvement processes, and actually either through a referendum process or a volunteer process, and that's what's going to be required.

To add to what Rip Anderson said about the perfect storm, the difference in the perfect storm at Yucca Mountain included also this very adverse political and not local regional opposition, but a sort of a manufactured distant opposition that played into the political decision-making.

So that's the other thing I would add as the seventh element, Jonathan, to that list that John Greeves came up with.

CHAIR HAGEL: Anyone else want to not only stay limited to Mr. Greeves' outline, but yes, Dr. Anderson.

DR. ANDERSON: One point to be made, in the past, sub-seabed, WIPP and even Yucca Mountain, we were in the process of building the computational codes that were needed. We now have most of those available,

with slight modifications.

So the needs of the next performance assessment for whichever repository is chosen will require a different direction, in that you won't have to build as many codes; you will have to collect the data. But the codes will be available for a quick sensitivity uncertainty analysis, which will then help focus the research very quickly.

MR. BARRETT: I would add that I fully agree with John Greeves' six points and what George added to that. I would add more the host relationship between the implementing organization and the host. I mean to me, that is the most critical thing, much more critical than the science and the technological part.

On the question of an organization of the SKB versus what we're talking here, I use the word "private-public," because there is -- if you talk to the public, if you say it's a private corporation, people think it's a profit motive here. It is not a profit

motive in SKB, even though it's owned by the utilities. They are to do this thing.

So this is a corporation, I would like to call it private. But there's no profit in this. It's doing basically public good. So I use the word "public-private," and it's just what the average Joe out there is going to have to understand, that I can trust these people.

As Mr. Ayers said, if we don't have trust and confidence in the implementer, this is not going to work. When you step on an airplane, if you don't trust that know what they're doing on an airplane, you won't step on the plane. We also basically have that, and it's something we accept in modern society. So that's how I would look at that.

CHAIR LASH: Just a comment. Having spent four days with the people who manage SKB, they seem to have reached the conclusion that they have absolutely two driving objectives. First of all, they have

to maintain community support, that without that they know they can't go forward, and second of all, they have to have good enough science in order to get their license approved by the regulator, who's completely separate from them.

They will exactly that science in exactly that way that enables them to achieve those two objectives, and they will do it totally transparently. It was quite striking that they learned that lesson by making mistakes, and they just practiced it again and again and again.

MR. BARRETT: If I could comment a little on that, I absolutely agree. I've known the SKB people for 20 years and what they -- their hard times and what they've learned.

We in DOE try to do exactly that, but the cards were really against us. I mean we had a situation where the state of Nevada, because they had a legitimate grief of 1987,

anything we did was going to be kind of wrong, almost by definition, okay.

Even if, I think Mr. Loux, who used to run that program, was questioned in the hearings. If the site was perfectly safe, would you then back off? The answer is "No, because this is unjust", and I can understand their views on that.

So we could never, in the case of DOE with Yucca Mountain, all through the 90's, we could never over -- we could never bridge that, that huge chasm, and it's led to what's happened, which is to me unfortunate and wrong, but it is what it is.

So I mean we tried to do some of that, but there was never an opportunity under the existing policy laws, and frankly real politics, to bridge that gaps. The Swedes have done that.

But again, we are the United States of America, you know. If we're just DOE and Nye County or the locals, you know,

community, I think this would have been done with a much different outcome, but it isn't.

CHAIR LASH: Good.

DR. ANDREWS: Yes. I was going to agree with John's slides, but I would kind of link bullets 1 and 4, that is, developing the site-specific standards and having multiple sites, because having a standard that's not site-specific, having worked through Yucca Mountain, is pretty difficult, because you have to answer the question, and I think all the stakeholders have to answer the question who are you trying to protect, what population are you trying to protect, what individuals are you trying to protect.

Where are you trying to protect them and what other resource, if any, are you trying to protect? Because the resources will be different from site to site. The people will be different from site to site, and understanding who and what and when you're trying to protect them will vary, you know,

from site to site.

You might want to protect that fisherman on the Columbia River if you chose a Hanford repository. That's probably not that relevant for Yucca Mountain, quite honestly, or any other, you know, arid site in this nation. So I think -- and going back to Lake's comment of he hopes you could get a rule in five years.

Well, he knows the difficulty of developing the rule that was developed, not just the legal aspects of it and the contentions that occurred after the fact, but just all of the interagency discussions, because of the three agencies, and all of the technical and scientific discussions.

It was not an easy process to get a site-specific rule for Yucca Mountain, nor would it be for any other site when you add in all of the interested parties, which there will be many, for any other multiple sites that are investigated.

I think it's fair to say that going back to the discussion that we had a little bit earlier, this is on a slightly different topic but it kind of relates to the six bullet that is associated with the management aspects, there's the technical aspects and the scientific aspects of this too.

The scientists that worked on Yucca Mountain and WIPP, many of them have, of course, left. Some of them are still involved, but many of them have left. By the time this process starts again, most of this table will be gone, and probably most of this room will be gone.

So those scientists have a little bit of a learning curve be retrained, to take their scientist hat off and become a nuclear safety person. That will take training of that next generation. You know, maybe it's my grandkids, I don't know. I'm a little more pessimistic than Lake, quite honestly.

But that will take some more training of those, that group, wherever they are, whoever they are.

CHAIR HAGEL: Mr. Dials, did you have --

MR. DIALS: The only point I wanted to add, and Lake and I looked at the list and said well, the budget stuff's in there. But it's critical, to avoid the perfect storm in the future, that you take the funding for the program off the annual budget.

But the money is there, you know. It's in the trust fund, so to speak. Plus the IOU is there, the money's not there. Senator, you know that. But the money's been provided by the utility, just like it is in Sweden, but the management structure's not in place.

It needs to be a not-for-profit off budget that's funded, that has a responsibility for carrying this forward and will give it the best opportunity for success.

CHAIR HAGEL: Did you have --

MEMBER PETERSON: I'd like to follow on a bit on this question of who should develop and implement standards, because we have the success at WIPP. But a big difference is that at WIPP, DOE regulates the materials until they get to WIPP, and then I guess EPA.

So I'm interested in where the interface occurs between who regulates the materials at the facilities that generate, versus who regulates and where does the transfer of responsibility occur when you get to the disposal facility?

In the case of civil materials, of course, you've got NRC. It would seem to me that it's logical for NRC to regulate everything up to at least the surface facilities, because that's a very standard thing that they'd be competent at.

So I guess the question is, is the -- when you get to the interface of what happens underground, is that a place where you

might transfer to EPA? And then is it, do you let NRC regulate the operational aspects of emplacement, but EPA is the long-term performance or does EPA do everything?

Where is this interface or do you -- I'm hearing that you don't want to have two different agencies trying to co-regulate, you know, in terms of the way we've done it on Yucca Mountain. So should there just be a clean break at some point in this system?

CHAIR HAGEL: Go ahead.

MR. GREEVES: Well first, I think I'll just punctuate. We need to get the standards right before we lose this group. You're going to lose us, and somehow I think the country needs to get the standards right.

The question of two agencies, in the commercial world, EPA sets the standard. NRC implements. So for Yucca Mountain, it was the NRC would be regulating the processing materials, as they do on the reactors and everything else, and the implementation.

My understanding, which is not perfect of what happens at WIPP is the Department of Energy self-regulates those materials, and the materials that are at the various sites, they come to WIPP under an NRC-certified cask system. All NRC does is certify that cask.

Then what happens at WIPP, and George correct me if I'm wrong, is the EPA goes through a certification process, and they periodically recertify every five years, and Rip and others do the calculations. But effectively it's controlled by the Department of Energy and their contractors in large part. So George, did I have that right?

MR. DIALS: Yes. You have it right. It's a little more complex. DOE self-regulates the storage of the transuranic waste where it is now and mandates the kind of configuration and the kind of containers it goes in, the kind of drums you put it in or DOE self-regulated determined activities.

But DOE has also volunteered to fall under the EPA requirements for hazardous waste. So then we follow the mandates of the requirements for dealing with the hazardous waste components of the mixed waste, and then the waste are characterized, both just the transuranic waste and then the mixed waste, in a way that is consistent with the requirements of the EPA as the regulator and as defined in the compliance requirements.

Then they document the characterization. They do put it into containers and put it into NRC certified shipping containers and configurations. It goes on the highway that is regulated by the Department of Transportation in compliance with NRC standards.

It gets to the site. It is evaluated at the site and says this complies with the EPA requirements for disposal, and then it's disposed and the site, the facility has to comply and document compliance with the

EPA's standards, and it's recertified every five years. So that's how it works.

So there is more than one regulatory agency involved in the process, but there are agreements in place for both EPA and for the Department of Transportation requirements to be met by under DOE programs.

CHAIR LASH: Per has one more and then I'm going to ask a couple and then we'll wrap this up.

MEMBER PETERSON: Okay. Another important issue for regulating repositories or disposal facilities is whether or not you establish capacity limits, in particular say statutory limits.

Capacity limits play an important role, I guess, from the perspective of providing some assurance that there's not an open-ended obligation to take an infinite amount of waste into a facility, which I think is maybe politically and socially difficult to swallow.

On the other hand, prescriptive statutory-imposed capacity limits also have bad issues associated with them too. So this goes to the question of perhaps maybe the same way to achieve this basic goal of making sure that there's not an open-ended obligation to take an infinite amount of waste might be to go with the certification, recertification process that requires that you recertify that the facility remains safe and is acceptable for continuing to accept and dispose of materials, and try to avoid prescriptive capacity limits.

Does that make sense, and basically how should we deal with this question of capacity limits that are non-technical limits on a site?

MR. BARRETT: I can start with that one. My view of that are two different things. One is safety and one is social-political, okay, an equity matter, okay. I would say there ought to be a standard, and in

my view it ought to be .3 millisievert standard.

Dealing with EPA versus NRC, I would have just NRC do it and EPA can give them advice, and that will take care of the split, you know, in the shaft, who gets the difference. Regarding the capacity limit, I want to say it's the safety standard or the safety standard doesn't matter how much you put in there, okay.

Now in the agreement that the implementer would have with the host, it would say I have a contract with you, okay, and the contract says I'm going to accept this much waste and it's phased.

I want to start off with a little bit of waste. You prove to me you're a good partner with me in my community and we're all doing the right things, I will increase that as time goes, and this is a --

Just like you work for a Mercedes, doing a new auto plant in Mississippi or

something. You negotiate that between the entities, between the hosts, and let that grow as it needs to grow, as they would wish it to grow. It's not forced on anybody, okay, is you can make that kind of agreement.

Because it really is a social equity matter, is what is the host willing to do and what demonstration does it want, and what is the implementer really willing to do, and that's how I think you can deal with it, through a market-driven approach, with a basic, with a fundamental safety floor to it.

MR. GREEVES: Let me just add, to follow on what Lake said. This really is a social and a technical process, and as I stressed in my remarks, having a demonstration is a tool to help bring the public along.

I have a lot more confidence in the public, you know, that they can actually grasp. But just don't, you know, do it too quickly. You go with a demonstration facility and let them be involved in the capacity

question over time.

This notion of doing evaluations, it's standard practice internationally to repeat performance assessments at least within a five-year time frame. So they're updated. Smart people like Rip Anderson here, they will be doing those things, and that will help inform any capacity limits.

Don't write in a regulation or legislation what the capacity limits are. Allow that to evolve with a demonstration facility.

CHAIR LASH: So I have a question that's an immediate follow-up on that one. As we've heard different testimony, but in the full Commission and this subcommittee, it has certainly come across that there's universal respect for NRC's expertise, best in the world, and capacity to do these kinds of analyses.

At the same time I'm hearing from this panel and I've heard from others that in

terms of NRC's process and culture, it might have difficulty implementing a staged adaptive approach. I'd be very interested in your response, and assuming there is a new entity, and that NRC is regulating, how will you do that?

MR. GREEVES: I speak for myself. I worked there for 30 years, I retired. I can make observations but I certainly don't speak for the agency. I don't think it would be a problem for NRC, because the adaptive staged approach is holistic, and it requires an independent regulator, and that's all the NRC or the EPA would be.

The mistake is to have two of them. You need one of them, and the resource issue is a valid issue, and having spent a lot of time there, and I don't mean to be self-serving, but the NRC has set up a world class ability to do the kinds of calculations that Rip was talking about. They can do them themselves. They can review them.

A concern I have is they may lose that capacity with this lull in the process. Fortunately, the very same people that do the calculations on Yucca Mountain are actually working on many of other difficult questions like this, the one that Linda raised out at the WIPP facility, the very same model.

They're looking at the incidental waste issue, which by the way is one of your definitional problems. So the capacity is there. You're in danger of losing it.

The independent Southwest Research Institute that the NRC has as a captured lab, I have concerns about how can that survive and that had to be set up, and Lake remembers this, because NRC would get expertise and that expertise would go to the bigger paycheck. They would leave the NRC family and go work for the DOE. So that lab was set up to help NRC.

CHAIR LASH: Any disagreement with that?

MR. BARRETT: Yes. I agree with all he said, and I would go and add a little bit. I believe the NRC can do it in a phased approach. It is unique though for a regulator in the federal world to do this, and you'd have to help clear some underbrush to empower them to do that.

I believe they can do it and it's the right way to go. But for example NEPA rules, okay, where you segment. They could -- somebody's going to oppose whatever's being done, and that's just a given, and they'll use NEPA law to do it. There's always a way to do it. You didn't dot the I and cross the T.

So you'd have to basically free them from segmentation issues, because the phased, evolving approach is exactly the opposite of what NEPA law case generally is. So you'd need to empower the NRC to do this, and I believe that's the right way to go, and I believe you are the body that can do that.

Because whatever we go forward,

it's going to take legislation to empower this. So just put that on your "to do" list. It needs to be done to empower the NRC.

CHAIR LASH: So just one more follow-up on this, because it's a very important, very immediate question for us. Can the NRC change its processes so they are more open and easier for people to participate in for this purpose?

MR. GREEVES: I'm not sure what prompts the tone of your question. NRC's process is very open. They participate, even more so in the last decade.

CHAIR LASH: Let me change the tone of my question and try to be clearer. The EPA tends to have in its rulemaking processes, a process in which it is very easy for people with limited resources to participate.

It's my perception that the NRC's processes, because they are formal administrative proceedings, require people

with a higher level of resourcing to participate effectively. Do you think I'm mistaken?

MR. GREEVES: No. You know, to participate in a reactor hearing process requires resources, but even those proceedings, the public gets an opportunity. It's a question of how effective they can be. So I'm struggling with how to help you with that. I'd like to think about it a bit more and perhaps provide some follow-up. That is a difficult point.

But the proceedings themselves are quite open. The NRC takes questions. They are an independent regulator, which is not always the case in some of these activities. So I'd have to thank about how to help that process. I'm just not an expert on figuring out ways to enable the public to participate.

I'm actually consulting for a group in Canada, the aboriginal community, and there's -- it's like the committee here.

You've got to figure out a way to bring everybody up to at least a minimum level of understanding of what's going on, because that way they will be able to have some input into the process.

CHAIR LASH: We'd welcome that from any of you, and one piece of the solution that we saw in Scandinavia is the willingness to fund participation. I know DOE has done some experiments with that, but they do it quite extensively.

So if a community sees someone who has systematic questions, they will say we welcome you to participate, and we'd provide some funding for you to get expertise.

MR. GREEVES: Let me just punctuate that. The topic that Linda Lehman brought up about these scoping meetings, which I did participate both in South Carolina and out at Hanford, my observation is they are quite effective in communicating, because the public in that environment gets to see the

Department of Energy in a room, answering questions from the Nuclear Regulatory Commission, the Environmental Protection Agency and the State Department of Encology.

It's a very healthy process. It's like pre-licensing consultation, and it happens before the technical document is delivered, and having those in the open public arena I think was very effective, as Linda raised.

MR. DIALS: And I might add that I think there's some lessons learned from the peer review process that went on with the WIPP project. We did informal reviews, where the public were invited, EPA participated as the regulator, in terms of hearing the public.

The public were invited, the public participated. There were in fact funded opposition groups like Concerned Citizens for Nuclear Safety, the Environmental Policy Institute and others who participated and were welcome to participate. It was a

very open process.

Then when we went to the formal peer review process, which took a bit more resources, they had been informed about the issues ahead of time. I think we did eight peer reviews; seven of them were done nationally, and then we had one international peer review that I mentioned earlier.

But in each case, the public were enabled to participate. Their speakers were provided access and opportunity, and it was really meaningful in terms of tabling issues and having a full discussion about it.

Those who, in the dedicated opposition groups didn't always come to terms and say okay, we accept, we agree with you now. But they did come to terms saying we were heard, and we were able to participate.

That went a long way to giving credibility to the transparent process we were trying to do, and having the regulator there in an interactive way was really an important

part of that early on.

MR. BARRETT: If I could add, I believe the NRC could do it, and I believe the new implementing organization could do it very well, as utilities do, working with their communities around their reactors.

In the case of Yucca Mountain, over half a billion dollars was given to the state and the counties to do oversight. It really didn't communicate as well as we all would have liked it on both sides. Yes, some good science that Linda talked about was done very nicely by the state and counties.

But there's a -- you need to go more than that, and the evolution when I was at DOE to 2002, we made their public meetings much more effective.

For example, NEPA scoping meetings are very formal, legalistic meetings, where I would sit in the front and get hollered at in front of the TV cameras. So when the TV cameras were gone, everybody was gone, and

communication was terrible, okay. It was negative communication, in my view.

At the end, we evolved these things to have breakout rooms, where an honest citizen -- somebody could go who cared and sit and talk with the scientists and talk with the regulators as well, and actually have communications.

Things really improved, because if I was a third party citizen coming in, what this all about and sat in the back of the room, I'd say what a disaster this was. We're missing those people, who are critical. Many of those were workers in the union, all of them.

So I think the, everyone has learned a lot of this, and I think you can establish good communications along the lines of both what John and George both said, in a room, and if we can find ways to do the legal requirements that we have to do, but also be able to communicate with people and listen and

respond back, not just listen, but to actually do things. We can have a much better, a much better path going forward.

CHAIR LASH: I'd like to thank all of you. I actually have three or four more questions, but I'm not going to ask them. I may catch you during the break. This was extremely helpful. These are of course exactly the issues that we need to address in this committee.

I think that there is a consensus that we have a problem that we have to address. We've been through our period of making mistakes now, and we need to find a way that will work for all of the parties concerned and for the national interest and you've contributed to that. So thank you very much.

We will come back at 11:15. Thanks very much.

(Whereupon, the above entitled matter went off the record at 11:00 a.m. and

resumed at 11:17 a.m.)

MR. FRAZIER: Okay. We're going to go ahead and get started. Senator?

CHAIR HAGEL: Tim, thank you and we this afternoon or almost this afternoon welcome our next panelist. He is Gary Gates, who is President and CEO of the Omaha Public Power District.

I have worked with Mr. Gates over many years as -- well, as all who are associated with the Omaha Public Power District since I once upon a time had a job that connected me rather directly to Omaha, and Nebraska.

Gary Gates began his career at OPPD in 1972, became its president and CEO in 2004. Mr. Gates is a member of the boards of several industry organizations, including the World Association of Nuclear Operators, Institute of Nuclear Power Operations, and American Nuclear Society. He's also chairman of the Nuclear Energy Institute.

Gary, we are grateful for your input, your thoughts. What we'd like to do is hear from you on what you think are the important points that would enhance and contribute to our mission, which you know about and clearly understand.

Then we'll open it up and have an opportunity to discuss some of the things that you said and some questions that we have and further detail. So welcome.

Implementation of Nuclear Waste Policy

MR. GATES: Thank you very much, Chairman Hagel and Chairman Lash, and distinguished members of the Disposal Subcommittee and the Blue Ribbon Commission. I really appreciate this opportunity to visit as a practitioner.

I heard part of the previous presentations, and I'm here as a utility representative. I guess we're producing the spent fuel that you're all talking about on a daily basis.

I appreciate the introduction as well, Senator Hagel, and really have an opportunity to serve on a lot of boards that influence a lot of the decisions going on in the nuclear power industry.

First, just a quick description of my utility. It has some unique pieces to it. It is a publicly-owned utility in Omaha, and by that, I mean we have an elected board of directors. We are owned by our customers, so direct link to the customers. They are the shareholders of the utility.

We serve a population of about 765,000 people in the eastern part of Nebraska, and we own and operate a single nuclear unit, Fort Calhoun Station, which began commercial operation in 1973.

The decision for our utility to go nuclear was made in 1966, and it was based on studies showing that it was a great way to produce electricity, and helped our mix of generation, which we have every kind of

generation that you can have, including hydro, wind, coal and gas and a nuclear plant, and the nuclear plant produces about 35 percent of our energy on a daily basis.

In 2003, we got our first extension of life at Fort Calhoun 20 years to 2033. The 40-year life time from 1973 would have expired in 2013. The NRC granted that extension. They assumed that we would operate the plant safely, and that includes all aspects of the plant, including our management of the spent fuel.

But we're in it for the long haul. As a matter of fact, Fort Calhoun is going to be a pilot plant for 80 years of operation with EPRI. So we're going to go 20 more, and I would hope that plant would run until 2053. I assume someone else will worry about that operation than myself at that point.

We have, we talk about assemblies at the power plant, as I'm sure you know, on our spent fuel. We do understand the metric

tons uranium piece. But today, we have 323 assemblies in dry cast storage at our facility. We have 553 assemblies in our spent fuel pool.

We expect the policies and programs to manage commercial use fuel that were established in the Nuclear Waste Policy Act of 1982 to be implemented. That's what we've been operating under that assumption.

As the president of the company, and also my role as chairman of the board of the Nuclear Energy Institute, I concur that the principles, that the nation must have a durable policy to manage used nuclear fuel is critical to what we're doing going forward, and we must have a plan for ultimate disposal.

Now our utility, you've got John Rowe on the Disposal Committee, I would say representing the largest nuclear utility, and Sue Wallace is here that can support that. You've probably got in front of you one of the smallest.

But I can assure we're aligned on those issues from a utility point of view, and to give you some perspective, for our utility, which is again a smaller utility, to date we've spent $110 million into the waste fund. We put about a million dollars a quarter into that fund or $4 million a year.

That is an impact on our customers. That's about a two and a half percent rating for us to support that. We don't complain about putting the money into the waste fund, assuming it will have a good use at the end of the day, and will provide a product for us, but to give you some perspective from the utilities' point of view of what that money is and where it goes.

As you discuss solutions, and I heard some talk this morning, an ideal technical solution is not required to begin implementation of the policy, in my opinion. The direction can be evolutionary as opposed to revolutionary, and advances in technology

can be incorporated over time.

This problem is not an urgent issue. In other words, we have time to develop a proper plan and to go forward. Non-proliferation goals must be met, as well as storage safety. Successes and failures of the past, as I heard this morning, need to be listened to and heeded, and I believe you are.

Generally, as I heard discussed also, the hallmark of projects that have good acceptance and support at a local level are the most successful, especially if that also continues to the state level with the governor, federal level and beyond.

I can cite a local example of how extremely important support and acceptance is. Now this example deals with low level waste, but has all the same attributes. The central interstate low level radioactive waste compact in U.S. ecology purchased plan about two miles west of Butte, Nebraska in Boyd County, and the time frame was the early 90's, with the

intention of placing a facility there.

There was extensive controversy over this decision, and the waste site was eventually removed from consideration. Citizens and factions throughout Boyd County where Butte is located fought for over 15 years about the placement of that disposal site.

As a matter of fact, a governor that was heavily involved probably cost the reelection for that individual going forward. Nebraska was officially removed from the compact after a series of long court battles that ended in 2004, 1990's until 2004, and the state had to pay a very high settlement to other states because of that contract.

So that local acceptance on the failure side really made it clear in Nebraska, on a local level, that that's important. In the area of support and acceptance, the Blue Ribbon Commission is encouraged to keep that recommendation simple and outcome-based as

much as possible.

I think other examples, and I'm sure you've heard about them, but a good example, I believe, are the new nuclear plants at Vogtle 3 and 4 in Georgia, and Calvert Cliffs 3 in Maryland, are great examples of how that local Congressional support can work.

As a matter of fact, I think Calvert Cliffs 3 is really an interesting example. Once Constellation backed out due to inability to negotiate and accept a loan guaranty and subsidy fee with DOE, the governor, Congress and the community leaders went to work to figure out a way to make it work.

I think that's the typical process that you might see if it's accepted. Other examples of successful acceptance are the URANCO USA uranium enrichment facility at Eunice, New Mexico; the Areva enrichment plant in Idaho. Although not yet built, it has a lot of local support.

I heard you talk about WIPP this morning and the local support that was gained there. As a matter of fact, as I understand it, that has been so successful that the community has sought other nuclear facilities as well.

You talked a little bit about some foreign experience, both in Sweden and Finland, that have local support. There are differences in our country that I think you should learn from, and particularly the way the government is organized with the states.

We have state government that has a lot of power. They have a township, so it's much more local. Those are factors that need to be factored in as you put together your process, in my opinion. Also, their uniform geology is a physical attribute that is very important there.

There are many examples of unsuccessful acceptance. I think Yucca Mountain is one that you know well and

everyone has talked about, where there was some local acceptance and state non-acceptance of that, and delayed the project or eliminated it.

The private fuel storage facility in Utah has a similar history, where it was accepted at many levels and then not accepted. So that difference going forward is very important. I would also say on the technical side of keeping it very simple, that that is an effort that should continue.

For example, rather than perhaps specifying exact geology, specify outcomes, and what the desire would be for the storage life, as opposed to specifying directly how you get there, and let the individuals get to that point.

We do need an integrated used fuel management strategy that consists of the three major elements that you have been briefed on before. Long-term managed storage of used reactor fuel, preferably at centralized sites

and volunteer locations; development of a permanent disposal capacity; and development of advanced fuel cycle technologies.

For the short-term, however, managed storage at nuclear power plants is a workable plan; centralized interim storage should be considered as another short-term solution for used fuel management. Used fuel, as has been stated, can be safely stored at a central storage facility for at least 60 years.

Going back to my previous example of our plant, Fort Calhoun runs until 2053, and you add 60 years to that. It's going to put us into the 2100's of storage. I do believe there are workable solutions. I pointed out evidence of those solutions for site selection, and that could avoid some of the issues of the past.

I'd like to share, and perhaps not directly on your agenda, but some thoughts around international perspectives and the role

of the United States. Specifically, should we accept spent fuel from reactors in other countries, and how would that factor into your decisions.

Will or should the United States be a player in the global fuel cycle. My experience on the governing board of the World Association of Nuclear Operators has provided an opportunity to see impressive growth in nuclear power around the world.

There are approximately 62 new plants under construction, 24 in China alone. Over 30 countries that have never had a nuclear power plant have expressed interest in constructing one or are constructing ones, such as the United Arab Emirates.

Should the U.S. have a role in how waste is handled in these countries? To provide a complete picture, should the U.S. consider shipping spent fuel to another country?

Another important consideration is

around small, modular reactors. They are gaining popularity, they're gaining interest, particularly for a utility of our size.

When you can add increments of 145 megawatts to 200 megawatts, all the components are made in the United States. They can be shipped by rail. The design is underground and eliminates many of the accident analysis that are required, and can be located in remote locations.

They will provide a resource that will not be overlooked, in my opinion, but they will provide many more sites than the 104 we have. Currently, the large plants are co-located typically with existing power plants. Small modulars will be located all around the country, and will have the potential of having many, many more sites for spent fuel than what we're dealing with today.

And lastly, I know you've talked about this, I believe, in previous meetings, but India is projecting using the thorium fuel

cycle when the uranium process runs short for them. They have a 250 year energy plan. When I was there in January and saw that slide presented, I questioned several times the scale on the bottom. I thought it was months.

But it was years in their direction, and they have the cycle going from uranium to thorium and then recycling. So as we look at those different fuel cycles in this country, and what that will mean to the waste stream, how will that factor in?

Because I'd encourage you as a commission, as a utility representing the customers, the people, we're looking for a 50, 100, 150 year type of solution. I think that's what it's going to be out of this commission.

In summary, nuclear power is poised for growth to meet America's energy needs, and environmental goals. But we need a plan and a path to manage used fuel. The greatest service the Commission can render to

the nation is to develop that used fuel management policy in a timely manner.

We do have time to do it right, but we need a direction. We are counting on you from the utility point of view to provide that direction, and our commitment to you is to manage our current spent fuel safely until we have that direction, and I really appreciate the opportunity to speak here today and I'd be available for any questions. Thank you.

CHAIR LASH: I appreciate that very much. I'm tempted to go off and follow up on your comments about inherently safe modular reactors, but it's not really within our mandate, so I will resist that temptation. I hope Per will also.

(Laughter.)

MR. GATES: I threw the bait out there, but I was going to --

CHAIR LASH: I could tell, and I could hear him chomping. A question about

process and institutions.

One of the key questions we face and certainly raised by the panel before you was the question of whether to create a new entity, or to recommend to Congress to create a new entity to carry out this process that would be single purpose, have a mission focus on safely disposing of waste, and could presumably have the authority to spend the money that you put into the fund without going through the annual appropriation process.

I welcome your reaction to what kind of institutional arrangements should be set up and how expenditures out of the fund should be reviewed. I think we share a sense that it hasn't worked well so far.

MR. GATES: Thank you for that question. I do believe there should be a separate entity set up that is independent from any cycles, either election or others. The expenditures of that money would be driven by, in my opinion, in three components.

I think there should be a component for R&D. I think there should be a component for the practical piece of installing or building facilities if they need that, and I think a third component should be an education and education of the public.

So those three areas of expenditure, to answer your question. That type of system works in many cases, and I'll give you an example on a state level.

In the emergency preparedness area, that is a staff that we worked with consistently, no matter what administration or governor may be there, and that staff has provided then continuity.

If we ever have to implement it, and it doesn't have to be on the nuclear side. We have some things called tornadoes in the Midwest that can deal us fits, and when we have to implement it, we're going to back to the same people that we've practiced with, that we understand and that we know how to

respond with.

That's the biggest advantage, I think, of having this separate entity as a utility. It would be the consistency of who we're working with.

CHAIR LASH: And just a brief follow-up. Should the board of the entity have sole control over the expenditure of the funds, or should Congress have some review and who should be on the board?

MR. GATES: The board should have control of the expenditures. On the board, as it's been proposed earlier, I agree with. I think it was a nine-member board, without about half of those being from the utility side, half from other resources. I would say it's a good check and balance, because it's the fundamental basis of our country.

But those expenditures should be reviewed at the Congressional level on some time frame. I don't know if it's three or four years, but there should be a check and

balance there in any system. Just in my life, I think that's been important, that there's some check and balance.

But on an individual basis, yearly basis, it should be at the discretion of that board.

MEMBER AYERS: I'm going to show how little I know, but I'm going to tie this incorrectly about small, modular reactors. What are the waste characteristics of the small modular reactors?

MR. GATES: Waste characteristics, as far as, you know Mark, not to get into the isotopic detail, but it's very similar. If they're a white water model to what we have today, there wouldn't be any difference in the actual waste.

The size of it would be different, the amount of it generated, and my point, and not trying to draw you in a conversation on small modulars necessary, was just to say if they would become a viable entity, there's

going to be more of them around and they'll be smaller, and your locations will multiply that you'll have spent fuel at.

MEMBER AYERS: Well, the only reason I bring that up, I just left a Disposal subcommittee meeting in Chicago two days ago, and I think that will come into play as we address the need for interim storage, regional interim storage, if the small modular reactors take off, because there is going to be a waste component there.

MR. GATES: That's right. You're exactly right.

MEMBER AYERS: Or transportation and storage, I'm sorry.

CHAIR LASH: Per.

MEMBER PETERSON: There's a tough policy question that we're likely to have to grapple with, which is the taxpayer liability under existing contracts, DOE contracts to accept spent fuel.

I guess the policy dilemma is that

as soon as we do get and we need to get centralized storage established, as well as disposal capability, if we were to do what would be in the best interest of the taxpayers, which would be to comply with, as rapidly as possible, these contracts we would start taking spent fuel not from say decommissioned reactor sites but from places where actually technically and economically, it really wouldn't be logical to take it first, in order to minimize liability on the contracts.

Conversely, if we were to use that centralized storage capacity in the most logical way technically, we would focus on first of all cleaning out decommissioned sites, but then the taxpayer liability could be higher.

So how do we, once we have capacity to take spent fuel into centralized storage address, in some equitable way, what's logical from the perspective of the economics

and technical priority to focus on decommissioned reactors, yet not leave the taxpayers with the liability that really, in the end, we should try to -- I think at least personally, we should internalize the costs of managing waste into the cost of the power that's generated.

MR. GATES: I think that's a great question. We have had some conversations about that internally as utilities, in today's framework, not in a future framework.

I think there's always a solution to come to the table with, and that has been historically they precedent. I think through NEI and through other current EEI and other organizations that exist, those are the tables to go to and work out a solution.

Utilities are very pragmatic individuals. We have our shareholders in some cases, and we all have them. I've got them.

They happen to be directly customers, which can be a good shareholder

base, that we would have to negotiate that. But we understand practicality in many situations, and I think that would have to be hammered out once we saw what the update capacity is.

It's going to be the flowthrough that's going to be the first thing. You know, how many assemblies or metric tons can you start taking? I mean if you have many, not many, but more than one centralized location that from a good old industrial Engineering point of view you know you've got more lines; you can get more through to it.

So I think that would help. But I think as you look at this or when I look at this, it's how much can you take per year, and that can be balanced pretty well, I think, to really solve that problem. I think you could almost formulize it.

CHAIR HAGEL: Thank you, Gary. You had noted that you heard some of the discussion this morning from the previous

panel, and a considerable amount of that discussion revolves around regulatory agencies.

I would like to hear your reflection on regulatory agencies, not just as an operator but open it up to the larger universe of what we're grappling with here or what you heard this morning. Obviously, EPA, NRC specifically. But then the DOE standards and DOE's obviously not a regulatory agency.

But nonetheless, the governmental dynamics and oversight capacities and responsibilities that play into all of this that need to, and as an operator, you're dealing with all of it and you can keep going. OSHA and then the state regulatory agencies and so on.

Give this subcommittee some reflection on regulatory agencies. Should we streamline them? Should there be one or two or is it a problem, anything that you want to offer in that area.

MR. GATES: From our experience, and as a utility, our preference would be to have one single point of contact. For us, it would be the NRC. We understand the logic and what my view of that would be if a standard is to be set by DOE or another and it's science-based, the certainty is what we look for.

We would love to engage in the conversation and understand that. But the certainty. What is it, and we'll meet it, because it should be based by science or fact that you can meet it. So that standard, once it's set based on science, the implementation and checking and review of that by the NRC is very adequate.

NRC is an extremely professional organization. They're not -- they're tough, as they should be. You need a tough regulator. We know that in this industry. Absent that, you're going to lose a lot of public confidence.

So it is a tough regulator. It's

a fair regulator, and that would be to our preferred, from my point of view, the single point of contact, fed to them the standards that they're inspecting or implementing based on science, and give us certainty, and we'll meet them.

CHAIR HAGEL: Let me go back to a point you made on the international front, which you, in making a point, mentioned that -- I think you said there were over 60 new nuclear power plants under construction or soon to be in the world.

I think you said 24 in China, and if I remember what you said, 24 new countries that had not had or have not had nuclear power before.

Here's the question. Based on those numbers, and what you said today and what you heard today and your knowledge of the industry, is America in a position where it is going to be left behind in nuclear power capability, leadership in the world if we do

not start sorting out some of these big issues?

I mean that seems to be a pretty significant number of new nuclear power plants, especially when you focus on, if I'm correct, 24 new countries. Obviously India has got some of those in that over 60, I know. Then what kind of consequences would that present for American leadership in the field of energy?

MR. GATES: I think the answer to that question is we have the potential of falling behind. I think it's pretty commonly recognized.

With all the development occurring, most of the development, not all. We have some development here, but being in other countries overseas. What I've seen in my five-year tenure on that governing board is that the manufacturing capabilities are not here for the larger reactors.

I've seen a shift in the vendors

to not in this country. I've seen an interest of new plants obviously focusing on other countries. I have seen though a consistent, to this day, view that we're among the best operators of nuclear power plants still to this day, our 104.

I think more than you may realize, there is a real look at the world and what you're doing, because they have reprocessing in countries, as I'm sure you're well aware of. They're looking at different fuel cycles.

They still want to watch what the United States is going to do, but they're not going to keep watching for very much longer. They need to move ahead. They have their programs moving. The countries that have never had a power plant before are really looking at what this Commission is doing and what the NRC is doing as a model to this day. I don't know how long that will last.

I'm not -- this isn't just

commenting to your importance as a committee, but it is -- I mean I hear it. I was just in Hong Kong in a governing board meeting two weeks ago, over in India in January.

The United States, we have a seat at the table. We're not a player to the extent in the new plant construction, which is where the focus is right now.

We're still a major player in the operation, and we're a huge player in how we regulate and how we handle things like waste, and that is still there, but it is diminishing.

CHAIR LASH: I have a very mundane question compared to that large-scale one. One of the things we saw in Sweden was they've made the decision not to go with dry cask storage.

They keep spent fuel in pools and then tend, at centralized storage, to keep them in pools much longer in order to cool the fuel more before they move it into their long-

term waste disposal.

I didn't get a chance to ask them. I'd be very interested what the cost differential is if there's -- we make a choice to keep waste until it's cooler in pools? Is that a much more expensive way of storing waste?

MR. GATES: Yes, it is, and here's the basis on it. It's just a capacity issue. Pools in existing plants are a defined size. At Fort Calhoun, we've re-racked our pool three times. We started out with a capacity of around 200 assemblies, and our core has 133 in it. So we had about room for one and a couple of reloads.

Then we re-racked to about 380 assemblies. Now we're up to 900 that we can store there. But it's taken a tremendous amount of computational ability, changing the fuel racks is obviously a difficult thing to do when you have fuel in there.

So we've got that about capacity-

maxed. We can't do it again. So we're into the dry cask storage piece. So the real expense is if you had to expand spent fuels wet, spent fuel pools, it would be extremely expensive. The economics definitely swing in the favor of dry cask storage at that point.

CHAIR LASH: What about at a long-term storage facility at a separate location, a centralized storage facility?

MR. GATES: A centralized storage facility, in my opinion the dry cask, is still the favorite type of storage, because its handling is easier. When you handle remotely under 40 feet of water, there's just inherent difficulty in doing that. It's doable, but it's, you know, it's something that is not easy to handle as dry cask storage.

CHAIR HAGEL: Gary, thank you. We know you took a day out of your schedule to come out from Omaha, and we appreciate it, and we may have follow up questions which if it's okay, we'll get back to you and staff. But

you have contributed to the effort, and we appreciate it.

MR. GATES: Thank you. Thanks for all you do.

Public Comments

CHAIR HAGEL: Thank you. We are at the point in the schedule for public comments, and we have two individuals who have signed up, and to begin the public comment portion of our agenda, let me ask the first individual who has requested some time, Steve Frishman from the state of Nevada, if he would come forward, and we would each of the individuals if they could limit their comments to five minutes. Steve, welcome. Good to see you again. Thank you.

MR. FRISHMAN: Thank you, Mr. Chairman, co-chairman and members of the Subcommittee. After listening to the panel this morning, I think it was inevitable that I had something to say, and --

(Off mic comment.)

MR. FRISHMAN: I hope so. I want to go into this area that was talked about pretty heavily this morning and not very much substance that was really brought out, and that's this question of how you bridge between societal understanding and the understanding of the technical and the scientific people, and where do you bring society to the point where acceptable decisions can be made, both to them and to the technical community.

It's a difficult one, and we've been playing with it for decades. But it brought to mind one area that I think probably needs some exploration, because expectations on the side of society seem to be quite different from the expectation on the technology end, and there are some interlocking elements, just as there are in everything else we talk about here.

But it starts with this idea of multiple barriers and defense indepth. The expectation of the concept of multiple

barriers, which is actually embedded in the Nuclear Waste Policy Act, is that it provides confidence because what multiple barriers mean is redundancy, and that's the expectation.

In the case of Yucca Mountain, we have had to make a lot of excuses, or I haven't, but a lot of people have, and that's the multiple barriers are not for the sake of redundancy, but for the sake of making the system work.

In the case of Yucca Mountain, it became apparent, as Linda talked about and others have agreed, that once the hydrologic model came into question, then the necessity for the engineered barrier becoming an integral part of containment or isolation was there.

And I think sort of the proof of that is in the arguments over how long a regulatory period should go. Yucca Mountain sort of created some new ground. The EPA's answer for why you shouldn't go beyond about

10,000 years is that uncertainty increases through time.

Well, in the Yucca Mountain case, because of the reliance on the engineered barrier, uncertainty actually decreases through time, because the vast majority of the uncertainty in the early time is the uncertainty about the effectiveness of the engineered barrier.

So people's expectations are that the multiple barrier is for redundancy. In reality at Yucca Mountain, it became an integral part of providing a solution that otherwise would not have been a solution. Now linked to that is John Greeves' sort of disdain for subsystem performance requirements and the cottage industry it produced.

Well, that's another sort of function Yucca Mountain, and it's a function of it in terms of if you look at the question of what does substantially complete containment mean? Well, in the original EIS

for geologic disposal, substantially complete containment was an outgrowth of the idea of multiple barriers, where substantially complete containment for the first thousand years was that you needed that redundancy to make sure, absolutely sure that the fission products were not going to be released to the environment in the first 1,000 years. That was the original idea.

But now we've ended up with a very complicated site, and I think Rip has it right, and that's that the more complicated the site, the less likely it is that performance assessment is going to do much more than give you large uncertainties, or expose the large uncertainties.

So in the case of a reasonably simple site, and the idea of some system performance requirements such as substantially complete containment, such as a very tight requirement for understanding ground water travel time, these are the demonstrators.

These tell you that you -- if you can demonstrate this with very little uncertainty, it tells you you understand that site, and in the case of understanding that site that well, that allows you to maybe get away from this idea of looking out at million years.

If that site's going to work for the first 10,000 and with very high certainty, then that tells you something. It tells you that you understand the site sufficiently well to make a less rigorous projection out to a million years. You should be able to do it anyway, but make a less rigorous one.

So this bridge is expectations on the part of society, that you actually will achieve isolation, as opposed to expectation on the part of technology or the technology side, which is you do essentially the best you can with the site that you have.

So I think that's sort of a concept that you need to look at, but it's

from the technology side, I'm talking the technology language.

We need to sort of get a language that is accurate and that is representative of what the technology and science thinks, but is understandable to the societal side, where if you say "waste isolation" you mean waste isolation. You don't mean it doesn't leak anymore than the regulation says it can.

So I'll leave it there. I could go on much longer on this particular topic. It's interlocked, but I think I'm trying to point out that people's expectations need to be responded to. They don't need to be educated. The expectations need to be responded to in a way that makes technical sense and societal sense at the same time. Thanks.

CHAIR HAGEL: Steve, thank you, as always. I appreciate it. Judy Treichel, who is the Nevada Nuclear Waste Task Force. Judy? Nice to see you again. Welcome.

MS. TREICHEL: Thank you. I know that you may feel that you're hearing way too much from Nevada, but after we did this for 30 years, and we sit and we listen to what people have to say about it, it makes you think about a lot of things.

This opened up with George Dials and Lake Barrett talking about WIPP being a success and Yucca Mountain was a failure. Since your trip to Sweden and Finland, what would have happened if the government of Sweden had decided that one of those communities that they had talked to, who said no, we don't want any part of this, what would have happened if they'd have decided that was the place they wanted to go? I think you would have seen the same sort of failure.

The idea about public understanding is almost offensive, because we think we really did understand what was going on, and as time went on, we became pretty much able to understand everything, whether it was

technical or whatever was being thrown at us. We just had to.

You couldn't fight a war like this if you didn't understand anything that the other side was doing, and we did. George or Lake were right when they said that it was regional in and it's a problem, and it was, because Nevada and Utah had attended the school of hard knocks for a very long time with the Nevada test site.

We had been through lawsuits with victims of atmospheric nuclear testing, and after those long, drawn-out lawsuits, they lost. Even though the victims had presented really compelling cases, and the judge was on their side, and he told them at the very end I can't decide in your favor because the government here has sovereign immunity. It has discretionary function.

They can make decisions that hurt people, and there's really nothing you can do about that. So we were familiar with that.

We had already seen that, and we had made the decision not to jump into another case where that could have happened again.

As I say, it's offensive when it appears that people who agree with what DOE wants to do somehow understand. They're just a little brighter than those that keep opposing, and then there's also that third group, and that's what you see a lot of in the Nye County area, the Lincoln County area, which are people who think it's inevitable.

They think their opinion really doesn't matter, so they can be a supporter or an opposer, but it's going to happen anyway. So where's the lemons that we can make into lemonade, and those become people who then somehow understand.

I can't give you any advice. As long as I'm here and as long as I think about it and I talk about it, I can't give you advice for how to turn an opposing community into one that somehow becomes in favor of the

project, because it's not my experience, and I don't think it will happen.

But when you start looking at and going through the list of problems that DOE says that they have, or particularly the slide you used that John Greeves had presented, where it showed things that could be fixed, I think you should be very aware that some of those are not things that would have been a problem if you'da had a willing host, or a voluntary+ site.

So when you look at fixes that need to be made or things that have to be tweaked, I don't think you should look at that with the idea of fixing something so that you can win, or that so you can defeat someone who's in opposition to a project, because it's just not going to work that way.

If you start out with an opponent and the opponent stays. They talked about changing management at DOE and changing rules and changing stuff, we didn't change. Bob

Loux's office stayed the same for well over 20 years, and those of us that were there, Steve, me, others, we were always the same people, and we got better at it.

And yes, there were problems that they had and we used every one of them in order to do this. So we don't feel that we were a failure. We think we had a success, and I think you should, you know, factor that in too and not try and overcome opposition, but rather make a system that will work with a willing community, and then you'll have a success. Thanks.

CHAIR HAGEL: Judy, thank you, as always. We have a third individual who requested some time, Alex Pavlak with the -- where is he? Okay, good. Alex, welcome. Thank you.

MR. PAVLAK: Good morning. My name is Alex Pavlak. I'm an independent consultant. I'm an engineer. All my degrees, all my experience has been in engineering. My

area of expertise is system architecture. I understand how to create systems, and when I look at the BRC, it leads me to some puzzlement.

I see the Commission as functioning as if it were a fact-finding commission. But that's not the charter. The charter is to recommend policies and that confuses me. Also in the world of architecture, we would view that charter as a conflict of interest or has the nature of a conflict of interest, because you're mixing value judgments with objective technology judgments, and there's a risk that the Commission imposes its own values on the judgments that are subsequently made.

A classic example of this is cost and performance, where do you draw the line. Do you recommend a system that is the lowest cost competent system for managing the fuel cycle, or do you spend a higher price on a higher performance system that minimizes the

environmental footprint?

There's a whole list of these value judgments that I've been making a list of as we're -- I'm listening to folks speak today, and I think this conflict between objective judgments, technology and societal judgments, values, is the -- is a real core issue behind a lot of what I've heard going on here today.

Now the way architects manage the problem is that you separate the two. You separate values from technology, and you set up a clean and invisible interface between them, and this becomes an iterative process.

So what this leads me to is a degree of puzzlement. I do not understand what the Commission is eventually intending to deliver, and how you expect to pull all of this together. I think this is an extremely important topic. I agree with the comment that the world is looking at the Commission for guidance, and I would feel a lot better

about this if it were more clear to me how the processes are going to work. That's the extent of my comments. Any questions?

CHAIR HAGEL: Thank you. I would only respond by saying that we appreciate your thoughts. But we do intend to go forward, this Subcommittee, and deliver to the full board a set of recommendations, as you had noted is our charter.

But those recommendations, I hope, I think it is the will of all the members of this subcommittee, will be based on facts. That's why we have put a lot of time into hearings, meetings, both in the United States and outside. We'll continue to do that.

As to your concern about or, I guess the way you expressed it, puzzlement about what we are doing or how we're going to do this, I would go back to a statement I made at the opening of the hearing this morning, when I said that this would be the last subcommittee meeting for the year, unless

something comes up.

But I also said that the Subcommittee will now take time to process the received information and facts, and we'll have additional hearings and so on and so on.

So I think I understand what you're saying, but if I can give you any reassurance, that we think we're on track with fulfilling the objectives and the mandates which we were given. So I appreciate your thoughts, and thank you very much.

MR. PAVLAK: Thank you.

CHAIR HAGEL: Meeting adjourned.

(Whereupon, at 12:05 p.m., the meeting was adjourned.)

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