UNITED STATES

NUCLEAR WASTE TECHNICAL REVIEW BOARD

FALL MEETING

Tuesday

October 26, 2010

Washington Dulles Airport Marriott
Salons A/B/C
45020 Aviation Drive
Dulles, VA 20166

NWTRB BOARD MEMBERS PRESENT

Dr. B. John Garrick, Chairman
Dr. Mark D. Abkowitz
Dr. William Howard Arnold
Dr. Thure E. Cerling, Panel 1 Moderator
Dr. David J. Duquette, Panel 3 Moderator
Dr. George M. Hornberger, Panel 2 Moderator
Dr. Ronald M. Latanision
Dr. Andrew C. Kadak
Dr. Ali Mosleh
Dr. William M. Murphy
Dr. Henry Petroski

INTERNATIONAL PANEL

Enrique Biurrun - DBE, Germany
John Mathieson - Nuclear Decommission Committee - UK
Gerald Ouzounian - Andra - France
Olof Soderberg - Consultant - Sweden

NWTRB STAFF

Nigel Mote, Executive Director
Karyn D. Severson, Director External Affairs
Joyce M. Dory, Director of Administration
Linda Coultry, Meeting Planner

NWTRB SENIOR TECHNICAL STAFF

Bruce E. Kirstein
Gene W. Rowe
Carl Di Bella
Douglas Rigby
Daniel S. Metlay
David M. Diodato – via internet

I N D E X

program, influence the technical design, planned operations and logistics of the Yucca Mountain Program?

I N D E X
(Continued)

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Each Panelist will be invited to make a presentation of approximately 10 minutes based on the following questions:

1. How has oversight performed by affected units of government in Nevada influenced technical decisions related to nuclear waste management and disposal? Please give examples.

2. What factors increased the effectiveness of the technical oversight? Conversely, what factors might have reduced the effectiveness of the oversight?

3. How does the performance of technical oversight affect the confidence of units of local government and the public in the validity of the technical process?

I N D E X
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Each Panelist will be invited to make a presentation of approximately 15 minutes based on the following questions:

1. As you were observing the Yucca Mountain Program, what technical approaches seemed to be the most persuasive in terms of making a safety case? Which were the least persuasive? Which appeared to have a low probability of achieving their objective? Which seemed to be at odds with the prevailing international consensus?

2. If a new waste management and disposal effort were to be launched in the United States, what would be the three most important lessons your country has learned that should be taken into account?

3. Which aspects of the Yucca Mountain Program and the repository program in your country indicate technical features or developments that should be avoided in developing a repository program in the U.S.?

I N D E X
(Continued)

P R O C E E D I N G S

8:00 a.m.

GARRICK: Good morning. I want to welcome everybody to this meeting of the United States Nuclear Waste Technical Review Board.

As most of you know, the Board has been in existence now for more than 20 years. I've been its Chairman for six of those. I'm told that today's meeting is our 130th public meeting, but it is the first time we've met at Dulles. Many of us have been to Dulles many, many times, including myself, I've probably been through that airport 300 or 400 times since it opened, starting with the second day it opened. And, all of those times, I was headed for someplace other than Dulles. So, in that respect, this is the first time for Dulles as my destination. I hope it does turn out to be a good location for us. I think that it's convenient to the travelers. It may not be so convenient to the locals, but we're hopeful.

We have a very busy and interesting agenda today, and it's going to require some good management from our moderators and others to keep on schedule. As you see from the agenda that you picked up at the back of the room, the meeting is arranged in three panels, with each panel having a

Board member as its moderator. And, as is our practice, and it's always been our practice, the panel discussions will be followed by a period for public comments.

Since it's been a while since we have met in the Washington, D.C. area, and there have been so many changes in the landscape of the nuclear waste business, I think it appropriate to provide some background on the Board and its role, after which I will go through the usual practice of introducing ourselves.

The Nuclear Waste Technical Review Board has eleven members. We are appointed for four-year terms by the President from a list of nominees submitted by the National Academy of Sciences. I don't believe any Board member has served more than two terms. The Academy makes its nominations completely and solely based on the eminence and expertise of the candidates in the relevant scientific and engineering disciplines. This is somewhat unique among agencies dealing with radioactive waste management in that it is really the only entity that performs an independent, integrated, and ongoing technical evaluation of all elements of the U.S. high-level waste management program, including waste acceptance, transportation, packaging and handling, facility design and operation, and waste storage and disposal, a somewhat awesome scope.

Congress created the Board as an independent

federal agency in the 1987 Nuclear Waste Policy Amendment Act. The Act spells out the Board's duties very clearly. The Board is charged with evaluating the technical validity of all activities undertaken by the Secretary of Energy related to the Department of Energy's obligations to manage and dispose of spent nuclear fuel and high-level radioactive waste. Based on these evaluations, it's our job to advise Congress and the Secretary of Energy of our findings and conclusions--and, of course, our recommendations--which we do in reports, testimony, and correspondence. All of this is on our website, which has a very simple address, just the initials of the Board--nwtrb.gov.

Now, the reason that Congress created the Board is quite clear from the legislative history. While it was deliberating over amendments to the Nuclear Waste Policy Act of 1982, Congress concluded that there was a need for an ongoing, independent peer review--something that is essential for increasing the confidence of the public and the scientific community in the validity of the technical and scientific process.

For the twenty years up to the end of 2008, DOE's principal waste-management focus was the program to develop a deep underground repository at Yucca Mountain in Nevada for disposal of spent nuclear fuel and high-level radioactive waste, which for simplicity, I like to refer to as high

activity waste. The Yucca Mountain Project consisted not only of the development of the repository itself and the facilities at the repository site, but included transportation and packaging of the high activity waste and operation of the waste management and disposal facilities. Accordingly, since our responsibility is to evaluate DOE's technical activities in the waste management area, those Yucca Mountain-specific activities were the Board's principal focus during that time as well.

In the last couple of years, however, there have been a number of significant changes that have caused the Board to refocus its work. Secretary of Energy Chu has made it clear that DOE does not consider Yucca Mountain an appropriate location to site a permanent repository and has established--at the President's direction--a Blue Ribbon Commission to conduct a comprehensive review of the policies for managing spent nuclear fuel discharged from nuclear power reactors and the high-level waste that comes from processing spent nuclear fuel, what we call "the back-end of the nuclear fuel cycle." The BRC is expected to make recommendations on how policies should be changed to enable the country to develop a high activity waste disposal program that can be implemented successfully.

DOE zeroed out the Yucca Mountain Project in its fiscal year 2011 budget proposal that was submitted to

Congress in early February, and has now terminated all work on the project. It also has petitioned the Nuclear Regulatory Commission to withdraw the license application for the Yucca Mountain repository. As you know, DOE's authority to withdraw the petition has been challenged and it is unclear when the current situation will be resolved. The only reason I'm noting these events is because of the impact they've had on the Board's work.

In parallel with ceasing work on the Yucca Mountain project, DOE has proposed increasing funding for research and development into alternative strategies for managing the back-end of the nuclear fuel cycle. As the Board's statutory role is to evaluate the technical validity of DOE's activities in these areas, we have refocused our ongoing review and priorities to evaluate the alternatives that DOE is considering. We also are producing our own evaluation of how each of the alternatives would affect the management of high activity waste. And, it is largely because we have redirected our work in this way, that we are urging that action be taken to not lose the value of the work that so many have contributed to on the development of a deep geologic repository.

Now, let me say a few words about my colleagues on the Board.

As is our practice at the beginning of each

meeting, I like to introduce the members of the Board. And, you should be aware that we are all part-time. This is not a full-time job, although at times it feels like it is. The members of the Board's staff are full-time, so they do most of the actual work and do it pretty well, I might add.

I will start by introducing myself. I'm John Garrick. I'm the Board's current Chairman. My background is in nuclear science and engineering and risk assessment, and I spend most of my time doing consulting in those areas. I do have some academic ties as an adjunct professor at Vanderbilt, a member of the Deans Advisory Council for the School of Engineering and Applied Science at UCLA and as a member of the Leadership Council for the School of Physical and Mathematical Sciences at Brigham Young University. And, thanks to my peers, I was elected to the National Academy of Engineering in the early Nineties.

I will introduce the rest of the Board members in alphabetical order, and I will ask each of them to raise their hand as I call their name.

And, I'll start with Mark Abkowitz. Mark is Professor of Civil and Environmental Engineering and Professor of Engineering Management in the Department of Civil and Environmental Engineering at Vanderbilt University. He is also direct of the Vanderbilt Center for Environmental Management Sciences.

Howard Arnold. Howard is a consultant with an impressive history of senior executive positions in the nuclear industry, including vice-president of the Westinghouse Hanford Company, president of Louisiana Energy Services, and engineering manager and general manager of the Westinghouse Pressurized Water Reactor Systems Division. I like to refer to Howard as Mr. PWR, although he doesn't like that name. Howard is a member of the National Academy of Engineering.

Thure Cerling. Thure is a Distinguished Professor of Geology and Geophysics and a Distinguished Professor of Biology at the University of Utah. He is a geochemist, with particular expertise in applying geochemistry to a wide range of issues, such as geological, climatological, and anthropological studies. Thure is a member of the National Academy of Sciences, and I should note that he also has an additional responsibility today. He will be the moderator of our first panel.

David Duquette. David is the John Tod Horton Professor of Materials Science at Rensselaer Polytechnic Institute. And, his areas of expertise include physical, chemical and mechanical properties of metals and alloys, with special emphasis on environmental interactions. David is also one of the two corrosion experts on the Board and has done a lot of the work in this area related to the

performance of waste packages following disposal in a deep geologic repository. David will be the moderator of our final panel today.

George Hornberger. George is a Distinguished Professor at Vanderbilt University, where he is Director of the Vanderbilt Institute for Energy and Environment. He is also the Craig E. Philip Professor of Engineering and a Professor of Earth Sciences there. His research is aimed at understanding how hydrological processes affect the transport of dissolved and suspended constituents through catchments and aquifers. George is a member of the National Academy of Engineering, and will moderate the second panel of our meeting today.

Andy Kadak. Andy is a Principal in Exponent, a consulting engineering firm. Before joining Exponent earlier this year, he was Professor of the Practice in the Nuclear Science and Engineering Department at MIT. His areas of expertise include the development of advanced reactors, space nuclear power systems, and improved standards for advanced reactors.

Ron Latanision. Ron is Professor Emeritus of Materials Science and Engineering and Nuclear Engineering at MIT, and Corporate Vice-President and Practice Director, Mechanical Engineering and Materials Science with the engineering consulting firm, Exponent. His areas of

expertise include materials processing and corrosion of metals and other materials in different aqueous environments, so along with David Duquette, Ron is one of our corrosion expert “twins.” Ron is a member of the National Academy of Engineering.

Ali Mosleh. Ali is the Nicole J. Kim Professor of Engineering and Director of the Center for Risk and Reliability at the University of Maryland. Ali’s field of study and practice are risk and safety assessments, reliability analysis, and decision analysis for the nuclear, chemical, and aerospace industries. Ali is a member of the National Academy of Engineering.

William Murphy. Bill is Professor in the Department of Geological and Environmental Sciences at California State University at Chico. His areas of expertise are geology, hydrogeology, and geochemistry. Bill also serves as an administrative judge on an NRC Atomic Safety and Licensing Board Panel.

Henry Petroski. Henry is the Aleksander S. Vesic Professor of Civil Engineering and Professor of History at Duke University. His current research interests are in the areas of failure analysis and design theory. As many of you know, Henry is an accomplished author in engineering and science. Henry is a member of the National Academy of Engineering.

We have 100 percent attendance today of the Board, and we're very thankful for that. It's hard to get this group together at one place at one time.

Having introduced the Board members, let me now recognize the staff. I am pleased to say that we have all of our technical staff here today, either in person or linked via internet, and some of our administrative staff, as well. They are sitting at the table on my left over against the wall. Time permitting, the technical staff will follow Board member questions with questions of their own.

Now, let's turn to today's meeting. As I indicated earlier, for more than two decades, developing a repository at Yucca Mountain was the primary activity of DOE related to the implementation of the Nuclear Waste Policy Amendment Act, and consequently, the focus of the Board's ongoing technical review. Although the alternative fuel cycle strategies that DOE is now considering include recycle of uranium and plutonium, fast reactors and other advanced reactor designs, as well as more esoteric concepts, such as accelerator-driven transmutation reactors, the Board believes that whatever strategy is adopted, there will still be the need for a deep geologic repository. Consequently, we believe it is essential to preserve as much as possible the information generated over the past two decades, plus an interpretation of the lessons learned, and that is the subject of the

discussion at this meeting.

And, the Board is not the only group trying and interested in preserving our experience. For those of you who read the Energy Daily last week, you noted that there was a letter to the Editor from the Chairman of the Nuclear Regulatory Commission, Gregory Jaczko, and I'm quoting one of the paragraphs in that letter, and I quote, "Many NRC Staff have spent years of their careers working on high-level waste and have deep experience and expertise in this area. They will now turn their attention to developing a comprehensive plan for ensuring the extensive data gathered during the licensing review process is fully preserved. The close-out plan will describe the form and schedule for publication of extensive public comments." So, it's good to hear that they recognize the value of the work that has been done to date.

Today, we intend to hear the opinions and discussions of three groups of experts and other interested parties on the technical information that was generated by and collected during the period of the Yucca Mountain Project. In other arenas, this activity is given such fancy names as Knowledge Management, or Knowledge Retention. The Board doesn't much care what name it's given, we just want to make sure that we are prepared to accept the challenge to assist in this whole process of preserving information, scientific and technical.

Part of the way the Board is assisting is by holding this meeting, during which our panelists will discuss from their varying perspectives their sense of the lessons learned from the technical work of the Yucca Mountain Project. A second way we are offering assistance is we are in the process of preparing a report on the technical experience gained from the Yucca Mountain Project, as well as other programs and other activities having to do with the management of high activity waste.

Some of the information generated by the Yucca Mountain Project was groundbreaking, such as understanding the impact of the air quality in a repository on the rates of corrosion of the waste packages, and the modeling of water flow and transport of radionuclides in the unsaturated zone. It would be irresponsible for us not to preserve this information and what we learned.

So, let me turn to the arrangements for today. We have organized the meeting in four segments. In three of them, we have panels of technical experts and interested parties who are here to share their experience with us. In each panel, we will have short presentations by the panelists on what they consider important information from the Yucca Mountain Project to preserve. We provided three questions to the panel participants to focus their deliberations, and each of the moderators will read the questions for their panel in

advance of the presentations. After the presentation for each of the panels has been completed, we have allotted time for questions from the Board that will likely turn into an open discussion between the Board members and the panelists.

As has always been our practice, the final segment of our meeting today is for public comments.

The first panel is composed of senior managers from the Yucca Mountain Project. One of them is a former DOE project manager who was also chief scientist for the program at that time. The others were all in senior roles in the "Management and Operation" contractors, that is, they were from the companies that were selected by DOE to run the program.

The Nuclear Waste Policy Amendment Act specifies that funds from the Nuclear Waste Fund will be provided to "units of affected local governments" to perform oversight of the repository program. Today, we have invited representatives from four counties in Nevada and the state of Nevada to discuss their oversight roles, and also to provide their assessment of technical aspects of the program. We look forward to their presentations and that discussion.

Everything I have said so far has been related to our program in the United States. The Board is well aware that other countries have been developing repository programs in parallel with the U.S.--in some notable cases, much more

successfully than we have. So, we are very fortunate today to have with us representatives from four countries, each of which has a wealth of experience in this area. We have asked them to give us the benefit of their experience in two areas. First, their view from afar of the Yucca Mountain Project in terms of the good and the bad; and, second, what they learned in their own programs that may benefit other programs, including our own.

I should note that it would be very easy in looking back on the Yucca Mountain Project to be critical of things that did not work out as planned. However, this is not our purpose. We are intent on primarily looking at what was learned that could benefit future similar projects.

Finally, I should report that we originally planned to have an additional panel as part of the meeting comprised of senior officials from the Department of Energy and the relevant National Laboratories. Because DOE’s attempt to withdraw the license application for the Yucca Mountain Repository has become a legal issue, DOE’s General Counsel considered it unwise for DOE or National Lab staff to discuss the Yucca Mountain Project in a public forum at this time. DOE did indicate, however, that it would be very interested in the outcome of this meeting, and I understand that there may be some DOE and National Lab staff in the audience. Meanwhile, we may approach DOE again in advance of our next

public meeting in Las Vegas on February 16th of next year to determine if they would participate in a second meeting on the subject of preserving the knowledge gained during the Yucca Mountain Project. And, at that time, we would include other organizations that have been involved in oversight of the Yucca Mountain Project, because not all of them are represented here today, and we want as broad a view and as many perspectives as we can possibly get.

The final segment of our meeting, the public comment segment, is always an important part. In fact, it is appropriate to acknowledge that it is largely because of a comment made at our last public meeting by Abby Johnson, one of our panelists here today, that we have the agenda we have today.

If you would like to make a comment during the final session this afternoon, please enter your name on the sheet at the back of the room. I think there will be people back there to assist you. We have an attendance sheet there as well that we'd like you to sign in on, if you would, please. If you prefer, remarks and other material can be submitted in writing and will be made a part of the meeting record. These statements will be posted on our website along with the transcripts and presentations from the meeting.

Sometimes we get asked whether it is appropriate to pose questions during the course of the presentations. We do

have a convention. First, the Board members will ask questions. Then, time permitting, staff members will ask their questions. And, beyond that, members of the public will be called to ask their questions. Frankly, we rarely get to the point where staff members can ask the questions they have. However, there is another mechanism that would allow you to question our speakers. And, if you write down your questions and submit them to one of the staff members, they will carry them to the appropriate Board member and will try to get an answer for you.

Now, I would like to note that in these meetings, we Board members like to freely express our views and opinions, and we want to continue to operate in that free and open manner. But, we do ask you to realize that these comments are not necessarily the Board speaking. So, any opinions you hear, or infer from a Board member’s question or comment are not necessarily Board positions. When a Board position is voiced, we will try our best to clearly state it as such.

As usual, to minimize interruption, we ask that all of you turn off your cell phones, or at least switch them to silent, and we should do the same. I should also like to indicate that it is very important for you to identify yourself if you are speaking, and to speak into the microphone. These microphones don’t always pick up voices

clearly, and as we want to develop a complete record of our meeting, we want to record clearly what you have to say, and this goes to the Board members as well, to speak into the microphones and use complete sentences as much as possible. Also, give your name, your affiliation, and any relevant information that would identify your remarks.

So, with these preliminaries out of the way, I'd like to ask our first moderator, Thure Cerling, to take over the podium, or however you wish to do it.

CERLING: Good morning. I'm just going to introduce the Panelists and read the questions that we ask with respect to this issue. So, as John has introduced the subject today, we're interested in what are the important lessons that we learned in the last twenty years in consideration of the Yucca Mountain repository program.

So, this first panel will be the view from within the project, and the panelists are from left to right Russ Dyer who is Former Project Manager and Chief Scientist for the Yucca Mountain Project; Tom Coleman, Former Subsurface Engineering Manager for USA RS; Ted Feigenbaum, Former General Manager, Bechtel-SAIC; and Jean Younker, Former Deputy Assistant General Manager, Bechtel-SAIC.

Now, each of these people have been asked to make a short presentation based on some questions that we were interested in. And, those questions are what technical

advances were made during development of the program that would be applicable in developing future programs for management of spent nuclear fuel and high-level waste in the U.S.? Second, what scientific research or technical development work should be undertaken now, or in the near future, to support further development of a repository for disposal of spent nuclear fuel or high-level waste? And, then, lastly, how did different managerial approaches and changes in management approach during the development of the program influence technical design, planned operations and logistics of the Yucca Mountain Program?

So, we anticipate that each of these four panel members will speak for ten or fifteen minutes, and then we'll have about an hour, or so, to ask questions and pursue this topic.

So, Russ Dyer?

DYER: Thank you, Thure.

It's good to be back before the Board again. It's interesting. Looking at the audience, I think there's maybe four or five people I don't recognize, and I've been out of this for almost eleven months now. So, some things change and some things don't, it appears.

But, let me start with going through what, in my opinion, were some of the technical advances that came out of Yucca Mountain. Chairman Garrick mentioned the challenge of

knowledge management, and I personally would put that pretty close to the top of things, positive things that came out of the program. There was an enormous amount of data and information that was generated. Archiving, cross-referencing, accessing that information was a major challenge.

Putting in place systems that allow the continuity of the access to that information I think would be a positive thing to do. And, I do not consider the license support network a knowledge management system. It's a litigation system, so there needs to be either, if there is a program that comes on as a follow-up, I would urge strongly at the very beginning that there be conscious thought put into place into developing an architecture and system and set of programs to deal with all of the knowledge and information that will be relied on and generated in that program. Because not every bit of information you need is generated within the program. It may be generated anywhere in the world, and knowing where it is, what it is is very critical.

The second thing I think we did right was put in place a rigorous System Performance Assessment with a rigorous treatment of uncertainty. Especially in a system that has both natural and man made components, it's really really important to have a tool that will allow you to determine what's important. It would be advantageous if this

tool could be exercised relatively easily to aid in day to day decision-making, but it's not absolutely necessary, but you must have some tool, because there's an infinite number of things that can be done.

What are the ones that you really must do? You've got to be able to have some way to help filter through what are the critical bits of uncertainty that additional work can reduce that uncertainty. There are some things that you could do much much more work, but you really would not significantly decrease uncertainty.

The third area I think we did some very positive things in was, as was mentioned earlier, advances in modeling and supporting databases, UZ hydrology being one. I think chemical/geochemical databases and approaches were--there's some fundamental steps forward in process understanding and putting things on a more rigorous footing.

And, finally, something that really is just wrapping up now, and that the project didn't get to take too much advantage of, was advances in understanding risk from extremely unlikely seismic events. This was a study that we had going on involving industry and the USGS, which puts on a better footing the understanding of what the true risk is from a very large consequence, but low probability event. What is the true risk associated with that?

So, those were the things that I personally picked

out as things that were advances.

Things that I consider being candidates for a future or continuing work would be, well, first off, revisit the bases for safety and health standard for a geologic repository, if you're going to pursue a geologic repository. We all remember the issues that swept back and forth over the years as to what constitutes an appropriate health and safety standard, and so much of what you're doing as you're trying to design a system, trying to establish a set of information needs for that system, and the associated research or site characterization activities, falls back onto what is it you really need to be able to demonstrate. So, having a firm and acceptable bases for what the health and safety standard is is, I think, very critical. And, the existing Yucca Mountain standard is specifically for Yucca Mountain.

I can't think of any specific site-specific information that needs to be pursued until a candidate site is developed and a safety and health standard is put in place, because until you do that, there's really not a--you can have a generic system identified, but until you have a fairly firm idea of what the system is, it's hard to identify what your information needs are that need be satisfied.

And, the, kind of the flip side of this is that flexibility is, I think, a fundamental key asset. It was a little frustrating in the early days because we developed an

iterative approach to design, site characterization, performance assessment, and go back through modifying design, re-evaluating the information needs through site characterization or through other research. So, it became about a, I think we did four complete iterations of the design, site characterization, performance assessment effort before we finalized on a design for the license application and the associated performance assessment. But, there's a level of flexibility that needs to be maintained in the early time to keep you from locking into something prematurely.

And, then, finally, on my list of candidates for future development or continuing development, fundamental information on key processes, especially those that are operative on very long time frames, could be quite useful. And, here, I'm thinking of things like corrosion, thermal effects, things for which we have a limited body of knowledge now, and some of these test or information needs could, I think, meaningfully be continued for decades, and add meaningfully to our current knowledge base.

Moving on to managerial approaches, the first one I have is maybe a little optimistic, divorce politics from management. I was talking to some people earlier. Since I retired, my blood pressure has gone down by 70 points. My cholesterol is below 60. And, it is just a whole lot nicer whenever you're not having to deal with the day to day

turmoil and chaos that is associated with the government appropriations process, and not to mention the day to day direction on the project.

I would say using nuclear-experienced prime contractors is a lesson I think we should have taken to heart from the very beginning. This is a different business, going in with a nuclear culture gets you a long ways toward where you need to be. It is a different environment. It needs to be recognized as a different environment, and it has everything to do from the mind set. The Quality Assurance Program, it wasn't until we had senior managers sitting in the daily or weekly Quality Assurance meetings, senior managers from DOE, sitting in those meetings dealing with day to day issues, that we really got our hands around that issue. And, I really think that was kind of the fundamental basis for the nuclear culture concept.

And, also, again from my perspective, we went to a lead lab relatively late in the program, and I think we could have benefited from using a lead lab approach probably much earlier in the program. It was good to have scientific management managing scientific programs.

And, I think, do I wait now and--do we take comments now, or wait until we've all finished as a panel?

CERLING: I think we'll go through and have all four presentations, and then we'll have questions.

DYER: Okay.

COLEMAN: My name is Tom Coleman. Hopefully, you can hear me in the back. Okay, I see some heads nodding back there. Let me thank the arranger of the meeting. I'm very glad that I'm going second rather than fourth. My apologies to Jean because I have a little different perspective.

I think Russ gave us an excellent overview, but I'm going to focus on some specific areas that I think are of particular interest.

I've been associated with the Yucca Mountain Project since the early 1990's in various management positions primarily relating to the waste package design and waste acceptance, storage and transportation. As mentioned earlier, my most recent experience was as subsurface manager for USA RS, which primarily was responding to requests for additional information from the NRC, based on the license amendment that had been submitted to the NRC. I want to thank you for allowing me to come here and express some thoughts concerning the technical lessons from the Yucca Mountain Project.

Regarding technical advances, I have four specific examples that I would like to go through, but I certainly did not make an exhaustive list of advances that came from the project. I think that would be a very lengthy list. I've picked, again, four specific items that I'd like to talk

about. Some of this is a little bit redundant with what Russ had to say.

But, first, I believe that the techniques and methods for investigating near field environments that came out of this project are very important, and I think they will be important regardless of where a future repository will be. The technical issues will have to be identified and modeled, and I think many of them will be the same technical issues. What's the chemical environment? What media is the waste going to be stored in? What amount, how much water is going to be there, and what's the migration of the water? What are the heat loads associated with the waste package or the waste forms?

Of course, the applicability of the methods to other potential sites will have to be verified, but again, I believe that many of the particular techniques that were applied at Yucca Mountain will be of value in studying any future repository.

The program placed a lot of emphasis on the development of new and improved materials, and the understanding of their performance under a variety of conditions. While it's difficult to predict which specific materials might be of benefit without knowing the future environment, it's likely that many of the same issues, such as corrosion of the waste package, and leaching of

radionuclides will have to be addressed in the licensing of a future program.

The methods developed to understand corrosion on a molecular basis to support Yucca Mountain materials should be of benefit, even if different materials are used in some other future repository.

The third area that I think is important is welding techniques. Now, of course, we don't know exactly what the waste package might be at a different repository location, but stress corrosion cracking is a potential problem with many materials exposed to moisture and chemicals over extended periods of time. The Yucca Mountain Project has been a leader in developing stress mitigation innovations. Examples of this are the narrow groove welding, which is now commonly used in replacing major nuclear components, such as steam generators in nuclear power plants. Narrow groove welding was applied to prototype waste packages and measurements proved that the residual stresses were much less than those from classical welding techniques. Other mitigation techniques that were explored as a part of the program were peening of the closure weld to mitigate stresses in the weld heat affected zone, so that's, you know, again an advance that already has other applications in the nuclear industry.

Another important area is disposal criticality

methodology. The Yucca Mountain project was a leader in pursuing burn-up credit and long-term criticality issues. Several topical reports were prepared and submitted to and approved by the Nuclear Regulatory Commission concerning the methods to be used to calculate and verify the accuracy of the physics computer codes to predict long-term criticality behavior of the waste package and its contents. Additional work is needed to develop recognized standards for using burn-up credit so that unnecessary conservatism can be removed from the calculations and from the repository design.

So, again, those are just four items that occurred to me. I guess I could say that those seem to be the four most important. But, there would be a much more extensive list of advances that could be developed from the Yucca Mountain project.

Regarding future work that should be undertaken, I had three or four different areas that occurred to me. One of those is the development of prototypes, particularly for the specialized equipment. And, the reason that I think the development of the prototypes should proceed is so that they do not become critical path issues in the future, and I think, again, it’s likely that there will be applicability of some of these prototypes in whatever future repository we have.

A primary example of this is the transportation and

emplacement vehicle, the TEV. This is an electrically powered vehicle which involves proven components that will be configured for a unique application. It's reasonable to assume that a similar vehicle will be required to support repository operations, regardless of the exact location finally selected.

Now, one reason that I bring this area of prototypes up is because I spent about 35 years of my career engineering and working with commercial and nuclear fuel. And, I think in order to build public confidence, it's very important that you have hardware that the public can see and that you can talk about. With Yucca Mountain, an awful lot of the issues have been addressed as paper studies and highly analytical items. The public really likes to see tangible items that they can see how they work, and it helps create their confidence in what you're doing.

I think that for the future, we need to continue to pursue burn-up credit methodology. The spent fuel criticality analyses did not take full credit for the actual isotopic inventory of the irradiated fuel. In particular, the negative reactivity effects of certain fission products are not recognized. This leads to a very conservative approach to long-term criticality control for the repository. Additional work to take more credit for the effects of burn-up on fuel reactivity should be pursued.

I think that we should also pursue facility design in certain selected areas. The design of the Navy and defense high-level waste processing building should move forward because they will not be impacted by decisions concerning the commercial nuclear fuel cycle. Because of the regular standards being applied to the design, the facility could be built in many locations, and design should proceed so that construction of the facility could move rapidly once a site decision is made. So, again, this is a suggestion to buy time on a schedule so that whatever decision is made on the repository, it can move very rapidly toward implementation.

Regarding managerial approaches, I decided to change that question just a little bit and address it as decisions that required changes in the management approaches for the project. Some examples of those decisions are a hot versus cold repository, wet or dry fuel handling, EPA rules concerning doses and periods of consideration, and performance of the natural barriers versus engineered barriers.

One of the more recent decisions or changes was to use the transportation aging and disposal canister versus bare fuel handling. This decision potentially minimizes the handling of bare fuel at a repository, simplifying operations and logistics, so it’s of benefit to the repository, but it

also could potentially increase the handling that the utilities have to do.

In conclusion, I believe the Yucca Mountain Project has developed many methodologies and scientific advances that can be used at other potential repository sites. This work should continue. The materials development program moved the state of the art for waste package designs forward, and burn-up credit methodology should be pursued.

Again, thank you for allowing me to present my views.

FEIGENBAUM: Good morning. My name is Ted Feigenbaum, former General Manager for Bechtel-SAIC from 2005 through 2008 during the development of the license application.

When I first got the call about sitting on this panel, and the questions having to do with what were the technical advances, and all these other questions about Yucca lessons learned, I thought this was going to be a pretty painful experience, having to go back and think about what we had done over the years. It turns out it wasn't difficult or painful at all. When I started to think about it and talked to others that were on my team, it was clear that there were many dozens of technical advances, and important lessons learned. So, my list is really a compilation of input that I got from people on my team that I contacted over the last couple of weeks, and the list was too big to really present

today, so I culled it down and triangulated it down to what I think are the top issues for the Board to hear.

And, being the third speaker here, you're going to start to see some repetition, not surprisingly. But, certainly, at first, the TADs, the multi-purpose waste canisters, came fairly late in the process, but never too late for a great idea. This is a standardized canister that would simplify operations, result in less spent fuel assembly operations, therefore being much safer. It reduced our facility cost for the surface facilities, and over time, as more people adopted the TAD, they use a scale certainly for manufacturing these, would come into play. So, we thought this was an excellent innovation.

The second item, clearly PRA and probabilistic risk methods have been applied to facilities most often after the fact to assess levels of risk. This is the first application that I'm aware of in a nuclear facility where the use of probabilistic methods was built right into the process. And, not only built into the design of the structure itself with fragility analysis and evaluating the risk of various seismic events, but also in the design of the equipment, the canister transfer machines, the controls put on how high canisters could be lifted, the interlocks in the design of the equipment, and so forth, this was, every step of the way, including operations, there was human reliability analyses on

how the workers would move the material and operate in the surface facilities, every step of the way was analyzed to try to prevent events. And, if an event occurred, how we would mitigate it. So, it was really, I think, an excellent application of risk techniques.

The combined use of natural and engineered barriers seems very obvious, but obviously the mountain was the prime protection for the population. However, where the uncertainty that rises into an endeavor that supposed to operate for eons, the engineered barriers provided some additional assurance and confidence in the design. So, the waste packages themselves, the inverts that the waste packages sat on, as well as the pallets, the waste form, drip shields, the combination of the engineered barriers, together with a vast safety of the mountain itself, and how we studied that, in combination, I think, provided us great confidence in the performance of Yucca Mountain.

Remote welding of Alloy 22, we talked about welding. There was an outstanding program going on at Idaho National Labs developing state of the art tooling to do remote welding of Alloy 22, canisters and lids, to be able to inspect and weld in the quality, if you will, of that work. It would provide a consistency of weld quality as well as dose savings. And I’m not sure they ever got as far as actually producing actual test welds, they may have in the

last year or so, depending on their funding, but they were just about ready to go, but the methods that were developed were useful for any future repository that uses Alloy 22 and I expect that that would be certainly under consideration.

The transport and emplacement vehicle, this was a concept, very innovative, of reducing the handling and providing shielding and protection to the workers, both in the surface facilities and the subsurface. It was a vehicle that would pick up the canisters in the surface facilities and transport it in a shielded manner, and place them in the mountain.

The Total Systems Performance Assessment model, obviously the Board is very familiar with this. It's a compilation of analytical models that looked at the natural and engineered barriers based on site data, based on material testing, and so forth. It yielded an overall assessment over a range of conditions, and really an excellent tool that gave us confidence in the overall performance of the mountain.

Not to be confused with the TSPA is its little brother, the total systems model. This is really an operations research software. It's a multi-faceted simulation of the total waste system around the country, very useful to study from the time waste was located in the nuclear power facility, for instance, how it would be transported, how it would be aged, how it would be processed

over time, and then ultimately disposed of in the mountain. We did many studies and what if kinds of scenarios. For instance, what if we took the waste from decommissioned units first, how would that affect the host system. And, in just a matter of hours or days, you could get a very good assessment of the impacts, the pinch points in the whole transportation, as well as processing at the plan. So, an excellent model, excellent use of operations research.

Okay, in the area of what research or development work should be undertaken in the future, now, I talked about and praised the TSPA, it was the heart of our license and application and safety case. But, it wasn't user friendly. Russ talked about flexibility. It was very time consuming to do different cases, and very expensive to run. It wasn't the kind of thing where you could put an input in and get an output in a day or two. It was months, actually.

The lead lab had proposed making the TSPA a more integrated model, and I'm not sure that got as far as we would have hoped, given the funding issues. However, for the future, if you're going to consider a repository that's going to use a model such as this, that there's got to be a way to integrate it better, so that it's a more user friendly and more flexible program for assessment. Excellent results, but difficult and expensive and time consuming to run. And, maybe Jean can talk about that. She's probably more

qualified.

The transportable aging disposal canisters, the design, as far as I'm aware of, was never completed. They were just about to issue contracts to various vendors to develop these designs. I think Tom mentioned going ahead and fabricating and testing prototypes would be a very good idea. I think it would, if you had a prototype that was tested and proven and validated, the utilities would embrace them, and get the customers more interested in using them. Because, as of now, everyone is still going their own way and building their own different spent fuel storage systems, which is not an idea situation, and certainly moves away from stabilization, which helps reduce costs.

And, as the waste builds up at the various sites around the country, those are the numbers and volumes of the various canisters that are being used today, and the waste packages just keeps growing. it seems to me that it would be worth an effort to try to determine the capability of the existing waste canisters. We always found it difficult to assess the long-term performance because these canisters were not built for that purpose. However, I think some study could be done to see what it would take to make those canisters more usable or more acceptable for long-term disposal, and certainly as the volume goes up, I think this becomes and more and more important issue.

The last thing I had was the transportation cask. Transportation is a large part of the issue for any repository, and I think little was done in this area because of funding issues in the last few years to really develop this transportation cask and get it designed and tested. And, also national transportation planning, there are much better tools now, even in the three years that I've left the program, in terms of Google maps and other satellite photography techniques that one could really study various transportation routes and come up with advanced planning for those areas, or those problem situations that would need to be addressed, or maybe even routes that would be taken off the books because they didn't meet various criteria. But, if you consider your computer these days, and almost follow a whole rail route and get a pretty good idea of where your issues might be. So I think there's some effort that could go into that.

And, the last area I was asked to touch on was managerial approaches. Certainly at a point in the 2005, 2006 time frame, there was a true transition from a science project to an engineering/design/licensing project. I think there was a mental shift that took place. It had to take place. We had collected sufficient information and data, reams of data to be able to now move into the design of the facilities in much greater depth, and also to prepare the

license application documentation. And, I think the management both at DOE, as well as the contractors recognized this and mentally turned the ship around in that 2005, 2006 time frame.

Russ mentioned the introduction of the lead lab concept. I won't say it was like herding cats before there was a lead lab, but it was pretty much like herding cats. It certainly made my job easier with a lead lab, scientific management managing scientists was, it turned out to be, a solution. I was personally resistive to it in the beginning, and it was one of those lessons learned for me that it was a good concept, had had it happened earlier, I think things would have been even smoother.

We projectized the license application preparation effort. When we moved into the engineering licensing design phase, we really put in project management systems for measuring ourselves, accountability. We had routine meetings. There were so many players in the Yucca Mountain Program in terms of not only DOE and the M&O, but also the labs, the Navy folks, the USGS, we all formed a true project team. We developed a license application in phases, and it was improved at every step of the way along the four phases of development. There was just a lot of project management applications applied here that perhaps in the early years when the project was more of a science program, that were not

evident. So, I think there was a managerial shift, a focus, a recognition that we had to get this license application complete. It had to be accurate. It had to be validated, and it had to be of high quality, and we went through a process of making sure, almost like a PRA process, every step of the way making sure that we mitigated any problems. So, projectizing the license.

And, I'll tell you at some point, we recognized that we had a good case, that Yucca Mountain was very safe, that we had extreme data backup and rationales and justification for what we were doing, and it was a very focused effort, recognizing that we were going to be moving into a very contentious licensing program here through the regulatory system, and there was a focused effort on accuracy, completeness, transparency, credibility and defensibility. We knew that scrutiny would be immense. It would probably be, you know, the biggest licensing effort of all time in the history of this country. So, a big effort on making sure that we presented a defensible and credible case, and we felt good about the case that we had.

Again, with the projectization, we formalized decision making. Things were documented much better in the last few years of the program. The licensing support network really created a very open atmosphere, particularly when e-mails were included. As you can imagine in a licensing

support network, I can still look up now and find some of my e-mails that I had written three or four years ago on the internet, it's amazing. But, anyway, we embraced this openness, we embraced the fact that we had a strong case, and it did permeate the atmosphere in the last few years of the project.

And, lastly, there were some shifts and changes in the approach, and we did change the schedule in terms of an early demonstration of waste handling. We developed the concept of the initial waste handling facility that would handle Naval reactor waste. This was a plan to really phase in the operation of the mountain. When you have an immense construction project that would be built out over many years, to be able to demonstrate your ability to handle waste safely and to use all the systems and procedures at an early stage was a good concept. It came fairly late, it was a little disruptive having to change course a little bit, but in the end, I think it was a good idea, and certainly motivated our staff because when you're building something that's so many years out into the future, if you can bring in the schedule a few years, it really made a difference that people felt on the project, that it was going to happen, and that we needed to move with deliberate speed to be able to develop these designs. Because, we were going to have an initial facility that was going to be operational.

So, I guess that's really the major things that I came up with in response to the questions, and I'd be happy to take your questions at the end.

YOUNKER: Okay, I guess I'm up. I am Jean Younker. I'm very pleased to be here to talk with you today. For nostalgic reasons, I thought I'd put a picture of Yucca Mountain, but I do go there on geological site seeing trips now, even though I have been retired from the project for five years, almost five years. This is for those of you who haven't seen this view, this is from the southwest looking out across the flat with the two little volcanic cones and the western ridge of Yucca Mountain along the Solitario Canyon Fault, for nostalgic purposes mostly.

I have a technical background, so as a result, most of my comments will follow on what Russ said, and pick up a little bit further detail on some of them. And, I would like to also mention that I don't know how many people in the audience were on the program before the Nuclear Waste Policy Act, but I was, that's the original Nuclear Waste Policy Act, not the Amendment, and I also would add that I was present at the first formal meeting of the Nuclear Waste Technical Review Board, in the basement of the Forrestal Building downtown. So, I can say that I have some longevity here that probably most people in the audience and on the Board do not.

So, let me go to the technical advances. As Russ

said, the unsaturated zone testing methods and the approaches to gaining information about an unsaturated zone, thick unsaturated zone like we have at Yucca Mountain, in a way that would minimize disturbance to the in situ conditions was one of the areas where I think the project played a really important role. Should the country go to a thick unsaturated zone site as a possible geologic repository in the future, we certainly know how to characterize it. We know the type of techniques we have, the drilling techniques, well established.

In the early days, back in the 1980's when we were first looking at site characterization methods, we knew that the role of fracture flow in this kind of a setting was going to be important because even the early daily siting guidelines and the early Nuclear Regulatory Commission guidance before we even had the current regulations established and made clear that groundwater travel time would be an important player, would be important criterion, so the idea of exactly how water flows through the unsaturated zone was something that was an early focus, and it stayed with us of course all the way through the final dose calculations and the big system models.

The development of suite of process models. In thinking back over this, in preparation to talk with you, it occurred to me that we really had very much a parallel

process here. And, in some cases, in some ways, I suppose that was good. It probably added confidence to where we finally ended up with the system model. But, what we had, as some of you who have been watching the program for a long time, is that we had a period of gathering data and developing process models relatively detailed in many cases of the various pieces of Yucca Mountain geological and geoengineering type processes, and we didn't have a system model to start with, we had kind of a rudimentary one that we used to calculate groundwater travel time in the early environmental assessment days, in the 1980's, and it was very rudimentary.

But, even in those early days as we began to put the pieces together, over and over I have to tell you the importance of working the science and engineering and the integration would come home to us. And there are specific examples that have been talked about in front of the Board in the past where we found that even fairly late along in the process development, we had some assumptions in our modeling that led to results that in fact were really the result of the assumptions, not surprising for those of you who are mathematical modelers, but it was sometimes an embarrassment. Fortunately, quite often, we found out ourselves rather than having someone else find out for us. But, the importance from the very beginning of having close integration in all of

the disciplines that are working on this kind of a multi-discipline program, I think is something that we learn, and hopefully, that can transfer to the next type of work that would be done in a geologic repository in the future.

The last point on the process models, and I'll come back to this when I talk more about the system modelers, that one of the things that we had to do was, early on, figure out how to apply NQA-1 type of quality assurance to site characterization phase of the program. And, that had some resistance among the technical staff at the time. The view, of course, at the early days, Ted talked about the nuclear cultural changes, we went through two or three kind of revolutions in our understanding of how important it was going to be to follow those kinds of standards and procedures.

And, in the early days, I think most of the technical staff felt that their work was, you know, good quality technical work was all that you needed. Document it the way you do when you normally publish in peer review technical journals, and that would be good enough. And, little did people recognize at that point, you know, in part because I think as Russ said also, we didn't really have much nuclear perspective in the management of the program at that time, either in DOE or in the contract managers, so as a result, we probably were a little late getting, you know,

that perspective of how important the whole maintenance of records, chain of custody, all of that kind of thinking was going to be.

But, one piece of it that we did start fairly early, and we did I think a very good job on is an objective method for model validation. We had some insights provided from the Nuclear Regulatory Commission and some guidance documents, but we took those methods and developed them into a controlled process, where we had a team of technical people go step by step through the models, and moved them in a way very parallel to what you do when you do code verification. So, that took you to a point where you had a level of confidence that was at least somewhat uniform across your models, to the extent that you could get it.

Now, as I said earlier, one of the things, thinking back, we had a parallel process going on in that once we had an active system model team developing what ended up being the TSPA, they went down a route of a formal process that had been developed through the international TSPA integration teams for include and excluding features, events and processes. And, you have heard about this before, I know.

What’s nice about that is that it gave you kind of a cross-check back over your whole process model development to make sure that you hadn’t missed a potentially key process as you put together the building blocks that were used to

then feed the total system model. So, this formal process, which is documented as you, I'm sure you all know, very extensively documented, both including and excluding those particular features, events, disruptive processes that had to be included or excluded.

And, then, I think Russ also mentioned, the high value, once you have a good credible system model that you could use, the sooner you have that, the better you are of course, and we had rudimentary ones we could use early on, but further along, the more you can focus your testing, both the laboratory and field, on parameters that are important to the results of that model, and certainly improve the process models that have the greatest impacts. And in fact, as I think many of you are aware, many of the process models ended up being way too complicated and, speaking to Ted's point, if the total system model had tried to link them all together and run that, it wouldn't have taken just days, it would have taken months to run the model. So, we did what was called abstractions, and those abstractions left a lot of the detail behind, but the intent was to take on the critical parts of the process and include that in the total system model in such a way that your total system model would then produce a credible result in terms of doses. So, improving the process models with feedback is important in several different ways because it also then improved the total system model through

that feedback.

Other technical advances, I already mentioned. Just application of NQA-1 controls to the characterization phase. Later on, it was more obvious what to do and how to do it and why we had to do it. In the early days, there was a lot of resistance. Some of the people in the room, like Ike Winegrad would recall, we had some very combative periods in the project when some of the technical folks said, you know, I don't need any help from Quality Assurance, you know, my work is scientifically valid and defensible. Well, you know, that was pre-the time when the nuclear culture had really permeated Yucca Mountain Project and the staff members, and the sooner the better in the future program, and hopefully we've learned that lesson, I believe quite well by this time.

Another point on technical advances, or technical realizations, I guess, is the importance of the peer reviews and the oversight, like from this Board, as well as from other organizations that had the role of critiquing and reviewing what we were doing. I could almost have done this same talk and gone through and picked out the points where I personally think specific challenges and questions from either peer review panels that we had ourselves requested do peer reviews, or the Board asking questions, caused us to make fundamental changes and do something really differently

technically. The biggest one as far as the Board goes, and I know there was a lot more to it than just what I'm going to say, but I will say that the early incarnation of the Board had a whole lot to do with the way the whole Yucca Mountain underground facility looks today. It was going to be a very different facility had the questions and the challenging and the probing from the original Chairman of the Board and some of the Board members not taken us in the direction that we went. So, I think the independent peer review and oversight is really quite amazing when you look back over the project.

Okay, looking back at Site Characterization now, I decided to just make a few points that might cause some discussion, and these are obviously personal opinions. I would think that moving to a new site, the undisturbed ambient geologic environment in that site would be very--you could constrain the program considerably, in a major fashion from what we had at Yucca Mountain. And, I would say that our understanding of earth materials is generally adequate to provide the kinds of parameters you need for model development. There's very little site specific, I believe, if you go back and look at the models as they ended up and as they provided a basis for Total System Performance Assessment. The only exceptions I would, of course, draw would be you have to do some good paleo climate investigations in order to get the best handle you can on

your long-term climate change, so that you can bound the effects that that will have in terms of range of infiltration fluxes that you'll need to use in your total system models.

The key then I think would be, what I would do if I was "Queen for a Day" and running that project, would be to focus my data acquisition on testing any kind of predictive models that I could come up with, building confidence in those models so that it would really become a part of validation of those models, rather than any kind of broad-based site characterization program. I just personally don't think that would be necessary.

As far as disruptive events go, now we're looking at something where you have to get site specific data to estimate occurrence intervals. However, you get as much as you can, but what you find out, what I found out and certainly we did in the project, was that formal expert elicitation plays a major role because the measurements you really need, you can't make. It's just not feasible to make those kinds of measurements to get at the recurrence intervals. You can get the best information you can, but those of you who are scientists know that that kind of information is extremely hard to extract from the geologic record.

So, what you should do, in my view, what I think we should have done a better job, would be to focus data

acquisition on the kind of information, the best information you can get to inform that expert judgment. That would be the way I would go about it.

Next one, please? Okay, now, this is the other big area where, looking back, it seemed to me we had some, well, some major challenges, several different iterations of challenges. But, the repository-induced environment, meaning what it was going to be like through the life of the waste package as it deteriorates and as it finally has breaches and as there's finally some water and contact with the waste form. The major driver for getting that kind of the data about that repository-induced environment clearly is to get at the corrosion environment, the environment for material performance.

And, what I learned from the peer review panels that we had for waste package, and Dr. Latanision was on those, was that we heard loud and clear every time we had this discussion, if you can tell me the environment, I can tell you the material behavior. But, if you can't constrain the environment, can't constrain the chemistry of that environment, then I can't be very confident, very certain about the material behavior. So, this led me to think about how this probably, in my experience and the part of the program that I played a role in, this was probably one of our biggest challenge areas, and a lot of frustration, because of

this back and forth of tell me the environment, I can't tell you any more about the environment, then I can't tell you any more about material performance. So, in terms of area of uncertainty, that would be one that I think the more you can do to get at this question, the better the program will be.

Future refinements to waste form degradation models, clearly, and also to cladding performance, should someone decide to try to take credit for cladding, would also be informed by that improved environment characterization.

And, of course, then looking ahead, the only kind of work, from my viewpoint at least, that I can imagine that might be useful, like Russ said, until you have a site, if you are moving to a different site, I can't think of any site specific work I would do. But, if there's anything I can do to spec material behavior or spec materials for types of environments and the range of environmental conditions so I get a better handle on my failure rates and modes of failure, more confidence in that area, it seemed to me, at least at the time that I left the program, that that would be an area that would be of high value in the future repository program.

Finally, in terms of impacts, I think the engineering guys have covered this very well. I'll say a couple of points from my kind of narrower viewpoint. What I saw at the time when I was a manager of the geotechnical staff, the staffing changes due to those fluctuating annual

budgets were just very hard to manage. When you manage through those, you had what I term natural de-selection, and those of you who have been in those roles know what happens is, of course, your best people are the ones who can find new jobs, and so you have a natural tendency to lose some of the talent that you most need for a first of a kind program like this. So, that fluctuating budget annual cycle was a real killer in many of the years that I was on the management side of the program.

It also makes technical integration more difficult. I guess that goes without saying that when you're losing the people who are your key integrators, it's very difficult to build somebody back into that position with the level of intelligence and knowledge that they can pick up where that person left off. You lose a year or two in every one of those change-outs. Also, as these guys probably mentioned already, but long-lead procurements, equipment or services, many times we needed to get a contractor on board, we needed to be able to plan ahead for next year's work, and you couldn't because you just didn't have that kind of budget continuity.

And, then, it also led to the same challenge that was mentioned before. We went through the nuclear cultural renaissance at least three times on the project, and that was, in part, I believe due to the changes in management and

the evolution of the program and the way we went, having to do with, you know, the whole political and social context of this program.

So, thank you. Those are my thoughts.

CERLING: Okay. So, we're now open for questions. Mark?

ARNOLD: Howard Arnold, Board member.

Ted really turned me on talking about the transition to it being an engineering project, and my frustration, being an old engineering manager myself, old in both senses of the word, my frustration with the project when I first got on this Board six years ago, was that it was not an engineering project. It was a collection of scientific investigations. And, I'm wondering why such an endeavor as this couldn't be an engineering project from the very beginning.

DYER: This is Russ Dyer. Let me try to address that. And, you're not going to like this answer, because I didn't either.

Very early on, one of the first duties I had with DOE was to take over management of the performance assessment, what later became the TSPA program. And, as we looked at where uncertainty lie in the program, one of the places where we had the largest uncertainty was performance of the engineered system, specifically the waste packages.

And, I personally went to the director at the time and requested that we put money into that program, even if it had to come out of performance assessment, and was told that we couldn't do that because we couldn't do engineering. We were going through site characterization for a while. So, it was okay to be an academic research project, but even in the early days, it was a little hamstrung as to really making progress as a system.

COLEMAN: My comment to that question would be the reason that it wouldn't work is because there's too many changes. As you know with engineering projects, you need a very well defined objective, and you need to know where you're going, how much money you have, how much time you have, and a lot of other issues like that. With the management, well, even for a future repository, if it is managed in the same way with the same type of let's call it governance, that is not a recipe for success. It needs a focused objective with very clear cut rules as to how you're going to go forward so that you can have confidence in the cost of building facilities and doing the engineered items that you have to do associated with that project. So, I think if we could establish a level of certainty, then you could treat it as an engineered project. But, in the past, we've just allowed too many changes.

FEIGENBAUM: I think Tom and Russ addressed it

correctly. In my view, the time was right in the 2005 time frame to start moving in a different direction. It was necessary, absolutely necessary to complete the project to turn the ship around and make it into an engineering projectized project, and we did that, and it was a culture change. Not everybody was able to handle it. So, it was not easy, but it was necessary and necessity drove the change, and I agree with what Tom and Russ had to say about the timing was not quite there yet previously.

YOUNKER: I don't think I have anything to add.

ARNOLD: Okay. I guess I think the answer as being under proper governance, it may have been, or could have been an engineering project from the start. That's my take.

ABKOWITZ: Abkowitz, Board.

First of all, thank you all for participating in this format. I know that you spent very long and distinguished careers working on this project for extensive periods of time, and sharing your views sort of after the fact is very important to our process.

I actually have an individual question for each of you. So, if you'll bear with me, I'm going to start with Russ.

Russ, you mentioned that the TSPA was a significant accomplishment, and I certainly don't disagree. But, I was wondering if we can drill down a little bit deeper and have

you talk about the trials and tribulations that were required to piece together what I understand to be a variety of different modules that were farmed out to different places, and what went on internally in terms of trying to make the mass balances of all of these different modules match up with one another, and just the complications that are introduced when you have thousands of variables that you're trying to populate with credible data.

DYER: Jean hit on probably the key issue, which was building a TSPA that is in every element of every subsystem element is a process level model at the fundamental process, becomes if not impossible, at least very very difficult, and reaching a level of abstraction where a simplified model incorporates important aspects of the fundamental model yet is amenable to a rigorous treatment in uncertainty space, as well as being computationally effective, was a balancing act that we had to go through. The TSPA kind of grew like topsy, so there were different approaches, different solvers, different system or process models that were kind of added on here and added on here.

Ted talked about something that was discussed at one time, which was a next generation TSPA, which is taking what we learned from the current model, which gives I think a good answer. It's just not very--it's certainly not nimble or terribly flexible. It's not a great decision aiding tool,

and making it into something that is more of a, besides being a regulatory compliance tool, also being something that could help day to day decision making. That's something that I think could very positively be pursued in the future.

But, you know, it's really hard to make a model of anything that has every aspect of the model in it. If it is, it's not a model. It's reality.

ABKOWITZ: Thank you. My question for Tom, I was struck by your comments about prototyping. This is something that the Board has had a pretty strong position on in terms of the significance of that. You mentioned it in the context of building confidence, and I was wondering if you could expand on that and talk about how important it is just in terms of informing the design process for those internal to this development.

COLEMAN: Well, I think with any first-of-a-kind equipment or system, you're going to learn as you go through the process, and clearly, for some of the equipment, I think the engineers and the scientists would learn a lot more. If we go back, for example, to the waste package welding system, remember Ted talked about that a little bit, too, and, in fact, the work out at Idaho National Lab was completed, and they had a successful prototype welding phase there. But, for example, the heater that was designed to reproduce part of the conditions that the waste package would see did not

work quite as well as desired.

So, again, when you begin to put these systems together, you may know a lot about the individual components, but there's always something to learn, and you can, from exercising them, and people are so innovative that they will come up with ways to do things better, faster and cheaper when you build those prototypes. So, it's extremely informative for the engineers that are involved in developing the systems.

ABKOWITZ: So, would that process then have extended to the design of the emplacement vehicles and the fabrication of the drip shields, et cetera?

COLEMAN: Yes. I mentioned the TEV specifically as being there, and, yes, I would have liked to have seen more done in drip shield fabrication, because I think we would have learned more in that area, but that was one of the items where there's a tendency with some of these items, Ted mentioned transportation, for example, of is it a delayable item. You know, yes, of course you can argue that you don't have to have it now in the schedule, but there's a certain amount of these activities dealing with these prototypes that if you'll go ahead and do them in the near term, you can discover items that might really trip you up and cost you a lot of time later. So, I would characterize again drip shield fabrication. I don't see it as a, let's call it a

huge technical challenge, it's just one of those things you need to do it so you can show everybody that you can do it, and you can learn the lessons from it that you need to know so that you can do it better. So, that's kind of my perspective.

ABKOWITZ: Thank you. Ted, my question for you gets back to your comments about the TAD, and how you believe that was a step forward in the contributions to the Yucca Mountain project. I was curious to what extent you and your colleagues engaged in sort of a total systems view of what the TAD would do. My sense is that it was driven by issues that had to do with handling of the surface facility, and I was just curious to the extent to which as that decision was being made, there was any thinking going all the way back to the waste generation sites, and what types of transfer handling responsibilities would be taking place there, as well as the transportation modal access issues that had to do with the weight of the TAD vis-à-vis the modes of transport available at those sites.

FEIGENBAUM: Well, as I recall, we really focused in mostly on the commercial nuclear fuel and less so on the legacy waste, DOE waste sites. Our feeling was is that in looking at the design of the surface facilities, if we had to handle all different kinds of waste packages in wet conditions, it just would complicate significantly the whole

surface operations, be more time consuming, and we felt safer to standardize the design, really deal with canisters in a dry environment rather than build a lot of spent fuel pools, so to speak.

Clearly, a standardized package would help in the transportation arena. I think, over time, it would be a less costly approach because a standard design, you know, could be built in volumes that would reduce manufacturing costs. You know, overall, it just made abundant sense. I never quite understood why it wasn't brought to the forefront sooner, given all the advantages, particularly safety. I just felt handling all these spent fuel assembly sticks over and over again could raise some safety issues, and certainly increase the risk profile. So, it seemed to be a clear advantageous system, both at the utilities as well as transportation, the surface facilities, and emplacement, a standardized design just had multiple advantages, and that's why we pursued it.

Now, I have to say that the utilities didn't immediately embrace the idea, and that's why I think having a prototype built and tested, and you'd know something about the costs of producing one of these, and how you would use it at the site, if you could demonstrate that, I think the utilities would come on board. But, there wasn't immediate positive reaction either from the cask vendors or the utilities. But, nonetheless, I think from an overall

perspective, if you step back from a safety perspective, from an operation of a repository perspective, it was the right approach.

ABKOWITZ: Would you advocate at this point in time perhaps the design of a mini TAD, for lack of a better term, that would not require rails, since we didn't have a railroad at that point in time?

FEIGENBAUM: A mini TAD? You'd have to explain that.

ABKOWITZ: Something that could be moved by truck.

FEIGENBAUM: Oh, for fewer assemblies. Yes, well, that's kind of a cost benefit, you know, analysis. Certainly, yes, I think that would be something worth studying. I think we had looked at the differences of cost of doing that. You know, it wasn't the most cost effective solution.

ABKOWITZ: Okay, thank you. Jean, this is one, my question for you, I am really taken by this whole discussion we've been having about scientists and engineers and the eccentricities of each, and whether the twain shall meet, et cetera. How do you over come that? It seems to me that any project of this nature requires an understanding of the science, but at some point, you have to engineer a system. So, how do you manage this process? And, what type of unique skill set is required to see that we end up with a positive outcome?

YOUNKER: This is Jean Younker. That's a very good question, which I must say that we, at various stages of the program, had long talks among our management team trying to do a better job of that.

All I can say is that the awareness that you have such a multi-discipline type of work force, as you had to have on something like Yucca Mountain, you know, with something that as being with all of the different M&Os that DOE had, I can tell you that the management team sat down, and with external consultants helping us, trying to figure out the dynamics of that kind of a work force, you know, my guess is that today, 15, 20 years later now, there's probably a lot better expertise out there that could help you, because there are a lot of other projects now perhaps that have that kind of multi-discipline type of challenge in their management structure. But, we did get help. We still had cases where I guess probably the hardest places to work that interface seemed like it was always also associated with organizational assignments, in that, as you know, throughout the history of the project, we had pieces of the work assigned either to a national laboratory or to a subcontractor, and sometimes those subcontractors just simply didn't have the kind of integration that we needed to have, or the national lab interface with those subcontractors was difficult.

So, I think it all goes back again to the management structure that you have, the talent of the technical managers. I don't know of any other solution, other than to say certainly if I was in that position again, you know, here today, I would seek out the best help I could from organizational experts who help people with multi-discipline teams, like we had for Yucca Mountain.

CERLING: Andy Kadak?

KADAK: Andy Kadak, Board. I'd like to ask Ms. Younker a question. This refers to the site characterization process. If we were to go forward and start looking at another site, you mentioned that you don't need a lot of information to do this. Could you explain that?

YOUNKER: Yeah, and what I tried to say there was not that you don't need a lot of site specific information, but that you can be--we're smart enough now having done this once and done it very thoroughly once, to know the kind of site specific information that we need and what we don't need, I believe, is broad brushed geological characterization of a site. What we need to do is think early on from what we already know about what the total system model will look like, based on the one that we have today, not that we couldn't do it better, I agree with my other panel members that we could certainly approach it differently with a different architecture, we could have a much more efficient

total system model. But, nevertheless, you will in any geologic repository in the future, still need some kind of system model to generate doses releases to the environment.

And, so, what that does, though, is take you back to what did I use from these reams of data that you heard the managers talk about having collected. Well, you know, frankly, an awful lot of that information was nice to have, gave you confidence that there were no ringers, there were no surprises lurking. But, for example, when we drilled 40 or 50 boreholes, when we excavated seven and a half miles of tunnel, you know, did we really have any real geological type surprises. And, I'd have to say not really. We knew what the earth materials were going to look like before we ever drilled those holes or excavated the tunnel. And, I'm exaggerating a little bit for a fact.

So, my point would be, you know, we know that certain disruptive events for whatever site you choose are going to be key. We need to characterize those. We need to get the best handle we can on the information for those. We know we're going to have to bound climate change over the long term for a million year standard, you know, long-term standard. Other than that, I would be very judicious in my choice of site characterization, site specific.

KADAK: If you can go back to when they started looking at the three sites, you know, Death Valley, or no, it was not

Death Valley, Death Smith, or something?

YOUNKER: Death Smith in Texas; right.

KADAK: Someplace in Washington State.

YOUNKER: Right.

KADAK: And, also Yucca Mountain.

YOUNKER: Utah and a bunch of salt domes; right.

KADAK: So, we the characterization process that they carried out at that time adequate to down select to maybe one or two for perhaps more detailed studies, even more limited but detail studies?

YOUNKER: I think it was.

KADAK: It was adequate?

YOUNKER: Adequate.

KADAK: Can I just ask one other question? What are your biggest regrets about this project? If you had something to do over again, like we're apparently going to do, what would you do differently, in your own perspective? And, you can speak freely.

YOUNKER: This is Jean again. What I would say, it would be the management challenge. The sooner you can get the key parts of your organization working together, exchanging information, ensuring that the models in the science area are not making dub assumptions, or even absolutely inappropriate assumptions about engineering, the sooner you find that out, the more time and money you save.

So, I would improve, to the best extent I could, the technical integration.

CERLING: Ali?

MOSLEH: Mosleh, Board. This question is to Russ.

You mentioned in one of your slides, some technical development candidates, revisiting the basis for health and safety standards. Can you elaborate for me?

DYER: Well, let’s look at the history of the health and safety standard that exists now for Yucca Mountain, which is not what originally was proposed by EPA in response to the Nuclear Waste Policy Act. The original health and safety standard was a release-based standard. There was a mandate from Congress to develop a specific standard for Yucca Mountain. We had started forward with the site characterization and the rudimentary parts of the engineering design with a presumption that the original EPA standard was going to be the standard that was needed, or that provided the objectives that needed to be met.

And, then, fairly late in the game, a new standard was put in place, and there was quite a rush to see whether the existing design was consistent with the standard, would meet the standard. If changes need to be made, what were the information needs that needed to be fulfilled? If engineering changes need to be made, what were those changes? So, my desire would be to try to reduce the level of

uncertainty and frustration that you have in the process. I think we had a couple of extra iterative steps introduced by changing the rules halfway through the game.

CERLING: Dave Duquette?

DUQUETTE: Duquette, Board.

Let me preface by telling you that my personal opinion is that eventually we will need a long-term geological repository.

Having said that, the repository that you all were working on was rife with materials problems. And, I've been watching the program long before I was a member of the Board, and I saw materials changes on a regular basis with what the infrastructure was going to be and what kind of materials you would use for the canisters, and so on and so forth.

If the Secretary came to you as a Panel tomorrow and said what should we do about a long-term geological repository, what would you tell him?

DYER: Is that for an individual or for us?

DUQUETTE: That's for either individual or Panel, I'm just curious as to what--we've all talked about the problems about Yucca Mountain. My own feeling is that there was a lack of flexibility in many cases in some of the management schemes. But, assuming that we need a long-term geological repository in the United States, and someone came to you as a Panel, as a group of people, and said you've got lots of

experience with this, you've got lots of experience with management of Yucca Mountain, and so on and so forth, what would you do for a recommendation? Would you say start over again? Would you say reopen the mountain? Would you say that we need a completely different kind of site? What would you tell him?

DYER: Well, I'll start and we'll go down the row here.

DUQUETTE: Okay.

DYER: I remain convinced that an effective repository could be developed at Yucca Mountain. Something that I think is kind of forgotten is that we're looking at a very long-term facility here with a 50 or 100 year life. And, the ideas for design, operational concept, are subject to modification as we learn things. I really had no expectation that the third buy of waste packages that we went through would be the same as the first buy of waste packages. So, my presumption is that we would learn and improve things as we went on.

Having said that, if a program is not afforded support to allow it to be a program, I don't think you ought to waste your time on it.

COLEMAN: I'll come back to my earlier remark about the Navy and defense high-level waste facility, that while we can have issues and questions about the commercial nuclear fuel cycle, such as would it be more advantageous for us to

recycle fuel or not, for at least the Navy fuel and defense high-level waste, there is not a contemplation that I'm aware of of doing anything with those other than taking them to the geological repository. So, I would say we need to get on with that, and that sort of a baby step can help move the total project forward. And, in this particular case, I would urge consideration of Yucca Mountain as at least being on the table as a place to look at. And, I think that, again, that would help generate public confidence if we can begin to move those particular items into a repository. Now, there's challenges with that because, you know, the Navy fuel is the heaviest package, so you've got to have the rail system. But, that would, again, be a way to move things forward, and I think that should be pursued.

FEIGENBAUM: Yeah, let me preface my remarks by saying, first of all, that I believe that Yucca Mountain was a technically adequate site and met all the requirements and regulations, and was fully compliant.

Now, having said that, obviously, we're on a different path now. You know, I would say that when you look at the, you know, the who shot John on this, you know, the lack of state and community support for siting the repository there was clearly a major factor. And, that may have to do with mis-steps early on in terms of communications, a lack of adequate effort to educate the community, and it seems to me

that if you could find a host community that would at least entertain sitting down and negotiating benefits, because there obviously is some negatives and stigma associated with storing the nation's waste, it's a necessary activity, but there are negatives to it, and there should be some positives to it, and I don't think we ever got to the point where the Federal Government was willing to sit down and truly negotiate the upside of, you know, jobs, economic development, even payments to the state and local community.

So, you know, I think that was a mis-step. I think there are probably communities in this country that would be willing to entertain a repository with certain benefits. And, you know, the Federal Government, negotiation requires give and take, and I'm not sure we saw a lot of flexibility there on the Government's part.

And, also, the last thing I would say is that any program in the future ought to be structured in a way that they have long-term capital budgets. I think Jean very eloquently stated it, when you have a program that you're building over 10, 12, 15 years, if you go in for annual assessments, you know, that's a very, very difficult situation and we saw our budgets go up and down, and it created a lot of inefficiencies, extra costs, and our inability to get work done the way we wanted to get it done. And, certainly with the fund that's available for the

building of a repository, it seems to me strange that we weren't able to get that kind of freedom in terms of a long-term capital program.

And, I guess the last thing is to structure an organization that's more independent of election cycles. It just seems to me that, you know, in my experience in the past, not only Yucca Mountain, but sometimes when science runs into politics, politics often trumps, and when you're dealing with hazardous materials like this, long-term safety of the public, it seems to me that some independence from those influences and making decisions based on science, on economics, on public safety, are the most important issues.

So, I think I'll stop now.

YOUNKER: This is Jean Younker. I guess my response would probably carry on pretty much with what has already been said, except to say very explicitly if the decision maker wants a thick unsaturated zone in an arid climate, if they were to go that direction, I can't imagine that there would be anyone who said oh, no, that's a poor way to go from the geologic standpoint for a repository in the future. You know, I agree with Ted, I think that the geologic setting and the information that we gained, the knowledge we gained about it, Yucca Mountain, leads to the conclusion that if you want a geologic repository in this country, that is a perfectly reasonable place to put it. You know, I have huge confidence

in all of you engineers that the engineering challenges are not insurmountable. There are lots of things it sounds like would be a good idea to do, but the question of how you go about selecting a site that would be any better, you know, I can't from a geologist standpoint, I can't imagine a better site, equally good site probably. But, if you want a good geologic site in this country, I don't think you'll find a better one than Yucca Mountain.

GARRICK: Well, this is a technical board, and I'm not surprised that major issues seem to be non-technical. They seem to be budgeting. They seem to be public acceptance. And, they seem to be, and this one does cross over a little bit into the technical arena, effective project integration, effective project management.

And, one of the things that has come out of the discussion has been the importance of site characterization and the Total System Performance Assessment, and I agree with that. They were major efforts. On the other hand, one of the difficulties the Board had in reviewing the Total System Performance Assessment was making the connections between the analyses that were performed, and the supporting evidence.

The most successful probabilistic risk assessment of a nuclear power plant that I ever was involved in, and I was involved in about 70 of them, was when the utility absolutely insisted that the PRA effort be very much an

integral part of the design effort, and we developed a PRA almost every week. And, what happened there is that we made very visible to the design people that in order to be able to demonstrate that this plant has this risk, we've got to have this type of information. And, we didn't see that. Even though the Total System Performance Assessment had many iterations, the iterations did not seem to be driven by that kind of an engine, that kind of an engine being what information do we need to increase our confidence that this performance assessment is, and is that information, the field work that's being done, making a commensurate contribution to that.

So, I think that one of the things in the future, it would seem to me, that would be very beneficial would be to see a much stronger and much more transparent linkage between the performance assessment activities and the site characterization, and that means doing things, as you've already discussed many times, early. That means even the simulation studies, they didn't come early. They came late in the project. They came kind of under pressure, that we needed something like that in order to get a sense for how all the pieces fit together. And, we were frustrated on many fronts simply because what appeared to us at least, and I think there was probably much more than we were privy to, as a lack of a tight cohesive integrated project.

We saw this, for example, in the safety analysis work. It wasn't a Total System Performance Assessment on the total project. It was a Total System Performance Assessment on the post-closure performance. Meanwhile, the safety analysis that went on in connection with the preclosure operations was an entirely different methodology. So, there was no way that we could draw any comparisons, although there was some evidence that the greatest risk was not with the post-closure, but with the preclosure, but the analysis was not sufficiently seamless for us to have high confidence in that kind of conclusion. Entirely different methods of approach. Entirely different teams involved in those two activities.

Another thing that frustrated some of us much more than others, and we haven't heard anything about that today, was that if you took at the Total System Performance Assessment very very carefully, and you ask yourself what is it we're trying to calculate here, and you backtrack that calculation into where it is most influenced, well, very often, at least where I get, is the source term. And, while this project made great strides in analyzing the degradation of the engineered barriers, we made very little strides in the back end of that problem, namely the actual mobilization of the waste.

And, so, I think that the kind of things that we're

talking about here of being able to make much more transparent the things that are important, and I like what you said about that, that we should not be looking at this from a site characterization point as kind of a geological survey, but we should be looking at it from the standpoint of what's important to the performance of the repository. And, I don't think we were always doing it that way. So, I'm hopeful that those kind of lessons are going to be very much a part of the future thought processes.

So, I think that one of the biggest challenges in this whole thing has been the timing of activities and the balancing of scope. For example, on the surface facilities, some of us were very concerned about the design criterion. It wasn't evident what the design criterion, how hard and fast it was. Because the four foot walls and the earthquake design capability that was put into those facilities did not seem to be justified on the basis of any rational criterion. The criteria seemed to be even more severe than a nuclear power plant. And, why? We didn't understand that. And, when we talked to some of the structural engineers that were earthquake engineers, you couldn't see the basis for, the design basis for the surface facilities, which I think is another example of where integration can come into play.

And, I think one of the other things I'd like to make a comment on is that in projects that are under

licensing processes, such as this, there's such an obsession with the safety aspect of the project, that I think the tools and approaches that you normally think of with respect to design optimization just kind of go out the window, and that there is a tendency to just design this thing such that, you know, it gets its license without necessarily due consideration to it throughput capability, or the cost of the facility, or what have you. And, I don't know how you'd deal with that, but I would certainly like to hear any comment on it, because we saw very little what I would call actual design optimization with respect to surface facilities, and even with respect to the acceptance and transport and handling part of the waste.

And, the fact that the TADs was something that was very sensitive to timing of the project and was not necessarily capable of handling the dual purpose canisters, and all of the canisters, was another thing that seemed to indicate that maybe there was not as much tight integration of the technical requirements as there ought to be. So, I would appreciate any comment that people have about the integration issue, about the fact that the site characterization, which is critically important, can be tightly linked to the performance assessment maybe next time we do this. Any of you are free to comment.

DYER: I'll take a shot at the site characterization

comment and leave the hard one to the other guys.

It was before any of your time, but the site characterization plan that was put in place in accordance with the Nuclear Waste Policy Act was essentially an encyclopedia of geologic terms. It was a list of all things that could be studies, and ideas of what we could study at Yucca Mountain. There was not a prioritization that went into it aforehand that said here at the important things. It took us a while to figure out what relative importance of things, and it took us a few years to even develop a tool that gave us some performance assessment input to that.

But, in the early days, the concept of site characterization was pretty much, well, what can we find out, and we employed a lot of people for a long time finding out things that I think in the grand scheme of things, didn't contribute that much to the understanding of what was important to the safety of the system.

FEIGENBAUM: John, let me just make a comment regarding the surface facility design.

Certainly, we didn't want to be right and optimize, but not be able to get a license at the end of the day. And, the regulations for the preclosure, or the regulations for the facility did not really, as you well know, did not really distinguish a break point so that the mountain post-closure case would be based on a probabilistic approach, whereas the

surface facilities could be a more mechanistic design.

It seemed to me during my time at Yucca Mountain that the surface facilities that were going to operate 50, 60 years, like a regular operating commercial power plant, could have safely been designed to existing standards. But, we were not, in our view, in our interpretation of the regulations, not able to take that approach, and that we did have to consider, for example, low probability, high impact earthquakes over the operating period. And, that led to some inefficiencies in the design, and over design, as you've characterized it, but at the end of the day, we didn't sense the flexibility to be able to make changes unilaterally, certainly working with the NRC, we were not able to sense that we were going to be able to distinguish post-closure from preclosure work in terms of the design and the facility. So, we took what we thought was a conservative and safer approach overall in terms of our overall objective, which was to get this facility licensed.

YOUNKER: This is Jean again. The only thing I can add to what Russ said from kind of the site characterization side of performance assessment is that, as I tried to say in my talking points, we know enough now that, in my view at least, any potential site that you would choose to move forward as a repository, prospective repository, we know enough now about what is going to be important given the kind of system models

that we've developed, you just don't have to go back through a lot of that early, from as Russ said, site screening. You know, there were early siting criteria we had to follow, early criteria that were kind of stand-ins for the final type of standards that we finally had, that required you to in fact gather a lot of that broader site characterization data.

But, in the end, when you look at what matters in the abstraction models that build the total system performance model that is now used, you know, a lot of that information you really didn't need the level of detail that we paid to gather. And, so, we should be able to benefit from that. And, another site, you know, the geological information about any site you would potentially look at in this country, I believe is such that you should be able to skip over an awful lot of that and use the system model that's already existing, and fine tune it to the best knowledge you have about that site, and then drive your testing laboratory and field directly from that. I would just tie the two together, as you said.

GARRICK: One question I did want to ask, as you know very well, a lot of the countries that are engaged in trying to develop a repository have moved in the direction of underground laboratories. Is there anything we should be doing along those lines while we're trying to decide what to do? Is there any merit in having an underground laboratory

unless, as Russ points out, you're talking about a specific site? Is there anything we could learn from having some sort of making maybe use of the Yucca Mountain site, or another place to conduct studies so that we, this time around, become very focused on what we need? Is there an R&D program that we should be undertaking?

COLEMAN: Well, I think we need to continue to look at I want to call it dry storage systems for spent nuclear fuel. Coming back to your earlier question about the TSPA and integration, I believe that there's still a huge amount of conservatism in the way that's addressed for Yucca Mountain, and if that cued over to a future repository, that's an area that we needed to develop better modeling, because the scenarios where the fuel on the inside of the package just essentially disappears and you get into all of these criticality events, and that drives you to do other things. Those are, in my opinion, very unnecessary conservatisms.

And, we need to develop, do more studies on the behavior of the materials in those environments to be able to develop more confidence that we can adequately predict what's really going to happen, rather than doing what I would call making a simplifying assumption that allows you to produce a result, but that result is then a conservatism that drives you to, for example, not be able to use the containers that the fuel was stored in currently, because you don't have

enough burnable absorber in there to handle the criticality requirements for the repository. So, I think there are things we definitely need to be studying.

GARRICK: I'm also thinking of, as a result of the project, and other people's projects, we have a pretty good handle on what radionuclides tend to drive the performance of the repository.

I remember early in the Yucca Mountain project, how much uncertainty there was about the solubilities and the concentration limits of particular radionuclides that were ending up being very important contributors to risk, like neptunium. And, for a while, we were just making an assumption. It just seems to me that we have learned to much about the nuclear side of a repository, that we could probably enhance our analysis capability greatly by improving the way in which those particular radionuclides are modeled and expected to behave in different media. That's kind of a nuclear element of the problem, but it's a big part of the problem.

ARNOLD: I wanted to tie right onto that, if I could.

CERLING: Okay. But, then, we need to move onto, because we've got Henry and John and George and Bill. So, let's not make them--

ARNOLD: All right. Arnold, Board.

I just wanted to tack onto what Tom said. The

behavior of the fuel itself has been overly simplified to a great extent, and I think some work could be done on that quite usefully.

CERLING: We've got to move on to Henry.

PETROSKI: Petroski. I was very pleased to hear an acknowledgement that this really should have been an engineering project from the beginning, or at least that's what I heard in response to Howard's question. But, then I heard a resignation that, well, it wasn't, it was a science project from the beginning. And, then, Jean, you made some comments about the difficulty of managing a multi-disciplinary team, as you put it, which I interpreted as meaning scientists and engineers working together.

Could you elaborate on that a little bit? Because, it seems to me that this is a problem that is going to be faced going ahead. A new project would have to deal with multi-disciplinary teams, and if there's something fundamental that makes it so difficult to work with them.

YOUNKER: This is Jean. I don't know that there's anything fundamental, but I do think there's an overlay in the management construct that we generally used within the Yucca Mountain Project that probably made it a little harder, and that has to do with the fact that we always had multiple subcontractors, as well as multiple national laboratories, as well as USGS, all working together gathering data, doing

analyses, you know, all contributing to the forward motion as it was during site characterization and during the analysis phase. So, I don't have an easy answer for it.

Obviously, you know, if you had a situation where you had a single project organization that at least the key staff members, technical and engineering, scientific and engineering staff members all wore the same hat, and by that, I mean worked for the same company, or worked for the same organization in some manner, such that the lines of management were clear, such that the lines of responsibility were clear, you know, in many cases, I'll have to say that although my job was really to get the science and engineering work done and to get a product out, I had to do that by coordination, not by direct management. Because my responsibility for the technical work many times, if you read my job description, it was coordination. I didn't directly technically manage the work. And, I think that's a very challenging way to get a job done, and inefficient, frankly.

So, my answer would be, you know, construct the organization differently. Have at least the key technical, scientific and engineering staff employed by the same organization, with clear lines of management and responsibility all tied together, and I believe that that would address at least some of the issues that we're talking about here.

PETROSKI: You alluded to a situation where there was some scientific work done that was incompatible, as I took it, with some engineering knowledge or assumptions. Could you elaborate on that, or reference that, or in some way give me a better idea?

YOUNKER: Sure. Well, one of the areas, I'll give you the best example, or the one that comes to mind easiest, is as we were in the early days of wondering what effect the repository thermal load would have on the environment, one of the things that we did was, you know, fairly detailed modeling of what would happen to the water that was held in the pore spaces of the unsaturated rock as the rock went above boiling. And, so, where would the water go, was the question. We had several different modeling teams addressing that question.

Well, it turns out that the assumptions that you make about what kind of flow can occur down the drifts versus into and out of the rock, and flow of water vapor and air is very important to that answer that you get. And, so, if you were to make an assumption, for example, that you had air-tight bulkheads, such that you couldn't have any flow of moisture down the repository drifts, you would get a very different answer than if you had in an open system. And, basically, we had some assumptions built in that we had air-tight bulkheads that would not allow the moisture-laden air

to move down and out, those flow paths, in fact, would drive it into the rock, so we ended up with lakes created about the repository openings where saturated zones developed up there, small saturated zones, which then, when we looked through the thermal phase and cooled off that water we had to worry about, where did that water go. Well, of course, it was going to rain back down on you through the fractures into the repository environment.

It turns out that for the most part, not entirely, but for the most part, that was a modeling artifact. Those kinds of perched water zones due to the thermal energy just wouldn't develop, at least not on a large scale, like our model showed at one phase of the program.

PETROSKI: It seems to me that that's a very important kind of lesson learned. It really should be somehow archived.

YOUNKER: Absolutely.

PETROSKI: Thank you.

CERLING: Ron?

LATANISION: Actually, Jean just addressed the question I was going to ask, so I can pass, Mr. Moderator, and give you some time.

CERLING: Well, good. Hurry up or you'll get a reputation like mine. George and Bill Murphy.

HORNBERGER: I will try to hold to that, Mr. Moderator.

My question is actually for Jean. I think it's in my experience a bit unusual to have an earth scientist suggest that what we really needed to do was exercise models to figure out how a potential waste site might behave. I was also struck by the fact that not too many people I know who would say that going underground didn't really lead to any surprises. Am I interpreting you correctly that the cross-drift, the experience that we gained underground at Yucca Mountain was really modest, that there weren't any surprises?

YOUNKER: I think I took that position to make a point. Certainly, we gained some confidence about the structure of the earth materials as we did the excavations and as we did the surface drilling program. But, from the standpoint of, you know, take a panel of expert geologists, field geologists who had done work in that part of the arid southwest, based on the range province, my guess is that we could have sat down with that panel and put the parameters down that we needed to build most of the process models that would have to do with the ambient conditions in Yucca Mountain, with, what, 10 percent of the work that we did, I mean, a very small amount of site specific data, I believe would give you adequate knowledge, adequate input to put the kinds of in situ conditions together that serve as a basis for feeding the total system model.

And, I'm not saying that you didn't gain a lot by

the excavation and by the cross-drift and the five mile tunnel, but, you know, from the standpoint of did we have, you know, did we find the sleeping Aztec princess, as someone on the Board used to talk about, you know, it simply wasn't the kind of exploration where we had surprises that were at the level where you want oh, my God, you know, that is something we really didn't anticipate. We had predicted what we would find, and we pretty well found it.

HORNBERGER: And, if an expert panel originally had suggested that the percolation rate would be one millimeter per year or less, that would have been just fine?

YOUNKER: We had expert panels who said, as you probably know, who suggested they were all the way from a tenth of a millimeter to 40 millimeters a year.

DYER: Let me add something to that, because I think one of the things that we gained by not just the ESF, but 450 boreholes out there, and a whole lot of work, was a high degree of confidence in the models that we came up with. And, experts might come up with models, but they'll feel better about the models if they have some data that supports the ideas.

CERLING: Bill?

MURPHY: This is Bill Murphy.

First of all, I'd like to say that it's a real privilege of our Board to have the four of you here. You've

contributed a lot and we've benefited a lot, and we could go on all day I think with questions for you. So, thank you very much for your participation here.

And, I'd like to ask a technical question actually. Tom, you said that one of the things we ended up knowing very well was the characteristics of the near field. And, I have a different impression. I have a sense that we had a very poor, we still have a very poor understanding of the chemistry of the near field environment. And, as an illustration of that, one simply has to look at the solubilities that are used in TSPA that range over many orders of magnitude, and are based on water chemistry characteristics that vary over such a huge range of potential values that some of them can't even be modeled with EQ3. It's almost unconstrained.

And, if one wanted to select a single parameter that's essential to performance, it would be solubilities, and they were almost completely unconstrained in the end. So, I'd like to comment on that.

And, one other example that I'd like to raise, and this is in the case of surprises in the ESF. Another essential problem at Yucca Mountain was the question of fracture flow, and we never solved the Chlorine 36 problem. That was a huge surprise underground, and it was never resolved by the project. Now, maybe I'm wrong about these

things. I'd like your comments.

COLEMAN: Well, perhaps I misspoke, but again, I believe what I was talking about is the techniques and methods for investigating near field environments would benefit another future repository. It was not a comment about the accuracy of the models associated with Yucca Mountain, but the phenomenon, the chemical environment, the water, the amount of water, how it moves, the heat loads, and whatever media it's embedded in, that we should be able to use the techniques and methods from Yucca Mountain to help us improve our understanding of other potential locations. So, it, again, was not a comment about the accuracy of the specific models for Yucca Mountain.

And, I think Jean talked about this a little bit earlier. It all comes back to do you really understand the environment and the bounds of that environment, and if you really do, then you can make a better selection of what materials you really need to be using in that application.

YOUNKER: Bill, I certainly agree with you completely, and I think I tried to make that point on one of my slides, that it seemed to me that one of our biggest challenges was when we faced the fact that the environmental conditions during the repository-induced heating, chemistry episode, you know, were so unconstrained that, and that when we had the waste package peer review panel members telling us we can't

help you very much with material performance if you can't help us very much with the constraints on the chemistry of the environment and the moisture content. So, your point is well taken.

You know, to go another level of sophistication and put more reality in, take out some of the conservatism, you know, not just waste form to solution, but cladding performance, you know, I'm sure there's a lot to be gained there. Do you need to do it would be the question that I ask going back to the Chairman's comments. A risk informed approach, you know, I would look at it how much would I gain by doing that, you know, how much would that benefit me in terms of my confidence in my dose results. You know, that's how I would address it if I was going forward.

CERLING: I think we'll, in the interest of trying to keep this meeting on time, we'll take a break and resume in about 15 minutes. And, I thank you for your comments.

(Whereupon, a brief recess was taken.)

GARRICK: Take your seats, please.

The next Panel is in the able hands of Board Member George Hornberger. I'll turn it over to George now.

HORNBERGER: Thank you, John.

We have another great Panel here today to address some of the issues having to do with--I can't remember what we titled this, but basically it's the government

perspective, local and state governments, the people who have been engaged with Yucca Mountain primarily within the State of Nevada.

And, again, we set several questions that the Board was interested in. Let me see if I have the right order here. Steve Frishman is on the left. Steve is a Nuclear Waste program consultant. He, from 1987 until 2008, he served as Technical Policy Coordinator for the Nevada Agency for Nuclear Projects, overseeing Yucca Mountain.

Abigail Johnson has been the Nuclear Waste Advisor for Eureka County, Nevada since 1993. Irene Navis has been with AICP, she's with AICP. She was recently appointed Clark County's director of Emergency Management and Homeland Security. And, before that, she was a planning manager with the Clark County, Nevada Department of Comprehensive Planning. We have Connie Simkins. She currently works for Lincoln County Commissioners as Coordinator of Nuclear Oversight Program for Yucca Mountain. And, Joe Ziegler is a nuclear engineer who began his career with TVA, the nuclear power program, and he's had nuclear licensing management positions from 1975 to 1990, and he's with NUS Corporation, and I'd better stop here, or I will use all the time.

So, as you can tell, it's an excellent Panel we have. We did pose the following questions. As our Chairman is fond of pointing out, we are a technical Board, and so the

Panelists have been asked to address the following questions.

How has oversight performed by affected units of government in Nevada influenced technical decisions related to nuclear waste management and disposal?

2. What factors increased the effectiveness of the technical oversight? Conversely, what factors might have reduced the effectiveness of the oversight?

And, finally, how does the performance of technical oversight affect the confidence of units of local government and the public in the validity of the technical process?

And, I believe we're going to go from left to right, so, Steve, you can start for us, please.

FRISHMAN: Thank you. I'd like to start out by thanking the organizers of this meeting for having a very unique perspective. Who would have ever thought I'd be sitting in Russ Dyer's seat?

Ten minutes is a really short time to distill what for me has been almost three decades of oversight of this program from the State perspective. I am very pleased to see that you'd set aside about an hour for productive Q and A and discussion afterwards, and I will try to be brief here and maybe set you up for some things that you'd like to ask and discuss. As always, it's a real pleasure to participate in your meetings, and I'll mention a little bit more about that later on.

I know that you're interested in the technical aspects of oversight. But, you have to make one recognition, and that's that oversight is an institutional issue. It's an institutional issue in a formal way because it was established under Section 116 Nuclear Waste Policy Act. And, I have provided a couple sort of general information pieces. One of them is the mission and purpose of the Nevada Agency for Nuclear Projects. And, if you look at that side by side with the provisions of 116 for oversight, you will see that it largely coincides. So, we set up an agency in 1985 to carry out Section 116 of the Act as regards oversight.

I've also included a hand-out that's a page out of DOE's Summary of Program Financial and Budget Information as of January of this year. It shows a page that indicates financial assistance and funding for the State of Nevada and for the Yucca Mountain Affected Units of Local Government since 1983. I did this because it points out a few things about oversight, and also finally, I think it contains an important message. First, you have to remember that this is a 27 year period, a long time. Second, the $527 million total represents only about 5 percent of the approximately $11 billion that the government spent on Yucca Mountain.

Third, the actual oversight under the Act and the items that are considered oversight under Section 116 accounts for only about 40 percent of that $527 million.

This is roughly 2 percent of the total expenditure of the Waste Fund and DOE Appropriations for oversight of Yucca Mountain. So, just trying to put it in perspective. Fourth, while this funding break-out is information, the fact that it's included as the one page of additional information in that DOE's otherwise straightforward budget and financial summary indicates, to me anyway, the pervasive mind set about oversight that DOE has had throughout the years.

Many examples show that DOE viewed oversight as a gratuitous action on their part, where but for their largess, they would not have to deal with this annoying buzzing fly around their head. And, apparently, also feeling that it distracted from the importance of their work. Their approach was one of control and micro-management aimed to stifle legitimate participation, despite the clear mandate in the Act. And, this has been a rub ever since day one under the Nuclear Waste Policy Act.

Just a couple quick examples, not to belabor it. One, years ago, I was director of the Texas oversight program, and at one point in negotiating the budget grant for the entire state oversight program, I was faced with a panel of so-called technical people at the Forrestal Building wanting me to, in a miniscule way, justify every bit of independent oversight that we wanted to carry out, meaning independent work that we planned to do. And, my total

proposal was for about $600,000 for the entire program.

Well, when it turned out was that their intent and their purpose in that meeting was to make sure that essentially we undertook no independent oversight activities. We were supposed to be good and review their work and not ask any further questions that we ourselves could carry out investigations to try to get to the bottom of.

Another probably more serious in terms of the action that was taken was at one point, Nevada had to seek and ultimately get a judicial review and relief to undertake oversight investigations that were not deemed appropriate by DOE. What appropriate meant was that they were not coincident with work that DOE itself was investigating. So, this is the world that we lived in, and I think there's a message there that you should probably pay close attention to, and that's that you can't ignore that oversight must be institutionalized, but the entire institution must recognize it.

Now, to your questions. The first one you can read the question off your agenda, so I don't need to repeat it. Despite the hundreds of technical reports and comments produced by Nevada and submitted to DOE, I'm not aware that any had a direct influence on DOE technical decisions about Yucca Mountain. In our thousand pages of comments on the site characterization plan, which DOE simply nit picked and

belittled, we made a case for there being fast pathways and fracture flow domination in the unsaturated zone, that it was vastly different from DOE's model at the time. It was primarily a forest flow model.

DOE ignored, and at one point in the early 90's, actually said at a meeting with Nuclear Regulatory Commission, said that if fracture flow dominates, we don't have a site. Only in 1995 after the Chlorine 36 issue emerged, did DOE realize the significance of fracture flow, but still persists in its license application today in trying to minimize its importance while recognizing it through a designed reliance on engineered barriers rather than a reliance on a site itself to isolate waste.

The second question, from the State's perspective, our oversight was greatly enhanced by being able to actively participate in meetings of this Board, technical exchanges between DOE and NRC, and meetings of the NRC advisory committee on nuclear waste. Absent the ability to have consistent communication with DOE on technical issues, these meetings allowed us to hear DOE's view on the progress of its work, ask questions and have serious discussion of alternative views on technical issues.

In the time between the site recommendation and the license application, there was virtually an embargo on every bit of new DOE work. And, almost everything that went in the

license application was different from what we saw in the site recommendation. So, we were operating very much on our own in that period of time, other than what we could glean from what little this Board and other independent panels were able to get out of them. And, this was essentially a legal embargo. They didn't want to show their hand in their license application, and it greatly affected our ability to oversee the program.

Third, in the case of Yucca Mountain, because of DOE's obvious efforts to make it work by any means, the federal agent and the federal agencies are rewriting regulations, guidelines and standards to make the site work, there is no confidence in the technical process. And, I think this has been recognized pretty well over time.

Finally, the oversight throughout this long period of time has been an evolving process for Nevada and the local governments. In effect, its true value was to prepare us for an unprecedented contest of the DOE's license in EIS, because prior to that event, DOE held itself unaccountable to us, and, in fact, did whatever it could to diminish our having any meaningful role.

Now, I noticed that in Jean's presentation, and she knew a certain piece of that would irk me a little bit, and it did, I noticed in Jean's presentation, she talked about peer review and oversight. And, was I totally meaningless to

the program in hundreds and hundreds of reports? She only mentioned oversight by the other Board. She never mentioned the oversight that went on through the state and local governments, when I'm sure there must have been some value there for them at some point. It's just that that's back to the mind set that I pointed out. It really didn't matter. And, in terms for us, we had to use opportunities that we could, and I didn't realize this until fairly recently, how important that was that we were able to actively participate in these other areas, where DOE was essentially required to perform, and boards under their makeup were essentially required to give some deference to the public, because in this case, we were operating as the public.

So, I think there's some lessons to be learned if you're going to continue to value oversight, and it needs an overhaul, both probably in its mechanics and an overhaul in the mind set of all of those who have to be involved in it.

Thanks.

JOHNSON: My name is Abby Johnson. I'm the Nuclear Waste Advisor for Eureka County, Nevada. I've been doing that for about 15 years. I've been involved in the nuclear waste issue personally or professionally, or both, since 1983 when I went to the Guideline Hearings in Salt Lake City.

Eureka County's oversight program has involved primarily transportation and emergency management because

we're north of Nye County, and that's the impacts we primarily have. But, we've also cared a lot about overall impacts to the County, to the State of Nevada, and we have been a full participant in the variety of meetings, yours, EPA, DOE, NRC. We have concentrated on a public information program. I've been doing a newsletter since 1993, and have the popular website, yuccamountain.org, thanks to its name primarily.

First of all, I'd like to talk about oversight. I think oversight should not be categorized into technical and non-technical. As we've already heard today from our first panel, many of the major challenges have been institutional rather than technical--management, policies, systems issues. However, those essentials have received far less recognition and attention from this Board, although there have been exceptions to that, from Congress, from other agencies, and from DOE itself.

Did AULG oversight influence technical decisions? Well, yes and no. The AULG sponsored, believe it or not, a multi-purpose canister workshop in 1995 to bring attention to that concept. Then, it went away. I don't know where it went, and then it sort of kind of resurfaced as the TAD, or as we heard today, perhaps the TADpole, a little TAD.

Nye County sponsored, I remember a long time ago, an atmospheric pathways seminar to bring to the attention of

the local governments that very important essential issue. From Eureka County's point of view, we were able to use our oversight funds to do a couple of things that DOE did not do.

In preparation for the Yucca Mountain draft EIS in the late Nineties, we analyzed, first of all, what the rail line would look like, because DOE didn't provide that analysis. And, then, we looked at where the rail line would go in the northern part of our County, the Carlin route, and discovered major land use conflicts with private property. We have a sort of dream in the desert development where there is like many, many, many individual property owners. We believe that that work that we did, which ultimately informed the EIS process, resulted in the Carlin route being considered less favorably than other routes.

But, in order for the AULGs to have influence in oversight, the project proponent has to be open to ideas. I think Steve touched on this a little bit. The NEPA process was one way for the AULGs to understand DOE's project to provide input and involve citizens. But, DOE did not allow any local government or the State of Nevada to be a NEPA cooperating agency for the Yucca Mountain EIS, they later did for the supplemental, resulting in inaccurate and outdated baseline data and inadequate impact analysis.

Was oversight effective? I'm not going to belabor the funding issues. I'm just going to focus on a couple of

things. When the AULGs collaborated on an issue or project, I think the results were considered more seriously on the one hand, but then less effective. AULG oversight of transportation was a challenge because DOE minimized and marginalized the transportation issue.

Was there confidence in the validity of the technical process? The AULGs are on the front lines in our counties to explain what's going on with the Yucca Mountain project. We must explain complex technical information to the local public. When there's better oversight, there's better information. When there's better information, there's better understanding, and that benefits everybody. I think that direct participation in studies and drilling may have increase confidence of that particular county, but not of the AULGs overall.

The technical process, though, must be valid to have confidence in it. And, we have questioned the validity of the technical process all along. When Congress enacted the Screw Nevada bill in 1987, then there was no site to compare Yucca Mountain to, and equity was abandoned. When DOE changed its siting guidelines in 2001, because it realized it couldn't meet the guidelines, that called into question the technical validity of the process.

DOE's own studies reveal that Yucca Mountain is not what was assumed or advertised. It's wet not dry, young

volcanoes, multiple earthquake faults, and the mountain won't contain the waste. Safety now depends on special canisters and titanium drip shield carports to contain the waste. Take this set of facts, and instead of Nevada, substitute Vermont or Maine or Wisconsin, or wherever you live, would the government be able to continue with the project in those states? No, they wouldn't.

So, what's missing? Respect for Nevada and Nevadans. Common sense. And, in our view, no room for dissent in DOE's "Getting to Yes" management style. Scientific findings that identified flaws in the site were forwarded to management for policy and public relations spin. There was never anything wrong with the site that could be acknowledged.

So, to conclude, AULG oversight and AUG oversight, the State as well, is essential for a large controversial technical project such as a repository. Oversight enabled local governments to participate in the process, raise concerns and questions with decision makers, educate the public and occasionally be part of the constructive process. Oversight efforts would be more effective if DOE had been consistently supportive of funding and oversight activities, and local and state government oversight must be consistently and adequately funded, but not by the proponent.

That concludes my remarks, except I do want to

thank the Board for listening to me in Idaho, and it does show that one person can make a difference, albeit it small.

NAVIS: Thank you. I'd like to thank the Technical Review Board for inviting us here today. It's always a pleasure to appear before you and contribute to this process.

First of all, I'm going to cover the Clark County context without being too repetitive to the other two speakers, trying to give you our own unique perspective. I'll talk about oversight in a brief snapshot way. It's hard to distill almost 30 years of work into a brief period of time, but I'll just give you the highlights. I'll talk about influence over technical decisions, effectiveness of our oversight program, and what I think are some key links between oversight and increased confidence.

I've been involved in this program for nine years, but aware of it since I moved to Las Vegas in 1987 and became a Clark County employee, about two weeks before the passage of the Nuclear Waste Policy Act.

Clark County is about 8,000 square miles in size, and it's about the size of the state of New Jersey, and we have a unique mix of urban and rural community. We are the population center for the State of Nevada at about 2 million people. Contrast that population today with the 680,000 in population in 1987 when this program first started. And, we have about 40 million annual visitors, mostly coming through

the sixth busiest airport in the country.

The elected officials of Clark County, and throughout most of the State, have been opposed to Yucca Mountain since 1985, and certainly starting in 1987 with the Amendments to the Nuclear Waste Policy Act. The majority of Clark County residents have also been consistently opposed to the project, which is why our elected officials have not changed their focus or their position.

The areas of focus for Clark County's oversight have been in the arena of socioeconomic impacts, looking at property values, impacts to tourism, public safety, as well as environmental justice and community sustainability issues. In terms of environmental, we've looked at species, air, water, public health, issues covered by NEPA in general. And, also, from a technical and scientific standpoint, repository performance, short-term and long-term, in terms of hydrogeology and volcanism.

Transportation arena, both rail and truck, we have major freeway systems coming through Clark County, as well as the Union Pacific Railroad, which would be major thoroughfares for transporting nuclear materials. The safety and security and impact assessment and planning were our main focus, with attention paid to specific rail and truck routes, as well as how that integrates with emergency management and public safety concerns.

In terms of our approach to oversight, we have always been striving to provide an independent and balanced approach to our oversight program, with focus on the methodologies, tools, and the credibility and validation of our results. We wanted to make sure that we created tools and techniques that could be replicated by other communities as well.

In terms of some specific results and findings, we were able to demonstrate stigma-related socioeconomic impacts. We were able to demonstrate significant public safety impacts, especially in terms of first responder preparedness. We were able to demonstrate a long-term repository performance, especially in terms of impacts, the impacts of volcanic activity and the probability and likelihood of those. 14 of the 16 contentions that we put forward in the licensing proceeding were accepted by the Construction Authorization Board.

In addition, we developed some pretty robust GIS tools, some methodologies for assessing public safety impacts that are unique to I think anywhere else in the country. I don’t think anyone else has applied the methodology that we have. We also have developed a set of indicators for measuring public safety impacts, and some studies such as commodity flow studies of hazardous materials through Clark County, rail vulnerability assessments, and a report on state

laws related to transportation that no other county has, to our knowledge.

In terms of influence over technical decisions, I'm going to cover the decision-making aspect, especially in the arena of federal agencies, some changes to regulations and technical reports that we believe we had influence over, and the ability to provide input to other bodies, for example, the Technical Review Board, the National Academies, GAO, and the ACNW.

First, I'd like to acknowledge that the most important aspect of the culmination of our two and a half decades, almost three decades of work is the ultimate acceptance of most of our contentions in the licensing proceeding. Next after that would be the influence that we had through our technical review and comments, and the ability to make presentations and participate in public comments before various venues. And, we also feel that we had significant input and some influence over the studies conducted over the years by the GAO with respect to this program, as well as the National Academies, in particular, the "Going the Distance" report that was issued by the National Academies several years ago.

Another specific example where we had influence is in the draft EIS for the repository. DOE did not acknowledge any negative socioeconomic impacts of any great note. By the

time they got to the final EIS with input from us and several other stakeholders, they did acknowledge the presence of stigma-related property value and impacts. So, we felt we made quite a difference there.

Another specific place we had influence is the EPA radiation standard, and the changes that were made there, comments that we put forward for Section 180(c) of the Nuclear Waste Policy Act relating to training and technical assistance for first responders. And, also, the quality assurance program. The GAO spent 22 years providing reports and criticism of the DOE's quality assurance program, and ultimately once the license support network became available and those flaws were revealed, we believe that the increased scrutiny from the public, from the affected units of government, as well as from members of Congress, resulted in an improved QA program for the DOE.

I think most importantly--well, and one more is the NRC's waste confidence rule. We believe that our comments had some influence over the ultimate rule that was most recently issued by the NRC with respect to waste confidence.

I think most importantly, we influenced the approach to stakeholder input, how decisions were made in terms of convincing federal agencies to be more open and inclusive with stakeholders, and holding more meaningful public meetings and paying closer attention to those public

comments.

I believe there were some positive effectiveness of oversight in terms of public and political support for Clark County's position and approach. 70 percent opposition consistently for over 20 years from the public is something that elected officials pay attention to. We also, even though the Board of County Commissioners was officially against the repository for all of these years, regardless of the makeup of the Board, they were also in support of our approach to balanced and independent oversight.

We also want to acknowledge the validation by other groups with similar independent technical findings. We want to recognize and respect the importance for and acceptance of high quality work by technical experts, and how important it is to have adequate federal funding to support oversight. And, I'll talk about the converse of that in just a moment.

We also believe we were successful in leveraging the funding that we did receive and extending the usefulness and replicability of these tools and techniques that we developed, so that it could be used for other purposes or by other entities. We believe that our contributions have been recognized in various venues, like the Waste Management Conference, the International High-Level Radioactive Waste Conference, IAEA, and the West Institute of Technology in the UK. We also received recognition and had interactions with

folks from other countries interested in how we approached oversight, and how we approached public engagement in particular.

Some things on the more negative side of the effectiveness. One of the major problems that you've heard about already today by various speakers is the inconsistency and timeliness of funding, both through the Congressional Appropriations process and also in the timeliness of the pass-through from DOE that we were subject to. You've heard already about DOE's program level micromanagement. One of the problems is that DOE tied the release of our funding with the review of our work plans, and we actually ultimately had to go to Appropriations language, which was required to address this potential conflict of interest, especially as we approached the licensing phase.

We also looked at DOE's approach to considering alternative analysis methodologies and findings as an impediment, and we found in many instances attempts to discredit the affected units' work, as well as our own experts. We also feel like a major problem was the constant programmatic and political uncertainty encountered by this program in terms of funding policies, legal actions that cropped up from time to time, and the progress and timing of program deliverables.

We believe there are three key links between

oversight and increased confidence, and you see them there. It's very important to have independent research, analysis, and monitoring and reporting, which increases public confidence. Peer-review of technical studies is extraordinarily important. Bringing together respected experts, whose studies are peer-reviewed, is the way to engender the highest level of confidence.

And, the most important point I think in that linkage between oversight and confidence is being able to translate those technical studies for lay audiences in order to foster that public support and confidence. And, in fact, Clark County has won several awards for public outreach efforts, which to us is an indicator of our success in that area.

Finally, in conclusion, the Yucca Mountain project provides valuable insights for current and future generations of technical experts. The Nevada experience provides instruction and guidance for government, for academics, scientists, technical experts, as well as the public.

And, finally, I'd just like to say that the body of work accumulated over nearly three decades should be retained and protected. Questions remain on how to protect and maintain the license support network body of work, should we continue it or not, and if so, who should? How do we incorporate or provide lessons learned for future efforts to

manage nuclear waste and spent nuclear fuel? Clark County is undertaking a lessons learned and best practices project, both video and book form, which will be completed by mid-2011 so that we can pass that on to either folks who come behind us who may have to deal with this issue, or that we can share with other communities and other countries, as well as technical oversight boards for their use.

Thank you for your time.

SIMKINS: Thank you, Chairman Garrick and Board Members for this opportunity. I'm Connie Simkins, the Coordinator of the Nuclear Waste Oversight Program in Lincoln County, a rural frontier county of approximately 4,600 residents that covers 10,600 square miles. 100 of those miles are proposed to be covered by the Yucca Mountain Railroad.

It's nice to be the fourth in line, because the three previous speakers have made a lot of the points much better than I could. They've talked about funding and they've talked about the start-stop motion of studies and the change in politics, and those things are all very important.

We have used our oversight funding to do approximately 85 studies on a number of different issues. We have prepared well thought-out comments because of these studies, and submitted them to DOE and a number of different venues. Despite this rigorous effort by Lincoln County and the City of Caliente, little of this information has found

its way into the DOE's plans and assessments of impacts.

Of course, transportation is our big issue. The railroad, as I've said, will cross our county. There are six valleys in Lincoln County that the railroad will leave the City of Caliente, the main Union Pacific Railroad line in the City of Caliente and move ten miles north through little valley, crossing 83 private property owners that will have their pieces of property split in half by the proposed railroad. This is a huge impact that was almost totally ignored by the DOE in their Environmental Impact Statement. They felt like they would make an offer to the landowners for the land physically underneath the 200 foot right-of-way, and everything else was of very little or no consequence.

One positive example of how we have provided input is we took a look at the proposed route of the railroad across our valleys. It will go across six valleys in Lincoln County before going into the northern part of Nye County, and then around into Esmeralda County and back into Nye County into Yucca Mountain. And, the comments that we made, we felt had a positive influence on where the labor camps would be best located, the wells, supply pits, staging sites in an attempt to reduce the impact to our local landowners and public land users. Even though DOE has asked for local inputs, and they have been extensively provided, the Yucca Mountain Project has remained somewhat inflexible, with

little use of lessons learned.

One example I would site, a specific example, is Lincoln County's recommendation to DOE to use a mixture of plant seeds, both native and non-native, when revegetating the area that's disturbed in the building of the railroad. Well, the DOE said well, we'll do what BLM tells us in the right-of-way stipulations. We went to BLM, and they said oh, we can't change our stipulations. We'll use the same ones we use with every single right-of-way. Even though our recommendation was based on technical range science that promotes this specific mixture to assure early establishment of the non-native plants, which would act as a cover crop for the native plants, both those things are very important, the native and the non-native. The non-native would help the native get started better, provide fire resistance, retard invasion of noxious weeds and non-palatable plants, such as tamarisk, halogeton, and cheatgrass, even though our suggestion is quicker, cheaper and works better, according to science.

We're also the site of the dreaded downwind from the above-ground tests that took place in the Fifties and Sixties on the Nevada Test Site, and we have tried our best to get the Department of Energy to look at the cumulative impacts of these downwind tests, added to the impacts that will come, especially with the transportation issues, to our

citizens in our County. They have failed to provide adequate consideration of these cumulative exposures.

And, secondly, we were asked to talk about increased and decreased effectiveness. The other speakers have talked about how well the AULGs work together. Sometimes we have differences of opinion, but we have been able to be successful in sharing information. It's been very helpful to Lincoln County to have Nye County have a person working right in the DOE/Yucca Mountain Office, and it's been helpful to be part of these meetings with the planners, the scientists, the engineers, and the attorneys.

Something that has been spoken about that decreases the effectiveness of oversight of course are politics, change of administrations, the turnover of the decision-makers, the uncertainty of the funding, it's made it very difficult to design an effective and continuous oversight program. DOE plans have failed to recognize and plan mitigations for this divisiveness. For example, Lincoln County has never taken, or the City of Caliente, has never taken a position for or against the Yucca Mountain Project. Our position is if the best efforts of the State of Nevada to stop this project are not successful, it is our duty to be well prepared for the project if it's coming. And, this has put us in a somewhat alienated position from other political and government entities.

For instance, after making a recommendation to DOE for the establishment of a rail to truck intermodal facility 20 miles from town, the Nevada AG's office thought that this was inviting nuclear waste into Nevada, and they sued all five of our City Councilmen and two of the three County Commissioners to remove them from office. Fortunately, the State did not prevail in this lawsuit, and the Attorney General at that time was censored by the Nevada Legislature for an abuse of power.

And, lastly, we'll talk about technical oversight increasing the confidence. Very shortly, they ask us, if they listen, the confidence meter goes way up. They ask us, they don't listen, it goes way down. The success of the program can be directly tied to its ability to revise their plans, to be sensitive and responsive to these locally identified technical and science based issues raised by the affected units of local government.

And, in conclusion, I would say several things can provide increased confidence in this process. Most of them have been mentioned previously. Design of the program that is not political, but puts the administration in the hands of a quasi governmental organization that would have the authority and the funding necessary to complete the long-term mitigation of identified impacts; that would put the lessons learned into the final designs and operational plans; that

would assure a long-term permanent storage of the license support network information in perpetuity, and remove the LSN uncertainty of funding and facility; and, finally, make sure that the Nuclear Waste Policy Act as amended, is followed by all government agencies, including DOE, the states, the counties, the Nuclear Regulatory Commission, staff and Board members, leaving politics aside and basing decisions on science.

Thank you. I look forward to answering your questions later on.

HORNBERGER: Thank you, Connie. Joe?

ZIEGLER: Thank you. I'm Joe Ziegler, and I appreciate the opportunity to address the Board today. I'm going to present a few lessons learned from the Nye County perspective.

First on the list is state and local government oversight. Such ongoing oversight is valuable, though it's extremely expensive and would not be possible for any rural community without federal funding, such as provided by the Nuclear Waste Policy Act. Nye County hired a staff of hydrologists, geologists and other scientific experts to review DOE activities, conduct independent studies, and form its own opinion of repository safety.

For example, Nye County's independent scientific investigation program developed a series of saturated zone

wells and data from those wells were eventually incorporated into DOE's performance assessment models. Additionally, the Nuclear Waste Policy Act under Section 117(d) permits both Nevada and Nye County to designate an on-site representative for oversight of project activities. Nye County took advantage of this provision and had offices co-located with DOE, providing access to project personnel. This greatly enhanced the County's ability to stay abreast of project activities. The State of Nevada declined to participate.

Based on its independent oversight activities, Nye County concluded that the Yucca Mountain repository could be constructed and operated safely. We believe this provided an important perspective to the residents of Nye County, and to others willing to listen.

Next item is NRC as the regulator. Its historical record as an independent regulator should give the public confidence in the safety of any facility that NRC regulates. Care should be taken not to breach that confidence. I've got this on the "What Went Right" list, but recent Commission actions regarding Yucca Mountain are troubling, more because of the implications regarding NRC's independent role of assuring nuclear safety than because of the specific Yucca Mountain actions.

The "What Went Right" part included DOE and NRC pre-licensing interactions. These included the Nuclear Waste

Policy Act, formal milestones requiring interactions between DOE and NRC. DOE and NRC also began holding public meetings on technical and procedural topics in the 1980's. These pre-licensing interactions continued through submittal of the license application in 2008. DOE provided office space and cooperation with the NRC so that they could have on-site representatives and issue periodic reports critiquing project performance. Although this openness subjected both DOE and NRC staff to criticism from external stakeholders, I believe the experience was valuable to both agencies in establishing a common understanding to both technical and licensing issues leading up to the license application.

The next item is Yucca Mountain EISs and the National Environmental Policy Act process. The NEPA process facilitated public and stakeholder input. This was particularly useful to Nye County for the 2008 supplemental repository EIS when the County was a cooperating agency. DOE agreed to inclusion of differing view from Nye County and adopted a recommended concept of adaptive management to monitor actual impacts and provide mitigation as necessary if the project proceeded. DOE management at the time of the 2008 supplement EIS was very receptive to the County's input, even when they disagreed with some of our views.

Now, a few things that could have been done better. First, the project timelines were never realistic. The

Nuclear Waste Policy Act statutory date to begin waste receipt in January 1998 was established in 1982. But, the information and data requirements for site characterization were not well defined until late 1987. DOE and Congress never recognized or acknowledged the inevitable delays associated with the contentious environment for siting and licensing a repository, or the impacts of funding short-falls or policy redirection.

Next item is structure of performance assessment models. Conservative inputs to performance assessment were used to facilitate a more timely license application. This is an acceptable licensing position if results show the repository is safe. But, it could grossly understate repository performance. Reasonable expected performance should be more fully understood. Even DOE’s performance confirmation program is not defined to address this. Model interfaces should facilitate revision and parameter sensitivity studies. In the existing performance assessment, downstream models sometimes use the output of upstream models as a direct model component. Updates to one sub model could cause massive redevelopment and time for what should be simple changes. Once the original performance assessment model was developed, there was never enough time or resources to restructure it in this manner.

As an example of the problem, hypothetically,

presume there was a need to revise performance assessment input, such as surface water infiltration rate. Models exist, including one developed by the Nevada State Engineer, that estimate infiltration in the same range as the Yucca Mountain models. It sounds like this ought to be simple. Because infiltration outputs just might be hardwired into downstream parameter models, such as unsaturated zone flow and seepage, changing the infiltration outputs could be very time and resource intensive, causing many sub models to need revision. This resource intensity would be multiplied if other downstream output parameters have similar interface issues.

Definition of the form of all sub model inputs and outputs should be made before development of the overall performance assessment model. This would facilitate model updates, sensitivity studies to demonstrate the relative contributions of the various repository barriers, and allow better understanding to make necessary design decisions and support licensing.

A couple of other notes, benefits to state and local governments. Benefits to state and local governments should not be conditioned on a predetermined position regarding the repository acceptability, such as required by Section 171 of the Nuclear Waste Policy Act. Benefits should accrue to those who bear the burden, regardless of their

position. That's all I'm going to say on that.

And, lastly, lack of project continuity. The policy direction, DOE and project leadership, and annual funding were always uncertain and subject to change for Yucca Mountain. This has been discussed in several forums, so I won't discuss it further, except to say that continuity is necessary for any multi-decade project to be successful.

A couple closing points. Regardless of what the future holds, results from the Yucca Mountain licensing process are valuable. The NRC licensing process has already yielded valuable information for any future repository licensing efforts. NRC regulations clearly require at least three decision points for repository licensing: construction authorization, authorization to receive and possess waste, and authorization to close the repository. The level of detail required at each decision point is far from clear. NRC staff recently issued Volume I of the Yucca Mountain Safety Evaluation Report.

It concludes that DOE descriptions of the physical security plan, the material control and accounting plan, and the site characterization work are adequate for the construction authorization phase, even though the plans that I mentioned were not fully developed because they're not needed until shortly before repository operations began. This clarification regarding construction authorization

adequacy is important to any future repository license application, regardless of the location, and similar clarification will be provided by future volumes of the NRC Safety Evaluation Report if they're allowed to be issued.

My last point. Although it may be possible to find a local or tribal government willing to support a host repository, or an interim storage facility, it may not be possible in our political environment to find a state willing to be the host. We can built on what has been done, continue what has worked well, and improve in designated areas, but uncontested acceptance of any repository location is far from likely.

Thank you. That concludes my remarks.

HORNBERGER: Thank you, Joe. We are running just a little late, so I want to warn my colleagues that it would be good if they would keep their questions concise. Howard?

ARNOLD: Howard Arnold, a Board member.

I have some perspective on this. I spent a great deal of time at the Nevada Test Site in the 1960's, and in Las Vegas also. At that time, the City was probably a couple hundred thousand people, and there were close to 20,000 people, I think, working on the test site. But, there was very little friendly interaction as far as I could tell, and the opportunity that has been missed here is more like 50 years old than 20 or 30. And, it seems to me the great

lesson that ought to be drawn is that the benefits to the community of having a thriving technical operation have never entered into the discussion, as far as I can tell. And, that ties into the earlier discussion of having a negotiation of benefits with whatever host community there is.

Also, I want to respond to Joe Ziegler's last point. If you go to New Mexico to the southeast corner of the state where the WIPP facility is located, you will find almost unanimous acceptance of that facility. And, also, as a result of the same feeling, they allowed a brand new uranium enrichment facility to be built close by.

You may be right about maybe the State of New Mexico would veto it, but certainly there is a corner of New Mexico that would in fact probably welcome a facility like this.

Thank you.

HORNBERGER: Are there any comments in response that any panelists want to make? Mark?

ABKOWITZ: Abkowitz, Board.

One of the common themes in the presentations and the conversation is an indication that good technical work and important insights were brought forward by your representative jurisdictions and in most cases, it seems to have just, you know, fallen by the wayside.

So I understand the problem, but I didn't really

get a clear indication of what would be the best way to do this. Is there any example that you can draw on from other situations, maybe non-nuclear, in the United States, or what other countries have done that we could use as a model for how to overcome the problems that you've encountered?

FRISHMAN: Well, I think some of the institutional arrangement that went with the Swedish repository selection approach may have some benefit, where they were looking at finally a couple sites, and you had a fully engaged public operation, fully engaged in the sense to where the implementer had to listen to the people. And, they had to listen to the results of their technical analyses, it was, you know, done by experts that they hired with the financial assistance of the implementer. So, it became a formalized system where there was accountability, because ultimately, if either side did not play fair, it was to their own harm. But, I think there needs to be recognition of benefit and incentive to draw benefit, benefit in terms of a meaningful participation. And, the Swedish system, as I am somewhat familiar with, seems to have some elements of that that make it work.

NAVIS: This is Irene Navis.

I concur with Steve. I think the Swedish example is a good one, particularly since they sort of started out the way we did in the United States, and switched gears based

on some of the failures that we experienced here.

I also think it's important for whoever the lead agency is to not disregard opinions just because they're adverse to their own, that they should be explored in terms of just from a pure science or technical perspective, look at the methodology, look at the research, look at the resources that were used to accomplish those studies, regardless of the results. You don't necessarily have to agree with everything, but at least explore the possibility that there's some nuggets of usefulness there, and not disregard it just because of the source of the study.

FRISHMAN: To the best of my recollection, with only one notable example has DOE even responded to the hundreds of technical reports that we've sent them.

ZIEGLER: I guess Nye County has got a little different view. You know, we reached out to DOE I think maybe even more than some of these other entities, particularly the state. DOE didn't agree with all the studies that Nye County did either, but we did not view DOE as not listening just because they disagreed with the work. I mean, they've got some pretty smart people working at the national labs on the project. So I believe there is room for differing views, and we thought that our views were listened to, sometimes there were actions taken, sometimes not. But, we still thought we were being listened to.

HORNBERGER: Ali?

MOSLEH: Mosleh, Board.

Most of you, particularly Irene, mentioned the importance of translating technical information to layman's language, and the importance of communicating the issues through public forums. I'm wondering to what extent you have engaged, or representatives from different counties, engaged the public to get their input and opinions, what form or shape did that participation take?

NAVIS: This is Irene Navis.

We used every possible method we could to engage the public. We used our website. We used a newsletter. We sent out invitations to whatever the public meeting venue happened to be, if it was a DOE meeting, we worked through our own channels to get people to participate. The final meeting prior to site characterization, which happened September 5th of 2001, was not expected to generate a lot of interest. There were 600 people present at the meeting, largely due to the efforts of the affected units of government to get people there. Even though it was in a very inconvenient facility for the public, we managed to get that many people there, and a lot of public comment was generated there.

We also used technology to the best of our ability. We have the ability to do pod casts, which generate a lot of

interest, as well as our web and personal presentations that we do out in the community, out in the public.

SIMKINS: Connie Simkins, Lincoln County.

We have taken advantage of the opportunity to form an advisory panel. We call it the Joint City/County Impact Alleviation Committee, and all those meetings are held according to the Nevada Open Meeting law, open to the public, whereby the scientists and the specialists that we have hired under contract give reports to the panel. The panel makes recommendations to the County Commission. We make regular reports to the Hospital Board, the School Board, the local newspaper. In a small county, we talk to the schools. We go to the City Council meetings. We go to the Chamber of Commerce. And, we have a regular newsletter and we have a student-run website.

ZIEGLER: I think like most of the others, you know, most of the big meetings where a lot of turn-out shows up, tends to be the ones that were initiated by the Department of Energy, EIS meetings and site recommendation meetings, public meetings for that board, NRC meetings, these meetings for this Board and others. But, we did some other things as well. We have two County Commissioners always assigned as technical leads to work with our repository oversight project. The Chairman of the Nye County Commission, Gary Haas, is here today, they’re very active and they are

constantly in interactions with their constituents.

We have other meetings in the County. We actually took over DOE science center, and have moved what's left of the science center and reformulated it into the Nye County Museum. We encourage people to come out to that. We have public events associated with that. So, I think we do what we can to get the public to be involved. I think many times maybe the public is not quite as interested as we think they are, and that's why, you know, unless there's an event sponsored by DOE and well advertised, maybe they don't show up very much.

JOHNSON: Abby Johnson, Eureka County.

I have a slightly different perspective on this. Crescent Valley in the northern part of Eureka County is a place where people move to get away from the Federal Government. So, we have meetings there when we need to. This is actually past-tense pretty much. Now that we're not under consideration for the rail line, things have gotten a lot quieter. However, at the time when the Carlin route was active and when we were expecting the Environmental Impact Statement meeting, we had a pre-meeting to help people understand how to participate. We did a mailing so that people knew that the meeting was coming up, and also if their property was directly affected, could be directly affected by the land use conflicts that I spoke of earlier. And, then,

as I recall, the meeting itself, the EIS meeting itself was quite the community marathon.

So, it's good to do public information and participation. It depends on who your population is, and sometimes it's more appropriate, in our case, we pick and choose how often we go to the public, and what they need to know. We don't over saturate.

HORNBERGER: John?

GARRICK: In your interaction with the public, have you been able to learn any kind of a reasonable basis, establish a level of support or non-support? This Board has heard from other people, for example, in Nye County and Lincoln County that were actually in pretty strong support of the program. I don't get that flavor from any of the speakers today. The Mayor of Caliente I think was one of the people that spoke to us, and was very much in favor of the project from the point of view of having an operation in Caliente with respect to the transport issue. Can you quantify in any way, any of you, what the level of support is in your respective counties, or non-support?

NAVIS: Mr. Chairman, Irene Navis.

In Clark County, we have done studies for a number of years, and anecdotally received information from the public, the majority of the public in Clark County is opposed. We do a formal community survey annually, and that

result ranges from 70 to 70 percent opposition to the project. I think the lowest that it's dipped is maybe 69 percent. We also ask in that survey in terms of a list of quality of life issues, one of the choices is stop Yucca Mountain in terms of a positive for improving quality of life. That response comes out within the top 10, no lower than number nine consistently in that annual survey. So, it is still a significant issue of concern within Clark County. The majority of the public remains opposed, regardless of political leadership, regardless of who the County Manager is, regardless of what else is going on in the community. And, we were very surprised to see Yucca Mountain as a top five issue, even in the early years of the Iraq and Afghanistan wars and economic downturn, and all of those issues.

SIMKINS: Chairman Garrick, you're very accurate about former Caliente mayors.

GARRICK: Former?

SIMKINS: Yes, he was term limited out after 12 years.

GARRICK: Okay.

SIMKINS: My instructions when I was hired in this job was to give the public all the information they wanted, and let them make up their own mind. I believe, as Joe has talked about, that some of the non-participation is because we have so many federal agencies doing so many things in our

counties, my particular County has 98 percent of the land is managed by the Federal Government, mostly in Lincoln County, the Bureau of Land Management. We have a very long and contentious history with the decision makers in the federal agencies. So, when you hear about a meeting on Yucca Mountain, most of my citizens think it's a done deal, they can't make any difference, so why show up. They show up and make comments, and the people they're commenting to don't take any heed in what they're doing. So, that impedes the level of participation in our County.

GARRICK: Thanks.

SIMKINS: My Commissioners and my City Council have taken a position, not in opposition or for, but to protect our citizens' health and welfare.

GARRICK: Thank you.

ZIEGLER: I'm going to go ahead and answer for Nye County anyway. I think we take a different view. A large portion of the population in Nye County live there because either they or their families were former Test Site workers, or Test Site workers currently. They're not necessarily afraid of something because it has nuclear attached to its name. And, I think the County Commissioners have similar feelings, they have feelings of the public that elected them.

I will say that also, the County developed a long time ago what they call a policy of constructive engagement,

neither for or against the repository. But, if it was going to happen, then the County should receive the benefits that they're due from such a repository. And, they've tried to move in that direction, and I think the residents, at least through their electoral politics, have supported that position.

FRISHMAN: For the State, our polling results are consistent with what Irene has said for Clark County. And, they've been consistent for years, and I think, well, I first came to the Nevada agency in 1987, and I think we did a poll in 1988 that started this consistent stream of numbers ever since then.

GARRICK: Isn't 70 percent of the population of Nevada in Clark County?

FRISHMAN: At the time we started. Now, it is. At the time we started, no. And, we also in talking to the people who do this kind of surveying, the professionals, they say when you get to about 75 percent, you're at about a saturation number, because you then have to go to the unknowing and undecided, and it gets smaller and smaller for proponents. And, what we do find through time is depending on other political and economic issues in the State, the approximate same number of proponents had their volume go up and down, and you might have been, you know, subject to some of that volume as opposed to some of the number.

GARRICK: Thank you.

HORNBERGER: Ron?

LATANISION: Latanision, Board.

Irene, I wonder if we could go to your next to last slide? Could we put Irene's next to last slide back up?

This question is in the broad context that nuclear electric generation is part of our energy mix in this country, and nuclear plants create waste. We have to figure out how to deal with them. How would, if you could roll the clock back a couple of decades, how would you have approached this in order to pursue it differently? And, would it have made a difference in Clark County? Would 10 percent of the population be opposed, as opposed now, the 70 percent? Is there something that could have been done differently? Because I think we'll hear this afternoon from our international panel that there has been a different approach and with different results in some places in Europe, and perhaps there's something we should learn from that. But, I'm just curious from your perspective, could the DOE, could independent researchers, who could have done something different that might have changed the attitude in Clark County? Or is it an irreconcilable issue?

NAVIS: Well, I think that there's a contrast between the 50 year scenario and the 1987 scenario, in that I think a lot of people saw the Test Site work as a patriotic effort,

an economic development effort. It was kind of a natural progression from those who had participated in the military. Perhaps they worked at Nellis Air Force Base. There was a national imperative at that time to participate well with the Nevada Test Site. And, I think one of the reasons that there's a lack of trust for federal agencies in some regards, and in particular DOE, is little booklets were put out by the Atomic Energy Agency that said, you know, fall out may be inconvenient. Just go out and brush it off your car, or brush it off your clothes, and go about your business. And, now we see some health effects that are directly attributed to those Test Site efforts back at that time. So, you have that aspect.

So, right away, DOE coming back in the 1980's and saying we want to do this program, the initial effort was part of a sort of a process of elimination, with a number of sites under consideration. And, I think the day that we went from three sites under consideration of sort of equal value and equal process, to what was somewhat of a financial decision and largely a political decision, to narrow down to one site, I think immediately the situation started to erode. Following that, the Secretary of Energy only designated three counties as affected: Nye County, Lincoln County, and Clark County. And, the other seven counties that ultimately ended up being affected units of local government had to do so

through a lawsuit. It was Esmeralda County and Inyo County in California that initiated that legal action. And, were it not for those two counties stepping up and sort of demanding equal consideration as an affected unit, none of the rest of those counties would have been designated as such, and had the ability to participate to the level of oversight that we've seen over these more than two decades.

So, I think that some of those initial actions where DOE appeared to be closing off stakeholder involvement and focusing very solely on the getting to yes issue that Abby brought up were the two main things that caused a problem. I think if they had started out more inclusive, more understanding of people's mistrust issues and areas of concern, more understanding that the program was more than just about the site county, even when I came on, we heard things out of DOE and other counties, frankly, well, everybody knows that transportation isn't going to go through Clark County. Well, how does everybody know that when we have major freeways and the railroad coming through, of course it's going to come through Clark County. So, sort of diminishing the concerns of the major population center of the State, is not a way to engender trust and a cooperative relationship.

JOHNSON: And, at the same time, if it's not safe enough to go through Clark County, why is it safe enough to go

through Eureka County?

HORNBERGER: David?

DUQUETTE: Duquette, Board.

Just one comment to you, Abigail, and it was on your second slide, if we can put that up quickly? And, the comment has not to do with so much to defend the Board, but I don't want to mislead anyone in the audience, and I'm sure they're aware of this, but in your second slide, you say, "Management, policy, and systems issues," and you said these essentials have received far less attention from this Board. We are a technical review Board, and so we really, while we discuss management and policy and systems issues, that's really not in our total purview. And, so, I just wanted to correct that statement a little bit in terms of what this Board has done in the past.

But, having said that, my comment really had to do with Steve, Irene and Connie, with your 70 percent disapproval numbers that you're throwing out. Do you have any feeling whatsoever if those 70 percent are just NIMBY or are they technically based?

FRISHMAN: I think there probably has to be some NIMBY aspect of it, but related to what Irene was saying, and that's that we have been singled out. And, so, people would have a visceral reaction to having been singled out for something that not only our State doesn't want, but no other

state wants. So, I think if you're going to call that NIMBY, then there's some element of that.

There's a strong element that is concerned about transportation, a somewhat strong element that is concerned about groundwater, and protection of groundwater, because groundwater in Southern Nevada is an enormous issue, and it's been a go to war with each other type issue for counties. And, so, here you have the Federal Government in a situation where not only are they proposing to ultimately put at risk a groundwater basin that at one time someone actually tried to capture so they could sell the water to Clark County.

But, also, and I like to point this out because sort of the Department of Energy, you know, doing things against its own interest, the first well that would be contaminated if radionuclides are released from Yucca Mountain, would be their own water supply well. And, they don't quite understand the first law of the West, which is don't poison your own water.

So, yeah, there are elements of different reasons for people, but I think given Nevada's sort of personality, if you want to call the Federal Government forcing something down our throat, then you can take two dozen other issues, and it's just as NIMBY as this one.

NAVIS: Just to follow up with Steve's comments. I think that the fairness and trust issues play into the

response, and the top issues relate to public health, public safety. A lot of the people who respond to our annual survey are gaming employees, resort employees. They're concerned about impacts to tourism, but mostly related to transportation. I mean, the general public don't understand total system performance assessment and performance confirmation and quality assurance, and all those things that we also have to become familiar with. And, that's why I put that one bullet in there about translating for the public the basics of what we're concerned over. You know, what does radiation exposure really mean? And, we put that in a realistic and not alarmist context for people so they understand what that radiation exposure really means. And, that's what they relate to more than the technical performance of the repository. It's what hits them at home and at their work.

JOHNSON: Could I just follow up? I just wanted to say that I realize it is a Technical Review Board, and I also realize that the Board has tried to stretch the limits of that as much as they can, and we appreciate that. And, looking to the future, however, it seems to me that a lot of the most difficult gnarly issues are issues that aren't directly technical, things that Jean referred to this morning. And, so, if I were Queen for a Day, I would change the charter of the Nuclear Waste Technical Review Board to be

the Review Board, and have a much broader charter and a much broader mandate to look at the systems issues and the management issues that really seem to be what the obstacles are.

HORNBERGER: Thank you.

SIMKINS: If I may make one comment. Connie Simkins for Lincoln County.

The only public opinion survey that we have had conducted in Lincoln County during the lifetime of our project was put forward by those who were opposed to the project, and the results of that public opinion were just about fifty-fifty.

The other thing is we have a number of people who for the past 50 years have been employees at the Nevada Test Site, and understand the security issues and the safety issues that are employed there, and would look forward to a job at the Test Site any time. So, that component of individuals understand that it can be done safely.

KADAK: Just making sure nobody else has another comment. Andy Kadak, Board.

I'm trying to distill what I just heard about your comments. From Steve, I understand that there's a frustration that the technical commentary, the reports that you have written, have been ignored by DOE, and not responded to. Is that a fair summary of your position?

FRISHMAN: It's a portion of our position. It's a fair statement.

KADAK: Okay. So, had they responded technically, you believe that there might have been some opportunity to have technical people agree on data, facts and findings?

FRISHMAN: Agree or disagree and understand.

KADAK: Okay. But, that didn't happen?

FRISHMAN: No.

KADAK: Okay. Now, on the communication side, DOE was not viewed generally as an open transparent communicator. And, that led to resentment, mistrust, fairness, which created more difficulties, and perhaps more anger, if you will, if that's the proper way to describe it.

What did you see, or what would you recommend? I'm looking to the future now because obviously, whether Yucca Mountain proceeds or not, some other place will have to be selected. And you all have obviously some recommendations to give to the government, forget DOE, about how to do this. The Blue Ribbon Commission is now struggling with this question, how do we engage the public in a way that's productive? Productive meaning getting the right health and safety issues addressed, making sure this repository is safe, and accepted. I mean, not everybody will accept it, but what recommendation would you give to the government as to how to carry this question forward, because it will come back.

FRISHMAN: You've heard a few things collectively, pieces here and pieces there. And, I think as I was trying to convey in my statement, and I think you heard from others, there has to be a federal commitment to oversight. A federal commitment in the sense that it is a known quantity, quantity meaning establishment. If you are going to be involved, you're going to be involved, everybody can be involved fairly. There isn't going to be any of the chiseling game, there isn't going to be any of the agree/disagree game. Congress is going to have to set the rules for what oversight really means and what the commitment is to oversight.

Russ also had a good point, and that's that one of the things from the standpoint of at least the State technical oversight, is it wasn't until we had the LSN, which is just barely functional, that we actually had access to the vast majority of the technical work that DOE has done. We, for years, have wondered and tried on and off to get access to at least some element of what was called their Intranet. That's where they kept all their information, and that's what we couldn't get. We had to look on their webpage for what they were willing to put on their webpage, which was often way out of date, often available other ways anyway, and what wasn't, was not very useful, or most of it was not very useful, and even that is gone now.

So, there are a couple, there has to be ingenuous

commitment to oversight, ingenuous including all the pieces that we all say are missing. There has to be essentially complete access to relevant information. Relevant meaning any scientific work that they're doing that's not classified. And, it has to be organized in a way that it is usable as opposed to many of us who, and I'm sure some of you have, from our own standpoint, wasted an awful lot of hours trying to figure out how to use the LSN and get answers. So, the LSN, right, Russ, is for a legal process, and we're used to legal processes being blind anyway. So, what we really need is access to all the information that's there that is relevant that's not classified. Those are two, and I'm sure collectively, we can come up with a much longer list for as long as you want us to talk.

NAVIS: Just to add a couple. This is Irene.

I think clarification of roles would be very important. NRC is the regulator when a license application is filed. But, they have this sort of squishier role before the license application is filed that gave the appearance of much more coordination and communication between the NRC and DOE than between other stakeholders.

The other issue that came to light most clearly for me, in terms of movement of deadlines, movement of milestones, appearance of accommodation of DOE's schedule more than maybe what was warranted, was the research I did on

the 22 years of GAO reports on the quality assurance issue. One of the problems identified by the GAO was that NRC kept moving the milestones for DOE to achieve a legitimate quality assurance program. Well, if you do it by this date, then we're okay.

Then, that date would pass and then they'd, well, if you do it by this date, it will be okay. Ultimately, it was well, by the time they file a license application, we'd like to see a legitimate quality assurance program, which they did ultimately accomplish under the leadership of Ward Sprout. But, the flaws in quality assurance were not revealed to the majority of the stakeholders until the LSN came out, just to pick up on Steve's point.

We knew there were flaws, we knew there were shortcomings, we knew or we had suspicion of some things that didn't seem quite right, but until we saw the internal decision making of DOE to get to those points, we were not aware of what all the depth of what those issues were. So, I think clarifying what is the role of the regulator before a license application is actually filed, and how much help do they give this applicant, or potential applicant.

I think one of the difficulties is NRC is very comfortable regulating the private sector, but they didn't have the experience of regulating another government agency. And, so, how far do you go before you look like you have a

conflict of interest or perceived conflicts in the advice and interaction that you're giving. I think that would give a lot of confidence to the stakeholders and public to have those clarified roles. And, we are presenting to the Blue Ribbon Commission a lot of these ideas and our thoughts on how things can be done better and more openly, as transparent as they could possibly get, as open and inclusive of public comment.

Another, I used to call it the game that was played was, for example, DOE would release a document for review. They'd give us, they'd miss their original deadline for getting the document out, they'd finally put the document out, give us 60 days to review it, we'd write in and say that's not enough, we want 120 days, and they'd give us 90. So, we'd do this over and over and over, just to have sufficient time to respond to what were very complex technical documents.

So, just being honest about knowing that you want public input, knowing that you need to have public input, and giving the public adequate time is another I think plus that should be taken away from these discussions.

HORNBERGER: Joe, and then Ron.

ZIEGLER: Okay, very briefly, I think all these are okay ideas, and we can try to implement them if we're ever where the next repository is, assuming there's going to be one.

But, if the going in position of the opponents is as an opponent, in other words, nothing is adequate until this thing stops, I don't believe that those entities will ever agree that the process was run fairly, unless it stops.

HORNBERGER: Ron?

LATANISION: Latanision, Board.

I think the focus that all of you have placed on communication with the public is a really important part of any, frankly, any technology evolution. And, candidly, I don't think technologists or the government particularly have done a very good job of communicating with the public, as a general rule. We're seeing that play out in Massachusetts, my home state, today regarding establishment, or plan to establish an off-shore wind farm off Cape Cod, which has a lot of people upset. I don't know what the fraction is, but it's a significant concern to the public.

So, my question is the following. If we look at the electorate, or the population in Nevada, is the population opposed to nuclear electric generation, or to Yucca Mountain? Is the public comfortable with wind farms, and is the public comfortable with solar farms, and has there been conversation that have led to the public opinion? I see a head nodding, so obviously there is. I'd like to hear about that. Go ahead.

NAVIS: Well, I think Lincoln County and Nye County have

quite a bit of experience in this, but in terms of Clark County, you get NIMBY involvement no matter which of those you select. I think that there's an acknowledgement in general that nuclear power should be part of the nation's energy mix. I don't think you get a lot of disagreement on that.

I think you get disagreement on where nuclear facilities ought to be located. And, I think you get disagreement on where wind and solar and geothermal and where those, as long as people don't have to see it and they don't feel like it's literally in their back yard, you get mixed results there. I think that the inclusiveness and the communication and the involvement, and feeling like they were asked rather than mandated to take a specific course of action makes the difference.

So, I think that people who are involved in alternative energy technologies have learned over the years about that, and are trying to do a better job. And, so, the sustainability initiatives that you see in each county, and the different energy mixes that are coming forward now I think are learning from some of those failed past attempts.

LATANISION: But, they're still unpopular in general?

NAVIS: Yes.

ZIEGLER: I'll address Nye County on the solar, because there's quite a bit of solar proposed in Nye County. I think

it’s one of the top areas in the country, if you look at the maps that a different part of the Department of Energy has issued. And, there’s several private developers looking to doing that, getting the land rights and the water rights, because solar energy production does require a certain amount of water, and it’s very scarce, as Steve mentioned, in southern Nevada.

One of the other issues is even though at a State level, our politicians are all for solar development, there’s some issues with transmission of the power, especially the Las Vegas load center, right, there’s an Indian reservation in between, so there’s some issues there. And, those issues are not insignificant.

So, I think the general population probably is all for solar energy and do it and do it right and create jobs and all the benefits, and even though there’s probably a certain number of desert tortoises and habitat that’s going to be at least changes. So, in Nye County, I think any development that’s done and done safely and environmentally responsibly, I think is a positive thing.

FRISHMAN: Just last week, ground was broken on a transmission line that would join the northern Nevada and southern Nevada grid, where its primary purpose is to collect from alternative energy sources all up through the central part of the state, which would be primarily solar, and maybe

some wind. But, it's the vital link for Nevada being able to use renewable energy. And, that line is, what, about 500 miles, and they started building it last week, and it will probably take, what, a year and a half to build. And, people love the fact that it's going to employ about 600 people to build it.

SIMKINS: Lincoln County has been intimately involved in these discussions for renewable energy and the Swift line south and the Swift line north. The Swift line south starts to the west of Ely, between Ely and Abby's community of Eureka, and runs generally north and south through Eureka County, White Pine County, Lincoln County, and into Clark County. In our county, we have nine wind applications, four solar applications, three geothermal applications, and a proposal for biomass electricity. So, we're involved in this.

Our County has taken the position that we want to be involved early and often, because we think we know our County better than anybody, and we're suggesting locations for these plants. Some of our suggestions are being heard, and some of them aren't. I had a meeting with a wind generator gentleman the other day who said, "You might as well put up with me because I'm the best of the lot. If you don't have me, you'll have somebody a lot worse." So, we have a full spectrum of renewable energies. We recognize the

cost of generating these renewable energy things as compared to either water, hydroelectric or coal or nuclear.

The other thing I was interested of Steve's mention of the opportunities to put renewable energy on this new Swift line. The fact of the matter is, Ladies and Gentlemen, is there's no substation planned by the people who are building this line. They cost somewhere between 30 to $80 million per substation. So, whatever renewable energy we may be able to create in rural Nevada, has no way at the present time of connecting onto this line. So, if you know anybody who knows anybody who knows anybody, tell them to build us a substation, will you please?

HORNBERGER: Bill?

MURPHY: This is Bill Murphy. This question is a change of pace, but it is a technical question. I'm interested if any of you are aware of and can speak to the possibility of the reconcentration of radionuclides at the discharge point for the water that flows under Yucca Mountain?

FRISHMAN: We've been interested in that, yes, and there's been some work done on it by USGS. And, it's primarily a concern over the long-term because probably the most likely discharge point is in that playa in Amargosa Valley, and that is just essentially a perfect mechanism for reconcentration and then redistribution, because you have the water there to help it concentrate. When you have rising and

falling water in the playa, then when you have a dust situation when there's no water in the playa, and what you're doing is, you know, just literally having an open ended discharge from Yucca Mountain, and that's the way we've looked at it, and I can't come up with any other way to look at it.

ZIEGLER: There's one Nye County report I think John Walton did that raises that issue a little bit as a possibility. I don't think there's any extensive study of it. I think the first natural discharge is like Franklin Lake playa about 40 or 50 miles away. I think it's a reasonable question. I don't know whether NRC has raised that question or not, from a compliance standpoint, you know, because there's probably dispersion and hold-up, you know, as this thing goes downstream. So, maybe there's not enough radionuclides that it would ever get that far. And, of course the way the law is written, the way the regulations are written, it doesn't lend itself to doing that analysis. So, it's a reasonable question. I can try to get you a copy of that John Walton report, but it just very, very rudimentarily deals with that.

FRISHMAN: We have admitted contentions on that subject, having to do both with Franklin Lake playa and with the springs in Death Valley and with the transport beyond the compliance line on the EPA rule. So, I think it's a total

of, we have I think a total of four admitted contentions on that, and I think the Shoshone also had at least two admitted contentions on that.

HORNBERGER: All right, thank you. I'd like to thank the panelists very much. We really appreciate your coming and we appreciate the wealth of experience you bring and your perspectives. It was a fun session, so thanks very much.

GARRICK: I have an announcement here. I'm supposed to let everybody know that the restaurant has set up a lunch buffet for today. They also give you the option of some menu selections.

All right, we'll adjourn until 2:15.

(Adjourned for the lunch recess.)

AFTERNOON SESSION

DUQUETTE: Good afternoon. For those of you who don't recognize that, that's the American Cavalry Charge. So, with that, we're going to introduce our foreign speakers this afternoon.

It's a great privilege this afternoon to have four outstanding speakers from Europe, who are going to be telling us their reactions to what has happened, how Yucca Mountain had affected their thinking on what they're doing in their own programs. So, I'm not going to read the questions to you that we ask them. I'm going to let them address them on their own rather than just repeating them.

But, let me introduce them. The first one is Dr. Enrique Biurrun, which is supposed to be German, but it's not. He tells me that he was born in Argentina and is of Bask origin. And, so, he's going to give us a spin on the Bask people and the German people and the Argentinean people at the same time. He is a member of the staff at DBE, which is a German company for the construction and operation of repositories for radioactive waste. And, I'm sure since it's German, it probably has eight syllables for each of the words. And, he manages the company's participation in

international projects. And, I'll introduce the rest of the panel.

The second one is John--John, do you pronounce it Mathieson or Mathieson (pronouncing)?

MATHIESON: Mathieson.

DUQUETTE: Mathieson. John Mathieson is head of International Relations with the United Kingdom's Nuclear Decommissioning Authority, and responsible for developing and implementing an international relation strategy for the NDA. He had a great deal of experience with Nirex, which is the predecessor to what was going on in England, and there's been a massive reorganization there, that he'll probably tell us something about.

The third speaker is Gerald Ouzounian from Andra, and he has a background in physics. He was head of the Earth Sciences Modeling Team for Andra, and at the present time, he's--one of the major things that he does is organizing information and communication with foreign counterparts, stakeholders and international agencies, and promoting strategic and technical approaches of Andra. And, I'll tell you something about how busy these folks are.

John is on his way to Jordan after he leaves this meeting, and Gerald is on his way to Moscow, stopping in Paris without even going home. So, he's just going to fly through Paris, using it as a stopping place to go to the

men's room, and continue on to Moscow.

Our fourth speaker is Olof Soderberg, I believe it's pronounced, because of the double mark over the "o". He's been involved with issues associated with radioactive waste management for more than 25 years. He has served as Director General of Sweden's National Board for Spent Nuclear Fuel, Chairman of a Government Inquiry reviewing the Swedish Financing System for Spent Nuclear Fuel. I hope he's not going to say too much about that part of what he has done. And, is currently a consultant to SKB, the Swedish Nuclear Company.

And, without any further ado, I will turn the floor over to Enrique.

BIURRUN: Thank you very much. I actually used to say to my colleagues when it comes to joking about immigration, and so welcome fellow immigrants. I'm a member of the first nation, so I'm an origin of Europe. My people have been there for 6,000 years. I personally was born and raised in Argentina and am proud of it.

Remarks on the United States, DOE and the German Repository Programs. There have been a number of astonishingly parallel, some similarities between these two programs, and I think there are lessons to learn in both directions. Because of that, and assuming that you are perhaps not so aware of the German program, I will present it

briefly and then I would elaborate on the similarities and difference of these two programs in the way of doing things, and the arrangements and that kind of things.

Then, I will refer to this special case, the Asse Experimental repository that I think is well known to you, we are having some water in flow, and lessons learned at the end.

The German repository program, we started using nuclear power again in the middle of the Fifties, and the very first nuclear program was already stated that it is very important to take care of this radioactive waste that was produced by now. And, at the beginning, it was this famous report that the U.S. National Academy of Science Publication 519 suggesting salt as repository host formation. Then, Germany made a decision that all radioactive waste was to be disposed of in deep geological repositories.

Meanwhile, as far as I know, Switzerland had followed suit, and Canada is intending to do so. Other countries still dispose of most of the waste on the surface. And, especially heat generating waste was to be disposed of in a salt formation.

A first experimental deep geological repository started receiving waste in April 4, 1967 after being selected back in 1964, bought by the federal government in ’65, and reconstructed for this purpose.

I ask you to remember that at that time, all our neighbors were dropping their waste into the Atlantic salt plane located between Ireland and Spain. We are now being blamed for the Asse, but I still think that this is a much better environmental friendly than it would have been the other way around, kick the waste into the sea and forget it.

In the early Seventies, Germany developed a concept for an Integrated Waste Management Center, one of those endless German works, solvent center. That would contain spent fuel reprocessing plant that should be co-located with a high-level waste repository, and also a repository for other kinds of waste that result from these activities. That means on one side, there is a reprocessing plant and the repository below it. Because of this, it was of vital importance to find a site that had a prepared infrastructure for a large scale industrial 1,400 tons at that time, a reprocessing plant, and also a host formation for a repository.

This site was identified in February 1977. As far as I know, it’s the first site to be identified for a repository for high-level waste in the world. It is quite amazing to say, because you have seen Gorleben, in the course of time, that this site selection had the highest possible legitimization in the country, that because of its sad history, did not allow any referendum. Both, the federal

government, the local government and the states, the federal states, were agreed with this site selection, and then there was a joint statement of the federal council in which the Federal Chancellor of Germany and the heads of states of all federal states would sit together, and they issued a statement thanking the state for providing this site, and a number of other sites. Agreement at all levels.

Of course, in the course of time, this has changed. It isn't surprising with this kind of projects, that of much longer duration, that our election people in parliamentary democracies. We had an important change back in 1976 with the fourth amendment to the Atomic Energy Act, the federal government became responsible for providing waste repositories. In Germany, unlike in the United States, all other activities are the responsibilities of the waste user. The federal state is supposed to take over the waste at the fence of the repository, and property of the waste, at this very moment so that the transfer happens at this point, and we are not responsible for the transportation or the conditioning of the waste.

One problem with this amendment of the Atomic Energy Act back in 1976 is that it required a plan approval procedure for repository licensing. A plan approval procedure is a very complex process, a legal process that is intended to concentrate all the legal aspects that influence

a large infrastructure project. And, for instance, the construction of a new airport, highways, and so on, and repositories. And, from my personal point of view, this is totally inadequate for this purpose, but it's the legal framework that we have right now. And, the probability that it has, this is a one stop license. We have got such a license for the deep geological repository, and for the full operation of life of the repository from day one until final closure.

Correspondingly, the license application contains everything, even today's technology for something that we are going to do 80 years from now. It also became, after this new change in the government, an underground research laboratory and waste disposal was discontinued. The reason was quite clear. To continue would have required such a licensing procedure, and was impossible to do in such a site.

KADAK: Could you explain that again?

BIURRUN: I'm sorry?

KADAK: Could you explain what you just said? Why was it discontinued?

BIURRUN: Because it was felt that in this site, it would be very difficult to collect information necessary to go to a licensing procedure according to the plan approval procedure.

KADAK: So, was the site inadequate or you were just not

allowed access to the site? What was the reason?

BIURRUN: The site was accessible, of course, all the time. It's federal property. I think that it was not especially suited for these kind of things, especially for police operation, especially for receiving waste, that we had opportunity, or we had the content of radionuclides. But, we had already at that time, we were studying an alternative, which is quite close to the site, and I will describe that. You will understand when you see the picture, I think. If not, we can come back to it later.

The Konrad mine was then investigated to use as a low level waste repository. I must say we call it only non-heat generating waste because it is everything after heat generating waste, and the heat generating waste is supposed to go to a dedicated repository at Gorleben.

The site exploration at Gorleben started in the late 1979, and by 1983, the surface exploration was finished. So, the site was ready and we decided to go into it to continue the exploration. The German repository safety concept is the geology. We do not rely on casks and stuff like that. It's only the geology. And, because of that, and because salt is actually a wonderful rock, we don't want to disturb it, so by going into it, we explore the site from the inside. What we are doing now is building an exploration mine, a set of galleries, and drilling and operations and

using geophysical instruments, probes and whatever, to explore the site from the inside. The start of the exploration mine development was in 1986. It proved quite difficult to dig, because of the special geological separation there, but then we succeeded, and the mine is under construction.

You will see here one picture of this site and some points in the milestone. I think you will be distributed this paper, so I don't need to repeat them. An interesting point is that on October 1st, the politically motivated moratorium to the exploration of the Gorleben site ends. This moratorium has lasted for ten years and was associated between the federal government and the electricity utilities as part of their bargaining to phase out nuclear power in Germany. The government adduced, the Red Wing government at that time, it was anti-nuclear, adduced that they needed to resolve some issues, and in order to resolve these issues, further results on the site exploration were unnecessary. So, we came to a full stop, similar to what you have in your site right now, Yucca Mountain, back in a moratorium. In a sense, the facility was maintained. The scientific program of collecting data was continued, but we weren't allowed to do any additional drilling or excavate any additional stuff like that, only studies.

We did so for ten years at a cost of around 25

million euros per year, and in the last five years the issues that the government wanted to have resolved, were resolved before 2005. So, the last five years, there was no longer a reason for continuing the moratorium, but no one was willing to restart the project. This is one of the risks when you stop something. It is very difficult to move ahead.

For none of you that have been to Gorleben, Gorleben is right here, over there on the Elbe River. That used to be the end of the world for 40 years. That was the German Republic. And, you see here quite clearly, this is the facility run by us, and these are the facilities run by the waste producer for waste aging. This is an interim storage facility in operation right now for spent fuel and vitrified high-level waste. It contains a couple thousand tons of vitrified waste. This is the encapsulation plant, something similar to what you planned to build at Yucca Mountain. It's dry processing, but it's designed to take the fuel out of the transportation and storage cask, disassemble the spent fuel and put the fuel rods into our final disposal cask.

By the way, Minister of Environment over there has agreed by a measure, has been re-elected right now for around 20 years. This is one of our best friends, and is very in favor of having a repository. Even under the Red Wing government, they wrote a letter, together with a neighbor of

the neighboring community, to the Minister of Environment, Mr. Tratine (phonetic), asking to continue the site exploration. And, if the site happens to be suitable, say you continue, please, with the construction of the repository. This is their position, and through today.

The facility underground, seven kilometers of tunnels at different levels, two shafts, 400,000 cubic meters of excavated volume. The access will be two shafts. It is similar to the WIPP project. We are not so rich as the United States, and we live with two shafts instead of four. Blue is down at 20 meters level, red is down at four meters, the main exploration level, and it goes down to 999 over there. This area here is the exploration area one, which was the first part where we went into the rock, that will receive the waste if this happens to be suitable and it happens to become the repository.

And, we have here in this place a very nice surprise, because we found an area of pure Na3, older halide, which is much bigger than we expected. I have another viewgraph showing the evolution of the design of the EB-1, with a very small piece here, to one-half this size, and then to this final size. Actually, the thickness of the material that we were looking for is 150 meters wider than expected, a very nice gift of mother nature.

You see work underground. Salt is such a wonderful

material, you can build large openings without any support, like our workshops here, this is typically 12 meters times 7 meters times 100 meters of salt, and we, of course, maintain all the diesel equipment. We have 35 pieces of heavy equipment underground for all these kind of activities.

Concurrently with site development, the technology for waste disposal was developed and demonstrated. This is the main difference with your program where you never demonstrated anything. No, sorry, I don't want to be rude.

DUQUETTE: It's not rude. It's the truth.

BIURRUN: The pilot conditioning plant was designed and built. Two interim storage facilities for 4,000 tons heavy metal were commissioned. Meanwhile, we have commissioned 13 interim storage facilities at the power plant sites, was a requirement of the Green Government. So, we have, I don't know, now interim storage capacity in place to run our power plants probably until 60 or so such age without the need to expand anything.

The technology for spent fuel and high-level waste shaft hoisting to the disposal level was developed and demonstrated. This is also very important because our regulations require us to use technology for the repository, which is according to the state of the art of science and technology. That means either we come right out of the shelf, or we have to demonstrate that it is feasible to do

so. And, at that point in time, we have to move 85 tons down the shaft and the limit of existing technology was 40 tons. And, they'll probably say well, that's nice that you tried to do so, but I'm not quite sure that you will succeed, so show me, and we did.

Quite interesting, one of the most impressive tests was the emergency braking system, and we had a special installation with 200 tons, we let them free fall four meters and then hit the emergency brake. That's a very nice thing to do for an engineer.

The full underground waste handling and disposal system was developed and tested, and in recent times, an optimized alternative for high-level waste and spent fuel borehole disposal in an optimized system has been demonstrated and tested. Russ Dyer was visiting this facility one and a half years ago.

This is the encapsulation plant. I don't have much pictures for you, to take it's too much time for my colleagues. This is our waste emplacement test. This is the machine that handles the cask with 65 tons, transportation system, and we use a rather standard transportation system derived from mining technology.

Interesting enough is this is designed to run and negotiate curves with 20 meters of radius, with a weight of 65 tons on it, and it is--the minimum radius, the federal

rate in Germany is 200 meters. So, one-tenth of that, and it must be flat because if it is higher, then we need to build all our drifts much higher, and this is an enormous amount of additional excavation.

This car gave us a hell of a battle until we managed it to go through the curve, actually, we had to have it measured to do so, and this is quite interesting lessons learned. The most simple piece of equipment is probably the one that contains the bag that led to fate.

This is our second waste emplacement machine in a different facility. It's much bigger. And, we have here an overpack that moves back and forth between underground and the surface, and brings vitrified waste canisters, or a canister with the same diameter, but longer duration, that contains 1.5 tons of heavy metal in fuel rods, used fuel rods.

Konrad's, just to tell you that we are at this very moment, building a deep geological repository. We have already committed something like $1 billion in contracts trying to make it irreversible, because you know we don't know who is going to rule Germany after the next elections. It has been a very long period until we got this repository through. The license was finally granted in 2002. We had five years of litigation, so, of course, after that. But, now, this went after the constitutional court, and the one

plaintiff is now appealing at the European Human Rights court, but this is probably going nowhere. So, we are moving it, but are facing serious delays because the system, the organizational system that we have is very inefficient, is a combination of the state and private and it doesn't work properly.

This will be the disposal fields, we have to show you that between 800 and 1,300 meters, and this is island four, but it is covered by a layer of 400 meters of clay material, which is the real barrier. And, one of the interesting aspects of the licensing procedure in Germany is that the laboratory here contains 1.5 billion tons of poor iron, and they have some impurities that make possession quite difficult. But, nonetheless, we have a limitation on the iron that its content of our disposal material, and we have to comply with the limit of 600,000 tons. We are not allowed to add more than 600,000 tons of iron to the 1.5 billion. This is difficult to understand the logic of that, but the licensing authority decided it that way, and are complying.

Also, for this case, we have already developed and tested all the equipment that we need to move the waste. You probably would see that although this contract handled waste, our people are always sitting in heavily--this is also one peculiarity of Germany, the radiation protection ordinances

say that we have to keep any unavoidable radiation exposure as low as possible, and this as low as possible let us go a little bit farther. This is how it's going to work.

The last repository operated back in the Seventies, until 1998, where we had a change of government, and the disposal was phased out like that waste disposal in the salt mine, 500 meters below the earth in the former German Republic.

Similarities and differences between these two programs. The legal basis, some that I always admired in the United States, you have this Nuclear Waste Policy Act, which assigns the provision of repositories also to the United States government. Construction and operation is contracted to an M&O for periods of time, typically five years, I guess, and extendable, and fixed the steps of the realization process. I think this last aspect is quite an asset for the United States.

In our case, the basis is the Atomic Energy Act, which assigns the provision of repositories to the German government, Bfs, Office of Radiation Protection, and BMU under the Ministry of Environment. But, defines already the law that a third party, who actually constructs and operates the repositories, and this is our company, DBE, was founded by government, and currently we have missed ownership, Government Waste Producer, utilities. The idea behind that

was to concentrate all the know-how necessary to run and build and operate a repository in a single company provided stability in time in order to be able to maintain this notice. We have gone through ups and downs very severely, and have actually managed to maintain a know-how in the course of time on the basis of this provision, which I think was quite wise.

The problem in our particular case is that we have a single stop license for all the repository lifetime, this Planfeststellung, I mean, it's so complex and it takes so long, that I don't think that this is the most wise way to do the things. But, this will be amended in the future, but nobody knows exactly in which direction.

With regard to licensing, the USA had the NRC, an independent body, not part of the executive. Whoever writes the license application along the lines of protection objectives set up by the EPA, quite an interesting separation of the responsibilities, and discharges its duties following a time schedule defined by Congress in the law.

In Germany, the licensing authority is the Federal State where the repository is located. And, as our repositories are located in two federal states, we have two different licensing authorities, one for the Morsleben Repository, which is the State of Saxony Anhaute, and one for Konrad, which is Lower Saxony. This would be the licensing

authority in future perhaps for Gorleben.

But this is a peculiarity of German law that nuclear matters are federal issues, and the federal states apply the law in the name and on behalf of the federal government. And, the one who is in charge of supervising that that happens in all federal states at the same level equally is BMU. You have the federal government with an authority subordinated to it who asks for the license, a licensing authority who is also subordinated to this authority and can command the licensing authority to issue a license. This is, from my point of view, not so good, and should be changed.

There have been intents in the past to change it, just like transferring the task of building the repositories to us, so that we will be the license applicant, and be--the Office of Radiation Protection will be the licensing authority. This has already a number of regulatory functions. For instance, it’s the regulator for all the waste transportation, radiation for all radiation purposes in the country, for licensing and approving radiation sources, interim storage facilities, transportation cost, and so on. And, this mixture of executed and regulatory functions is something that needs correction.

Funding. This is a point where we are much better than you. You have a dedicated fund, which is actually an

account in the Treasury, fed by payments by the utilities or electricity consumers as a fraction of a cent per kilowatt hour. You have yearly budgets, as I am informed, of the repository program appropriated by Congress in a political process that ends up giving you money which is not enough to live and too much to die, something like that. Your expenditures, the expenditures increase the federal deficit, and there is no finance ministry in the world which is happy with this situation.

In Germany, we have provisioning by the waste producers. The repository expenditures are pre-financed by BMU. The money comes from the federal budget in the account of the Ministry of the Environment. We have two years detailed planning and five years forecast, and the next year, this is planned very much in detail, and an item that is not included in the budget is almost impossible to procure. But, these outlays are annually reimbursed by the waste producers on the basis of an apportioning to the waste producers which have been previously negotiated. With that, there is no impact on our deficit. So, the money goes into one account and goes out the other.

There are two exceptions. There is the closure of Morsleben and the Asse. Morsleben is a legacy way from German re-unification. We never built this repository, we got it. And, the Asse was a further facility in the past,

and of course the utilities, although they delivered waste to this facility for disposal, they are not responsible for their fate right now.

The license application. Your LA covers transportation, interim storage, aging, packaging and disposal. Focus from my point of view quite a lot on repository long-term safety. It's very comprehensive on safety aspects and has a very limited focus on technology and actual implementation.

In our case, the LA covers only final disposal because obviously, it's the--players. Transportation, interim storage, aging and waste conditioning is the responsibility of the waste producers. The license application covers all aspects and phases of the repository life, for the time being, is it so, and must be based on state of the art best available technology. And, it requires appropriate technology demonstration, because there is no repository existing that could say this is our example.

The safety concept is also a little bit different, I guess. From my point of view, that of the United States apparently relies on an extensive technical barrier system. The rationale behind repository concept evolution is, for us, very difficult to understand. You started with high temperature and went to lower temperatures, and a different temperature, and the repository facility was to be wet and

then dry, and so on. And, all these things have been moving in a way that was difficult for us to understand what motivated all these changes along the line.

Quite interesting for us is that you have different, I call it protection objectives, the number of millirems you have to comply with for 10,000 and one million years. We have the same value for one million years, but we don't focus on that. Mainly, our safety concept relies on the geological barrier. And, the site exploration and repository design aim at preserving the geological barrier integrity. This is something that we really want to achieve, the barrier remains.

The safety analysis focuses on demonstrating that the barrier and the drift and shaft seals, because we penetrate the barrier to build the repository, will be good enough so that we can have a zero release repository. We are absolutely convinced of that in salt with a 10 to the minus infinity permeability, it's impermeable, we can build a seal with the repository if we manage to plug the shafts and the drift to cross the geological barrier in a manner that we have the same performance as the barrier itself. And, the repository at Gorleben, we will have a couple hundred meters of coarse rock in every direction, especially some 600 meters to where groundwater is.

And, in the other directions, the only weakness is

these two shafts, two shafts and not four or six, the minimum possible, and we have been working quite a lot in design of appropriate drifts and seals and shaft seals. And, this work is not finished yet, but we are confident that we are going to succeed. Up to now, we can build a drift seal that would have the same properties as the neighboring rock. And, the problem left is the contact point, the contact surface between these two. And, we are studying some sealing materials, and we have already achieved quite impressive results with a special kind of material that goes into very thin, down to five micron thin cracks, or micro-cracks, let me say, but we hope that we will be able to reproduce the thing. So, the purpose is on the seal release.

Of course, we have to consider that there can be some case, a low probability case in which we have a release, and then you have to review transportation and so on, but this shall be rather unlikely case that requires something terrible to happen in addition to having a repository in a certain location.

The Asse, and now I'm finished. As you see, it's long ago when waste disposal started. No German anymore, no official German anymore wears a hat these days. This is how the Asse looked like at that time, and this is the formation. This is salt mine, and they produced the salt quite near the flank. I will show you this picture that shows exactly that

they went after a mineral that is in the side of the rock, and at this particular location, and in 2000, they went through it into the adjacent rock. This is the weak part, and this part is very heavily excavated, so it's the weak part of the mine, all the time known. This is a view in the other direction.

In these chambers, at the 750 meter level, this is low level waste, and there is some remotely disposed of intermediate level waste in a chamber at 490 to 500 meter level. But, this contains mainly short-lived activity. The bulk of it is cesium and strontium. So, it will be gone relatively fast.

In 2009, the responsibility for the former Asse repository was transferred from the Ministry of Research to the Ministry of the Environment. The reason for that, I mean, we had a further election in this year, and nuclear was becoming a central issue in the election campaign. So, that case was definitely needed that could show to the people how dangerous actually nuclear is.

And, then, some people discovered the Asse. In the Asse, we had a rain flow since 1988, this is 22 years now it has remained constant ever since, and this is 8 liters per minute. You go to your room, open a faucet, it's a little bit less than that. 8 liters per minute, constant for 22 years right now. And, all of a sudden, it becomes an

international issue. The Swedish required concern because they made it into the first page of the newspapers in Sweden, and so on. I think without further elections, that would have never happened.

Now, we need a licensing procedure, according to the Atomic Energy Act, to close down this facility. How long it will take, nobody knows. Three different options were established. At the end, despite that the criteria for the way in which the concept was to be selected have been previously published, the petitions say we don't care, we will take the one which is safer, which is total recovery of the waste.

Most of my colleagues are absolutely convinced that this is not working yet. So, they are now focusing on the condition of the waste, and on the contingency planning, which is continually parallel, which is more or less the old concept, as anticipated, isolating the waste with drift seals, and put them--as you have in Yucca Mountain, and flat the mine with a very heavy brine, to avoid further dissolution.

Sorry for taking so much time from your presentation, John. Thank you very much.

DUQUETTE: Thank you very much, Enrique. John?

MATHIESON: Thank you, Mr. Chairman. I'll try and make up some time.

I've slightly mistitled this slide. I've called it Lessons learned in the UK for deep geological disposal site selection. It should really be overall repository site selection, as we all see.

But, to introduce, I'll talk very briefly about radioactive waste in the UK, about my organization very briefly. I've put in the presentation some summary slides and some more detailed slides. I don't intend to use the detailed slides, you'll be glad to know. But, I might go to the moving forward section, just depending on time.

The NDA, the Nuclear Decommissioning Authority, we are among what's called a non-departmental public body in the UK. We were established in 2005, and we took over the sites that were formerly owned and operated by BNFL and the United Kingdom Atomic Energy Authority. Our remit is to clean up the civil public sector nuclear wastes from those sites in both England and Wales and in Scotland.

Since 2007, we've been responsible for the geological disposal, and that will come out in a few moments about why that was. We're broadly equivalent to the United States Department of Energy Environmental Management Office, and also the Office of Civilian Radioactive Waste Management now that we're responsible for geological disposal.

We've got sites in the UK which I know some of you have visited, built from the 1940's onward, comprising Legacy

wastes from the weapons program, spent or used fuel in the new vernacular in the United States. We're a reprocessing country, a recycling country, like France and Japan hopes to be, so we've got all sorts of wastes to deal with, low level wastes, plutonium, uranium, and so on.

I won't go into the details of the siting failures we've had. They're in the presentation. But, suffice to say that we had failures, both within the 1970's, the 1980's and the 1990's. The kind of lessons which have come out of that is that the site selection process was led by the implementer. We failed in the late Seventies looking for a high-level waste disposal site due to public opposition. As Enrique has already mentioned, we used also to dump some of our intermediate level waste and low level waste in the ocean, and that was abandoned in the UK due to pressure from the Seamen's Union, and that eventually led onto the London Dumping Convention, which has banned paying of radioactive waste.

Our approach at that time was decide announce defend. I'm sure you're all quite familiar with that. And, that's, as I said, fermented strong local opposition, just not to do things, and you would have thought from those experiences in the Eighties, that we would have learned our lesson then when we abandoned some sites looking for surface disposal. So, that was the late Eighties, that first block.

And, then, we started a new siting process in the late Eighties, and that eventually led again to the site selection process being led by the implementer. That site selection process was deemed not to be transparent, because we ended up at the site, and Sellafield, near the reprocessing facility, which that local community felt it being imposed upon them, and so the site selection process came under quite strong criticism.

And, there were all sorts of reasons why we kind of lost that site, because we thought we had it not quite in the bag, but we thought we'd done enough to convince the local community again that it was a good site to go for, and that they would be happy with it.

So, what were the lessons learned, and I think you'll see what comes on in the next few moments, some of the parallels are quite interesting, which is what's happening with Yucca Mountain, and also from what we've heard this morning.

Our process for gaining planning permission, planning permission to build something, whether it's Heathrow Terminal 5 or a nuclear waste repository, or other large projects, is quite adversarial. It involves barristers, lawyers, expert witnesses, and so on, very adversarial and not the way that you would want things to go. And, as that quote says there, it's a quotation from parliamentarians

themselves, it's an "Adversarial system of planning permission is guaranteed to fail," just by its very nature is confrontational from the outset.

We have similar interests that we need a strong government policy of geological disposal. And, when we were looking at developing a repository site in the Eighties and the Nineties, we assumed that government policy was geological disposal because nobody told us otherwise, except the local community didn't quite buy that. They were saying well, what are you doing this by, and we tried to argue it was government policy, but the government wouldn't stand up behind us.

So, that led us to the other lesson learned again, this has come out from this morning, that it's strong consultation with the public, and we think in our case, it should be government led, as opposed to implementer led, and you could argue that we are government and we are the implementer, but we do distinguish ourselves from our Departments of Energy and Climate Change, and who is our sponsoring departments.

Again, another lesson learned, when we lost the site in 1997, we decided to maintain the core competence of scientists and geologists, and so on. And, that was important because they captured the memory of all they had done before, even though we had lost the site, we had gained

a lot of information from that, and a lot of how the processes involved in site characterization, again, something which came out this morning. So, we went down from a company size of 260 to a company size of 67.

The other thing we did as well in kind of reorganizing ourselves was to employ social scientists as opposed to just ordinary scientists and technicians and engineers. So, we created an environment, a better environment of openness, transparency and accountability, taking account of what the social scientists were saying to us about how to engage with the public. And, indeed, one of the things we did as well was we took on board one of our strongest opponents and formed the site selection process, one of the strongest opponents from Friends of the Earth, we actually paid here, but we took her on board for about a year, to get her perspective of why we did things wrong and how we could better do it in the future.

And, again, it comes back to this thing we talked about this morning, communication, how do you communicate science and technical things to the public.

The other thing we didn’t have at the time was an agreed siting process. Again, it was no less decide announce defend, and the siting process for the repository of the rock characterization facility, the experimental underground rock lab, was very much taking part behind closed doors. We said

we had 500 sites, we didn't name them until 2006 under a Freedom of Information Act question. So, quite secretive, and lo and behold, we ended up with a nuclear site where we wanted to site the repository, Sellafield, no wonder the locals felt that we imposed something on them.

One of the things which we are often accused of in taking things forward is what we call plan and gain. This is community benefits, some people talk about it as bribery. You can't bribe the local community. So, one of the things we did was we talked to ethicists, and we said how do we get around this issue of being accused of trying to bribe the local community into accepting the repository? And, basically, they said that they concluded, and they said if you do everything in the open, transparently with the local decision makers, then you can't be accused of bribery. Bribery is something which is underhanded, under the table. This is open and transparent and up front, according to how that's being done at the moment.

Also, something which I guess the local community at Sellafield did exercise on us was a veto. We think it's quite important for the local community to have a veto, the right to glance at some point, but only up to a certain point. But, when you're actually spending real dollars, real pounds, to get underground and actually construct the repository, then we think, and our regulators I think agree

that the right to veto should be at least reduced, or difficult to implement.

Again, addressing some of the issues which came out this morning in terms of the implementer. We were perceived, Nirex was perceived as elitist, talking to the community, not with the community, not engaging into a communication. We were telling them what they wanted--what we wanted them to hear, not addressing their concerns. So, in going forward, we hopefully now are more informed and responsive in our dealings with the local communities. The lesson was to work at the stakeholders' speed. So, hopefully, we have a target program, which I'll mention in a moment, but that is very much determined by the decision points of the local communities, rather than--or by any pressure put on us by the industry who want the repository. And, again, this is open and transparent points.

I'll just skip now to this slide in going forward. So, after the failure in '97, the government went on and did a few inquiries with the House of Lords, and came over here and I think talked to the Board even, and went to Nevada as well, and the government came back and they launched the new Managing Radioactive Waste Safety Program, MRWS, in 2001. And, again, with rather obvious remit behind it to address the question of how do we actually get a repository in the UK.

What they then did was had a consultation initially on how should we actually go about consulting on this, and that was stage one of MRWS. The next thing they did, which is something you may recognize, they established a committee on Radioactive Waste Management. And, this was an imminence group of scientists, social scientists, engineers, and so on, and they were to carry out research and public debate involving option evaluation, using the best public and stakeholder engagement tools, and the best available scientific knowledge. So, they basically had a blank sheet of paper on what should they recommend to government on dealing with the higher activity waste. So, they looked to everything you can think of in terms of sea disposal again, firing it to the moon, and they--I'll come to a moment to what they recommended.

But, then, the next stage was consultation on the government's framework for implementing the preferred options, and then implementation itself.

So, basically, CoRWM made its recommendations in 2006 after looking at all of the various options to deal with with radioactive waste, and lo and behold, they came down to the fact that there should be geological disposal, supported by safe and secure interim storage, and going forward to find a site. It should be based on volunteerism and partnership approach to siting.

Then, there was more government consultations, one of which led to Nirex being incorporated, integrated into the NDA, again to maintain that skill set of the corporate knowledge, the corporate history that we built up.

They then consulted again on how to take forward the new framework, and the upshot basically was again they were going to invite communities to, without commitment, to take part in discussions about the possibility of hosting a geological facility, and independent scrutiny by newly constituted CoRWM, Committee on Radioactive Waste Management.

Key elements of this are that the government invited them initially to express an interest in siting a facility. Based on the partnership approach, and I'll come to what the partnership does, BGS would screen out some sites, so if by some miracle more than several sites came forward, we would screen them out on a geological basis, and we've already spoken about those, so we're going to the rest of that.

What the current situation is, and this is an ironic situation, as Americans think the Brits are full of irony, so here's the ironic situation. Two councils, Allerdale and Copeland, and Cumbria council, have expressed an interest in hosting a facility. Copeland is the community in which we tried to site the facility in the 1990's. So, we're back to where we were over ten years ago, and that's

the expression of interest, obviously, they've still got to decide whether to participate. But, just through a change of process and a change in approach by both the government and ourselves, we're back in the community, at least talking with them.

They formed a local partnership in 2009, and the government wants other communities to come forward, but we think that's optimistic. And, the role of the partnership is to recommend to the decision making body, the local councils, the local government, whether or now West Cumbria should make a decision to participate in the government siting process. So, all they've done at the moment is express an interest. The next stage, which they will do at the end of next year, is make that decision. And, one thing they are doing is they're going around to a few other countries and working with the guys, to speak with the local communities there.

And, that explains again in more detail where we are. I'll just say that that is the point worth again, not assumed it, but it's our program in 2004, and that's if we don't go back to Sellafield. If we go back to, as we say, a site we previously characterized, then that could be very much shorter, by maybe 10, 15 years.

So, Mr. Chairman, thank you.

DUQUETTE: Thank you very much, John. Gerald?

OUZOUNIAN: Thank you, Mr. Chairman. Ladies and

Gentlemen, good afternoon. My name is Gerald Ouzounian, and since we have only 15 minutes, I decided to focus not on our story on our other projects we have, and siting, but more on the status of our underground repository project. And, since the Board visited it two or three years ago, I'll begin my story from that time. But before this, I wanted just to point out two or three points. The first one was that also in our case in France, everything began with failure, and since that time, we had a long process, it was 15 years, and 15 year research program, and this was defined by a low in 1991, which also defined the process to progress, which was different and agreed with the environment at both--of the stakeholders, and which involves also the public into decisions which will have a direct impact on their day to day life.

Another point which was decided very early was to organize regular appointments with the decision makers to confirm their willingness to progress. This is from the process side, from the cultural side, we have also a National Review Board Commission that's not--which was launched in 1994. We have a total development committee, GIP, which was installed in order to help the territories to develop their economy. And, we have a local information and oversight committee, which is very important, and I'll come back on it. We have our safety assessment and our political assessments

as well.

And, the last point I wanted to stress was about guarantees. First of all, we must show our commitments, and we must also show and explain how we comply with our commitments. The second guarantee we bring to our projects is the demonstration given through the safety assessment. We have another point, which is reversibility, which is also called retrievability or reconvertability, but we have just one word in French for all those three, it's reversibility.

We also refer to our public, a reference state, a detailed reference state of the environment, and we're working on it. And, last we have, as an example, we can show the quality of our operations from our existing and operating facilities.

Now, coming back to my presentation, in the title, you can see status of the CIGEO project in France. It's the first time we give this name outside of France, CIGEO, and this was decided a few months ago to give this name, which in French means industrial center for geological disposal, and we wanted to stress that we are moving from a research phase to an industrial one, and we are organizing today for our future repository, which will be commissioned by 2025, if we get the license and the license application is for the end of 2024--2014, sorry.

Now, for those who do not know our site, we

selected a site which was a volunteer site. We had--I will not come back on this story--but we had 30 volunteer sites, and at the end, we selected just one, which is in Eastern France, a little bit north, 200 kilometers, 150 miles from Paris, which is located here.

This is a cross-section of our geological system. We are in the Paris sedimentary basin, and we have a formation which is 155 million years old. Outside is at the depth of about 500 meters, with a thickness of the clay formation, which is about 130 meters. What is interesting in this site is that we have about 45 percent of clay minerals, mostly which are smectites, but also carbonates and others. But, we have also the mechanical strength, which is given with carbonates and silicates. The water content is poor, it’s less than 15 percent, which is very low for clay, but we have a compacted clay at about 500 meters. We don’t have any free water, and that means that we have no water flow, and we could demonstrate that transfer can only be driven by diffusion.

Now, this is a general view of our site. For those who visited our site, you can see the main exit shaft here, and auxiliary shaft, exit shaft here.

Now, what were the conclusions in year 2005? You can see first the cross-section of the laboratory, this is an underground laboratory, which was built under the ages of the

previous--of 1991, we began in 1999, and what we could do was from this laboratory, was to demonstrate that the repository is feasible from the technical standpoint in this agerite or clay formation.

We could also show that it is demonstrable from a scientific standpoint, which is very, very important. And, we could also demonstrate that it is safe, safety can be achieved, and moreover, safety can be demonstrated. And, why could we do this? We relied on several things. The first one is the quality of the geological system. Since we go in the geological system, it's to reach confinement and safety from the geological system. This is the first point.

The second point is about the design of the repository. Since we are in the geological system with a small amount of water, in any case, what we decided was to keep the temperature below 90 degrees Celsius in order to avoid any two face flow, not because we are afraid of the two face flow, but it's very difficult to demonstrate safety if we have a two face flow. And, we have a series of options which are very easy because we have a very linear system, a very simple system, very easy to describe, and very easy to model.

In year 2005, what we did was also--here, you can see the laboratory, which is known as the Bure Laboratory--and, we have defined 250 square kilometer zone, which was

called the transposition zone, in which we considered that the properties of the formation are the same as the ones observed in the underground laboratories. And, we considered that those characteristics and properties are suitable for the implementation of the repository.

From 2006 to 2009, what we did was a series of additional boreholes, boreholes in the Callovo-Oxfordian agilite in order to have additional information on the formation. We did new boreholes for the local hydrogeology, and we also drilled a borehole at the Triassic, which is at about 2000 meters, just to check, on the request of the communities that we don’t have any geothermal resources in this formation.

We performed a two-dimensional seismic survey on this zone, and we got also a new set of experiments in the underground laboratory. This is just to illustrate the underground laboratory. I wanted just to insist on this tool, which is 70 centimeters in diameter, a boring machine, 70 centimeters means about 30 inches, and this is just to demonstrate that we’re able to drill or to bore boreholes for the emplacement of the future vitrified canisters. We have many other experiments. This is just an illustration of the amount of boreholes from the last drift we drilled, we opened in the underground laboratory.

Just two words about the design. You can see on

this slide the underground facility, with a footprint of about 15 square kilometer. This footprint is used mostly for the vitrified waste, which are an inventory of about 7,000 cubic meters at the end of the lifetime of the present fleet, and a smaller zone here for the intermediate level waste, mostly coming from research or from the difference, which are historical wastes.

Another interesting point here is the surface facilities, for the direct access of the personnel, but we have also another surface installation for receiving the waste canisters for encapsulation and preparing the waste, and we have a ramp, five kilometers ramp, since we have a ten person slope at 500 meters, a five kilometer ramp, which gives us some flexibility to locate the surface facility.

About the design, you can see here just there is a small illustration of the disposal sites for the intermediate level waste, which are disposed of in standardized concrete canisters. And, on the next one, you can see the emplacement of the vitrified waste, as the experiment which was shown just before.

From this 2,250 square kilometer, we performed the work this year--or last year, just to restrict the zone to a 30 square kilometer area, which is almost the double of the future for the print of the repository. And, within this favorable zone, we have looked the most favorable emplacement

locations based on the depth, because we are in the sedimentary basin, and the deeper we go, the more expensive it will be. From the thickness standpoint, we need at least 100 meters, 120 meters thick formation, and from the hydrogeology, the present hydrogeology on the upper aquifer, and the future hydrogeology. And, from those studies in this 250 square kilometer, which is designated here in blue, we have all this white zone which is most suitable for future repository.

We also had a very strong involvement of the public through the local commission of oversight, formation and oversight, and their concern was not to have any village on the top of the repository, on the future repository. Keep a minimum of 500 meters from the border of villages, and favor the forest zones to locate the facility. This location, the restricted zone is this one, which is a 30 square kilometer zone, which was agreed by everybody at the national level, as well as at the local level. And, what we did was to submit last year in October to our government, this slide was reviewed by all the bodies and institutes you can imagine, and on March 9, we got the approval of the government. And, our repository will be located in this zone. You can see the laboratory, which is here, which is disconnected from the future repository.

What we did since that time, the first thing was

not to advertise. Why? Just in order to keep our opponents quiet. So, this was done, and everybody is happy now.

What we did was to perform a three dimensional seismic survey, additional boreholes on this zone. This was during the spring. And, here, you can see the same zone, which is called ZIRA, which is the location of the final repository. You can see here the transposition zone, and since I explained to you that we disconnected the underground facility from the surface facility, with the possibility of excess fluid affecting the underground, we could extend this zone to find the location for the surface facilities.

On this side, we could not because we have a series of 14 systems, and however, we can locate our surface installations at 5 kilometers in this zone.

The next step, and it began already last week, was to open discussion with the local public, because their position was to say during the discussion to locate the underground repository, their conclusion was to say you are the scientists, know better than we do where to locate and how to do this. However, for the surface installations, we have to live with those installations every day, and this is our concern and we'll make the decision.

However, we have a series of criteria where we can locate the surface installations, which are shown here, and discussions are now open with the public, and with the local

committee for information and oversight.

Also interesting, and the Board did not visit this, it is our technology showroom where we can see such--from our underground laboratory. You can see all our demonstrators, for example, canisters of every types of tests performed on the canisters. Also, the systems for transferring the casks into horizontal drifts, as well as to retrieve those casks, because as you know, we have a strong commitment or request for retrievability. And, just for your information, mid-December, we organize with the NEA, the Nuclear Energy Agency, an international conference on reversibility and retrievability in Anst, which is not very far from our laboratory and our future repository.

To conclude, this is our time table. Now, we are almost at the end of year 2010. We have selected the location of the underground facility. This has been approved by the government and by all the stakeholders. Now, our next deadline is the public debate, which will be organized the end of 2012, and the site approval by the government, not only for the underground, but also for the surface facilities, early in 2013. We'll apply end of 2014, and then we'll have a series of opinions, of reviews, of addresses, and a new law will be voted in 2016 about reversibility, the conditions for reversibility. And, we expect the beginning of the construction as early as 2017, and it's why we are

moving very fast from the research phase to the industrial phase, and it's not always easy to explain this to our researches, but we think it's due like this.

Thank you for your attention.

DUQUETTE: Thank you very much. Olof?

SODERBERG: Yes, Mr. Chairman, I thank you for your kind invitation to provide some comments from the Swedish perspective on the Yucca Mountain Project.

I was to present an overview of the Swedish situation, so I will not do that. I was asked to focus on what went wrong, what went right, and what could be indifferent. A small disclaimer. I'm presently working as a consultant to the SKB Company, but standing here, I do it on my own. SKB is not sponsoring my appearance here. These are only my personal views.

I elected three themes for this presentation and comments: political context, organizational form of the implementer, independent technical/program oversight. And, my comments to each of these themes will start with a question. And, I hope that you will not find these questions too provocative, but constructive enough to serve as a basis for further discussions.

What do I mean by using the term political context? Well, I've looked in the incident report to Congress that NWTRB issued last October, and I found there a section called

Context. And, that section contains textural descriptions of the capacity of a number of countries' commercial nuclear power plants, and the dependence on nuclear in the production of electricity. And, these descriptions of course are non-controversial hard facts.

But, and this is my point, these hard facts exist within the political context, which may help or complicate technical efforts to reach a solution of the problem of long-term management of spent nuclear fuel.

So, my first question is did the Yucca Mountain Project go wrong, as some see it, because of the political context that created the project? In other words, is something wrong with the political context that resulted in the 1987 Amendment of the Nuclear Waste Policy Act?

It might be worth recalling that public concern on the issue of long-term management of high-level nuclear waste and spent nuclear fuel developed into a political force, both in the U.S. and in Sweden, during the first part of the 1970's. On this slide, there are three examples. The first failure of siting a repository in Lyons, Kansas in 1970, and then legislation in California in 1976, and legislation in Sweden in 1977.

And, obviously, the 1987 Amendment of the Nuclear Waste Policy Act laid the ground for the Yucca Mountain Project.

Illustrated, how political intervention created starting points and also boundaries protective of the scientific efforts to solve the issue. And, of course, the same goes for recent initiatives by the current U.S. Administration to close down the project and set up the Blue Ribbon Commission.

Now, it might not be fair to compare the complexity of politics in the area of nuclear waste management between the United States and a small country like Sweden. Several impacts have made the difference. One is, of course, simply the fact of the different physical magnitude of the problem.

The second difference is that Sweden’s nuclear waste management problem does not encompass military waste. What I would like to highlight on a third difference is the different governmental system in our two countries. The U.S. governmental system has sharing of power between federal and state is one of the fundamental principles. The executive is of state and federal power. And, jurisdiction is, as you well know, often under debate and is sometimes settled in courts.

In Sweden, a small country, we have a less complex governmental system. Our governmental system is not so inclined to use courts, as I believe is the case in the states. So, perhaps the significant differences between the United States and my country with regard to construction and

functioning of our respective democratic institutions may have a clear bearing when looking for extra nations' role the nuclear waste issue appears, and the problem, appears to be more successful in Sweden than here.

So, back to the question. As an outside observer and without the necessary insight into your system of government, I have no answer to this one. I recall that during the previous session, it was said by some of the participants it may be not possible in our political environment to find a repository location in the state willing to be the host. I don't know if this is true. But, I believe that responsible U.S. institutions now have reasons to discuss how to, given the extraordinary political context, how to find a way which leads forward without unnecessary delays. I do not advise postponing a necessary decision into an uncertain future.

My second theme is organizational form of the implementer. And, the question is does the U.S. system facilitate or complicate long-term management of spent nuclear fuel from the commercial nuclear power plants.

As you all know, the implementer here is a federal government agency, a separate office within the Department of Energy. Although the industry has to pay a fee to cover the projected costs of the federal government for providing this service. In Sweden, the implementer is a private

corporation, which is formed and owned by the owners of the nuclear power plants. Also, in Sweden, the owners of nuclear power plants have to cover the costs, although separate state administered financing system, which is outside the regular Swedish state budget.

Now, it would be presumptuous by me to question your motive with federal responsibility. There may have been very good reasons for this when it was established. It may have been the natural choice, given the then already existing federal responsibility for high-level waste from production for defense purposes. But, I believe that the model which has been used in Sweden has been very helpful for us so far in developing a solution which may be implemented within the future. We have a clear division of responsibilities between the owners of the nuclear power plants and the states. The responsibility of developing a solution of final disposal of spent nuclear fuel rests with the owners of NPPs, who are acting through the SKB Company.

The role of government and its authorities is to ensure that the nuclear industry actually takes that responsibility. And, in the end, government and its authorities should approve or disapprove solutions proposed by industry. The industry has strong economic reasons to be committed to fulfilling their legal obligations. But, maybe it’s even more important that the industry knows that the

general public expects them to behave responsibly when it comes to waste management. And, my impression is also that industry does accept this responsibility.

So, back to the question. Does your system facilitate or complicate this issue? But, I can only formulate the question, and I'll leave it to affected parties in the United States to establish some possible conclusions.

My third theme concerns independent technical program oversight. And, as you can see, in both our countries, we have independent bodies. Both were established in the late 1980's for this purpose. And, both have the task to advise their respective governments on the countries' program for management and final disposal of spent nuclear fuel.

But, there is one important difference between the charters. As the office indicates, while the NWTRB should focus only on technical methods, and this has been stressed several times today, the Swedish organization may also consider other aspects of this complex problem. And, the Swedish body has, since its start, also paid much attention to ethical, legal, social and policy dimensions of waste management.

So, my question here, or, rather, two questions. Would the advice by NWTRB on the Yucca Mountain Project, would this advice have been different if its mandate had been

broader? And, the second question would advices, taking into consideration also ethical, legal, social and policy dimensions, have changed the fate of the project?

Well, to me, it seems that the Swedish experience is that the broad mandate of our oversight body has helped to create what I would call the necessary bases among the general public and its political representatives for a better understanding of the need for a goal oriented nuclear waste management program.

On the following slide, I have enumerated some examples of themes for seminars that the Swedish body started to have in the late 1980's and during the 1990's and early part of 2003. And, on the next slide, we have a selection of a workshop that has been recently carried out on different subjects.

I think that what one should say to summarize both slides, that openness and willingness to discuss difficult issues has been the key messages to the public from the Council. And, the stimulating public debate on these issues, the Council has created itself as an arena where representatives or affected parties and stakeholders can meet and discuss all difficult issues. And, I believe that the early initiatives by the Swedish Council also contributed to the process and the clearly successful efforts by the implementer, by SKB, to build confidence among potentially

affected parties, local communities and the local population. And, these efforts started in the early 1990's.

But, there has been a prerequisite for this confidence building, and that is, I believe, the existing legislation, also from the early 1990's, granting local municipalities, SKB perform the investigations, granting them some money to cover their costs for building up the confidence of their own. And, the source of this was our nuclear waste management fund. But, decisions of grants were made by a government agency, or by the government itself, and not by the SKB Company, which was very important.

So, to conclude, back to the questions, and my only comments to this question is that perhaps these are questions of this kind that are worth discussing when outlining the future policy of the U.S. on long-term management of spent nuclear fuel.

So, thank you very much.

DUQUETTE: Thank you, Olof.

I'm going to take the moderator's prerogative and ask a question of all of the presenters this afternoon. KASAM in Sweden is similar to our group, and when we were in England, we met with a similar group in London. The French had an advisory committee under the old law. I don't know if it exists under the present law. And, I'm not sure what's happening in Germany as far as an advisory group is

concerned.

As you all know, NWTRB makes recommendations. We have no authority to implement anything, only to make comments and hope that someone else will pick up the ball and run with it. In your four countries, do the advisory groups have any authority that is passed on either through the government or through any other agency that would make an advisory group a more potent spokesperson for science or technology, for any part of what we're talking about. And, you can answer in any order that you want to, but I'd like to hear an opinion from all four of you on if you have advisory groups currently, those of you who I'm not sure about anymore, and what the role of those advisory groups is.

SODERBERG: I can start, as you mentioned, specifically with the Swedish body KASAM, which was formerly called KASAM. They have no formal authority. But, they are giving advice to government on perhaps conditions for the future activities of SKB. We have a system that every third year, SKB has had the opportunity and responsibility to present their plans for the coming period. And, these plans are approved or disapproved by government, and as a basis for the government decision. There is, of course, advice from KASAM and also, of course, from the regulators. So, no formal position, but it could influence the government decision.

OUZOUNIAN: For the French case, it's almost the same.

There is no formal decision which can be made by the National Review Board. However, the role of the National Review Board is also to understand and translate our technical and scientific approaches and understand every way by the members of the Parliament or by the decision makers at the government level. And, in any case, the government will never have a position against an advice which was requested by the government. So, we have always seen the government following the advice from the National Review Board. They rely on it.

MATHIESON: Yes, in the UK, the Committee on Radioactive Waste Management has been reconstituted, as I mentioned, and their role is to monitor the progress that we make as the Radioactive Waste Management Division within the NDA. Again, they have no--I think it's important to distinguish between their role and the role of the regulator--so, their role is to monitor what we're doing with, if you like, the regulatory process. But, it's purely advisory. They have no clout. They can't stop what we're doing, but they can make strong advice certainly to government. And, again, if we manage to upset them or do something or they go against what we would say, that would place us in a very difficult position.

BIURRUN: In the case of Germany, the two commissions, the advisory board is through the Ministry of the Environment, and they have no authority, but, of course, given their expertise, but the government is, the Ministry of

the Environment is not bound to any of their advice.

DUQUETTE: Thank you. Questions or comments from the Board? Mark?

ABKOWITZ: Abkowitz, Board.

I was struck by the time table that each of you went through in terms of the history of what's taken place over the last several decades. And, as was pointed out by one of you, I believe failure is almost the starting point to potential success. And, I notice in almost every instance, the path that you are on now that has a lot more of an optimistic potential outcome, seems to come after almost a moratorium of 10 to 15 years following a failure.

I guess I would ask you to comment on whether my perception of that is correct. And, secondly, as this applies to the United States, if the Yucca Mountain situation is no longer on the table, would you suggest that we almost need to wait a decade or longer in order for emotions to calm and a new process to evolve that may have a more optimistic outcome?

OUZOUNIAN: I can begin because in France, we had a moratorium, which was decided in 1989, and this time of moratorium was used in order to analyze, to understand the reasons of the failure, to understand what was the expectation of the public, what was the expectation of the government to understand everything, and this time was used

to prepare the new Act, was an extension of the process, was all the bodies for reviewing and defining for the public. And, the first law was passed for a 15 year research program, and this was the first step. And, after the 15 year research program, at that time, a new law was passed, and from this new law in 2006, since we had the demonstration that the repository is feasible and can be demonstrated, we were requested to apply by the end of 2014 in order to commission it in 2025. This is not time, open time, it's time with very clear deadlines at each step, and these that we use all the time.

MATHIESON: I think in the case of the UK, yes, other countries was 10 to 15, your perception is absolutely correct I think. I think in looking around the world, probably only the finish program has maintained kind of a course which you could say has not had a failure at any stage. And, there also reasons we could go into for that. But, I think every other country, just about, has had a failure down the road. Now, in terms of the United States going forward, I think if you look to the UK process, we started again, if you like, and we set up the Committee on Radioactive Waste Management, you've set up the Blue Ribbon Commission to take things forward.

The other difference I think with the UK and the other countries is that we don't have specified laws on how

we should do things. It all comes out in this kind of consultation manner, and the process followed is all done through the government producing White Papers based on consultations. So, it's a very much less regimented, I should say, process. And, I think is there is one lesson in going forward, it's sometimes laws can help and sometimes laws can hinder, as we've seen with the Nuclear Waste Policy Act. But, in terms of a new process in the states, don't be surprised if it just takes ten years before something happens again.

BIURRUN: In the case of Germany, I think the situation is a little bit peculiar in the sense that from the very beginning there has been a very strong opposition to nuclear power that was the source of a party, which is now one of the largest parties in the country, but an important party, Green, which has a number of ideas, but oppose nuclear. It's one of their most fixed articles of faith. I think this is unique. The fight against the repository, and especially against Gorleben, has been always a kind of symbol. From the very beginning, it was a symbol of the opposition against nuclear. And, right now, we are about to decide if the plants are going to run for ten years longer--twelve years longer. This is now in the Parliament. The government intends to do so, and because of that, the resistance against Gorleben, the symbol of nuclear, is starting again. And, you

will always hear in Germany nuclear is inviable because there is no solution for the waste, and as long as there is no solution for the waste, we cannot accept nuclear. So, you fight the repository, but actually you would like to fight nuclear. And, the same Greens in private conversations say the moment where the last power plant is phased out, we are going to help you build the repository.

DUQUETTE: I'm sorry, Olaf?

SODERBERG: I think that to some extent, we share that experience in Sweden also, with the political turmoil on nuclear energy. It should be remembered that the waste management issue in Sweden has turned two governments out of office in the middle of the 1970's. So, this gives the history. Of course, there have been difficulties in Sweden also. I'm not going into that. But, let me just mention that SKB activities started around 1976 on this issue. There had been set-backs when looking for a possible site. In 1985, they found they had to abandon their strategy, and they were silent from doing work for seven years. In 1992, they came back with a more worked out strategy, and even during the early years, the case of these renewed processes, there were failures. And, it went well eventually from 1996 and forward. So, there was a long learning period.

DUQUETTE: Arnold, Andy and then John.

ARNOLD: Arnold, Board.

Gerald, the 70 centimeters diameter started me figuring my thinking, you are, thus, totally committed to only putting in glass logs; is that right?

OUZOUNIAN: Vitrified waste, yes.

ARNOLD: Yes, vitrified logs. So, there is no fallback in case you decide to dispose of fuel assemblies per se. You are totally committed to reprocessing and vitrified--

OUZOUNIAN: By law, yes. By law.

ARNOLD: Yes, right.

DUQUETTE: Andy?

KADAK: Kadak, Board.

I was intrigued by the differing standards by which you are licensing these repositories. And, from what I understand, the German approach is zero release, no Total System Performance Assessment, no probabilities, no uncertainties, zero.

BIURRUN: Absolutely.

OUZOUNIAN: I haven’t expressed myself quite correctly. We are convinced that we can build a zero-release repository and we are striving to do so. And, the basis of our safety case is to demonstrate that this will be so. The regulated value that we have to comply with 0.1 millirems for a million years, 10 millirems for a million years. And, there are somewhat higher values for cases that are very unlikely, and there is a definition what is very unlikely.

KADAK: Is there a probability number on that?

OUZOUNIAN: No, it's always a dose number. It's always a dose number, which is actually, you could immediately translate into risk figure. But, the new safety criteria prefer to express it in dose because it is felt that it is better understood by the public.

KADAK: So, what is that dose number, the higher number?

OUZOUNIAN: I'd have to look. This is a very new paper. I will tell you after.

KADAK: Okay. And, how about in the UK, what is your regulatory standard to which you must meet?

MATHIESON: Yeah, that's an interesting question because we don't have a regulatory standard as such, other than the operational standard, and I guess we're talking really about post-closure in this case. Basically, what the guidance says, and again this comes down to the difference between our respective countries in our approach to regulation. Basically, our regulators say to us you have to demonstrate that the repository is safe, is a very short way of putting it. Now, in doing that, we will provide you with guidance on what we mean by that. And, the guidance says that essentially, it's a risk figure of 10 to the minus 6 per year. So, risk a fatality.

KADAK: It's a fatality risk?

MATHIESON: A fatality risk of one in a million per

year, which you can then translate to dose based on the--

KADAK: Sure.

MATHIESON: Now, that is to essentially, a representative member of the critical group.

KADAK: Right. Are you also going out to a million years?

MATHIESON: Well, again, this is, again, where we don't get too prescriptive. Basically, it's up to the developer, ourselves, to demonstrate again to the regulator what our various scenarios are. In other words, we recognize and they recognize that the longer you go into the distance, the more qualitative your documents become, rather a specific quantitative responses. And, we will be developing that as part of the safety case preparations. So, again, it's up to us to show to the regulator how we've done that and whether he's satisfied.

KADAK: Then, they will decide whether it's acceptable?

MATHIESON: At the end of the day, yes. But, based on discussion.

KADAK: How about the French case?

OUZOUNIAN: In France, the same level of safety must be achieved, and this is given at .25 millisievert per year. And, we have to demonstrate that this can be achieved over 10,000 years. And, then, we must comply with this .25 millisievert per year, and convince our safety authority that

it can be achieved over one million years.

KADAK: Same number?

OUZOUNIAN: Yes, the same number.

KADAK: And, in Sweden?

SODERBERG: I'm not quite sure here. I have the impression that it's very similar to the UK.

KADAK: What I'm hearing basically is that no one's really applying the Total System Performance Analysis risk assessment on establishing the safety case. It's really more of a deterministic number. Is that what I'm hearing?

MATHIESON: Ours is a probabilistic.

KADAK: Yours is probabilistic?

MATHIESON: Yes. I'll send you a copy of the general requirements for authorization for geological repositories, which lays this out much more eloquently than I can say.

KADAK: And, Germany's would then be, how would you describe it? You're not going to do a TSPA, are you?

BIURRUN: We are doing that right now.

KADAK: I see.

BIURRUN: Right now. By the way, for the first time for the Gorleben repository. It has been done before only in the framework of R&D work, and having not due consideration of the specific geology of this site and of the specific characteristics. The geology of the sites impose a repository layout which looks like a painting of Miro, which

is very complex, and we are right now engaged in such a process. There's a number of institutions in Germany that have been charged, but the government would prepare this, we call it that way, and it will be based again in demonstrating the basic case, normal evolution of the repository with zero release. Of course, it will analyze historic conditions, which would then require a total system performance assessment.

KADAK: Do you believe that a million year standard is credible?

BIURRUN: Sir, we have been having, in the last years, a discussion because we have very strong influence from the Green party in certain--of the government, that their standard should be 1 microsievert for one million years, and this is at the level where you have to stop allowing that married people share the same bed, because irradiation is-- and stuff like that. And, very recently, there was an attempt to extend the period to 10 million years. Why not?

KADAK: So, your answer is you don't think it's credible?

BIURRUN: I don't think--I think that if the repository in salt remains tight during a certain window of vulnerability that lasts only a couple hundred years at the start, then it will stay tight forever. So, one point is believing and knowing that the repository is safe, and

there's a different story is to demonstrate, I mean before the court, that it's going to be so. That's a legal entity, and that's a total different story. Thank you.

KADAK: Thank you.

OUZOUNIAN: Just a very simple point. We have a very deterministic approach, and we can have it because we have a simple system, which is very linear and continuous. However, we have all the sensitivity, uncertainty in this, and we also begin to think about probabilistic approaches.

DUQUETTE: John?

GARRICK: I just wanted to get back, just for a moment, to the issue of authority, because the discussion kind of was left with the sense that what good are these advisory boards if they don't have any authority. And, there's a lot of difference between authority and action, and I think it's very important to note that. The Board, with one exception, and I'll bring that out in a second, has had excellent experience with DOE in having their recommendations followed up. As I think it was mentioned this morning, that certain things would not have happened with respect to the project had the Board not been involved. And, I think part of the reason, not all of the reason, is that the Board reports to Congress. Congress does seem to have some authority, and they do listen to what we have to say. So, I don't think the authority issue is an issue.

I do think that the obstacle that I spoke of, had it not existed, things would have been much smoother, and that is the lawsuits between the nuclear power plant owners and operators, and the Department of Energy, have compromised some of the interactions between the Board and the Department of Energy. I think had they not existed, there would probably be no evidence that the Board hadn't had essentially all of its recommendations addressed in some manner. So, I just wanted that for the record.

DUQUETTE: Are there any other questions from the Board? Bill?

MURPHY: This is a technique question for Enrique.

At Gorleben, are you concerned with migration of brine inclusions up the thermal gradient toward the waste? And, if that's not a technical problem, what are the technical problems that seem important to you for the long-term?

BIURRUN: It's quite interesting. Early this year, we organized a joint US/German workshop on salt science and technology, and were discussing exactly this, this aspect. This is one of the, I would like to term it, our being around since quite a long time, and actually we carried out a number of large-scale experiments at the Adesol Mine for determining the movement of water to the heaters. And, I remember one of these experiments ran for 1000 days heat at 200 degrees, and

we managed to collect with heat drops half a glass full of water in three years.

Then, we carried out another experiment in which we studied the dynamics of the release of water and a colleague of mine did a very interesting scientific work to identify the motives that appear to be working there, and he actually succeeded in producing tremendous variations of the rate of water release with movement that excluded the method that you mentioned.

What seems to happen is that we have, on crystals, one or two layers of water molecules, and these molecules expand with temperature, of course, and I move it near the heater, beyond the evaporation front. And, then, the water when it's passed into this area, evaporates very suddenly, and you get a peak in the water influx. But, this is not a mechanism that concerns us that much, because we know that when we put waste into a borehole, for instance, the void space around it will close within weeks, and then we have a pressure gradient. And, you know normal water molecule without special training is not able to climb up the hill.

MURPHY: Thank you.

DUQUETTE: Andy, and then I'm going to ask if the staff has any questions.

KADAK: Thank you. I was curious about how are you going to maintain the temperature of the waste package to

less than 90 degrees centigrade?

BIURRUN: This was France. We are 200.

OUZOUNIAN: We have two possibilities. The first one is to wait for the waste to cool down enough before its emplacement.

KADAK: How long is that?

OUZOUNIAN: Oh, it depends on the power of the initial fuel, but it’s between--it’s several tens of years. It’s typically 40 years.

KADAK: 40 years?

OUZOUNIAN: Yes. And, the second possibility we have is to space, to increase the distance between waste packages placed in the repository.

KADAK: And, what would be the typical spacing, what scenarios did you look at for spacing, and why?

OUZOUNIAN: Now, we are at twelve meters between two drifts.

KADAK: Twelve meters between drifts?

OUZOUNIAN: Yes. But, it depends also on the time, the cooling down time.

KADAK: Of course. So, as I understand, you have a tunnel. You drill boreholes?

OUZOUNIAN: Horizontally, between two horizontal boreholes.

KADAK: And, you’ll just fill it with the cylinder?

OUZOUNIAN: Yes, the reference is twelve meters because we are in the process of industrialization and optimizing.

BIURRUN: And, perhaps may I add something? The temperature for our repositories has always been 200 degrees. But, now we are starting another alternative. I mean, a lot of our waste is in transportation and storage casks, and we are studying the possibility to use these casks as a final disposal cask, which entails certain--because it's 120 tons heavy, and will require a little bit higher temperatures around the cask, not enough to have too long interim storage times. But, it will be quite a solution because it would obviate the needs to have an encapsulation plan and all these kind of things, and new casks for disposal.

KADAK: So, you're not worried about criticality?

BIURRUN: No, it has been studied, but it doesn't appear to be a problem.

KADAK: So, you take burnup credit?

BIURRUN: Well, yes.

DUQUETTE: Does the staff have any questions, or anything you'd like to add? Yes, Doug?

RIGBY: Doug Rigby, Staff.

John, you mentioned that you screen out unsuitable sites, and you had some criteria. I was just wondering if you can explain a little bit more about your subsurface unsuitability criteria?

MATHIESON: Essentially, what all that comes down to is natural resources such as coal, or something like that. And, in fact, I think this week, Thursday I think, geological survey, I'm going to publish a map of Allerdale and Copeland, and then five kilometers off shore from those locations, what they consider to be unsuitable areas within those zones. So, they'll be based primarily on whether or not there are natural resources such as coal there, or is there some other feature in the underground which will present the repository being located there.

Now, the other aspect, too, it says that it's purely geological, so it's not dependent on whether there are buildings on the surface, or anything like that at this stage. That will come much later, should the community decide to participate. They are fairly simple, straightforward criteria.

DUQUETTE: I think I'll close the session. But, did you want to add something else?

RIGBY: Just a quick follow up. Do any of your countries, would you have a criteria that would exclude a place like Yucca Mountain for its oxidizing atmosphere or unsaturated zone?

MATHIESON: If I could take that one? As I say, at this stage, there's initial exclusion. So, to get down to that kind of detail would be further down the road in terms of

demonstrating whether or not you could make a safety case for the environment.

OUZOUNIAN: It was the same answer.

DUQUETTE: As I said, I'd like to close this session. I really would like to thank our panelists. I think you've been very candid in sharing a lot of information with us and answering questions, and being beat up by the Board a little bit. But, thank you again for your coming all this long way to share your experiences with us, and I'd like to give you all a hand for taking part.

Then, I'll turn the meeting back over to John.

GARRICK: Thank you. Okay, we're to the point in our meeting, I believe, of public comments. And, the last time I looked at the sheet, we had public commenter, Judy Treichel on the list. And, we'd like to hear from you, Judy.

TREICHEL: I think it's interesting. Abby must have looked ahead because she recommended that you expand your outlook on this whole thing, and then Olaf told you exactly how to do that. And, it sort of goes along with what I was going to say as well, because there were countless times here today when people asked well, how would we do this thing then? If Yucca Mountain is done, what are we going to do? And, it seems to me that there's been a lot of guidance from the international programs, and I do think that there has to be a waiting period, because you get kind of a bad taste in

your mouth when you've had a situation like Yucca Mountain, and there were all sorts of reasons that went into the failure of the site, or the failure of the program.

But, after you've gotten over that, and after you've had a chance to think, and after there's been a little sanity, hopefully, put into the process, it seems to me you've got to get a national agreement that a repository is needed. And, if people across the country are willing to take a stand, make an opinion, decide that you need a repository, then the thing that goes along with that is that whoever is asking the question I think has to tell them what the repository solves. If you've got a problem, what's the problem and what's this thing going to solve.

And, there is really two big answers that could be possible. One is that you want to get rid of nuclear waste. If that's the situation and we've got this waste, which is existing now about the legal limit of Yucca Mountain, that's about what we've got sitting out there, and you want to get rid of that, and the country would be better for not having that stuff anywhere near the surface, then people could make a decision about whether or not they're going to help with that solution and getting to that point.

If the other answer is that you want to get the waste that's sitting out there and around moved so that you can replace it with new waste, that's a whole different deal,

and that's where you start getting the real big problems with people, I suppose like me and the Nuclear Waste Task Force and the other groups, the public representative groups that are out there that don't like nuclear power, don't like the stuff that's nuclear, and then they feel like they're just playing a part in the making of the waste, that they're part of the enablers for the waste makers. So, it's a really different question that people are answering.

And, once you've made this decision that you do want a repository, whether it's for the benefit of making more waste, or getting rid of all waste, then I think you have to set the standard, and that standard has got to be there, if you're going to have people making a decision if this thing is going to come and live with them. And, the idea that you said there was zero release, I think that's what somebody wants. If you're going to accept this facility where you live, why would you want it to come in and start emitting radiation that then makes your place less safe than it was before you said okay. You certainly have to have a great big reward if you're willing to take that.

And, I suppose that you would put out this request for places in the country that could volunteer. And, there again, you'd have to say what you were looking for. If there's areas in the country that have clay, or if there's areas with granite, or if there's areas with other things,

those would be the places where people would be encouraged to set up a dialogue after they knew what they were talking about, and so did the people who were asking, so that you had already defined and agreed upon the problem.

And, when Joe Ziegler was up there, he said well, it may not be possible to find a volunteer site. And, he's absolutely right. And, if you can't, that tells you something. That tells you that you have to wait a little longer, because the country, or whatever, that we're just not ready. And, I really think you've got to have a volunteer site, or a willing host for this, or it just isn't going to go. People are going to figure out a way. If people in Nevada could figure out a way to hold this thing off until we were able to get to the point where we are right now, then people in other places could do it, too. So, I just think you've got to have a willing host before you go into it.

And, there was a lot of talk today about levels of confidence, and I think during the process of the Yucca Mountain Program, DOE got really confident, and the general public around the place probably got less confident. So, there again, you've got to have sort of a confidence agreement that you're building with everybody involved.

And, there was also the statement that Nevada had the Test Site, and that they went along with that, and then Yucca Mountain came along, and how come they changed their

mind. Well, as a person that was there around that time, the longer testing went on, the more opposition grew to it because the more there were illnesses, there was what seemed to be very unfair situations. People fought for 40 or 50 years to get compensated. So, the opposition to nuclear testing was growing, and testing was still going on when Yucca Mountain landed in our lap. So, that sort of seemed like a really bad joke. And, it wasn't the kind of thing that, you know, where you had something good and you could add to it.

And, I do have to sort of reiterate what Steve had said about the Technical Review Board being really, really important to us here. And, from the very beginning, the Board was the one place where we heard from DOE, they were forced to tell you the truth, and had to answer even deeper questions, and there were times, depending upon what was going on at the time, that even people like me or other people who were in the audience were able to ask questions as well. And, it was the only time that we really got answers, or that we really understood what they were doing, because they were specifically told by you what you wanted to hear, and a lot of time, it was what we wanted to hear too.

So, thank you very much.

GARRICK: Just a moment. Don't leave the podium, I'd like to pursue this a little bit

different than what we usually do.

Because I agree very much with some of the things you're saying and implying, I've always believed that we've never packaged the repository question properly. If you ask anybody if they want a nuclear waste site, what's the obvious answer? I think we've already heard that, it's no. It's a case of the cart before the horse.

The real question is do we need nuclear power? And, of course, we do have the subsidiary question of well, we have waste, and we've got to do something with it. And, what are the options for doing something with it. And, I think you could take a decision analysis perspective on that, and come up with a very logical set of outcomes, and present those outcomes to the public and say which of these do you want.

I think the main thing is that you don't, and we've also spoke to this morning, you don't mandate these things. You give people a choice.

So, I think that to try to sell a repository in the context of a waste site has never been the right way to go. I think the country has to decide if it's going to continue to have nuclear power as an option for baseload power. And, once you get over that hurdle and you get national support for that, it's pretty obvious that implied in that is we've made a commitment to do something about the waste. And,

you've kind of hinted at that very thought process, and I just wondered if you agreed that it's almost an impossible sell to talk about a waste site.

But, that's not the real issue here. The real issue is energy, and what are we going to do about the hunger of the planet for energy, and are we going to play in that arena?

TREICHEL: Well, yeah, but you've got another sort of sticky problem, too, because you can decide not to have any more nuclear power, but you still have a repository full of waste.

GARRICK: Well, I know.

TREICHEL: So, you want two repositories.

GARRICK: But, I do think you could take a decision analysis approach to that and sell it in a very different fashion than we have been doing it in the past.

TREICHEL: I think so, too. I agree with you.

GARRICK: Yes, glad to hear that.

TREICHEL: We must both be real tired.

KADAK: I'm not tired yet. Judy, I have a question for you. You've been around this whole nuclear waste issue for many, many years.

TREICHEL: Yes, I'm very old.

KADAK: No, no, no, I didn't mean that. I meant it like I have been around it for many, many years. And, you know

how the process started with site characterization. You know the geology. You know the history of the United States. Can you give us some ideas as to where one might look, if not Nevada, for another spot that you might think is geologically suitable?

TREICHEL: Well, I'm not going to put a tack in the map for you. With a lot of the programs that you're seeing, maybe not a lot, I don't know, but certainly in Sweden and in Finland, the waste repositories are going very close to reactor sites, nuclear power plants, where the people have confidence that those are running okay, and they've been living with them, and they're putting the waste there. And, I guess the same thing was true at Sellafield at that point. So, in Nevada, you wouldn't build a nuclear power plant. It doesn't make any sense. So, it seems very strange to consider that as a natural for a nuclear waste site, and I don't think that the unsaturated zone has done a good job of proving itself to be a great medium to go looking for.

GARRICK: We have a comment over her?

BIURRUN: I would like to make a small observation to what you have said. It is actually the easier side of nuclear power, but we have already one country where this idea that you have proposed has backfired. That's the Netherlands. The people in the Netherlands didn't accept a repository, and what they make is they build a bunker and are

putting the waste in a bunker, and recently, they extended the lifetime of their only nuclear power plant for another 20 years. So, instead of solving this problem for the next generations, we are going to put them, roll them in front of their feet. So, when you oppose a repository, that might backfire. Please keep it in mind. There is already one example.

TREICHEL: Yes, because I think, you know, people say it's unfair to leave this for our kids. I think the real unfairness is if we leave them something in the ground they can't deal with, or if we leave them with a terrible mistake that we've made. But, there again, would the Netherlands open the door of that bunker and invite other people's waste in?

BIURRUN: No.

TREICHEL: There you have Nevada.

BIURRUN: No, but there will be, very soon, another example in Spain.

TREICHEL: Of a bunker?

BIURRUN: Of a bunker.

TREICHEL: Yes, that may be the best they can do.

GARRICK: Okay, thank you. Thank you very much.

Are there any other comments, questions, opportunities to get on your soap box on the part of any member of the Board? Yes. Well, I don't know about this.

KADAK: I thought today's sessions were really quite interesting. And, a couple of things that sort of stood out for me, and I think the most important was, you know, this is in fact an engineering project, which science needs to support. And, if we treat it as an engineering project from the beginning and asking the scientists I need this information, I need this information, I need that information, to make the safety case whatever it is, as we've seen very many different versions of that, so be it. Because, if you don't treat it that way, we'll just go on and on and on.

The other thing that came out very clear to me was, you know, the political impact of decisions or no decisions. The whole history of nuclear waste in all the countries, has been one of bring the ball so far, and then wrong ball, wrong direction, start over. And, I don't know how long this country or all the countries can sustain such efforts. And, it's huge costs of money being wasted, and I don't know what kind of stability one needs.

I think the Swedish system perhaps provides the best example, where the responsibility becomes that of the generators of the waste, and, they then have an incentive to succeed. And, the further we can keep the government, I kind of feel that Judy's problem is more--I mean, partially, yeah, we don't want it in our state. But, I think it's DOE as

being a problem, a lack of credible person or group entity.

So, I think--I'm not saying that the utilities have a better reputation, but they surely could work better at it than a government entity. So, those are the two kinds of messages that I've gotten, and I don't know if that resonates with the Panel at all or not. But, that's kind of what I've got.

MATHIESON: I think I'll slightly disagree with you because I think in our case in the Nineties, we did treat it very much, too much as a technical engineering project rather than include the public section side of it. And, I think you can go to Canada as well when they failed also in 1997, it wasn't a very good year. But, their post-mortem on their process did determine they had a very good technical program, but they didn't trust the socioeconomic side.

KADAK: I didn't mean to exclude that. I mean, if you give it to a private entity, and that private entity treats their engineering project like they would treat a siting of a new nuclear plant, for example, with all the public relations, the community outreach, the citizens' advisory boards, all that, that's what the private industry is capable of doing. I don't think the government does it as well, because it has political constraints in many ways.

ARNOLD: Arnold, Board.

When I was discussing the issue of whether or not

it's an engineering project, I really had a more restricted view, Andy. I was just thinking of once it is in fact decided that it's going to be here and it is approved by everybody, including the community, then to me that's when you really want to treat it like an engineering project.

GARRICK: I think that's what Andy means, too.

KADAK: Yes.

GARRICK: I think one of the things that strikes me about the repository that's very different from a nuclear power plant, particularly nuclear power plants in the early days, and certainly the repository is in its early days, and that is that there was a great deal more interaction and negotiation, if you wish, between the licensee and the regulators when they first started licensing nuclear power plants, because nobody quite knew what was the most effective thing to do, and there was a tendency to work together on that. I don't think this is collusion, this is something you see a great deal in Europe that you don't see here, and that's because we have too many lawyers here.

But, I think that, for example, the Yucca Mountain Review Plan that was developed by the Nuclear Regulatory Commission, I don't think had any input from industry, and the industry in this case being DOE, and I think that's a very serious mistake. I think that we would have ended up with probably a much better review plan, a much better

standard, had their been a great deal more engagement of DOE with the process.

And, in the case of reactors, in the case of industry, industry did engage and they engaged in a very active and vigorous way. The Westinghouses and the General Electrics and the combustion engineers and the whole industry really weighted in on the process. There hasn't been much of that with respect to the nuclear power plants. And, in this country, it's the private sector that drives most things, and I think that that's been missing in the repository project, and is probably one of the real reasons it's been kind of a "lost at sea" process.

Any other comments?

(No response.)

GARRICK: Any comments from the floor?

(No response.)

GARRICK: Okay, well, I think we've had a very successful day. We appreciate everybody's contribution, including the audience, even though they didn't get an opportunity to ask many questions. The Staff didn't get much of an opportunity either, but they will have their day.

With that, we will adjourn. Thank you.

(Whereupon, at 4:45, the meeting was adjourned.)

C E R T I F I C A T E

I certify that the foregoing is a correct transcript of the Nuclear Waste Technical Review Board's Winter Board Meeting held on October 26, 2010 in Dulles, Virginia taken from the electronic recording of proceedings in the above-entitled matter.

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