UNITED STATES

NUCLEAR WASTE TECHNICAL REVIEW BOARD

SUMMER BOARD MEETING

Thursday

June 11, 2009

Marriott Suites
325 Convention Center Drive
Las Vegas, Nevada 89109

NWTRB BOARD MEMBERS PRESENT

Dr. B. John Garrick, Chairman, NWTRB
Dr. David J. Duquette
Dr. Ali Mosleh
Dr. George Hornberger
Dr. Andrew C. Kadak
Dr. Henry Petroski
Dr. William Howard Arnold
Dr. Thure E. Cerling
Dr. William M. Murphy
Dr. Ronald M. Latanision

NWTRB SENIOR PROFESSIONAL STAFF

Dr. Bruce E. Kirstein
Dr. David A. Diodato
Dr. Gene W. Rowe
Dr. Carl Di Bella
Douglas Rigby

NWTRB STAFF

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

I N D E X

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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 Nuclear Waste Technical Review Board.

As is our practice at the beginning of all of our meetings, we introduce the Board and all of its members. There are eleven of us. My name is John Garrick. I'm Chairman. And, we all serve part-time in this capacity. My background is nuclear engineering and risk analysis, and I spend most of my time consulting in those disciplines. Besides Chairman, I also serve under the present organizational structure that we have as the lead on radiation dose calculations.

Now, as I introduce the rest of the Board members, I want them to raise their hands as I call out their name, and I'll start with Howard Arnold. Howard is a consultant to the nuclear industry, previously holding a number of senior management positions such as 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. Under our current regime, Howard chairs the Board's Panel on Preclosure Operations.

Thure Cerling. Thure is a Distinguished Professor

of Geology and 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 our technical lead, with George Hornberger, on the Natural System.

David Duquette. David is the John Tod Horton Professor of Materials Engineering 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, with Ron Latanision, is the Board's technical lead on Corrosion.

George Hornberger. George is a Distinguished Professor at Vanderbilt University, where he is Director of the Vanderbilt Institute for Energy and Environment. His research is aimed at understanding how hydrological processes affect the transport of dissolved and suspended constituents through catchments and aquifers. George co-chairs the Board's Panel on Postclosure Performance.

Andrew Kadak. Andy is Professor of the Practice in MIT's Department of Nuclear Science and Engineering. His research interests include the development of advanced reactors, space nuclear power systems, and improved licensing standards for advanced reactors. Andy is the Board's technical lead on Thermal Management.

Ron Latanision. Ron is Emeritus Professor of Materials Science and Engineering and Nuclear Engineering at MIT, and Corporate Vice-President and Practice Director, Mechanical Engineering and Material 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. Ron co-chairs the Board's Panel on Postclosure Performance.

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 fields of study and practice are risk and safety assessments, reliability analyses, and decision analyses for the nuclear, chemical, and aerospace industries. Ali is the Board's technical lead on Performance Assessment.

William Murphy. Bill is a Professor in the Department of Geological and Environmental Sciences at California State University, 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. Bill is the Board's technical lead on the Radiation Source Term.

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. Henry is an accomplished author in engineering and science and is the Board's technical lead on the design of Surface Facilities.

Now, we are missing one Board member today, and that's 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 Director of the Vanderbilt Center for Environmental Management Sciences. He chairs the Board's Panel on System Integration, and is the Board's technical lead on Transportation. Mark is attending a conference in Stockholm on social decisions involving risk, where he is also presenting a paper.

Now, before discussing the agenda, let me make a few remarks about the role of the Board. By law, the Board's responsibilities are to evaluate the technical validity of activities undertaken by the Department of Energy in the management of spent nuclear fuel and radioactive waste, and to advise the Secretary of Energy and Congress of our findings and conclusions. We are often asked, especially now, what this mandate means, given the unfolding scope of waste management within DOE. I'd like to maybe illustrate what it means by giving you three examples.

Example 1. To the extent that the DOE Office of Civilian Radioactive Waste Management, or OCRWM, does

new technical work, we will monitor, evaluate, and report on that work to the Secretary and Congress. Responding to a Nuclear Regulatory Commission (NRC) request for additional information, an RAI, or participating in the resolution of a contention is not in and of itself new technical work, unless it involves new analyses, new field or laboratory work, new models, or new computer runs. Also, OCRWM is doing a very small amount of new technical work under its performance confirmation program.

Example 2. The charter of the Department of Energy's Blue Ribbon Panel to study waste management alternatives is still closely held, but proposals for similar panels advanced by the Office of the Senate Majority Leader and the Senate Committee on Energy and Resources are completely public and have been reported widely. Whether either of those proposals will be adopted by Congress is uncertain, but one way or another they may influence the thinking and the language of the charter for the DOE's Blue Ribbon Panel, or Commission, whatever it ends up being. We are pleased that both the proposals explicitly recognize this Board as a technical resource. We expect to provide technical information and insights for the Blue Ribbon Panel. The Board has a wealth of information and experience in the waste

management area, and we kind of pride ourselves on being a source of unbiased, objective, and independent technical analysis for more than two decades.

I have been asked, and I'm sure other Board members have also been asked whether the Board could be the Blue Ribbon Panel. Now, let me comment on that. First, we are a technical board. Each of us is a scientist or engineer selected for the Board because of our knowledge and accomplishments in technical areas. Consequently, when the Blue Ribbon Panel considers technical issues associated with waste management alternatives, the Board will be an obvious and appropriate resource. However, inclusion of non-technical issues in the Blue Ribbon Panel's charter would require fundamental alteration of the Board's legislation. And, the makeup of the Board would have to be augmented to include policy analysts, financial analysts, social scientists, and cost analysts--things we all know something about but can hardly call ourselves experts. Our staff would have to be augmented similarly. All of this can be done, but it would take time.

What the Board will do, and this requires no change in the technical mission, is to look broadly at the waste management system and waste management alternatives to provide its objective view of technical

questions and issues that should be addressed. The Board also will draw on its long experience base to provide technical information and technical "lessons learned."

Example 3. This example is represented by the significant amount of DOE-owned spent fuel and high-level waste. Most of this, more than maybe 95 percent, I suspect, is unquestionably non-recyclable. It has to be disposed of. Until it is disposed of, it has to be managed which may involve treating and packaging, particularly for the liquid waste and sludges, to get into a safe-to-store form. While most of this waste is managed by DOE's Office of Environmental Management, a small but very significant part is managed by the Navy, and I believe a small amount of it is managed by the DOE Office of Nuclear Energy. We have evaluated DOE activities with these wastes in the past and will continue to do so in the future. In fact, one of today's speakers is from DOE's Office of Environmental Management.

So, the change in the Administration direction on waste management changes our priorities, which in turn affects our organization. One of the things we will be discussing tomorrow in our private meeting will be our reorganization to reflect today's realities. So, next time,

we'll be assigning probably and reporting on different assignments for Board members. And, we ask you to watch for the new organization of our Board, which will appear on our website. And, the new organization will place even more emphasis on what has always been one of the Board's hallmarks--a systems approach to waste management problems.

Now, let me turn to our meeting today. Our first speaker is Russ Dyer. As at our January meeting, Russ is standing in for Chris Kouts, who has been the acting director of OCRWM since mid-January. Russ will give us an update of the program, and I will introduce him in a moment. Next, we have a talk from Victor Gilinsky, a consultant to the State of Nevada Agency for Nuclear Projects. Following, we will hear from Rod McCullum of NEI on just how much commercial spent fuel there is already and how much there is projected to be. I believe he also will be giving NEI's vision of the future of waste management. Gary DeLeon, of DOE's Office of Environmental Management, will follow with the status of and projections for the inventories of DOE-owned spent fuel and high-level waste.

After lunch, we will hear from the Congressional Research Service. Mark Holt will talk about the report he recently authored on Alternatives to Yucca Mountain. Then, we will close out the day with a panel discussion that I have asked Board member Ron Latanision to moderate. The topic is

Research and Data Needs for Very Long-Term Dry Storage of Spent Fuel and High-Level Waste. That is, after all, one of the waste management alternatives, so we should address what we're getting into. I am looking forward to the brainstorming session. The panelists are John Kessler, EPRI; Tara Neider of Transnuclear; and Tom Brookmire of Dominion Resources.

Following the panel discussion, we have scheduled time for public comment, which is always an important part of our meeting, and it's important to the Board. And, if you would like to comment, please enter your name on the sign-up sheet at the table near the entrance to the room here. And, by the way, we also have an attendance sheet back there, and if you haven't jotted down your name and e-mail address, we'd like you to do so. If you prefer, remarks and other material can be submitted in writing and will be made part of the meeting record.

Now, some of you have asked about questions during the course of the presentations. We do have sort of a pecking order with respect to that, and a time element is involved and determines how far we can go. First, Board members ask questions. Then, if time permits, staff members. Then, if time permits, members of the audience. But, we have other mechanisms for audience participation.

Frankly, we rarely get to the point where staff

members can ask all the questions they have. Thus, our suggestion is that you write down your questions and submit them for the record. We will read them, time permitting.

As usual, to minimize interruptions, we ask that all of you turn off your cell phones, or at least put them on the silent mode. And, I also want to remind everyone that it is very important that you identify yourself, if you are speaking, and speak into the microphone. These microphones don't all have the same pickup capability, and we are very picky about developing a complete record of the meeting. And, when you do that, give us your affiliation, the name, and any relevant information that would identify your remarks.

As to introductions of speakers, I'm not going to read bios, and what have you, but at the table outside, you will find the bios on all of today's speakers. So, with that, I will now turn the time over to our first speaker, Russ Dyer.

DYER: Thank you, Dr. Garrick.

Chris Kouts sends his apologies. He wishes he could be here, but he's tied up back in Washington. So, I get to talk about the status of Yucca Mountain. And, about a month ago, the President submitted his budget to Congress, and that budget request had in it some very significant language associated with Yucca Mountain. And, I'm going to

spend most of my time talking about that, and what the implications are.

The budget language essentially said the Administration has decided that Yucca Mountain is not a workable option and proposes to eliminate the Yucca Mountain Program. And, the details of the budget request, there was a request for $197 million for DOE to explore alternatives for nuclear waste disposal, and to continue participation in the repository licensing proceeding before the NRC.

The proposed 2010, fiscal year 2010 funding request implements the Administration's decision to terminate the Yucca Mountain Program while developing disposal alternatives. It eliminates all funding for development of the Yucca Mountain facility, such as further land acquisition, transportation access, engineering and design development.

What this means is that contractor support has been reduced from about a level of 2,500 contractors in fiscal year 2007, down to about 700 today.

Now, where do we stand in the licensing process? The license application was submitted to the Nuclear Regulatory Commission a little over a year ago, docketed in September. The RAI process is underway, requests were due by the end of December, and responses to contentions. So, this is as of Monday, we had about 449 requests for additional

information. But, this changes daily, literally. We have submitted 333 responses to NRC. We have 113 responses to the requests for additional information currently in progress. Three are cancelled. There are still requests for additional information coming in from the NRC. We expect a fairly large batch of engineering-related RAIs today, and perhaps tomorrow. The expectation on all sides is that the balance of questions will be developed and transmitted to us by NRC by the end of September of this year, and our plan is to respond to all RAIs by the end of the year, by the end of December.

Next slide, please?

Now, the Atomic Safety and Licensing Boards, and there are three Boards appointed by the NRC have granted a hearing on the Yucca Mountain License Application. In its order of May 11th, it admitted eight petitioners as parties and identified a total of 299 contentions on safety and environmental issues. This is out of a total of around 321. It depends on how you count. Some are verbatim duplicates.

And, that is a short summary of the program. And, with that, I would take questions from the Board.

GARRICK: Bill?

MURPHY: This is Bill Murphy of the Board.

Was there a technical basis offered by the Administration for the termination of the Yucca Mountain

Project?

DYER: It was not in the Congressional language--I mean, sorry--in the budget language.

MURPHY: So, you're unaware of any technical basis for this change in course?

DYER: I'm not aware.

GARRICK: Yes, Ron?

LATANISION: Latanision, Board.

How does the Project and the Department interpret the instruction by Administration to continue participation in the licensing proceedings, given that the project is considered not workable? What are the possible conclusions to that process?

DYER: Well, the way we interpret it is that we will remain engaged in the hearing process, responses to the requests for additional information to the NRC. We will prepare to participate in the licensing process, which I believe the current schedule is that hearings would start next summer. So, dealing with the contentions, discovery, the discovery process, getting ready for the hearings.

LATANISION: What is the implication downstream now? Suppose, in fact, go through the entire process and the NRC agrees that the license application has merit, what's the implication at that point?

DYER: It depends on what happens in between. If the

program is actually terminated somewhere, then I assume that the licensing process would also be terminated. But, if we continue in the licensing process and construction authorization is ultimately granted, I think there would be a national decision whether or not to exercise that authority.

GARRICK: Henry?

PETROSKI: Petroski, Board.

Slide 3, you say that the proposed fiscal year 2010 funding request implements the Administration's decision to terminate the Yucca Mountain Program while developing disposal alternatives. How do you propose to do those studies or alternatives?

DYER: Well, as Dr. Garrick mentioned, there are a number of proposals. The Secretary of Energy is putting together a somebody called it a Blue Ribbon Panel, which will look at the alternatives and make recommendations, my understanding.

PETROSKI: But, this implies that DOE is going to be pursuing alternative technologies, or alternatives.

DYER: That's correct.

PETROSKI: So, are you saying that this budget is going to fund that Blue Ribbon Panel? What exactly are you saying?

DYER: My understanding is that the funding to support the DOE panel will come out of our budget. Now, the implementation of any recommendations would be another budget

action.

GARRICK: Andy?

KADAK: Yes, Kadak, Board.

Two questions. One, right now, what is DOE doing internally, with the exception of creating this panel, to seek out alternatives to Yucca Mountain as a disposal site? And, two, do you have sufficient resources to do a credible check into a licensing proceeding or just answering questions and participating in the process?

DYER: Let me take the second one first. Based on our experience to date, yes, I believe we do have adequate resources in this budget to be credible participants in the licensing process. I'm not aware of any activities that DOE has underway officially to look at other sites or media or techniques.

KADAK: Just a follow-up to the first answer. We have heard that the technical resources that you had, the 2,500 people, many of them dropped the state, gone on to other projects. A lot of the technical expertise is gone from the project and may not be available to you. I also understand that you're replacing the technical experts who worked on the project with DOE staff people. Can you answer the questions, the technical questions that are coming from the NRC adequately, given the lack of expertise, or at least the expertise that is departed from the project?

DYER: We believe we can. We've already experienced some of that, and what we've been able to do to date is to identify specific technical expertise that's critical to a particular response, and arrange for them to come back as a contractor for a period of time to assist us in developing the response.

KADAK: So, that's workable?

DYER: That has worked.

KADAK: Thank you.

GARRICK: David?

DUQUETTE: Duquette, Board.

I'm not sure you mentioned this, but in your Slide 3 again, I of course haven't specifically read the President's message on Yucca Mountain. Is it the Department's opinion that Yucca Mountain will be considered as one of the options, or will it be totally eliminated and other options will have to be looked at? In other words, if a Blue Ribbon Panel is appointed, will they be allowed to consider Yucca Mountain as one of the options that are available? Does the Department know that?

DYER: I can't answer that.

GARRICK: Russ, I'm going to--by Board member Murphy's question about technical and what the role of technical has been in the decision-making process. And, I guess I would like to get your views on that.

It seems that we're not really working independently if we leave the legacy of Yucca Mountain totally in political language in terms of its viability. Is there an institution, and you think that would be DOE, or an organization that could address the issue of the role of technical considerations in the decision-making process regarding Yucca Mountain? It seems unfortunate that the legacy of Yucca Mountain is going to be 100 percent dependent upon political language as to why it was not moved forward. Can you comment on that at all?

Our system seems to have some flaws in it in terms of representation, and especially given that the political message is very specific with respect to that the project is unsafe, and yet does not validate that statement in any particular way. Now, isn't this an opening for there to be an answer to the question Murphy raises as to should there not be a technical--representation of the technical issue as it relates to the decisions that were made? And, why isn't DOE much more aggressive in that respect? Because the country is looking to DOE to run this technical institution, and yet DOE does not seem to be very responsive to a decision that does not seem to be lined up well with DOE's technical and scientific work.

DYER: A complex and difficult question. I'll try my best at a response here.

Decisions, especially about the approach to nuclear waste or this program specifically, are not exclusively technical decisions.

GARRICK: I realize that. But, they're being justified on the basis, and I haven't heard Reid's commentary on Yucca Mountain yet, where the reference was made specifically to the lack of a safe repository with respect to Yucca Mountain

DYER: Well, we think we made the case for the safety of a repository at Yucca Mountain in the license application that we've submitted, and we will defend that before the NRC, which I believe is the technical arena that we're talking about.

GARRICK: So, you're sort of banking on the outcome of the licensing proceedings as being the venue for making the case for technical, but by then, if the decision is already made, it becomes somewhat irrelevant.

DYER: It may be moot. I agree.

GARRICK: Yes. Well, there seems to be something missing in this whole process, and it makes no sense. Sometimes you think maybe the scientists just out to give up and give the whole issue to the legal community.

Any other questions for Russ?

HORNBERGER: Can you tell me what the status of the facility at Yucca Mountain is that is addressed in maintenance, portals, and the infrastructure?

DYER: We have shut down the site essentially. We still have very limited access. We do a once a month entry, a walk-through of the ESF. We have a few monitoring programs that are continuing that are associated with the performance confirmation program. One of those is the construction effects monitoring. So, we have instrumentation underground that we go in and take readings of during this once a month entry. We still have the seismic network active at Yucca Mountain, and we are doing very limited precipitation monitoring. Those are the only active programs that we have going on.

The sample management facility is there, but we've put it in essentially cold storage. Staff has been moved somewhere else. We still have access into it, controlled, restricted access to the facility. But, there is very little activity at and around Yucca Mountain.

GARRICK: Howard?

ARNOLD: Arnold, Board.

I'm going to make more of a statement than a question. I'm familiar with cases where a licensing effort has proceeded through to the granting of a license, and then people hold off on actually proceeding with the work. I think the actual process of licensing itself will cast a lot of light on whatever process is eventually needed for whatever repository is needed. I think most experts agree

there will have to be a permanent repository at some point in time, and I just want to put my vote in for continuing licensing of Yucca Mountain, whether or not it is the chosen repository.

GARRICK: Yes, Ron?

LATANISION: Latanision, Board.

Howard, I understand that philosophy. But, I do not understand the wisdom of an Administration in continuing the process, spending more money, and, in fact, involving the time of the NRC, which will obviously have to staff up in order to make this all happen, if in fact this is an absolutely dead issue. Where is the wisdom from an economic or any other point of view in doing that? That's why I asked about the implications as read by the NRC. Maybe there are none, but this is a very mysterious process.

DYER: Well, I think the idea is that if Yucca Mountain never comes to be, there will still be lessons learned through the licensing process, maybe technical issues, procedural issues that are raised and dealt with, that would be useful in any follow-on program.

GARRICK: My concern with that is that as a person interested in decision analysis, if that's the decision we're trying to make and we're at the point that we're trying to make that decision, it seems that there's a lot more economical and efficient ways to get the answers than the

highly expensive and diffuse process that we're going through. You know, if they really want to get a package of lessons learned on this project, I think there's far more efficient ways to do it than continuing the licensing process. Go ahead.

KADAK: Just a comment to Dr. Latanision. The good thing about America is we are a country of laws, and the law right now is in 1987, the Nuclear Waste Policy Act, which says that Yucca Mountain, or to process the Yucca Mountain license, if it is acceptable, as they are now doing. And, until Congress decides that Yucca Mountain is dead, Yucca Mountain is not dead, and I agree with Mr. Arnold that we should examine--so much money has been spent on this project, that walking away from it for a political reason is just not technically acceptable, or at least not to me. And, we should, I think, at least examine whether it is an option for a repository, whether it's used or not used.

GARRICK: Yes, Dave?

DUQUETTE: Duquette, Board.

I'm going to ask you a personal opinion based on your discussions with your own staff and DOE. Do you, Russ Dyer, believe that Yucca Mountain is really dead, or that it's simply being put on hold by this Administration, and will probably be resurrected again under a different Administration?

DYER: You know, you could ask me that question every hour for the next three days, and you'd get a different answer. I have different sentiments at different times.

GARRICK: Yes, Howard?

ARNOLD: Arnold, Board, again.

I'm going to give a specific example of what I'm talking about. In the introduction that John gave for me, he mentioned the Louisiana Energy Services project. We proceeded with the licensing for that, and after some delays, received a license, but it was not built in Louisiana. It ended up, it's nearing completion now, in New Mexico. The licensing process itself ended up being of considerable value again to that project.

GARRICK: Any other questions, comments? How about the Staff, have you got any questions? You've got an opportunity. Yes, David?

DIODATO: Diodato, Staff.

Russ, I wonder if you could tell us a little bit about to what extent the Department, OCRWM is monitoring international programs in the nuclear waste disposal and geologic disposal of nuclear waste?

DYER: We still have a low level of participation and activity in international programs. But, we're not nearly as active as we were, say, five years ago.

DIODATO: Could you summarize the scientific consensus

with regards to nuclear waste management and geologic disposal internationally?

DYER: I'm sorry, Dave? Please repeat.

DIODATO: Summarize the international consensus, if you could.

DYER: Well, Abe can do a much better job of this than me, because I think he helped write the position paper from the IAEA, NEA, on international consensus for the need for geologic repositories, and some of the principles that ought to underlie them. But, there is an international consensus on this.

DIODATO: Thank you.

GARRICK: Any other questions? Yes, Doug?

RIGBY: Doug Rigby, Staff.

In I believe it was December of this last year--well, last year, 2008, there was a report issued by DOE about a second repository, possibly located, you know, back east. Is there any, other than that report, is there any other further discussion or anything with respect to a second repository?

DYER: No.

GARRICK: That was a simple answer. Any questions from the audience? Yes?

BAUGHMAN: Thank you, Mr. Chairman. Mike Baughman, Lincoln and White Pine Counties.

Just a quick question, Russ. Are you able to tell us with regard to funding and how much you're spending on licensing currently. It sounds as though virtually all the 197 million, or a very high percentage of that in '10, would be spent on licensing. In the current fiscal year, can you give us some sense of how much is being spent on licensing? I guess the crux of my question is this. Will you be spending more or less or about the same in '10 versus the current fiscal year, for licensing?

DYER: That's kind of a tricky question. The budget this year is about $297 million. We spent, our burn rate for the first six months of the year was substantially higher than the monthly expenditure rate for the last six months of the year because we were developing responses to contentions. We had a lot of people involved there. The 197 million is about consistent with an annualized monthly spend rate of what we have now. So, it's about what we're spending now.

GARRICK: Okay. Well, if there are no further questions, we want to thank you. We hope to get an update next time.

All right, our next speaker is Victor Gilinsky. And, Victor is speaking on behalf of the State of Nevada Agency for Nuclear Projects.

GALINSKI: I'm Victor Gilinsky. I'm a consultant for the State. I would like to give you an update on the State

technical activities. Bruce Breslow, who is the head of Nevada's Nuclear Office, was slated to be here, was invited to be here, but couldn't come and asked me to express his regrets. He's with his father on his 80th birthday in Michigan, and looks forward to participating on a future occasion.

I will concentrate mainly on the postclosure activities. I'm going to share the podium with Marty Malsch, who's one of the two top lawyers for Nevada, and he will deal with cross-cutting programmatic safety and legal issues.

As Russ made clear, there have been changes since the last Board meeting. On May 11th, the Licensing Board accepted a large number of contentions, essentially all of Nevada's contentions, most of which are safety contentions.

The point I want to make here is that these were the result of a very long technical process, and preparation, and I want to tell you a little bit about that. It wasn't sort of a late minute brainstorming session that produced a lot of contentions. And, the Board's action is very important, even though it's just the first step in a long process, because it validates the significance of these contentions, and is especially important because DOE opposed every single one for hearing, and the NRC staff opposed almost every single one. I think really a considerable loss of credibility on their part, on the part of the Boards.

I won't go into the President's message. Russ made that pretty clear. But, as there are funds for DOE participating in the hearing, the hearing goes on. Nevada remains strongly engaged.

Next slide, please?

Nevada decided early to deal with this issue, to engage on a technical level, not just on a political level. I hope in a way some of these things I will say are in answer to the Chairman's comment earlier, this was 100 percent political. It's not 100 percent political. There's a very large technical component here.

Starting in 2002, Nevada hired a couple dozen technical experts, had to go largely abroad to get them because almost everyone here was in one way or another connected with DOE, and, thus, ineligible. The overall coordinator of this technical effort is Mike Thorne. I don't know if he actually has a title like that, but he's an amazing guy. He's in Brittan. And, put together a very, very powerful team.

Next slide, please?

Nevada also decided early that corrosion was a very, very essential part of this, and funded work at Catholic University on corrosion, and then later, at the Institute of Metals Research in Shenyang, China, a world class institution. And, their work, different from the work

that DOE wants to rely on, in that they simulated dripping, which is quite different than what DOE is looking to. DOE concentrates on immersion experiments. DOE did fund some dripping work, but discounted.

The corrosion rates that were observed under deposits that formed on the samples suggested very rapid waste package penetration. Now, it turns out actually that these numbers are not so different than the numbers that DOE relies on in its early drip shield failure case, where it relies on numbers in the literature, and they're roughly comparable. And, I think that's very important because that case turns out to be an important component in our thinking.

Next slide, please?

Another very important capability that Nevada decided it had to have was being able to run the model. Now, at that time, NRC, which had a model of its own, was not planning to run the DOE model. So, the State of Nevada obtained a GoldSim license. GoldSim is, of course, a commercial package that is the basis for the TSPA, to which the SPA, so to speak--well, it's the basis of it at any rate. It maintains a GoldSim license for use on the TSPA program. The license is held by Mike Thorne in the UK, and he has a team of people working on this. And, they have long experience with GoldSim programs, which they have used in other applications, including voiced applications, and they

have studied the TSPA-LA. They have performed individual runs. It's not realistic for them to actually duplicate DOE's work because to get statistically significant averages for particular cases, you have to make hundreds of runs. But, they can spot check individual runs. And, their familiarity with the TSPA model influenced the formulation of a number of the contentions.

Next slide, please?

Here, I put together a slide which really concentrates on the experts. I sort of put the subjects in gray. It gives you an idea of who the people are, and I put in parentheses how many contentions they are responsible for. So, it kind of gives you a rough idea of where the concentration of effort is, or what these particular experts are doing. A fairly impressive group, I think, if you look in each area, the principal ones are in the middle column. The most recent addition to this group is Dr. Cottis, who is at the Manchester Institute of Science and Technology, and an expert on corrosion. It's in your package, and I don't think I'll go over the details of this.

Next slide, please?

Here, I've done the same thing in terms of the subjects. So, starting with the beginning of the TSPA, the climate model, going down to infiltration, then in the unsaturated zone, and so on, all the way down to the

biosphere, and, again, in parentheses, I've put the number of contentions in that area. And, it kind of gives you an idea where the effort went. The corrosion I put in red, because I think it's a really critical area, and you can see that it's concentrated on the early part, up through the corrosion.

Next slide, please?

There are a number of issues that come up repeatedly in these various contentions. Overall, Nevada believes that the program under-estimates the dose to this imaginary RMI, individual, at the measuring point.

But, criticisms that come up are reliance on inadequate models, under-estimates of uncertainty, failure to evaluate performance with alternative models, insufficient data, inadequately supported parameter probability distributions, and reliance on average flows when more realistic episodic flows would produce different results.

I particularly want to stress the item about alternative models, and the last one about using averages instead of episodic flow. All of these models, even the best ones, are very crude representations of reality, and it's very important to have alternative models. First of all, it's required in the regulations. But, there's a reason for it, because you really need cross-checks looking at things from different points of view in order to have confidence in the results. And, average flows often give you quite

different answers than episodic flow because you're dealing with another layer of systems.

Next slide, please?

I want to concentrate a little bit on the drip shield because to my mind, this is really the key area. The drip shield is in the design to protect the waste from the water. It's supposed to keep the waste dry, and that way, to prevent corrosion, keep waste package dry. The problem is DOE doesn't plan to put the thing in for 100 years. Now, first of all, there's a problem in relying on something like that just because it's so far off in the future, and intrinsically uncertain.

It may also be impossible physically to do it, and the Board has gotten the briefing from Frank Kendorski sometime earlier on this subject, who's a mining engineer. DOE does not at this point have a real design for remote underground drip shield installation. It's a very challenging environment, and so on. But, it does not even consider the possibility that drip shields won't be installed, and it claims it never did any calculations for this case, which I find incredible for a bunch of inquisitive people at a laboratory who are running this program, that they would not check to find out what the answer is. I'm also amazed that the NRC staff has not asked for this calculation.

Now, it turns out that if you use the early drip shield failure case, you can get an answer, and it turns out that the answer you get is that without the drip shield, the dose exceeds the EPA standard within about 1000 years, and it goes way above it by about 2000 years.

One of the responses from the NRC is well, there will be a license condition to require a drip shield. This is completely unenforceable, and it's just meaningless. What it comes down to is that DOE is asking for a license now on the promise that someone will install the drip shields in 100 years, and I leave it to you to decide whether that's a reasonable thing to rely on. Even with the drip shield, there is no redundancy in the system, and, therefore, no defense-in-depth, which is completely at odds with NRC's safety philosophy in reactors, and certainly power reactors. It is also completely at odds with international safety standards. Some mention is made, you know, what does the IAEA think, and so on.

I don't know how many of you know that we are party to something called the Joint Convention on the Safety of Spent Nuclear Fuel, of Spent Fuel Management, and so on. It's a treaty and one of the things it says is that in formulating your national standards, you're supposed to pay due regard to the internationally endorsed criteria and standards.

Well, if the IAEA, the closest thing to that are the guidelines from the IAEA in a report they wrote in 2003. And, one of the things they say is that a multi-barrier concept means that the failure of one component does not jeopardize the safety of the containment system as a whole. And, that is really the practice in other countries. I looked at in particular at the standards in Finland, which is the country closest to building a repository, and I quote what their standards say. It says, "The long-term safety of disposal shall be based on redundant barrier so that the deficiency in any one of the barriers or a predictable geological change does not jeopardize the long-term system." And, that is not the case in this design. And, to my mind, this is the Achilles Heel of the entire system.

I'm going to turn things over to Marty at this point for the remainder of the briefing.

MALSCH: Thank you. I'm just going to cover a few slides here.

First of all, programmatic and legal hearing issues. That has been mentioned. Almost all of Nevada's safety contentions were admitted by the NRC's Atomic Safety and Licensing Boards. In fact, three separate boards were appointed to rule on the various petitions and contentions that have been filed. Each board, the boards concluded both a legal component and a technical component. And, so, the

admission of these issues as contentions reflects their judgment that these issues were relevant and material and were supported by sufficient technical facts and opinion to make them genuine issues. So, this is an important step forward for the State of Nevada's case, although, of course, it's not the end of the State's case.

These included a number of so-called programmatic contentions. I'll just summarize them briefly. The first one, which is designated Nevada Safety 001, we had to follow a particular nomenclature in labeling these, said that DOE lacks the necessary safety culture to be an NRC licensee because it has demonstrated a propensity to put schedules ahead of safety. And, we supported that contention with extensive documents suggesting that that was in fact the case.

Nevada Safety 002, again, supported by extensive documentation, says that DOE lacks the ability to safety manage the construction and operation of a complex project like Yucca Mountain. Our documentation included some history of prior DOE failures in this respect.

Nevada Safety 003 says that based upon past history, DOE has not demonstrated its ability to implement an adequate quality assurance program. And, again, here too we had supported our contention with extensive documentation suggesting that that has been the case in the past.

So, those are three programmatic contentions. All were opposed by DOE. All three were opposed by the Staff, in part on what we thought was a ridiculous legal proposition, that in designating DOE as the applicant, Congress precluded NRC from inquiring into issues such as these three. It turns out there's no support for that proposition in the statute, and the Licensing Boards agreed. So, those three issues were admitted.

The next is a group of contentions which deal with the drip shield in the multiple barrier concept. We have about 20 contentions that--actually, a little more than that that address the drip shield. And, I wanted to focus here on just two especially important ones. Nevada Safety 161 reflects what Victor just told you a little bit earlier. It says that because of the requirement for multiple barriers and defense-in-depth, that postclosure safety cannot be so dependent on a single barrier, in this case a drip shield, that the EPA standards would be violated without it.

And, to support that contention, we not only provided some technical support along the lines that Victor mentioned, but we also pointed out to the Licensing Board that in promulgating its regulations on licensing Yucca Mountain in Part 63, the NRC said very clearly and specifically that safety could not and should not depend wholly on a single barrier. This contention, as I indicated,

was admitted by the Licensing Board, and so this will be a very important issue that will be litigated and discussed further in the licensing hearing.

The other important contention related to this that I wanted to mention was Nevada Safety 162, which points out that DOE's plans to install the drip shield about a hundred years from now, after all the wastes are in place in the tunnels, and just prior to repository closure, cannot be justified as safe because if it turns out that for some reason the drip shields cannot be installed, there is no alternative. The wastes will have already been emplaced, and there will have been no alternative there in that situation to deal with safety short of retrieving the wastes. And, in that respect, DOE has offered in the application no actual plans for retrieval.

So, from our standpoint, the analogy would be authorizing the operation of a nuclear power reactor with the cooling system to be installed, you know, at the first or second refueling outage. And, it's all fine to say we'll make that a license condition, but it's a little bit late. So, from our standpoint, to install the drip shields after the wastes have been in place is inherently unsafe. That's Nevada Safety 162. Again, that was admitted as an issue in the hearing.

I just wanted to mention briefly two other

programmatic contentions. One is Nevada Safety 146, which says based upon an analysis of the history of the regulations, that actually, Part 63 and its predecessor Part 60, were designed as precursors to what is now Part 52, and the intention was at the time, and that intention has never been changed, to require DOE to file its application, and include with that application final design information, not preliminary design information. And, so, this contention says that the application fails because at best, it has preliminary design information, and little or no final design information.

Again, that contention was admitted as a legal issue subject to further argument as to whether that is, in fact, the legal situation, which we think it is.

Last, I wanted to mention Nevada Safety 168 and 169, which really focuses on the retrieval concept. They say the license application is deficient for failure to include credible evidence that the waste packages could actually be retrieved, and for failing to include actual retrieval plans. And, again, this keys into also our contention relating to the timing of drip shield installation.

As I indicated, all these contentions were admitted, in fact, virtually all of Nevada’s contentions were admitted.

There was a process for appealing the admission of

those contentions to the Commissioners themselves. DOE filed no appeal, and, therefore, from not doing so, it has forever given up its right to complain about this particular Board ruling.

The NRC Staff did file an appeal. It implicated a number of Nevada's contentions, although it really only attacked and supported the rejection of a few of them. In any event, we filed an opposing brief before the Commission, and I think we expect the Commission decision under its decision schedule sometime toward the end of this month.

So, that concludes my presentation.

GARRICK: Thank you. Well, let's see, I'm sure we have some questions, so we need to have you up there, both of you. Yes, David first.

DUQUETTE: Duquette, Board.

I found it interesting that you, of course, have 34 contentions that deal with corrosion, and corrosion has been a major issue for this Board for a very long time, as you're aware. Do you think that you've lost some credibility by having to go abroad for your single corrosion consultant, especially since you had someone in your employ for a very long time who supervised the Catholic University work, as well as having outsourced the work to China. Certainly, from my point of view as a corrosion scientist, there were certainly other competent corrosion scientists and engineers

in this country who could have represented the State. I don't know if they refused to or you just couldn't find anybody who wasn't tainted by having worked with DOE before. But, I could name a half a dozen just sitting here without even doing much work on it.

I certainly was amazed at the fact that you used a single corrosion consultant for 32 contentions. And, while Dr. Cottis is a competent corrosion scientist and engineer, in my opinion, he tested on a lot of things where you could have gotten some other expert input. Could you comment on why you felt you had to go to Brittan for a corrosion scientist to represent the State?

GILINSKI: Well, I didn't do that, so I can't give you a specific answer. But, I know in general, in many of the areas, people you would normally go to had one or another relationship with DOE. But, I can't--it's a personnel matter and I can't give you a specific answer.

GARRICK: Ron?

LATANISION: Latanision, Board.

Just a follow-up to Professor Duquette's question. I do know the institute in China, the Institute of Metals Research, it turns out that it's led by one of my former students, and, so, while I can't be totally objective, I think it is a--

GILINSKI: Is this Professor Hun?

LATANISION: But, that not withstanding, I think there's an area of greater concern to me in terms of the corrosion work, and that is that, you know, we did hear quite a lot about the work that was done at Catholic University. It did create a bit of a stir, and I think ultimately, the state chose to look at a slightly different approach to the testing that was going on at Catholic, and they did move that work to China.

We had some very passing comments during previous public meetings about the work in China, and, in fact, at a couple of different junctures, we were told that there were reports available on this work, that it would be made available to the Board. And, we have never seen that, so I really don't know what kind of work has been done in detail. I don't know how thorough it was. I'm not able to judge, nor am I of the opinion that anyone has had that opportunity.

So, while I can verify that this institution does have a good staff I think, I can't tell whether or not the work is of value or not. And, I'm wondering why we have never seen it.

GILINSKI: Well, were you referring to Professor Hun?

LATANISION: Yes.

GILINSKI: There are reports of their work on the LSN, the Licensing System Network, in which all of the Yucca Mountain documents are placed. And, I don't think it would

be any problem to get those to you.

LATANISION: Well, I'd be interested to see them. We were promised them, and I don't recall ever seeing them.

GILINSKI: I'm sorry you didn't get them. But, they are public.

LATANISION: Mr. Chairman, maybe this would be a useful subject--you know, it may be a moot issue, but there are technology questions that they were addressing, and I'd like to hear them.

GILINSKI: No, you should have them, and we'll get them to you.

LATANISION: Okay, thank you.

GARRICK: Yes, Bill?

MURPHY: This is Bill Murphy of the Board.

I recognize the challenge of gaining confidence in a model as complex as the TSPA code. It's gigantic and it has--there are a lot of hard issues addressed, and I see in your presentation you note that you can in fact check, and I presume you have checked the individual DOE calculations. And, I wonder if it's fair to conclude that you have come to the conclusion that it is in fact reliable, at least to the extent that you are using it to do your drip shield absence calculation.

GILINSKI: No, they haven't made changes in the code. What they've done is basically taken DOE inputs and gotten

DOE outputs, and checked it that way. So, they've just made individual runs. What they have done, however, is looked into the code itself, into the structure of the code to try to understand that, and that has influenced their thinking.

MURPHY: To the point that you feel confident that you can use it to do your calculations of drip shield absent performance?

GILINSKI: I think the answer is yes. I'm not involved with them directly, but they have run the code and I think, in principle, could do that calculation themselves.

GARRICK: Yes, go ahead.

MOSLEH: Mosleh, Board.

I have a question regarding your interpretation of barriers. In two slides, your focus is lack of redundancy, and the IAEA criteria refers to a multi-barrier system, but doesn't say explicitly that those barriers need to be engineered systems. Yucca Mountain, or geological repositories such as Yucca Mountain, will have a natural barrier and an engineered barrier. What is your--

GILINSKI: Well, but if you accept the calculation, the extrapolation from the early drip shield failure case, then without a drip shield, you can't meet the EPA criteria. So, there are not redundant barriers. You're sort of piling up a bunch of barriers and getting to the point where you meet the standard. But, if you pull one of those out, you don't meet

the standard.

MOSLEH: So, it's a probabilistic assessment of the inefficiency of a lack of the barriers that is the question, but the barriers are there--

GILINSKI: Well, I mean, multi-barrier can't mean that you've got sheets of paper here, and then, you know, you can't count those as a barrier. They've got to mean something.

MOSLEH: No, I agree with you. But, in principle, the question then goes back to whether those perform.

GILINSKI: Right. Yes.

MOSLEH: There are barriers, but--

GILINSKI: That's right. There are barriers, but do you have redundancy. Does the failure of one of those barriers lead to failure of the system in terms of the EPA standards?

MOSLEH: Meeting the probabilistic criteria.

GILINSKI: I suppose, yes, in the sense that you have to do many calculations.

GARRICK: I'd like to follow up on that a little bit, just to illustrate the fact that the opportunity exists in this business to confuse the hell out of the public, and also a lot of scientists and engineers. When you talk about multiple barriers, and I think this is what Ali was getting to, from a risk perspective, and you tell me that, or you suggest that the multiple barrier situation with respect to

the repository is inferior to the multiple barrier situation with respect to a nuclear power plant, that's an outrageous observation.

GILINSKI: Can you deny that?

GARRICK: Pardon?

GILINSKI: Can you deny that, that there's a difference?

GARRICK: There's a difference, but--

GILINSKI: A significant difference?

GARRICK: What you're not saying is that in the case of a nuclear power plant, there's tons and tons of TNT equivalent stored energy, which is the driver that we tend to really worry about when we're assessing the safety of a nuclear power plant. In the case of the repository, we don't have that. It's relatively benign, and we have long, long time constants that allow us to deal with issues as they develop. We have the capability to monitor and to observe phenomenon, and there are barriers. There are clearly barriers.

And, the other point that's connected with that is that a lot of these dose calculations that you see with respect to removing of a particular barrier are an artifact of the model--an artifact of the model. If in fact the design approach has been to not include a drip shield, there would have been an entirely different model, and that model very likely would have put a great deal more emphasis on a

much more detailed characterization and modeling of the source term, for example. And, that was not done. That was not done. A very simple model was employed for the source term, and the models made it increasingly dependent upon these engineered barriers. But, it doesn't mean--it doesn't mean, you said it yourself, you know, that the models have a difficulty representing reality, they tend not to.

On the other hand, if you were trying to design this repository without engineered barriers, what one would do, of course, there's a lot more research and development that's been done with respect to the capability of the natural system. And, this has been one of the other issues that this Board has attacked, is that there probably is a great deal more opportunity for attenuation and containment and confinement and sequestering of radionuclides in the natural system, had we performed a much more detailed model, particularly in the near field.

So, you know, if you take these issues and isolate them, and isolate them with respect to a particular model, you confuse the issue completely. And, I have not seen, for example, a bottom line analysis by the State or by the UK or by anybody other than DOE. That's what's important. What is the opposing model of the risk of Yucca Mountain? I have not seen that.

GILINSKI: You know, you call this an outrageous

statement.

GARRICK: No, it's not an outrageous statement. All I'm saying is that a lot of these individual pieces are out of context, and they may be relevant and they may not. This Board agrees with you on a lot of them. We agree that corrosion is a major issue. We agree that the drip shield issue is an unsatisfactory one the way it's been handled. But, on the other hand, that may or may not be relevant. That may be--

GILINSKI: Look, you are speculating that somewhere out there there's a calculation that if properly performed, would result in a lower source term and more effective barriers, geologic barriers.

GARRICK: No, Victor, what I'm saying is the calculation hasn't been done. I'm not speculating on it, but I would like to see that calculation.

GILINSKI: Well, sure, let's see the calculation. But, we are dealing with the license application as submitted by DOE, and the standard as set by EPA.

GARRICK: Yes, and we're not doing that. We're looking at this system as a technical issue, as a technical problem. We're not experts on the regulations.

GILINSKI: Well, if you're just doing research on geophysics, or something, that's another matter. But, we're dealing with a specific project, the Yucca Mountain project.

GARRICK: Well, I think we do a disservice when we take these individual issues and we present them as if they are serious issues when in fact from a risk perspective, they may be irrelevant.

GILINSKI: You know, you may very well be right, and there may be calculations out there that prove that you are right. But, the fact of the matter is in the United States of America, someone said we're a system of laws, we have to make a decision, and we have to make a decision on the application as presented by DOE.

GARRICK: I understand that.

GILINSKI: Against the standard as set by EPA, and it doesn't make it.

GARRICK: Yes, I understand that. Yes, Andy?

KADAK: Do you consider the cladding a barrier?

GILINSKI: Everything is a barrier, sure.

KADAK: Do you consider the waste package a barrier?

GILINSKI: Yeah.

KADAK: The canister?

GILINSKI: Yeah.

KADAK: Do you consider the overpack a barrier?

GILINSKI: Everything is a barrier.

KADAK: Do you consider the drip shield a barrier?

GILINSKI: If it's there.

KADAK: Do you consider the geological media a barrier?

GILINSKI: Yeah.

KADAK: So, there are multiple barriers.

GILINSKI: Don’t play word games like this. It’s ridiculous.

KADAK: I’m just trying to clarify the issue.

GILINSKI: You know, you put a bunch of sheets of paper in there, you get more barriers.

KADAK: These are not sheets of paper, as you know.

GILINSKI: But, they’ve done calculations and they found that those barriers don’t meet the standard.

KADAK: I just want to make clear that this is a multiple barrier system, which you’re not saying.

The second question I have for you is you’re a former NRC commissioner?

GILINSKI: Right.

KADAK: You understand the NRC process. Do you think the NRC process is adequate for assessing something like a repository for geological--or would you recommend an alternative process that is perhaps more realistic in terms of getting at a safe solution to disposal of nuclear waste?

GILINSKI: You know, we have a system in this country of deciding on questions of nuclear safety, the responsible agencies, the Nuclear Regulatory Commission, we look to them to do a good job. We hope they will act competently and fairly. That’s our system. But, getting back to your point

about multi-barrier, you're just playing word games, you know. Of course, there are many barriers, but the question is are they effective. Is there redundancy?

KADAK: Yes.

GILINSKI: And, does the failure of one barrier fail the system, and the answer is yes. Now, how do you deal with that?

KADAK: But, again, you're making the assumption that the barrier that's imposed in the design, or included in the design, will not be installed, and I'm saying--

GILINSKI: First of all, even if it is installed, it's still not a redundant barrier. But, there's a serious question about whether it will be installed. And, you know, under the rules, you're supposed to look at things as there's a 10 to the minus 4 probability of failure over this period of time. Now, you don't have to take my view of this that it's unlikely the barrier will get in. You certainly have to agree it's not an absolutely sure thing, and there's a 10 to the minus 4 chance that it won't be in. And, in that case, they should be doing a calculation. And, I have to say I'm a little disappointed in the Board, that the Board has not asked for such a calculation either.

KADAK: Our role basically is to evaluate what has been given to the Board--

GILINSKI: But, you're a technical agency. You're not

supposed to work with blinders on. You're supposed to be inquisitive and inquire.

KADAK: We are.

GILINSKI: Well, why don't you ask for that calculation?

KADAK: We can.

GILINSKI: Please do.

KADAK: Whether it's being done or--

GILINSKY: Please do.

GARRICK: Okay. I like this kind of stuff. Yes, Thure?

CERLING: Cerling, Board.

On Slide 8, you comment that the TSPA calculations are biased towards under-estimates in water flow and waste package corrosion, and so on. And, what we've been hearing from DOE all along is that their estimates are conservative and build on each other, so that they in fact over-estimate. So, since water is the principal issue, what is DOE's belief as to the infiltration and the water flow rates in the mountain?

GILINSKI: What is DOE's view?

CERLING: Not DOE's. But--

GILINSKI: Well, I'm just conveying the collective view of the experts that are working for Nevada. If there was not a dispute of this sort, then Nevada wouldn't be involved here, and these are the questions that have to get settled at a hearing through examination by the parties and settling on

the answer.

GARRICK: George?

HORNBERGER: Yes, I'm curious, the question was asked of Russ about DOE and continuing funding given the Administration's standpoint. So, do you still have full funding, the State of Nevada, to support the consultants that you used for this work?

GILINSKI: In the appropriation is some amount of money set aside for Nevada. I'm not the right person to ask about that. I think it's been reduced from previous years, but I'm not sure.

GARRICK: Yes, Howard?

ARNOLD: Arnold, Board.

I'm going to partially repeat a question I think that Andy asked, and it relates to this process. Are you comfortable that the NRC process is the adequate--will adequately resolve these issues, and win or lose, you'll agree that they're settled at the end of the process?

GILINSKY: Well, I think, I can't entirely speak for Nevada, I mean, I think if they lose, they'll be unhappy either way. But, I think we have to rely on the NRC here and look to their, as I said, confidence and fairness and whatever reservations we may have about that, that is the system that we have.

GARRICK: Is the State in support of the continuation of

the licensing process?

GILINSKY: I think the State would like to see the project cancelled and the entire process ended.

LATANISION: I'm sorry, I didn't hear that fully.

GILINSKY: I think the State opposes the project, and would like to see it cancelled.

GARRICK: Yeah. Okay, any other questions from the Board?

(No response.)

GARRICK: How about the staff? Yes, Carl? Carl DiBella.

DI BELLA: This is Carl DiBella. I have two questions. One for Dr. Gilinsky and one for Mr. Malsch. On your Slide 10, at the very bottom, you say, "Disposal in an oxidizing environment violates IAEA guidelines." Can you elaborate on that?

GILINSKY: Well, I was referring to the same guidelines in the second bullet, and one of them is that there should be reducing environment. The document, Scientific and Technical Basis for Geological Disposal of Radioactive Wastes. I can supply that for you if you'd like.

DI BELLA: We can get it from your reference.

GARRICK: But, it has to be remembered that they're talking about guidelines. They're not talking about regulations or rules.

GILINSKY: Right.

GARRICK: Yes.

GILINSKY: I'm not representing this as a law, but those are the international guidelines.

GARRICK: Right.

GILINSKY: Did you have one for Marty?

DI BELLA: Yes, I do. Now, let's see if I can ask this correctly to get the answer to the question I want to ask.

Based on your experience, how long and how much effort, or what's the range of duration and effort that it takes to resolve a technical contention once it has been admitted, from just looking at prior experience, not looking at Yucca Mountain, can you pull something out of the experience that might answer that question?

MALSCH: You know, the answer depends, so importantly, on the contention. It's hard to give, you know, a general kind of an answer. I would say for a detailed, very specific technical contention, we'd be talking about on the part of all the parties, probably several person years worth of work. I would say that to complete this proceeding, assuming all 300-or so contentions go through the entire discovery process, and then the whole hearing process, would take at least three years, possibly in excess of four years.

But, there are processes built into the system to short-circuit issues. I mean, there are ways in which you

can dispose of contentions purely on the basis of legal briefings and arguments. There are ways you can dispose of contentions just on the basis of expert affidavits and papers, and never go to the hearing process.

So, I mean, I have to say I was a part of--I spent most of my career at the Nuclear Regulatory Commission. I was a part of the legal team that constructed these hearing procedures. As hearing procedures go, as government agencies go, they're pretty well constructed and very well designed to make sure that something doesn't actually get to an oral hearing stage unless it's really a big controversy. The whole effort is to get issues resolved on the basis of papers first, the contention stage, for example, or on the summary disposition stage, or whatever. And, so, the process is very efficient.

I would say, though, these are probably more contentions than the NRC has ever seen before in a proceeding such as this. They've seen lots of contentions and there have been very complicated proceedings, but this one could be one of the more complicated ones.

So, that's the best answer I can give. It's hard to give you, you know, anything more precise.

GARRICK: Andy?

KADAK: Do you think the NRC process, recognizing that it's going to be fair and objective, for this kind of a

facility, is this the right process? Are we really able in a regulatory way to make a finding that would give people confidence that something is a million years good, so to speak? Or, might there be another process in which the regulatory review process allows one to take steps and make judgments according to what the best analysis will show, and yet keep it flexible enough to correct should there be any difficulties. As opposed to getting a license, okay, this license is good for a million years, apparently what's going on now.

MALSCH: I think the process as it exists is pretty flexible. I mean, it's just that there are specific hold and decision points. And, I've been a little disappointed in the NRC review process so far, but as Victor said, it's what we have. I'm hopeful it will be very thorough, and I'm hopeful when the result comes down, we'll be able to say, all of us, that it was a very thorough, fair process, and the decision was a fair one. But, we'll have to see.

KADAK: I'm going beyond Yucca Mountain in the sense that if this Blue Ribbon Commission comes forth with a recommendation about alternative fuel cycle, alternative risk strategies, might want to also include an alternative licensing process that I guess gives everybody a better feeling about fairness and outcomes and technical credibility.

MALSCH: I mean, I have to think about that. I mean, I'm not sure I know what the answer is. It's a good question to ask. Lots of people have asked that question about this facility, about nuclear power plants, for that matter. I'm not sure I have a good answer, but what we have is what we have. It's, for at least the suite of nuclear power plants we have, it's been exercised very well and has produced generally very good results.

KADAK: But, this is very different.

MALSCH: Well, it's very different, but actually if you break it down into pieces, into individual technical issues, it actually turns out to be very similar. I mean, what is dissimilar about it is is because we're talking about such long time frames, you can't do analyses without making assumptions. And, so, hopefully, you've made the right assumptions, and given those assumptions, the result you end up with is actually telling you something that's useful.

KADAK: Thank you.

GARRICK: Any other questions or comments? Yes, John Kessler.

KESSLER: John Kessler, Electric Power Research Institute.

This is a comment or question more addressed at the Board and the whole licensing process. It brings to mind this discussion, the earlier discussion about needing to have

the licensing process continue. The example here is that EPRI did an analysis last year where we specifically said we don't think that the drip shield is needed because if one did, for best estimate, yet probabilistic analyses, one could find that at least in our case, the doses were still below the regulatory limits without the drip shield, and made arguments why things could be better without it, at least in terms of safety issues that don't necessarily have to do with meeting Part 63 regulations. So, that's certainly one way where it would be great to have a hearing of not only the State's opinion, but EPRI's, as well as certainly DOE's and NRC's on that.

The other thing that would be useful about proceeding with the licensing process is the issue of multiple barriers. I believe that NRC Staff, when they wrote Part 63, were very careful in distinguishing between multiple barriers and redundant barriers, and there is some question about what that means and what is adequate. And, I think the licensing process would be helpful there.

GILINSKY: But, when you say--I know you addressed it to the Board, but when you say this ought to be studied, you're really talking about an alternative application.

KESSLER: No, I'm not talking about an alternative application. I'm talking about the fact that the State has done an alternative analysis, EPRI has done an alternative

analysis, other people have done analysis around the DOE analysis. All of that presumably will be part of the licensing process, if the licensing process continues. That's all I mean.

GILINSKY: Well, okay, I mean a Board--I mean, the NRC is reviewing the DOE application, and--

KESSLER: Sure, and they're reviewing all the input to that application, including the State of Nevada's.

KADAK: Just a comment--

GILINSKY: Yeah, I think I have a comment I'd like to say--

KADAK: Hold on. I just want to respond to his statement. I think what John is saying and what both Johns are saying is that the assumptions and the methodology depend on--in the analysis that DOE did, they were very simplistic in their modeling of corrosion itself. They were simplistic in treatment of the source term because they felt that it didn't matter, which is what EPRI is having to do in terms of their more detailed analysis of how that package fails. And, in their analysis, they show the drip shield apparently is not significant.

So, I think what John was saying is if you go to the next level of detail and do a best estimate analysis of what you really think will happen, as opposed to well, let's make a simplifying assumption and then we don't care because

the drip shield is there, we get different results. So, it's not surprising that when you do your analysis, using the conservative assumptions of fuel failure, you'll get higher doses than the DOE did. So, this is not a surprise. But, I think what John is saying is in the licensing process, it is hoped that this kind of an analysis will come out.

GILINSKY: Well, it would require an amendment on DOE's part to incorporate that, unless EPRI wants to apply for a waste repository license.

KADAK: We're talking about what is the safety of the repository, and I think that's what--

GARRICK: Okay, yes, quickly.

ELZEFTAWY: Very quickly. I just wanted to, number one, commend the Board because this is the first time ever--the first time ever, John, that I saw the Board, and I have attended most of the Boards, that the Board is very active in asking very good questions. And, that's very good. They put you on the spot, they put Russ Dyer on the spot, and from my point of view, I like that. I wish the Board had done that from the year 1987, but many, many, many times it wasn't that way.

One other thing I wanted to say, when I went to work for NRC in 1983 to put together 10 CFR 60, I was a very passionate person like the Board people, and I was a very good scientist and I was doing all this. You know what?

They taught me to go to the lower areas of the NRC, and I think Galespy was a Commissioner at the time, to learn about what the NRC process--

GILINSKY: Gilinsky.

ELZEFTAWY: Then, all of a sudden I found out that even though that you have the DNA analysis 100 percent as a scientist, you may lose your case in the court. So, the court, that's why I have two daughters lawyers, so the court is completely different--I have one scientist, too--so, the court is completely different. The licensing application process, here's a person who might be a ticken tote on the Board some day, is going to be finding out what is fair and most of the time that when it went through the nuclear power plants, they found out really what's good and what's bad.

So, I think what I'd like to see is to continue on doing this thing, and continue on looking at another alternative. Your analysis doesn't have to be really complicated, Professors. Einstein made his thesis in maybe two pieces, and Einstein was German--he wasn't American, if you understand that. So, you don't have to be an American--I have a (inaudible) in America, too, but I have another one from Egypt. That doesn't mean the first one is gone. The first one is good. The second one is good.

So, I think we need to realize that instead of hitting the--I don't get any money from them or nothing--but

I read all their, what is it, 1500 pages on the internet, I downloaded and I read it. There are some good things you need to read, and the internet is available. The LSN system is available. So, if you don't have anything, get on the internet and you can read for yourself and educate yourself. It doesn't have to be coming to you.

Good luck to you.

GARRICK: Thank you very much. We're right on schedule. I want to thank you for your presentations. We appreciate it very much.

GILINSKY: Thank you for your patience.

GARRICK: And, we'll now take a break until 10 o'clock.

(Whereupon, a recess was taken.)

GARRICK: Okay, can we come to order, please?

Rod McCullum of the Nuclear Energy Institute is going to give us a presentation on the status and projections of domestic commercial nuclear waste inventory. Rod?

MC CULLUM: Thank you, Dr. Garrick, and it's a pleasure for being here today to address the Board.

I want to start by pointing out--actually, I was going to refer to the title slide. You're seeing a presentation on integrated used fuel management, and on your agenda, it says status and projections of domestic commercial waste inventory. I am going to give you our projections on commercial waste inventory, but I think as has been alluded

today, what's really important is the total systems perspective, and that the system is impacted by concerns, both technical and political. And, also because if I just gave you the numbers, I'd bore you to tears. Now, I might do that anyway.

Also, before I get into it here, I would like to empathize with some of the comments I heard made this morning, particularly when Dr. Garrick talked about the possibility that we could be making decisions on a 100 percent political basis, and that the scientists should just give up. I would urge all of you scientists in the room not to give up, and in looking at the current situation and some of the questions we have with the current situation, I'm a little like Russ, how I view it changes every three hours.

But, at all times, I think back to my favorite quote from Winston Churchill, which is--and, he said that, "Democracy is the worst system of government ever invented, except for all the others." So, as I try to figure out my way through what we're dealing with here in used fuel policy, I kind of take shelter in the wisdom of that quote, and figure we will move forward.

But, anyway, going to the first slide now? The most important part of the system is the overall implications of nuclear energy, of what we do with this fuel when we put it in reactors and produce electricity on our environment and

our economy and our general wellbeing.

And, you've seen this sort of thing before. The future for nuclear energy is very bright, and this will be a precursor to some of the numbers I will show you, because we will be looking at the future and projecting in some new plants and growth in the used fuel inventory. The extent and the pace at which that will happen, there are of course uncertainties, but there's a very strong basis for moving forward with new nuclear energy. You can see by increasing the capacity factors of our plants, and increasing the power rating of our plants, which we have done consistently over the last several decades, we've actually been producing a lot more nuclear energy over the years. You see the top graph there?

And, we have of course added the 104th nuclear plant when we brought the one Brownsferry unit back on line. We're going to bring the other Watts Barr unit on line, 105. So, nuclear energy is growing, and with the growth and the dependency on nuclear energy, public confidence is growing, and also what's important about this curve, I always have to mention, is is that the increase in public support for nuclear energy is sustained over several, several years. It's not a blip on the horizon. It's not a fad. It's not a TV reality show. It's something that's been steadily growing and it's based on our record of safety in operational

performance.

And, finally, I've always found it kind of quizzical that we didn't seem to care about how we were polluting the air until we started to melt the ice caps and the polar bears started to drown. But, now, we do care. And, nuclear is 73.6 percent of our non-emitting electricity. So, there's a very strong basis to believe that we will continue to use more nuclear fuel going forward, and there's 17 license applications in for 26 reactors, and 32 total under consideration.

So, this is how we view the system, the system in which we are accumulating these inventories of used fuel. We in the industry have developed--and, we began doing this I'd say five years ago, not as a response to the political change that could happen and has happened, but in response to we are a growing industry now. Does, you know, simply looking at disposal, which is part of this, make sense, or do we need to look at it broader. And, the answer is we did look at it broader. We believe interim storage, which is going on now at reactor sites and should be consolidated into one or a few centralized interim storage is the first element of the three pronged approach. We believe that recycling is important, reprocessing, the terminologies that get used, both in terms of the advanced stuff, and in giving consideration to what can we do with the technologies that exist out there in the

nearer term.

Permanent disposal facility of course is a vital element of this because in any scenario, no matter how successful you are in recycling or how successful you are in storing for however many hundreds of years, you will eventually need, for the longest lived isotopes, a permanent disposal facility.

There was a lot of discussion this morning about, you know, what's the basis for where we are now, and I think Dr. Kadak said it best when he brought it back to it it's the law. You know, the Yucca Mountain site was judged suitable, both the 1982 and 1987 amendments to the Nuclear Waste Policy Act, and the 2002 Yucca Mountain Development Act are law. They proscribe that the Yucca Mountain licensing process must continue, and that was explicitly recognized by the Department of Energy.

This is their Congressional budget request for 2010. This is the one that said they are planning to terminate the program, offering $197 million, though, to continue the licensing process and the Blue Ribbon Panel.

The language here I'm going to read from Page 9 is very important in terms of understanding what the state of play is here today. It talked about that, "OCRWM, to continue participation in the Nuclear Regulatory Commission license application process, consistent with the provision of

the Nuclear Waste Policy Act." So, the Administration, in this budget, recognizes that yes, Yucca Mountain is--the licensing process is still the law.

And, then, it went on further to say, when addressing the Blue Ribbon Panel, it said, "The Panel will provide recommendations that will form the basis for working with Congress to revise the statutory framework for managing and disposing of spent nuclear fuel and high-level waste." So, they recognize that it is the law until you change the law. So, that's why we must go forward.

And, I think all the other things that were said about this process being instructive, whatever direction we go in, we want these now 299 questions answered. The licensing process is underway. We feel it should be sufficiently funded. I know the folks here today from the DOE, they have to defend the request of the Administration. We believe that request is low. If you really want the licensing process to be a fair fight, we think a number like $340 million, not $297 million, is more appropriate.

It would be a shame to have DOE's ability to answer these questions, since we have to answer them by law, and we want to answer them to inform our path forward, to not be as well or thoroughly answered because of under funding. And, we get this 340 number from looking at what DOE had planned to do prior to the plan to terminate. We can't reconcile 197

million with what DOE had historically said would be necessary to adequately prosecute the licensing process.

We have intervened. We are one, NEI on behalf of industry, is one of the eight parties that is in the licensing process. And, also alluding to a previous discussion--I promise this is the last time I'll do this, and I'll get to your numbers--but, on the drip shields, the analysis that Dr. Kessler alluded to earlier, that is the basis for NEI's Safety Contention 6, which makes the point that even without the drip shields, you would meet the EPA standard. We would love to have our analysis compared to Nevada's analysis and DOE's analysis in an objective, fair, impartial hearing. We're looking forward to that, and would not understand why Nevada would not want that to also be so concluded.

The purpose of this slide is to illustrate that once you take the first bullet on the Obama Administration side as a given initial condition, which again it's only a given initial condition once they change the law, but they've laid out a plan to do that. The industry position, the integrated used fuel management approach that we are working towards, and that is how we are managing the fuel within the constraints of that approach now, is fairly well aligned with the Obama Administration approach. We believe that until we figure out a Plan B, we should reduce the nuclear waste fee

so that we're commensurate with what we're spending. We think they should spend more on licensing, but that you're bringing in 800 million into the waste fee every year now, plus interest, which is even more than that, you know, about a billion in interest, stop collecting more than you're spending until you figure it out, is what we're saying. And, you'll see continued action from industry on this.

We think that a Blue Ribbon Panel should look at this, and that they should be objective and fair and unconstrained. We'll talk about that. We think, and we haven't heard from the Administration on centralized interim storage, we'd like to hear more from that, and we've heard the administration, particularly Dr. Chu in his most recent testimony talk about recycling. We're glad to hear that. Dr. Chu has a lot to say about research. We agree with that. We'd also like to see some additional consideration given to present day technologies as well.

Going on, so, this is what I have tended to show you in the past, and I think what I was asked to do today is to get into a little more detail into these numbers and to project them forward. So, we are at the 60,000 metric ton level. We've just past that. And, as you can see, a significant fraction of that, 12,000 metric tons, is in dry cask storage there. And, it's in dry cask storage in a lot of places, 44 plant sites in 31 states.

We have a tremendous history with this. This goes back, and I know Tom Brookmire of Dominion is in the audience. Dominion is 1982, 1983--'86, okay, early, you know, mid-eighties that we began this, so we have a very strong history and over a thousand casks. This is very well proven technology, and we feel it can continue as long as it takes. And, I think the waste confidence proposed rule of NRC reflects this, that we can continue to rely on dry cask storage. Also noted that DOE has continued to sign new plant standard contracts, based again on this same confidence.

So, future dry storage by 2020, we'll see that this number will more than double. So, it's definitely a growth industry, and it will be at virtually all the plant sites.

Now, a couple things here. There's also a certain amount of greater than Class C waste. I know that the Board asked me to look at waste. I'm looking primarily at fuel. I'm not looking at low-level waste at all. You know, there are four low-level waste sites in the country, and there's a whole other policy system there. But, there's a small amount of greater than Class C waste. And, for the purposes of the projections I'm going to give you, I am not including the 313 metric tons at Morris, Fort St. Vrain, or Idaho National Lab, not because they're not as important as all the other wastes, just because they're hard to categorize. In order for me to give you the projections that I'm going to give you, I had to

fit things into categories, and it would have just--the math would have started to disconnect, so out of tens of thousands, you're going to be 313 off.

But, anyway, go ahead. This is the objects in the mirror are closer than they appear slide. I do not know with absolute certainty what the future is going to be, so we had to make quite a few simplifying assumptions here. We're going to assume that all the current plants operate for 60 years. We think that a lot of them are going to operate longer than that. There's already a life beyond 60 initiative going on in the industry, which, you know, as I'm starting to get up there in age, that might be a good thing.

And, we're assuming a measured pace for reactors, new reactors coming on line, and we're only assuming that the 32 that are currently under consideration come on line, and you will see in a future slide that we sure hope that's not true. We sure hope once you start building these few per year that we're assuming in this analysis, that things would accelerate based on the fact that you've established the process, and it's become more routine.

We're assuming nuclear reactors operate 15 years before dry storage is necessary, the new reactors. People aren't designing huge pools trying to guess when DOE is going to pick up the fuel. They're designing in right at the beginning of the new reactors. I think actually the AP-1000

is an 18 year dry storage facility. So, that's a slightly conservative number, 15 years.

You know, we assume that--I'm going to give you a TAD scenario and a no TAD scenario--we'll assume that TAD loading does begin on schedule in 2013. We feel it is important that DOE continue the TAD program, just as it's important and required by law that they continue the licensing process, because the TADs are integral to the license, not that it would necessarily be the optimal system, but even if you were not going to build Yucca Mountain, DOE could still go forward with TADs. Then, you'd have an initial condition for the next repository. I mean, you would have a standardized cask around which you could design the repository.

Certainly, that's not the business model we'd favor in industry, but then again if DOE showed up with a TAD, whether or not it had Yucca Mountain, and said we're going to load it and take it off your site as soon as it's loaded for free, I don't think too many of our companies would fight.

You know, we assume that--also, there's a trend in industry of DPC capacity, dual purpose canister, the non-TADs, vendors are going to ever greater capacities. We assume that trend will continue. Up to all the vendors will reach what is today's highest capacity.

This is a really bad assumption, and I really,

really, really hope this is not true, but we're assuming in this that there's no DOE waste acceptance before 2040. I'll call that conservative.

We've got data based on information from plant owners up to 2008. After 2008, we've assumed a ratio of, you know, the rate at which fuel is coming out of the reactors to the rate at which it's going into dry storage, in 2010, you know, for every two assemblies coming out of the reactor, you've got one going into dry storage. By the time you get to 2026, you'll basically be loading dry casks as fast as you're unloading reactors. Now, of course it won't be the same fuel because it has to go into the pool first.

And, I've got to give props to Brian Gutherman at ACI Nuclear Energy Solutions, who crunched all these numbers for us. Brian does a great job of staying in contact with all the companies out there, and keeping us in the know about where all the fuel is.

This is the only slide I'm going to show you the data in both metric tons and number of assemblies. It gives you a basis to do the math. It also shows the trend pre-2000 system capacity, and now we're up to bigger systems, and, future systems. I want to be especially clear here that I'm not showing favoritism to any one particular vendor. I'm just taking as a marker what the biggest cask is out there current day, and I'm assuming we continue to go in that

direction.

Of course, the TADs would represent a reversal of that historical trend. And, as I've said before this Board many times, that's fine with industry as long as DOE gives us a rational business reason to do that, if DOE shows up with TADs and pays for them. Otherwise, we're going to continue down the road you see in the first three rows there.

Going on. So, there's a lot of columns in this because, you know, there are a lot of different types of casks out there. You're going to see, this is the scenario where we begin loading the TADs in 2013, and there's another assumption in here that for some of these lesser loaded casks, you know, people keep loading what they are loading up until the TADs become available, and that may be an arbitrary assumption. They may change the systems, or whatever.

So, you can see the 2040 number down there, and that's pretty consistent with DOE's number that they got to in their EIS if you keep running all the plants to the end of their life. You can see with the impact of the TADs, you've got the older bare fuel, the older non-transportable casks, you've got transportable bare fuel casks, which again, are less in vogue these days, and then the more modern DPCs.

Now, you have two categories of each there. These all have obviously been licensed for storage because they're loaded. They also have been designed for transportability.

They may not have been licensed--they may not have received their transportation licenses yet, but there's a presumption that they would get them before we'd have to move the fuel off the site.

You can see that, in this scenario, you know, the TADs would grow to a significant proportion of the cask inventory, 6,000 out of 7,000. I'll allude to another NEI contention in the licensing process. Again, this is why we're in the licensing process, and NEI's safety too where, you know, we're taking on DOE's assumption of 90 percent of the fuel coming in TADs. We'd like them to use the 75 percent assumption that they've analyzed in the EIS. You can see 75/25 works here. 90/10, they're going to have to reload some things if they really want to get that, or you could also increase the capacity of Yucca Mountain, and if it's 10 percent of a bigger number, you're fine there. But otherwise, you'd either need a license amendment or a change in law to get to DOE's current design assumption.

Going on. Now, this is throwing in the new plants. Really, the only thing to say about this is you can see that between the 2030 and the 2040 time frame, the number of casks starts to become somewhat bigger because the new plants are starting to play a role. But, again, you see a lot of casks in a lot of places. A pretty similar scenario, again, the same type of ratios with the 90/10, 75/25.

Continuing on. Now, here it is without TADs, and you're looking at 8,000 casks. So, you are looking at a lot fewer casks if you don't use TADs. You know, is that a problem? I mean, you're starting to see all these numbers and the thousands of casks and the tens and hundreds of thousands of metric tons. Keep in mind all the fuel we've discharged today, if stacked on a single football field, would still be less than 10 yards deep. You're probably getting 15, maybe 20 yards deep, not even there, and, so, you're still talking about a relatively small amount of material.

You know, when you're looking at only 10, 15 metric tons in a cask, it's a sign of how well protected these casks are. You have relatively large casks for not that much fuel. And, again, having already loaded over a thousand of these things, postulating that we'd safely load 5,000 to 8,000 or 4,000 to 7,000 more in the next 30 years is not unreasonable. I mean, the base of experience supports this basically being a fairly routine iteration.

You know, we have, and I know there's people in the audience who can speak to this better than I can, you know, we have aging management programs in place. I know Tom has extended the license of some of his casks out there. We can continue to do that. NRC's Waste Confidence rulemaking that's pending recognizing the experience and the expectation

that these things are good for at least a hundred years.

When you look at the way a dry cask is designed, and you compare it to steel and concrete structures in places like Washington, D.C. and New York City, they weren't designed quite a sturdily and have still stood up for multiples of 100 years, 100 to 200 years, it really becomes apparent that as they're working on Plan B, dry cask storage can continue to go forward and continue to support a growing nuclear industry. And, that's one point I'm going to leave you with here. Even when you start to put the new plants in, you know, we're still in a reasonable scale in dry cask storage.

Going on to the next slide. So, those slides all said what? These slides kind of say where. And, there's one thing in here that's the artifact. It makes an interesting point, it's an artifact of the model and that's why I have, again, the assumption the plants operate 60 years. You notice between 2030 and 2040, all of a sudden, the number of operating plants drops dramatically. That's because we've assumed that the existing ones shut down after 60, and we've only assumed 32 new ones. That will be a great tragedy for America if that really happens, and I'm presuming that we will either extend a lot of the plants beyond 60 years and build a lot more than 32 of them at some point. But, it does give you pause to see how important all of this is.

But, as you can see, the number of sites where we have dry cask storage is again, you know, a fairly stable number, and the thing that might also open your eyes is we have more of these shut down plants as we get into that time frame where we do start to shut down the plants after 60 years. These are sites, we have a few of them in the country now in places like Maine and Oregon and Michigan and California, where there's no reason for the site to be a nuclear site other than the fuel has no place to go. So, that's again, you know, if we're going to slow the project down, an argument for interim storage, and that we should start to centralize and consolidate the material.

Going on. So, I was asked in preparing this what the technical issues are, and I think I've said, and I think there's some people in the audience here, Tom and Tara and John, who can answer the questions better, but we don't see this as a technical issue as much as we see it as a commercial issue. And, that's why there's litigation with DOE, and that's why a number of companies have settlements with DOE, whereas they continue to incur costs for continuing to have to hold onto the fuel. DOE reimburses them with the taxpayers money. It's a huge liability for the taxpayers, and it's getting bigger, and if we have in fact made a decision to slow the process down further, that liability grows dramatically. So, it's an issue for our companies, a

commercial issue. It's an issue for the taxpayers of America.

And, the outcome of the Blue Ribbon Commission will be absolutely key to our success. We don't just need great thinking here. We need an implementable and a sustainable plan. If for some reason the plan we developed in '82, solidified in '87, ratified in 2002 was not sustainable, then we need to figure out why not, and set up the next plan so it is.

Again, we're confident that while that's happening, and the NRC is confident, if you look at the proposed Waste Confidence Rulemaking, which I think should be finalized sometime this summer, they too are confident, and, in fact, they envisioned the specific scenario where the country walks away from Yucca Mountain and starts over, and they still said that they'd have confidence in dry cask storage. And, I think as you've seen, with 1,000 casks over 20 years, we have a basis of experience that supports that.

Going on. Yes, so as for the Blue Ribbon Commission, again, it has to be sustainable, unbiased, it needs a well defined path with firm milestones for recycling decisions. Recycling has to be, we believe for a growing nuclear industry, you have to look at this--you're always going to be disposing of a lot of stuff, the defense stuff, probably some commercial fuel, and, of course, the residual

from recycling. But, you can't just look at recycling. You need to look at recycling, but you can't just look at it as some notion that's out there in the future, like fusion energy. You've got to have something that marches forward down a path and down a believable path.

You do have to address eventual geologic disposal, which is why it's critical we learn from the Yucca process, why we carry the Yucca process forward to a logical and I would say adequately funded conclusion. And, this is something that was unveiled in the same budget request. DOE is creating these energy innovation hubs. Secretary Chu called them "Bell Lablets," mini "Bell Lablets." And, of course Bell Labs is taking advanced technologies quickly to marketplaces, those type of things.

Two of these innovation hubs will be placed under the Office of Nuclear Energy, one in Extreme Materials, which will specifically look at waste forms, and then one on modeling and simulation, among other things, but that's one of the extreme materials that we're looking at is waste forms, modeling and simulation will look at the overall assessment of fuel cycle scenarios.

So, if the Board's charter includes looking at areas where DOE is doing new technical work, we would think that these energy innovation hubs might indeed be an area of focus, and we would hope that the Boards would encourage them

to move smartly and jointly forward on these things. Because when it talks about having actionable, sustainable, real plans, real things happening in the integrated use fuel management, in DOE, the way it's presently configured, we see these as maybe one of the best opportunities we have for some real progress and some innovative thinking about how we do it differently this time.

So, going on. One thing that should not wait for the Blue Ribbon Commission is centralized interim storage. If, in stating their intent to terminate the program, at least stating their intent to have a Blue Ribbon Commission study what we really should do, the Administration is going to slow down the already long delayed acceptance of used fuel. There's really no excuse for not looking at some way that DOE can meet its obligation, begin consolidating inventories, begin turning over shut-down plant sites in the meantime, while these Plan B things are being worked out.

So, we do not believe the Blue Ribbon Commission should look at interim storage. We believe interim storage should move forward. We know there are already some private sector things bubbling out there. There's some communities and industry interests that are talking about this, and we expect to see those move forward. We'd like to see--of course, they have to be volunteer sites. We'd like to see DOE become a customer of these sites, DOE show up with

whatever, you know, just take your existing cask, show up with a TAD, whatever, and move, you know, buy space at this privately, NRC licensed privately constructed interim storage facility.

We feel that would demonstrate a lot of things towards the larger objective, which is of course facilitating our economy and our environment with clean, safe, nuclear energy.

So, in conclusion, we would encourage the Board, in looking at the growth of inventories and all the other aspects, to take a systems approach. We believe to take a systems approach, you have to look at the whole integrated picture, which is storage, recycling and disposal.

Absolute certainty, you know, I'm looking at Tara over there, the best business to be in, dry cask storage, guaranteed growth industry. And, we believe that the technology is well established to accommodate that growth for several decades, hundreds of years.

We know that the nation needs nuclear energy and wants more of it. And, it really is again about sustainability, a federal plan that embraces an integrated approach, and we can have confidence in going forward.

So, thank you.

GARRICK: Thank you, Rod. Andy?

KADAK: Thank you. A couple of questions relative to

TAD versus DPC. You stated this time and last time, as well, that DOE makes a good case, an economic case for it. Clearly, the utilities are loaded with bigger and bigger casks.

MC CULLUM: Right.

KADAK: How is that going to be managed in terms of repackaging, retransfer, where is this going to happen if TADs, even if they are available in 2013, your kind of stuck with a lot of already dry cask systems that you can maybe ship to Yucca Mountain, but it's a big problem.

MC CULLUM: Well, I think that's a great lead-in for me to again talk about why industry is participating in the licensing process. We have two contentions, actually three contentions in this area, two of them are twins, it's the environmental side and the safety side. But, on one contention, we have an analysis performed by EPRI which indicates, we believe, that a large number of these dual purpose casks could be directly disposed of in Yucca Mountain, would not have to be reloaded. Our contention would seek to compel DOE to build that into their licensing basis to directly dispose of some of these DPCs.

We also believe that DOE has--we know that DOE has an analysis in the EIS of taking 25 percent of the fuel in DPCs as opposed to 90 percent--well, 25 percent in DPCs, 75 percent TADs. We'd like them to make that their design and

licensing basis as well because that's less canisters reloaded on plant sites, which some plant sites, the shut-downs, can't reload, and it's more effective, from the dose and the cost standpoint, it's more effective to reload them at the repository.

We'd have one facility, that's all it does, as opposed to a reactor where it would be a very unusual operation if you were going to reload a cask at a reactor, even if you had the capability to do so. So, we are hoping through the licensing process to be able to accommodate the DPCs that we are loading, and even planning to load today.

Now, of course, another solution to this would be to license and commit again to Yucca Mountain and start actually loading TADs in 2013. We're getting close to the point where that assumption, too, may have to go away. And, then, these numbers would all start to shift more towards DPCs if you slipped this to 2014, 2015, 2016, you'd see the TAD numbers go down and the DPC numbers go up, of course.

KADAK: For the disposal, what is the industry doing to help justify a direct disposal of DPCs vis-à-vis the burnup credit question, and--well, I'll just leave it at that.

MC CULLUM: Oh yes, that is really the major question, and we're working with NRC to establish a consistent approach to burnup credit. You know, to us, in the reactor, you understand fission reactions, you understand what fission

products you get. You have reactor records which allow you to operate the reactors very precisely. It's not like you're surprised by what control rod positions give you criticality, and then all of a sudden, you have to pretend like some of these fission products don't exist when you're, you know, trying to license dry cask storage. So, we think we'll prevail. It's an issue we're working with our regulator.

KADAK: Just one follow-up.

GARRICK: He didn't quite answer the question about the DPCs.

MC CULLUM: Oh, yes. That's what we're working with the regulators, is trying to get more--

GARRICK: I mean not so much just the burnup credit, but what to do with them, what do with direct disposal alternative for dual purpose containers.

MC CULLUM: Well, other than the burnup credit issue, we feel that because DOE's analysis doesn't take credit for the inner canister that is the TAD, it only takes credit for, you know, the waste package outer barrier and the drip shield, and we feel, with the analysis that EPRI has shown in terms of how these things would fit in the mountain, we feel we don't have to modify DPCs to make them disposable, you know, other than the burnup credit issue.

KADAK: Then, why don't the TADs become DPCs? I was always confused by the limitation on size of the TAD, being

much smaller than a DPC, which arguably is also suitable for disposal.

MC CULLUM: Well, I would say that's a very good point, and I would say that this contention is intended to head us down the road where we get there. That is exactly why industry has intervened in this licensing process, and it's exactly what we're seeking to accomplish. We want to drive DOE's design in a way that more effectively integrates the system.

GARRICK: Bill, did you have a question?

MURPHY: Bill Murphy, Board.

On your recommendations for the Blue Ribbon Panel, you suggested that they address eventual geologic disposal and learn from the Yucca process. And, I'm curious from your perspective, or industry's perspective, what can we learn from the Yucca process?

MC CULLUM: Well, I think there's two things there. We can learn from the site selection process. I think the Blue Ribbon Panel, again, if the law is going to be changed, you know, '82, '87, also '92 with the Energy Policy Act, and then 2002, and it didn't stick, so how do you establish a site selection process that will stick? I would suggest more incentives on the front end, you know, and if you look at Sweden and Finland that have been very successful, they will probably now beat the United States. I think we were running

slightly ahead of them, but now we're not.

You know, you begin with a strong principal of a volunteer site, and this is the principal we're hoping to demonstrate with interim storage, by the way. And, volunteer site doesn't just mean the locality, because there's a lot of people from Nye County who would tell you Yucca Mountain is a volunteer site. But, you're building state-wide support early in the process.

And, then, the second aspect is the licensing process. If you go all the way through the Yucca Mountain licensing process, we will have tested all those questions we asked in many meetings like this about can you really regulate for a million years. And, when you're looking probabilistically as opposed to deterministically with these types of analysis and mean doses, what does that mean in a regulatory context. We will have tested all those things, and then we will be able to, you know, remember Part 63, it's an excellent regulation, but it's Yucca specific. There's the old style Part 60 that would presumably have to be revised to facilitate the next repository, and the Blue Ribbon Commission should look at this licensing process and ask what, I don't know, Part 63 and a half might look like.

GARRICK: Howard?

ARNOLD: Arnold, Board.

Rod, I want to ask your vision about recycling.

But, first, let me lay out a couple of concerns on my part. One, recycling once and getting plutonium out, and then making moxes is a small step. You haven't done anything with all the uranium, which is most of the bulk of it. And, of course, at the end, you're going to have fission products that are unaffected by recycling.

Do you see multiple recycling of the plutonium and the uranium, or do you just see a one-shot deal which gets you a little ways down the road?

MC CULLUM: I think you probably have to start with a little ways down the road approach. You know, we can postulate what might be possible decades down the road, but I think we're expanding the nuclear industry now, we need to continue to grow the nuclear industry in a steady pace. And, I showed you that one slide of what happens if you don't keep building new plants.

I think there needs to be a progression in technologies, and I agree with you, there's going to be things that--you're going to need a repository, and you don't necessarily, you know, there was a lot of talk years ago about how if you recycle, you can make the repository just like almost simple. And, I don't think it's quite that easy, but I think you need to progress.

ARNOLD: Just a follow-up. You know, the material gets pretty ugly after two or three cycles. It's really not very

useful, in my opinion.

MC CULLUM: Right. And, that goes to, at some point, there are things you want to dispose. I think of the existing commercial used fuel inventory where you really want to go back and reprocess every assembly? Or will it make sense to put some with the defense wastes directly into the repository? I mean, that goes to how you want to lay out your facility, what types of things you want to do. But, you're right, I mean, there are choices to be made, and I think starting with either the technologies we have today, or maybe just slight modifications of those technologies to build in more proliferation resistance is probably good, and keeping the research programs always looking can we make it less ugly in the future.

ARNOLD: Just for the audience sake, by ugly, I mean isotopes of uranium and plutonium that aren't very useful in a reactor.

MC CULLUM: Right.

GARRICK: Ron?

LATANISION: Latanision, Board.

I've been following the evolution of the Administration's proposal on innovation hubs, energy innovation hubs, and it sounds very interesting, my reading, and I'm just wondering if I haven't read everything. But, my reading of what's intended for the one bullet that is

identified as I guess what I understand it to be as more materials for extreme service, is that correct? I think of next generation plants, and so on, and I'm wondering--

MC CULLUM: Yes, that's what I said, among other things, I don't want to say that this is entirely focused on waste form, but I know that when the Secretary of Energy unveiled it in his budget briefing, he mentioned waste form.

LATANISION: Yes. Well, does it go as far as to suggest aging of materials over very extended periods, or is it looking at waste forms, materials needs for the next generation, plants and so on?

MC CULLUM: I think it's open for business, and I think if this Board had ideas about what it might want to look at, I would get those on the table.

LATANISION: I'll write that down. I think that's a good suggestion. All right, thank you.

GARRICK: Has the input on the Blue Ribbon Panel from NEI been voluntary or have you been requested by Congress or some other agency, the DOE to--

MC CULLUM: It's been voluntary. We haven't really been directly consulted, but we've provided our input.

GARRICK: One other thing. When you talk about the Yucca Mountain lessons learned, is NEI doing anything specifically in that regard? Are they doing any work or contracting any work to capture from the perspective of the

institute lessons learned from Yucca Mountain?

MC CULLUM: Only that we're just very carefully following and tracking the whole process. I think the time to--we're not losing what's going on, but yes, we want to see the process be fairly prosecuted so that you get accurate and fair answers to the questions.

GARRICK: One of the frustrations the Board has had in many of its meetings is making the connection between the analyses that are performed, and the site characterization work. I would think that one of the most important lessons learned would be a site characterization program that is better defined and more likely to be of greater use when it comes times to do the actual site analysis. Given the capital intensiveness of site characterization, it seems to me this is very important.

MC CULLUM: Yes, I'd certainly agree with that. I think that goes to the notion of making sure the decisions stick.

GARRICK: Yes. Yes, Andy?

KADAK: I've been trying to track down the basis, the technical basis for 140 year lifetime of the storage system, which includes wet and dry storage. And, as best I can tell, it's based on MRS design of the late Eighties. Do you have any evidence or any document that you could share with us about the storage capacity, and the technical basis for having these dry casks last for, say, 50, 60 years in

storage?

MC CULLUM: Well, I think obviously, there have been some licensed for 60 years already, and I know that Tom can speak to that, as Tara can as well, probably better than I can. The 40 years, the pool is licensed for 40 years, so they say 140 years, and NRC has made several statements about 100 years. And, again, Tom is probably the guy who most knows about the aging management programs that are helping us look into that. I think really to answer that question, rather than take up too much time, I'd like to invite the panelists this afternoon to address it.

GARRICK: Okay, any other questions from the Board?

(No response.)

GARRICK: The staff? Okay, we've got a couple of questions. Gene?

ROWE: Rowe, Staff.

If you look at one of your scenarios, like Scenario 3, you're showing like 5,100 storage casks, but you're still showing like 65,000 MTU in wet storage. If you carried that out another ten years, a lot of those plants, existing plants, are going to be shut down, and that 5,000 casks would probably go to 10,000 to 15,000, depending on the type of storage casks that you're going to use. And, if the plant is shut down, or if you have an interim storage site, you know, the chances of one of those 15,000 casks having a problem is

probably not unrealistic, and without a pool, what is the contingency plan for dealing with off-normal events if one of those dry storage casks does develop a problem?

MC CULLUM: Well, I think first of all, we stay ahead of the problems, we stay ahead of them with design, and we stay ahead of them with monitoring. And, these are problems that don't happen on the order of seconds, like you do when you're operating a reactor. I mean, you would have to--again, what you're making is a powerful argument, by the way, for central interim storage. For whatever mitigating capability you'd want to have if you developed a problem, having it at only a few places in the country makes a lot more sense than having it at a lot of sites. But, you'd have to engineer a solution, and again, I think there's some people here, like Tara, who could speak to the possibilities there. If you want to get up, Tara, and talk, you can.

NEIDER: That's been handled in a lot of different ways. First of all, most of the sites do depend on going back into the pool to do any refurbishment that's needed. However, there are some sites which have taken the welded canisters, and for their mitigation plans, put it into their transfer casks, or into their transport overpack. And, other sites have had actually oversized canisters to put them in, and put them basically in a secondary container.

ROWE: Did they do that because the original cask

developed a problem, or just as a safety measure in case?

NEIDER: The only casks that I'm aware of that developed a problem were at the Dominion sites, which was a metal seal, and those seals, it's a double sealed structure with an overpressure system in between those two seals, and the outer seal was exposed to the weather, and what happened was there was an indication of low pressure, so that went back into the pool and the sealed material was changed out.

ROWE: Yes, but again my concern is if you have a pool, there's no concern, you obviously can handle it. But, if you don't have a pool, then I think there's some issues associated with that.

NEIDER: Right. And, for long-term storage, very long-term storage, you would have some sort of extra overpack, you'd have to have that on site if you're going to shut down your pool.

GARRICK: Tara, would you give your full name and affiliation?

NEIDER: Oh, I'm sorry. Tara Neider, Transnuclear.

GARRICK: Thank you. Yes, David?

DIODATO: Diodato, Staff.

I'll be assisted in asking this question by Dr. DiBella.

DI BELLA: This is Dave's question. Does industry support--you are the industry, so the industry supports

recycling.

MC CULLUM: The answer is yes, we support recycling.

DI BELLA: Go to Slide 10. Can you go to Slide 10, the Conclusion slide. I think that's longer than 10.

Does the industry support recycling?

MC CULLUM: Yes.

DI BELLA: Okay. What level of expenditure is required for achieving the industry goal?

MC CULLUM: That is being looked at. There's an MIT study underway that I know Dr. Kadak is very familiar with, is looking at that. Perhaps the Blue Ribbon Commission would want to look at that, and then if the Blue Ribbon Commission's recommendations end up in a legislative proposal, it would have to address a funding scenario. I know I've heard some discussions that if you wanted to embark on an aggressive recycling program, you'd have to increase the one mil per kilowatt fee to two or three mils per kilowatt. There are varying views in this industry as to whether or not that's okay. Some would say sure, that's a small price to pay. Some would say I don't know. But, that has to play out through that process that would lead to, you know, the Blue Ribbon Panel and litigation studies that are going to come out.

DI BELLA: Okay. The level of expenditures, what sort of order of magnitude are we talking about, one billion?

MC CULLUM: Oh, these are multi-billion dollar facilities, yes. I mean, there's no question there. And, the question is how do you pay for them.

DI BELLA: And, you're thinking maybe user fee would be the way to do it?

MC CULLUM: Perhaps. But, there's also the issue of the DOE obligation, if DOE is deploying recycling, to enable itself to meet its obligation and the extent to which, you know, so on and so forth. Again, that all has to be played out, and I can't stand here today and tell you I have all the answers.

GARRICK: Very quickly?

KADAK: The expectation basically is if it goes to reprocessing in the first instance, it would be a commercial decision, and let's just argue for a moment that mixed oxide fuels would be the choice. There are some commercial companies that believe that for an additional two-tenths of a mil per kilowatt hour, that they could handle the reprocessing creation of the mox fuel, and the vitrified waste. So, they're looking at this as a commercial venture, not a DOE venture. But, our studies basically say the deployment of this, if you wanted to do it, and it will have to be a national policy decision, would not happen for at least 10 to 15 years at the earliest.

GARRICK: Okay.

MC CULLUM: Thank you.

GARRICK: All right, well, thank you very much, Rod.

Our next speaker is Gary DeLeon, Office of Nuclear Materials Disposition, Environmental Management, DOE, and he's going to talk to us about the status and projections of DOE waste inventory, spent nuclear fuel and high-level waste.

Gary?

DE LEON: I thank the Board for the opportunity to talk to you about EM spent nuclear fuel and high-level waste.

My plan is to give you an overview. First, my office is responsible for management and oversight and integrating our plans for disposition, surplus, special nuclear materials, and also spent fuel, but I'm going to do my best to give you also an overview of our high-level waste program, even though that program is not directly under my purview.

Next slide?

As far as our high-level waste, we're managing our high-level waste at four sites, at the Hanford site, Idaho, West Valley, and Savannah River site. Most of the high-level waste that we have is located at the Hanford and Savannah River sites.

The high-level waste program is probably a large cost element in the clean-up program. As far as our life cycle cost, the Department issued a report on what our life

cycle cost is. It ranges up to upwards in the $300 billion estimate, and almost 40 percent of the cost for the EM clean-up program is attributable to the high-level waste program.

Our current strategy for the high-level waste program at the Hanford and Savannah River site is basically, our plan is to separate out the liquid waste that's stored in underground storage tanks at the Hanford and Savannah River site to a high activity fraction and a low activity fraction. And, the high activity fraction would be vitrified and would be sent for disposal in a geologic repository, while the low activity waste would be treated on site and disposed of-- treated and disposed of on site.

I mentioned about the West Valley facility. We have vitrified the waste there into 275 canisters. The Environmental Management is responsible for providing surveillance and maintenance of that waste. And, Idaho waste is in a different form. It's in a dry form known as calcine.

We estimated that if we were to vitrify all the waste, it would be somewhere around the order of 23,000 canisters total.

Next slide?

At the Savannah River site, the defense waste processing facility has been in operation since '96, and I actually have a little bit more of an update. As of last week, the DWPF has produced about 2,721 canisters. It's

about over 40 percent complete. That facility is expected to operate through 2030. We are storing the high-level waste in glass waste storage buildings. We currently have two at the Savannah River site. Glass waste storage building Number 1 is full. It's storing a little bit over 2,200 canisters. And, the glass waste storage building is about 20 percent full. That's close to having about 500 canisters, and we do have plans to construct a third glass waste storage building. We're expecting to start construction around the 2015 time frame, and have that operational by 2018, is when we expect the second glass waste storage building to be full. That should house all of the canisters that we expect to have produced at the Savannah River site.

KADAK: Excuse me. Is this borosilicate glass, and can you describe the size of these canisters?

DE LEON: The answer is yes, and the size of the canisters is roughly about--I don't have exact dimensions--about two feet in diameter and about ten feet high. The Hanford ones are going to be, I think, a little bit taller. They're around 14 to 15 feet high.

GARRICK: Why aren't they the same?

DE LEON: That's a good question. I think it was when the DWPF was designed and infrastructed versus what they need to do for the Hanford site.

For the Idaho National Laboratory, we have 4,400

cubic meters of dry granular calcine stored in stainless steel tanks, and they're within six shielded concrete structures, and they're referred to as bin sets. We do have a seventh one, but it's empty. We do have a calcine disposition project. It's at the conceptual design phase, and it's looking at potential alternative treatment methods for that waste.

What's in the license right now assumes that the calcine would be treated by separations, and that we vitrify the waste. But, we are looking at current alternatives. We do have obligations under the Idaho Settlement Agreement to issue a record of decision, and the plan is that by the end of this calendar year, that we would issue a record of decision looking at treatment options for the calcine. And, the bin sets are stored under a RCRA Part B permit and that we do have a requirement by 2012 to submit a Part B application if we are to retrieve and package or treat that waste in another manner.

I am told that this calcine waste will outlast myself and most everyone else here in the room. So, right now, we don't--this material is being stored safely.

Next slide, please?

For Hanford, we have 177 underground waste storage tanks. There's about 53 million gallons of liquid waste. We do have the waste treatment plant under construction. It is

expected to start operations in year 2019. This is the world's largest radioactive waste treatment plant. It consists of several facilities. There's going to be a pre-treatment facility, which the primary purpose is basically to separate out the low activity fraction and high activity fraction. And, then, we do have plans to--it would have a low activity plant that would vitrify the low activity waste, and would be disposed of on site, and a high-level waste vitrification facility to vitrify the waste that would go off site to a geologic repository. There is also a lab and other facilities to support the plant.

We also have cesium and strontium capsules. There's about 1,929 capsules. They're stored in the waste encapsulation storage facility. They were separated in the early Seventies to basically remove the cesium and strontium to requirements in the tanks, in our waste storage tanks. Right now, we are looking at what options we can do to disposition the cesium capsules. They estimate 122 canisters, is basically if we were to pack them in the standardized canisters, that's about the estimated number of canisters that we would produce if we were to directly dispose of these capsules.

Next slide?

At West Valley, I mentioned that we've already vitrified 275 canisters. They're being stored right now in

on-site hot cell, and one of the things that's being evaluated by the Office of Environmental Management is to look at can we move this to an alternative on site storage so that we could move forward with decommissioning the hot cell, and also doing the clean-up, associated clean-up with those facilities, basically.

So, the alternative analysis is expected to be completed sometime late this summer or early fall, so what we will do and whether or not we will relocate the canisters into alternative storage on site.

Next slide, please?

As far as EM spent fuel, we have about 2,400 metric tons of spent fuel. The majority of that is at the Hanford site. They are stored mainly in the multi-canister overpacks. They're reactor fuel that was used in the production days. We do have also fuel being managed at Idaho. The Fort St. Vrain fuel is being managed by the Idaho site office, and we also have some fuel at the Savannah River site.

We listed our other domestic sites because there are some small quantities of fuel at domestic research reactors in universities that DOE is in the process of receiving and accepting at either Idaho or Savannah River sites. Now, these quantities do not include the Navy or any inventory, but it's much smaller quantities. This is just

the EM quantity that we're showing here. And, we estimated about 2,400 standardized canisters would have to be packaged for disposal of all our fuel.

Next slide, please?

For the DOE inventory, we have a wide variety of types of fuel. We have from production reactors, research reactors. We have the core debris from the TMI that's being stored at Idaho. We have the commercial power demonstration projects, and then we have the DRR and FRR program that is ongoing right now as far as receiving that fuel.

Next slide?

At the Savannah River site, we've consolidated all our fuel in the wet storage basin. It's referred to as the L-Basin. That is also where we are continuing to receive aluminum clad foreign research reactor and domestic research reactor fuel. Our current plan is to recycle or process the aluminum inventory, and basically, we would recover the uranium, down blend that and have that for use for commercial power.

In order to do that, though, we would have to plan for an exchange, called a swap, sometimes referred to as the swap with Idaho, where basically, we would consolidate all the aluminum fuel at the Savannah River site, and then the non-aluminum clad fuel would go to Idaho. That's because we have the capability, and that picture right there is the H-

Canyon facility. We have the capability at the Savannah River site right now to process that fuel and basically reuse that for commercial power.

One of the things that the Department is doing is that we are also evaluating on whether or not it makes--we should continue with our plans, because it is very costly to operate the H-Canyon facility, and we do expect to generate some revenue, but the cost right now, the estimated cost for that facility runs about $250 million a year to operate. And, if we were to process the fuel, it would start around the 2011 time frame, and will do so for about another eight years, or so.

So, we are looking at whether or not--what's more beneficial, whether or not we would just dry store that, or should we reprocess that. And, just for our perspective, and this inventory of fuel, aluminum clad fuel is less than 10 percent of the total DOE inventory.

Next slide, please?

At Idaho, we have the most diverse range of spent fuel within the EM complex. We're storing it in wet and dry storage facilities, but we've been moving forward with moving our spent fuel from wet to dry storage. We do have an agreement, referred to--it's called the Idaho Settlement agreement that requires us to place all our fuel in dry storage by the year 2023, and have all the fuel out of Idaho

by 2035.

Right now, EM has been moving its fuel into dry storage, and we're expecting to complete that by sometime next year, towards the end of next year in 2010.

The fuel from the Navy and NE would also be placed in dry storage, but the current projections for that would be around 2013 for the Naval reactor fuel, and the NE fuel would be around the 2023 time frame, if not sooner.

I mentioned about the exchange planned with the Savannah River site. We are planning on doing that. It's somewhere in the 2012, 2013 time frame that we would probably have to start the exchange in order to make sure that we have sufficient inventory that's being processed in the H-Canyon facility.

Also, for the Fort St. Vrain, we are planning to submit a license renewal in November of this year. I think the license for that is running out in the year 2011. And, then, we're also looking at treatment options for the sodium bonded spent fuel at Idaho.

Next slide, please?

For Hanford, we have completed transfer of all the spent fuel from wet storage in the K-Basins, down into the what we refer to as the 200 area at Hanford is called the canister storage building complex. The fuel there is stored in multi-canister overpacks, and we do have some dry storage

casks also for the other types of fuel that we have at the Hanford site. And, our plan is to have some capability at some point to repackage the spent fuel that's not in multi-canister overpacks into the standardized canisters so that they could be off-loaded and disposed of on site. That's sometime in the future. We don't really have a specific date of when we will do that right now.

As far as our path forward, I mean, we've talked about the Blue Ribbon Panel right now to investigate alternatives. EM right now, our main focus is to get our high-level waste, basically get that in vitrified form because of the risk being posed right now by the waste being stored in liquid form in the underground storage tanks, and also for our spent fuel, to put them in dry storage.

At Savannah River, I mentioned that we currently don't have--our current plan is to process the fuel, so we figured that by within a decade, that we would get rid of all our inventory at the Savannah River site. And, so, right now, the current thing is that we don't need to have dry storage, but by the time we do that--but, at the same time, we are taking a re-look as to whether or not that makes economical sense on reprocessing versus putting it in dry storage, given the cost associated with that program.

In the near-term, we see minimal impact to EM because we're continuing with our current plans to move the

fuel in dry storage. We can safely store our fuel and our high-level waste for quite some time, but we're certainly awaiting any outcome from the Blue Ribbon Panel, and will revise our strategies accordingly on what we need to do.

Summary, basically, I think I just stated that we're going to continue to manage our spent fuel and high-level waste safely. We don't see any significant near-term impacts to EM. And, the outcome from the Blue Ribbon Panel we're going to--we'll see what the outcome comes from that, and then we will revise our strategy accordingly.

Thank you.

GARRICK: Okay. Howard?

ARNOLD: Arnold, Board.

Gary, those glass logs that are being generated at Savannah River and that will be made in Hanford and have been made at West Valley, the specifications for those with regard to leachability, and things like that, which have a lot to do with the design of the plant that makes them, were I guess generated sometime back on assumptions having to do with how they would behave in a repository. Do you see any--have you looked again at the question of the specs for those glass logs, as to whether they should be changed, tightened up? Should the ones at Hanford have a different spec than the ones at Savannah River?

DE LEON: Well, we think the current spec is adequate.

But, one of the things that we may be looking at is that can we--we're trying to minimize the amount of logs that we would produce. So, one of the things that we are looking at and will continue to look is are there ways that we could increase the amount of material we can load in the canisters.

ARNOLD: And, in doing that, you make assumptions about the repository, I presume? I mean, that's where the specs originally came from.

DE LEON: Right. Our current specifications right now are to meet what's been submitted in the license application. So, that's our current plan. But, what we are going to look at are there things that we could do that may make sense for a more efficient or optimum production rate of glass logs. But, that's part of our kind of looking at alternatives and options. But, right now, our current plan is to meet what's in the license application, and, if necessary, we'll submit an amendment to that.

ARNOLD: But in the license application for Yucca Mountain, do you see any difference if there's a different repository?

DE LEON: I couldn't speculate on that right now.

GARRICK: Gary, can you indicate what the magnitude of the operation is of the exchange between Idaho and Savannah River? How many shipments are we talking about, and what kind of shipments?

DE LEON: Well, we're looking at about--we estimated roughly it will take about ten years, or maybe less, and we're looking at I think a total of about 200 shipments cross-country between Idaho and Savannah River. So, it's going to be a substantial amount, and, so, we're in the planning stages right now, and we'll try to optimize that. One of the things that's going to drive that is, you know, the H-Canyon facility, and that's going to be a more costly, I mean, as far as if you look at the total cost, that's going to be the major cost element. So, the exchange, it would cost some money, but we think right now, we need to--we don't want the exchange to be on a critical path for processing in H-Canyon.

GARRICK: I assume the trade-off costs of these have been done between doing that and building a packaging facility at Savannah River?

DE LEON: Well, we've looked at some of those trade-off studies. One of the things that we were assuming in those trade-off studies was that we would use a facility similar to what's planned at Idaho, that we would put it in dry storage and we're going to have to repackage that fuel, and it would go into standardized canisters, and if we're--disposed in a repository, and those studies indicated that the costs in very rough terms were equivalent as going to the processing route. Because one of the things, if we process it in H-

Canyon, is that it would generate some additional high-level waste, about somewhere around 250 or 300 additional canisters, but the amount of spent fuel would be, as far as canisters, would be reduced by 800. So, there's sort of a net reduction in that.

So, those costs were roughly the same, but one of the things why we, you know, when we looked at this initially when we were still looking at planning for processing the fuel, is that we have higher certainty in our costs for running and operating H-Canyon because we've been operating that since the 1950's. So, we have a higher degree of certainty in that cost as opposed to building a new packaging and repackaging facility, where we have a cost rate. So, from a cost standpoint, there's a little bit more risk in doing that.

Now, one of the things that we are going to look at this year is to, well, you know, maybe put it just in dry storage similar to what we're doing at, or what the commercial industry is doing, or what we've done at the Idaho site, and maybe leave it there for many decades. And, then, at some point, we're going to have to figure out what to do with that. So, we're looking at that. But, the answer is yes, we've looked at it, and the costs were roughly the same.

GARRICK: How about the operational and safety risks, you certainly would seem to have a greater safety risk of

implementing this exchange than you would if you--

DE LEON: That is another consideration as far as I know, there's going to be a significant amount of fuel that's going to be moved across the country between Idaho and Savannah River. I know that that was one of the criteria that was looked at, and I don't quite remember how the safety, but my recollection on the study was that it wasn't a major discriminator for us. It was more of a--it was more the cost certainty was a major discriminator when we looked at it.

GARRICK: So, it's more a matter of getting the plate type fuel in Idaho that they're very familiar with, and have handled for many, many years, and getting the oxide and other reactor fuels to Savannah River because they have much more experience with that.

DE LEON: Right.

GARRICK: Okay. Andy?

KADAK: Kadak, Board.

A couple of questions. First of all, your progress is very impressive, and your challenge is enormous.

DE LEON: Thank you.

KADAK: On what you've been able to accomplish so far. But, it's obviously a very big job. My question is if Yucca Mountain is not available, let's just say either not licensed or not used, what state agreements will you be in violation

of if you can't move stuff from wherever these wastes are located?

DE LEON: Well, part of that, you know, I guess depends on your assumption of when is it, you know, it's a timing of when, because like I mentioned like with the State of Idaho, we do have to get our fuel off site by the year 2035. So, if we're looking at a several year delay, we think we may have some time to still meet that requirement. If we're looking at a couple of decades, then obviously we would have to enter into discussions with the State of Idaho as to what is available.

At the Savannah River site, I don't think, I'll have to double check, I don't think we have a similar date by certain that we have to get it out of the site. And, at the Hanford site, we have a tri-party agreement that says we have to get our stuff road ready, but I don't think it's the same also. I'd have to double check that.

KADAK: Could you check that for us?

DE LEON: Sure.

KADAK: Because that's obviously a key factor in how things happen relative to the repository, or some other place. I can't imagine you'd move stuff from Idaho and say okay, let's send it to Livermore for storage. That would not probably be an acceptable solution.

DE LEON: Yes. I'm sorry, I should also add we also

have an agreement with the State of Colorado. It's the same time frame, the 2035. Basically, the fuel from the Fort St. Vrain would be moved to Idaho for repackaging, just repackaging, it also has to be out by 2035.

KADAK: Now, relative to your waste forms, you have many, and in answer to Mr. Arnold's question, you said that those were in compliance with DOE co-disposed package requirements.

DE LEON: Yes.

KADAK: In terms of heat source, heat load and all the activity as well for shielding, and so forth. We had not looked at those kinds of analyses. Our focus has been largely on the commercial spent fuel and waste package degradation, and so forth, and I'm not aware of anything that the Board has looked at relative to source term, and so forth. But, as I understand it, the source term, the driver for source term comes from DOE wastes, not necessarily from commercial waste. Is my understanding correct? Co-disposed package source term is DOE waste?

GARRICK: It's not driven, but it's a disproportionate contribution.

KADAK: Okay. So, how do you react or interact with the DOE OCRWM people, or whoever it is that's worried about your waste, to make sure that everything is consistent and in concert with Mr. Arnold's question about waste form and

suitability for the repository?

DE LEON: Well, we have documents called the--it's called the Waste Acceptance Product Specification, and through that document is how we interact with them. As far as to what is, like for example, for the Vit. Plant at Hanford, that document is going to drive what is acceptable and what we can, you know, what basically the specification is for those glass logs.

KADAK: Well, as I recall as well, the canisters are thinner as well than the typical TAD, the waste overpack package. So, I think, you know, it's a question I think the Board should take a look at as to whether or not some changes need to be made relative to the DOE waste stream, since it is arguably a dominant contributor to dose.

GARRICK: Any other questions from the Board?

(No response.)

GARRICK: Staff? Carl?

DI BELLA: On that same slide, I'm wondering if you could give a little bit in the way of characteristics of the aluminum clad spent nuclear fuel, particularly how much U235, U238 is in it?

DE LEON: In terms of heavy metal, it's about 19 to 20, around there, metric tons heavy metal, and it is mainly in the form, or it is in the form of HEU, and it's about 13, or so, metric tons of highly enriched uranium.

ARNOLD: Arnold again. Those are driver assemblies; right? Those were not targets.

DE LEON: I think it may be both. And, then, we also have--I'll have to get back to you just to double check on that.

ARNOLD: But, if it's HEU, they were drivers.

DE LEON: Yeah. And, then, also from FRR fuel, that's also HEU that we've been returning from all over the world, yes.

ARNOLD: Have they reprocessed all the old targets?

DE LEON: They have completed, right now, we are processing some unradiated material, so I think they've completed that as part of a Defense Board recommendation, 94-1, I think we've completed all that.

ARNOLD: But, this is SNF, it has been irradiated; right?

DE LEON: Yes.

ARNOLD: Okay. Because I remember some of that driver fuel is pretty degraded in the sense it's got a lot of U236 in it. They're using it to generate electricity. It might not be as good as you think.

DE LEON: I mean, basically, we're expecting to recover out of that, about, like I say, I mentioned there's about 13 metric tons of HEU that we plan to recover. Some of it does have, you know, other impurities, but we plan to recover

about that much.

ARNOLD: What I'm saying is HEU may be a catch-all phrase that includes a lot of U236.

DE LEON: Right.

KADAK: Just a quick question on transportation. I know DOE has been struggling to get approvals to ship spent fuel from various locations to, say, Yucca Mountain. How are you going to do your shipments of essentially the same type of material to Idaho and back?

DE LEON: Well, I mean, one of the things that we have an office of transportation that deals in work with the corridor states. We have begun some discussions with them on how will this work, and we're going to have to basically work more closely with them on doing that. We haven't really engaged with them very aggressively yet because we're not at that point yet, because we're still in the planning stages of just what shipping casks we're going to use, how many, and all that. So, we're still in the planning stages.

KADAK: By truck or by rail?

DE LEON: It will be by truck.

KADAK: By truck.

GARRICK: Okay. Gene?

ROWE: One quick one. Rowe, Staff.

Have you established a schedule for the construction of the Idaho spent fuel facility?

DE LEON: We have, we're thinking right now it will be somewhere--we need to have this facility somewhere in the late teens for it to be operational, in order to be able to package the spent fuel. But, we don't have a firm schedule at this point.

ROWE: Does the construction authorization from the NRC have a time limit on it?

DE LEON: You're talking about the Foster-Wheeler?

ROWE: Yes, the Foster-Wheeler one, yes.

DE LEON: Right now, we have submitted an application so that it could be transferred over to the Department. I don't recall the specific time frame for that. But that may have to be augmented to include all the fuel types at Idaho.

ROWE: The original license only included like two waste posts?

DE LEON: I think three.

ROWE: Three? Okay, thank you.

GARRICK: Questions from the audience?

MC KENZIE: I'm John McKenzie. I'm the director of regulatory affairs for the Navy's Nuclear Propulsion Program. I just wanted to correct one fact from Gary's presentation about the movement of spent fuel by the Navy from the NTEC water pool into dry storage. I think Gary represented that that would be completed by 2013. The correct date is 2017.

DE LEON: I think it's still well ahead of schedule.

GARRICK: Thank you. Okay, thank you, Gary, a very good presentation.

That means we have time for a nice lunch, so we will recess until 1 o’clock. Thank you.

(Whereupon, the lunch recess was taken.)

AFTERNOON SESSION

GARRICK: All right, I wonder if we can come to order, please?

Our next speaker, and we're very pleased to have him, is Mark Holt from the Congressional Research Service. Mark is going to talk to us about nuclear waste disposal, and alternatives to Yucca Mountain.

HOLT: Thank you. I'm glad to be here today. We can start, just keep it on the opening slide for a second. I'm just going to take a few seconds to talk about what is the Congressional Research Service. I did get that question today. We're not a real high profile agency, but we are part of the Library of Congress, and we provide analysis and information to Congress for the purpose of legislation, constituent service, anything that members of Congress need to do, and committees.

The key factor about my presentation is that the Congressional Research Service does not make policy recommendations. So, you will not see any recommendations in here. But, we do provide the information that we believe will be required by Congress to make policy decisions.

So, what I want to talk about, of course, everybody is fully aware of the Administration's policy, and that was the reason for our work, was when the new Administration came in, well, after the election, before the Administration came

in, the policy had been pretty well telegraphed, and, so, we wanted to be prepared with the information that Congress would need. So, I'll talk briefly about the redirection, what we know about it, but, of course, that's been covered, so we won't go into that in too much detail.

The rest of the agenda items are really things that we believe are important for Congress to understand in considering this issue. One being what is the baseline under current law, you know, what does that mean, and in order to change it, what would they be considering. In that case, what are the options for changing the policy? What are the potential consequences?

And, of course, one of the implications is if Yucca Mountain is not to be considered, that a new waste site, or sites, would have to be found, and we believe that the experience in pre-1987, in searching for sites, would be instructive for Congress in formulating a new policy.

So, I'll start with the redirection. We have talked about this quite a bit. This came up I think at lunch, how direct was the Obama-Biden campaign statement. And, they specifically said on their campaign literature that Yucca Mountain is not a suitable site. There was no mincing words about that. So, we certainly were well aware that there would be a policy change.

And, of course, as we've discussed quite a bit, the

2010 budget would “terminate the Yucca Mountain program while developing nuclear waste alternatives.” But, of course, continuing the licensing process. Congress, of course, has not weighed in fully on this yet, and we’ve mentioned that a little bit, that of course under our system of government, the Administration, the Executive Branch, can’t change policy entirely on its own in most cases, and, so, obviously Congress will at some point need to weigh in.

And, so far, on this specific question of terminating Yucca Mountain, which is of course a change in law, Congress has not directly addressed that. The fiscal year 2010 budget debate will be watched very closely to sort of get signals of where Congressional sentiment might be.

Congress did address this a little bit in the 2009 budget, of course, as we know, which cut the program budget by about $100 million. That was--I would not call that a full debate--that was in the midst of a giant omnibus appropriations bill, very, very fast moving and sort of chaotic situation. So, I don’t think that--but, it certainly showed that Congress was willing to cut the program, which it did.

This is just what we’ve seen already, the key points being, you know, no transportation, that’s gone, and of course the bottom line, another big cut, but as was discussed, that cut of course still leaves close to $200

million for DOE, OCRWM, and of course another $59 million for NRC. So, there's still quite a bit of money to move forward, and my understanding, as was discussed earlier, is that this is basically, even though it looks like another big cut, is, as of now, sort of a steady state budget.

So, what should Congress be considering in crafting a new policy, if that ends up being the direction? Of course, the parameters for a new repository site search. You know, how broadly should that site be done, what should be the method of selection, that type of thing. Congress, of course, will also need to look at what indefinite on-site storage might mean, since that is essentially the default option under current law. Is that an acceptable policy to continue on-site storage indefinitely? And, that will be a lot of people wondering about that.

Implications for new reactor licensing. Without a path forward on nuclear waste, what does that mean? The potential for centralized interim storage, that's been brought up quite a bit as a possible alternative. Waste treatment technology mentioned prominently in the Administration's 2010 budget request. And, then, federal liability under the disposal contracts, potential cost to the government.

So, this is the baseline, what I'm calling the baseline program. You notice the very first line is not too

many people would consider that the baseline anymore, but the latest DOE goal of course was waste shipments beginning in 2020. So, I've continued to use that because most of the calculations and things are based on that. At this point, it's considered highly optimistic that even if there were a complete sudden change, and Congress were to come in and reverse all the cuts and want to go full speed ahead, it would be very hard to still make 2020. So, it probably is delayed and very very most optimistic for Yucca Mountain at this point.

But, based on that, and this is all from the recent DOE reports, as we've seen, commercial on-site storage would peak, and the reason this is important for Congress is to see even under the current program, you're talking about a long time, 85,000 metric tons in 2023 from existing reactors, which is DOE's assumption. And, of course, all the waste is emplaced by 2066 from existing reactors, assuming no new reactors. Obviously, a pretty long time frame. That's sort of the bottom line, the earliest that the backlog of waste could be removed.

Annual funding would have to raise to $2 billion, ten times the current proposal, during the construction period. Total cost $96 billion through 2133. And, there is no alternative under current law to Yucca Mountain.

Here is the graphic of the baseline funding

profile, to some degree, and this is from a DOE chart. I think it's from the Total System Lifecycle Report. So, this I think started a few years ago. As of right now when they made the report, and corresponding to make the at that time 2017 deadline, was going to rocket upward. Of course, what really happened is this. Obviously, we're way off the path at this point, and of course this jump was the--this is the operational period, and then of course the closure period.

So, how could the change be made, and what are the major options that are under consideration that Congress would want to look at? Withdrawing the license application, right after the election, that was the question everybody was asking is are they going to withdraw the license application, because it appeared that under NRC rules anyway, the applicant did have the right to withdraw the application. It wasn't really clear whether that would work under the Nuclear Waste Policy Act. So, that has never really been analyzed. It hasn't been done yet, so it hasn't come up, but presumably, Number 1 and 2, withdraw the license application and find the site unsuitable, would have to be done in tandem, because once the site is found suitable, under the law, the license is supposed to be submitted.

And, that raises questions if you pull that back, you know, in the interim of course, there was the 2002 Congressional endorsement of Yucca Mountain. So, the

question is can you back up and undo that. And, so, there's a lot of legal questions that haven't been really answered as to how easy it would be to take that step. Other steps of course can be taken and have been taken to reduce the program funding. That has already taken place to some degree, and may go further. Of course, the new Administration has the right to make policy appointments to key positions. Of course, we have a Secretary of Energy and Environmental Protection Agency to make the regulations, and of course the Nuclear Regulatory Commission. The makeup of that is certainly going to change over the, and already has to some degree with the new chairman. So, those are things that the Administration can do to try to implement its program.

And, then, the broad review, which later--this report was written before all this happened, but it was pretty obvious that that would be a good way to deal with the program, is to start with a review. So, that's obviously the Blue Ribbon Commission that's been talked about.

So, if Yucca Mountain were halted, and of course Congress is very interested in this, without a change in law, I would point out, and that seems to be what the Administration, I don't have any inside information from the Administration, but that seems to be the general thought, that there wouldn't be any unilateral action by the Executive Branch to trigger all these consequences without a change in

law to address the consequences at the same time. But, this is what could happen.

Of course, the first point is almost certainly going to happen. Any alternative to the existing program would almost certainly be a longer period of interim storage, or a longer period of time before the waste gets removed from existing waste sites. And, of course, as we saw, the baseline was 2066. So, we're getting to push into a long period of time, maybe a very long period of time.

Nuclear waste contract repudiation and the federal liabilities that would result from that, it could be interpreted that the withdrawal of the license application would be tantamount to repudiating the contracts, the standard disposal contracts between DOE and the utilities. And, this issue has already come up over the years in some of the courts of claims that has repudiation already taken place, in which case, it appears that under repudiation, that would trigger the much speculated about potential total repayment of all funds that have been paid by the utilities as nuclear waste fees, either all the funds that haven't been spent, or even all the funds that have been spent, plus interest and penalties. That's the speculation.

The effect, of course, what does that mean for new nuclear power plants? There's a couple of things that new nuclear power plants have to have. They have to have, under

the Nuclear Waste Policy Act, they have to have disposal contracts with DOE, which the new ones have been signing. But, of course, if there's contract repudiation, what would that do to that? And, then the Waste Confidence Decision, NRC has to, under its policy, has to have confidence that the waste from a new power plant, a new reactor, can be dealt with and disposed of satisfactorily, and that's underway. We've talked quite a bit about that already.

I didn't mention in the slide, but of course state laws, there are several states that have similar laws that a nuclear power plant can't be licensed without some way to deal with waste. That has never been tested. There's been no order for a plant since these laws were passed. So, the question of federal preemption in that case is a little bit unclear. There's obviously areas where the states do have control. They can't regulate nuclear safety, but they can regulate--they're in charge of economic regulation in the case of a regulated plant. And, in the case of a merchant plant, there's all kinds of environmental permits and other things that are under state control. So, that could be an issue, aside from just the general issue of political opposition to nuclear power plants, especially at new sites, which we haven't seen yet, based on the potential lack of waste management facilities.

We also just talked about the DOE environmental

clean-up penalties. That could come into play. And, in the long-term, storage risk is sort of the big picture questions, since on site storage is the default option if nothing else happens, the waste just stays where it's generated. And, that, of course, has been the practice throughout the history of nuclear power. How long can that happen? We get a lot of questions about that, how safe is storage. And, of course, it's generally considered to be safe in the near-term, but what is the near-term, is it 100 years. I mean, obviously, the Waste Confidence Decision says yes, or the new proposed one, is about 110 years, 50 years after reactor shut-down.

Although, I did see that Nevada is concerned about the emplacement of the drip shields in 100 years. So, that implies a level of discomfort with institutional actions that far in the future. And, of course, DOE has analyzed the long-term consequences to roughly, you know, if you left waste in surface storage for as long as Yucca Mountain, or the repository, of course you would expect quite a lot of bad consequences. And, then, the real question is in the interim, at what point does it become an unacceptable risk, is it 100 years, is it 200 years, is it 500 years, is it 1000 years. Most people would agree there comes a point where the risk arises to an unacceptable level.

This is the Department of Energy's estimate of the costs of delays based on the standard contracts. And, the

way this works, these are based on the settlements that DOE has made so far with utilities, and those settlement costs are calculated every year based on what the utility that has the settlement is paying in addition to what it would have paid had acceptance started in 1998. So, they've got a 1998 curve, which note is a lot less steep than these curves, so they cross at some point. This is like a 2,100 metric ton per year acceptance rate, or something. This is done for the purpose of calculating the settlements. And, as far as I know, that's the only purpose of it.

So, that at point here, the utility could say okay, you would have taken this much, so we are going to pay for that much. And, of course, when you get to the crossing point, you don't have to pay anymore. But, what's happening is this line is continuing to move out, and the estimate is that every year adds approximately $500 million to the total cost, which the total costs are, you know, over this period of time when you get to that point. And, those are based on the settlements so far. There's still a lot of court cases that have been appealed. You know, they may very well end up with much higher costs based on those that would then push this whole curve to a much steeper level, and much higher costs overall. This is assuming no repudiation, where everything has to be paid back all at once.

The major alternatives that Congress will be

considering, those have been talked quite a bit about today. But, as has been noted, there is no alternative under current law. Yucca Mountain is the only candidate site. And, central interim storage, which has also been mentioned as a possible alternative, under current law, according to DOE's analysis anyway, is tied to Yucca Mountain. There is no alternative to the monitored storage facility, under the Nuclear Waste Policy Act cannot move forward without certain steps being taken at Yucca Mountain.

So, without Congressional action, basically on site storage or private central facilities would seem to be the main options without a new law. So, new law is required for redirection, which does seem to be the direction that has been going.

Institutional change has been a sort of overarching possibility that has been mentioned, a lot of talk about instead of changing, you know, instead of naming up front what option we want to go, will change the institutions involved. So, of course, Number 1 is the Department of Energy is a politically controlled entity, so maybe it should become a government corporation, or independent agency, or something along those lines, to eliminate the perception of political interference, which was especially pronounced in the early years of the program.

Private-sector organization, take it out of the

government entirely. There's obviously a few problems there. There's no funding available, or you'd have to change the funding quite a bit to make that happen. And, then, the question of permanent title, probably a private organization would not be able to hold the waste forever, the way the government could. So, that could be a problem. Other institutional changes, increasing oversight just to try to solve the problems that way.

This is just an example that was in one of the global nuclear energy partnership studies. In fact, if you recall, the four industry studies that were commissioned by DOE as part of that initiative, they all had something along these lines. This is the Energy Solutions, and, you know, if they have a federal corporation, and then they're getting money from the waste fund, the utilities pay for various purposes there. This is the legacy fund here going in. And, then, the federal corporation hires all the facility contractors and basically does everything, and of course all under the oversight of regulators, Congress, et cetera. But, it gives an idea of the kind of proposals that are out there.

So, what are the ramifications of extended on site storage? As I mentioned, just all options I'll say likely to result in longer on site storage, so we're pretty much looking at later than 2066, possibly very much longer. Options, if you decide okay, on site storage is acceptably

safe, even for that long period of time, it has to be paid for somehow, and of course the various options are there to compensate the utilities for their storage costs. Typically, that doesn't make the Public Utility Commissions happy, although maybe satisfy some utilities. That's sort of what's happening now under the settlements.

The option of the federal government taking title at the sites, that's been proposed many times in Congress, and, of course, that would still leave the waste on site, but it would remove the liability of the utilities. And, then, of course the use of the waste fund for on site storage is generally not liked by anybody since it essentially means the utilities paying themselves.

Federal interim storage has been looked at a lot. Of course the monitored retrievable storage, the MRS facility is, the prime example of that was, you know, originally authorized and DOE's original decision for the MRS at Oak Ridge was rejected and is part of the '87 amendments. And, the change, because of concerns that the MRS would become a de facto repository, that was the term that was frequently used, and considered to be the main objection to the MRS because at that time, there didn't seem to be any progress on a repository, their concern that choosing, if an MRS were to actually operate, the utilities and anybody in favor of the repository would be satisfied and there would be no longer

any political wind behind the permanent repository. And, at that point, the MRS would be the repository on the surface.

So, they solved that problem, the ’87 amendments said the MRS can’t move forward without Yucca Mountain at that point, and limited its size to 15,000 metric tons, which obviously is not nearly enough to handle the waste that’s expected to be generated, or even the waste that exists now.

A voluntary site selection program for, primarily for central interim storage, I’ll talk about that a little later, went forward, and that was ended by Congress in 1993. Since that time, there was the big push in the mid 1990’s, the last gasp effort to meet the ’98 deadline. Several Congresses in a row worked on the Yucca Mountain interim storage idea, which fell short by either two or three votes, a veto override at one point from President Clinton. So, that was a very very intense debate.

And, then, more recently some of the appropriations committees had been putting sometimes fairly detailed interim storage provisions into the appropriations bills, but those have not been enacted.

Of course private central storage, that does not have the restrictions that the MRS has on it. NRC can license those, and does, of course, at on site facilities. So, the PFS facility, private storage facility in Utah is the example of that. It took nine years to license, which was,

you know, essentially a concrete pad and some casks. But, of course, that was held up by the issue of the airplane crashes. And, they got the license, and as we know, that was, ultimately, the actual use of the license was blocked by the Department of the Interior administrative rulings. And, a private facility does still have limitations. In this case, there was a pretty strict storage limit, and the time period was limited I believe to 20 years, which at the time seemed adequate, maybe in the future would not seem helpful. So, that would be a real restriction. And, then, the ownership of the waste was retained by the utilities. There was no transfer of title. So, if the 20 years expired, the waste would have to go back where it came from. Not solving the problem.

Treatment technologies are talked about, again, a lot by the new Administration, and there's a lot of emphasis, which was discussed earlier, in the budget to focus a lot of DOE's R&D work on waste treatment technology, that in the budget are largely unspecified, is exactly what those technologies would be. I don't think they use the word "reprocessing," but essentially that would be along those lines, one would think. It would, of course, provide an alternative to direct disposal, and of course reduce potentially the waste volumes, long-term heat and radioactivity.

It would possibly have a near-term affect of giving spent fuel a place to go. If you built a reprocessing plant, the fuel could go there, although in if you recall the 1992 Energy Policy Act debate, there was a major push by then British Nuclear Fuels to bring spent fuel from the United States to the Fork Plant, which was undersubscribed, and I guess still is, for--they didn't even say they would reprocess it. We'll just store it for you, and it will be a great service. That actually made it into the Senate Committee version of the bill, but was eliminated on the floor. So, that was sort of the high water mark of that idea.

And, of course the industry studies that I mentioned have a lot of alternative concepts for such a closed fuel cycle type option. But, still the fundamental obstacles that have blocked the closed fuel cycle, reprocessing, recycling, really since the Ford and Carter Administrations still are there, and that is of course the higher costs that will be involved, and the concerns about nuclear weapons proliferation due to plutonium separation. And, of course, implementation would take many decades.

We have a couple of graphics here from the GNEPDS studies again. This is from the General Atomics GNEPDS team, and you can see the dates they're talking about. This is up to 2100 they're going to do this, which is continue with

light water reactors, and they go to the UREX process, and the fission products. And, of course, you see they calculate a certain percentage of long-lived transuranics from each process. So, even if the fission products are shorter lived, of course there's still a lot of long-term stuff, let along the long-term fission products.

But, their idea, since--of course, General Atomics has been promoting the high temperature gas reactors for a long, long time, is to take the uranium and plutonium and make it into fuel for a deep burn modular helium reactor, which is basically their reactor. The advantage is that it would, since it's a high burnup fuel, it would burn up more of the transuranics than a light water reactor, reducing the volume that would go into a pyro processing facility, and then into fast reactors to finish the job and make a loop for indefinite recycle.

So, here's Part 2 of their proposal after 2100. So, the main purpose is just to show the very long time frames we're talking about implementing these technologies, and just the complexity. At that point, they've eliminated the light water reactor portion and it's just a gas reactor, fast reactor loop, but still producing of course the fission products and a certain amount of transuranics. Obviously, a very complicated and long way from implementation proposal.

Here's the Administration's--we've talked about

this, the budget went up for this area. This used to be the advanced fuel cycle initiative, which was the R&D portion of GNEPDS. So, GNEPDS is no longer mentioned. The website is gone. And, the advanced fuel cycle initiative is gone, but this continues, and it's targeted at waste treatment. And, I think we actually went over some of these earlier, all aimed at various aspects of waste. So, there's quite a bit more money actually for the waste research area.

Non-repository options. Everybody has, you know, if we can't find a repository, we'll find something else, and these are always out there, the subseabed. The U.S. was involved for many, many years in the international program, although it is now prohibited by the London Dumping Convention. Space disposal, I mean, this is all out of the 1980 PEIS, you know, pictures of the space shuttle taking the waste up. We actually had to analyze--there was a professor who wrote to a member of Congress and had an idea for shooting small packets of waste with an electromagnetic rail system to be on a mountain, and it would shoot these little packets, one a minute, because they were so small, they wouldn't be dangerous, so we had to analyze that. So, the ideas are definitely out there. Deep boreholes is certainly still out there. Ice sheets, maybe less so. Volcanoes, I didn't see a lot of support for the volcano option, but it is mentioned. I'm not really sure what they meant by that.

So, the search for new waste sites. Assuming that none of the non-repository options are selected, would imply that a new repository site search will be needed if indefinite, meaning forever, on site storage is not considered an option. So, as far as I know, at this point, a repository, there's very few technical experts who believe that a repository of some sort is not necessary, whatever option is chosen, except for the non-repository options.

And, the lessons here of course are important from the past as to how we would structure such a search for a new repository, or obstacles, pitfalls, other things that might be a problem because most members of Congress were not here in 1987, nor their staff. But, luckily, the Congressional Research Service was there, so I personally witnessed this, so that hopefully gives Congress the institutional memory that it needs to avoid, or at least learn from the past, and move forward instead of repeating the problems, the ideas that didn't work before.

So, of course, lessons, we know that a lot of opposition, clearly Yucca Mountain did reduce the Congressional opposition and allowed the program to move forward in '87. But, of course, a new search would then maybe reopen that and many parts of the country that were off the table in '97, would suddenly be back on the table again.

So, let's just briefly review the history of the

site search, and this was the original concept, if anybody remembers, and this is a little different from the latest OCRWM director, Ward Sproat's analysis of how the program actually played out. The technically driven process that would be considered fair by everybody, including the selected site, the process would be designed so that even if you didn't like the outcome, you would accept that it was scientifically and objectively and in a balanced way carried out.

Two repositories were envisioned, in the East and the West, to try to create some regional equity. The first repository, because there was a concern that the program needed to move rapidly, they wanted to start with sites that had already been identified, so among those sites then the Department of Energy was supposed to choose a first repository site. And, then, the second repository site was going to be basically a search from scratch, a nationwide screening, or at least screening of certain crystal and rock bodies.

And, this next map gives a little hint of what was to come. People may remember in I guess it was '86, yes, January '86 when this report came out, and the operative information is all these dots all over the upper Midwest, New England, you know, Southeast Atlantic Coast, suddenly all of these spots were being considered for nuclear waste sites.

So, that's when things really started to happen.

The first repository candidates, at that time, it had been narrowed to five. If you remember, the multi-attribute utility analysis that was conducted, and ranked the sites, and of course one of the things that the five sites immediately noticed was that the results of the analysis were not necessarily what the final ranking was, so they didn't like that too much. But, DOE said no, that this black box analysis is only supposed to be a decision aiding tool and not supposed to be the decision, but that message didn't really resonate.

And, in the midst of all this, the DOE then cancelled the second repository, which if you recall, was the key compromise in the Policy Act to make sure that one region would not take all the waste. The justification being that nuclear power had not grown as fast as had been thought that it would and, therefore, a second repository would not be needed.

And, then, Tennessee, it was at this point very upset about having been chosen for the MRS. And, at that point, there was so much opposition through so much of the country that the program was essentially paralyzed. The budget was cut. They couldn't really move forward.

And, this next slide shows Congressman Udall's fairly bitter summary of what had happened. He was one of

the prime authors of the original Nuclear Waste Policy Act. He was the Chairman of the House Interior Committee. “We created a principal process for finding the safest, most sensible place to bury these dangerous wastes. Today, just five years later, this great program is in ruins.” And, he went on to say, “The potential host states no longer trust the technical integrity of the Department of Energy’s siting decisions.”

So, what was when--he was actually I believe, this happened in conference, but I believe based on his--he was just so unhappy with what had happened, that he didn’t want to play anymore games, is the way I interpreted it. The conference at that time, everything was pointing toward Yucca Mountain. The ’87 amendments were being drafted so that that would be pretty much the obvious choice. And, he said look, let’s just name it and, you know, quite playing around. So, that’s what happened.

KADAK: Udall didn’t say that.

HOLT: Well, it was in conference.

KADAK: He may have said that, but he didn’t say what you just said.

HOLT: I thought in conference later, he was the one, but somebody, if it wasn’t him, it was that that was the driving factor, because they were not naming Yucca Mountain until--I thought it was him that had said no, let’s not beat

around the bush, let's just name it, and they did. And, so, it's specifically named as the site.

Congress thought at that time that Yucca Mountain seemed to be the best site and probably would have been selected, so they were trying to, you know, move things along faster that direction. But, of course, the naming of Yucca Mountain did eliminate all other areas of the country for consideration.

The '87 amendments also eliminated the second repository program. And, then, of course, we talked about tying the MRS to the repository, so there would be no more concern about the de facto repository as an MRS. Monetary benefits, specific statutory benefits were offered to host states. The Nuclear Waste Negotiator was established, so this was definitely Udall's idea. The Nuclear Waste Negotiator was charged with finding voluntary sites, and actually was empowered to offer literally any inducement. But, of course, the inducements would have to be approved by Congress, but there was no limit on what the negotiator could offer.

And, of course, the Nuclear Waste Technical Review Board was established to address the issue of the lack of trust over DOE's technical decisions, and it was thought that an independent board of technical experts would serve as a check and be a trustworthy source of information for Congress

and the public, you know, in case it appeared DOE's decisions were being driven by politics, that this technical body would point that out.

So, here's where we're at, various ideas that have been tried. Of course, in the early days, remember the Lyons, Kansas site, AEC tried to choose a site on its own. That did not work out. DOE's selection administratively of an MRS site was unsuccessful. The site ranking process for the first repository was unsuccessful. The screening process for the second repository was unsuccessful, and the benefits agreement for the host states, no interest was ever expressed in those. The negotiations for the voluntary sites did not work. And, now, we're at the Congressional designation of a site, which is Yucca Mountain, and it should have a question mark there, that we don't know yet. But, we do know that nothing has succeeded. The Congressional designation is still active, which is not to say that a repository can never be found.

And here's of course an example, the WIPP site, the Waste Isolation Pilot Plant was sited. Of course, it's a bedded salt site, originally was intended as a high-level waste site, volunteered by the community of Carlsbad for economic development, was switched to transuranic waste at the behest of the state. So, Congress then authorized it in 1979 as a defense transuranic waste site, but the waste,

anybody following that program, knows that was certainly not easy either, and the first waste did not get shipped to the site until 20 years later. But, of course, it is operating successfully today.

There is some highly publicized local support for taking other types of waste at WIPP, but my impression is that the state as a whole is still strongly opposed, the state delegation is strongly opposed. I would guess that they're at least as strongly opposed as the State of Nevada is to Yucca Mountain. So, it seems like a tough idea to implement.

So, although we don't make policy recommendations, we can at least make a few observations. It would appear that based on the record, that long-term repository site studies, as opposed to the original concept of a purely scientifically driven objective site that everybody would accept as fair and unbiased, involve a level of uncertainty because of the long time periods involved, and just knowledge of geologic processes in general are so great that public concern is going to be present in any case.

And, this difficulty of siting is likely to mean without Yucca Mountain, there's going to be a lot longer period of on site storage, and we've seen that the alternative technologies are not technically quite ready yet, or they face other serious obstacles that have blocked them

throughout our history. There is no legal framework for selecting new sites under current law, no legal framework for moving forward with an alternative disposal policy under current law.

So, as a result, Congress is certainly the key to this. The upcoming Congressional debate, the most immediate upcoming debate, of course, is the 2010 budget. Whether that will be a full-blown debate is unknown. I'm guessing there will be a lot of commentary and discussion, not necessarily the big debate on Yucca Mountain yet, but that of course is coming down the road.

And, if you want to contact me, feel free. Thank you.

GARRICK: Any questions?

KADAK: You're--

HOLT: Well, it's very difficult. Certainly, anybody following this program in '87 can see why that was done, and in the report that this is based on, I didn't say that none of these other alternatives couldn't work. They haven't worked, and certainly some would say well, if we did it right, if we offered bigger benefits, if we did things a different way, implemented the program better, had more oversight, maybe some of these tasks could work. So, I'm not going to say that it's impossible. But, it certainly would not be easy.

ARNOLD: Arnold from the Board.

I was very impressed with your report. I thought it was an excellent summary.

HOLT: Thank you.

ARNOLD: The one thing you don't talk about, and I wonder was that deliberate or you weren't asked to, is a survey of what other countries are doing.

HOLT: We do have, I won't say the report is in the works, we have talked about it a lot. We do plan to do something like that because we do believe that would be another area that Congress would be very interested in, and of course the Swedish apparent success just recently announced would be of great interest. So, yes, we do want to do that. And, we also, you will notice completely lacking is any discussion of the technical merits of the Yucca Mountain site, we do want to do something like that, too. We have one of our earth scientists on our staff is planning to do a report on that.

GARRICK: Questions? Yes, Andy?

KADAK: You've written a lot about Yucca Mountain and the whole waste program, sort of checked some of your other writings, and you're a very close observer of the process, and in listening to your remarks, I get the sense that it's not so much the DOE that's the problem, it seems that the Congress when it tries to fix the problem becomes the

problem, with all the changes in laws, prohibiting an MRS, or linking it closely, avoiding the use of Tennessee, avoiding the use of--as a repository location, all in legislation. Do you think anything has changed that would make this process go forward since the years you've been following this?

HOLT: Well, Congress is the place where the political issues come together, and of course that will be the focus, and that is--part of the problem is when you set up a technical process in an agency that is supposed to be outside of politics, politics is still going to be present, and you could argue that the program did become overwhelmed by politics. There's two ways of looking at it. One is the Department of Energy, as Congressman Udall said, itself became subject to politics within the Executive Branch, and that undermined support. Or, you could look at it as basically anybody, any area that the finger started to point to was going to pull out all the stops, and use any tool that it could to fight this, and number one is to raise of course political alarm and get the public to put pressure on its elective representative to do what they can to stop it.

So, I guess the question is there a way to get around that, it would be difficult since to totally isolate this process from any politics whatsoever, I mean, I guess you could try to design something like that. It would be hard.

KADAK: I'm really asking do you see anything politically that has changed that would help in solving the problem?

HOLT: It may be more the opposite, that, you know, has the well be poisoned at this point, that we've tried all these methods and everybody now sees what it takes to stop it. So, you know, anything that you propose, any state that is selected has a play book, and knows how to go out there, so it would be maybe even harder politically now than in the past. I'm not sure that there's, you know, I don't see any other big change in the acceptability, political acceptability of nuclear waste sites at this point that changes the fundamental political dynamic.

ARNOLD: Any state can have a look at the play book, but only one can have the Senate Majority Leader--

HOLT: Well, remember, in '87, it was a junior senator, brand new, and he was of course thoroughly defeated at that time, so I guess patience is one of the key parts of the play book.

GARRICK: David?

DUQUETTE: Duquette, Board.

Perhaps I'm reading something into your writings and into what you've presented here that isn't there, but it looks to me like your group, your study group hasn't totally written off Yucca Mountain as an eventual alternative. I

understand that politically, both Biden and Obama have said that Yucca Mountain is not a viable site. But, can you imagine or picture something that would come out of, say, the Blue Ribbon Commission that says Yucca Mountain is fine, especially if your earth scientists says there are no real problems with it, could you see it coming back into the picture again?

HOLT: Well, my understanding is that in fact the question was put to either the Secretary or others in the Administration as to whether the Blue Ribbon Commission would consider Yucca Mountain, and I don't have it here in front of me, I thought they said no, that the Blue Ribbon Commission would not be considering Yucca Mountain. Now, it doesn't mean that I don't think that--do I think that Yucca Mountain is really off the table? Clearly, the licensing process is still going forward. As was discussed, that process carries well beyond the current Administration, and many intervening elections, so as long as the licensing process is going forward, it certainly does appear that the project is still the current law.

DUQUETTE: I can't imagine how any Blue Ribbon Commission could completely ignore Yucca Mountain. They would have to know something about Yucca Mountain to move onto--

HOLT: Well, that is my impression. Maybe that's going

to change, because it would possibly make it--I could imagine it would make it harder to recruit a commission if they were told that they had a preordained decision in some parts of what they were looking at. But, I thought that was the direction that they were going. I don't know for sure.

DUQUETTE: They'll come up with a decision that's putting it in an oxidizing environment in tuff is probably a good idea, but Yucca Mountain is not.

GARRICK: Bill Murphy?

MURPHY: Bill Murphy of the Board.

You mentioned that a number of states have precluded development of nuclear power plants in the absence of a solution to the waste problem. I know California is one of those. How many states have such restrictions, and is there a tendency for now that plants are being built again, or proposed again, is there any move of other states to implement such limitations, or is there a movement in the other direction?

HOLT: I think it's about six to eight states, I don't remember the exact number, and some of the laws are a little vague as to their exact applicability. And, of course, I won't say they do block it. The laws say that they can't do it. As I mentioned, there's a question about what the state can prohibit and what it can't. I don't know if anybody would want to move forward with a nuclear power plant project

in a state where, you know, officially, legally, and everything else opposing it. I don't think they probably would. I haven't seen any efforts to pass any additional such laws. I have seen a number of efforts, and of course California being one, in the state legislatures to repeal those law or modify them. But, I don't think any of those have succeeded yet, so the status quo is still, you know, a handful of states do have these laws in place.

KADAK: I think it's 13.

HOLT: I think it might be in my report.

GARRICK: Let me follow up with a question that David Duquette was skirting around. Is the Congressional Research Service able to write a report that ends up with a position that's different from the Administration?

HOLT: Well, we don't make policy recommendations, but we could certainly--we certainly in many cases have written reports that take issue with facts or just sort of sub-analysis that was presented by an administrative agency, and basically criticizing their methodologies and things like that. But, we wouldn't, in the case of nuclear waste, we certainly wouldn't make a policy recommendation that current policy should continue or change or anything like that.

GARRICK: What if you call it a technical recommendation?

HOLT: Well, it would be more along the lines of we try

to set the record straight on the facts that are being presented. Of course, a lot of the facts are based on analysis, so at that level, we would reach conclusions, but we wouldn't reach the broader policy conclusions. And, we try to represent all reasonable points of view, so if somebody is out there, we wouldn't say the Administration is wrong without presenting their view also.

GARRICK: It seems to me I've read some Congressional Research Service reports on terrorism that do make, at least imply recommendations or actions that are either not being taken by the current Administration at the time, or haven't been considered.

HOLT: Yes, and those are probably carefully worded. I think they're probably worded in a way that says this is pros and cons, or this is options, something like that. It does become a fine line, are you listing options because they're options, or are you listing options because you think they're a good idea. And, we do have an office of high-level reviewers who do nothing but attempt to scrub the reports to make sure that it doesn't appear that we are favoring one side or the other.

GARRICK: So, what's the primary mandate of the service? I'm trying to relate it also to the National Academies, which are there to review projects at the request of the government, and offer findings, conclusions and

recommendations. How does your role differ from that?

HOLT: Well, part of the reason that we have to be objective and not reach policy conclusions is because we have to serve all members of Congress and all their staff. So, the minute we made a policy recommendation, we've immediately lost half the members, who won't trust us anymore on that issue. They'll say, okay, these guys are on the other side. But, typically what happens is if there is a big debate, we are supporting both sides of the debate equally. They call us. We're totally confidential. We're just like an extension of their personal staff or the committee's staff, that if they're talking strategy, if they're talking, you know, what I need to do to implement this, they know we will not even mention that or even mention that we've talked to them to the other side, and vice versa. So, that's why they trust us. We don't take sides. They know that we will support them to the best that we can.

GARRICK: So, Congress is the mechanism by which you decide what you do, in other words, what they ask you to do?

HOLT: They either ask us or we anticipate what would be useful, or we just know that there's certain things that we do automatically that are used by Congress. But, we don't recommend policy.

GARRICK: Yes?

KADAK: The Government Accounting Office also does

studies and report?

HOLT: Yes.

KADAK: They are pretty much, I guess certain Congressmen ask the question that he kind of knows what he wants as an answer. You don't do that?

HOLT: Well, we have a form called directed writing. So, if they do have a preordained conclusion they want us to reach, it gets a special form and it says right across, you know, in giant letters right across the text "Directed writing. This document was prepared at the direction of the requestor with the preordained conclusion." So, we will do that. People typically don't want those because it doesn't really help them that much. If they want a CRS product because they know it's fair and unbiased, and GAO would probably greatly take umbrage at the idea that they do that. GAO does reach conclusions, GAO is also not supposed to be making policy recommendations either. Now, they'll make recommendations on government process and government operations. There's certainly some reports that we would think maybe get close to the line. But, they do make recommendations. They're not supposed to come out and say we think nuclear waste should be put at WIPP, or whatever.

KADAK: It's a little bit more inflammatory than--

HOLT: Yes, they'll get pretty heated up about, you know, somebody is not running a program right, or something

like that. But, if you look at their reports, you usually won't find heated rhetoric on the substance of the policy that much. It's more on how the program is being run.

GARRICK: Yes, Ron?

LATANISION: Just to be clear, on this particular report, was this written in an anticipatory sense, or did a member ask--

HOLT: We'd gotten a lot of questions after the election, and I had given some briefings, which essentially this was the briefing, and I thought, well, this should be a report because everybody is going to want to know about this. So, I wrote the report as quickly as I could, because I was hoping to get it out before the Administration took office. I got pretty close. And, it would be ready for when this policy change came down, which it did, and we did indeed get a lot of questions about it. So, there's a lot of Congressional interest.

GARRICK: This report was not a particularly good report card for Congress. What's been their reaction?

HOLT: Well, I mean, they weren't here, and so they probably don't mind too much. But, I mean, everybody knows the legislative process is very difficult, and prone to, you know, political forces.

GARRICK: Okay, yes, George?

HORNBERGER: I was interested in your recounting the

events of the Eighties and what not, and certainly that's all well known now, although I sometimes think that we look back with rose colored glasses. I think Luther Carter, for example, was suggesting that Nevada was the--

HOLT: Yeah, that was actually his book was very influential and did actually, I think, sort of tilt key members of Congress toward Yucca Mountain.

HORNBERGER: Of course, he later changed the tune. But, I'm curious because at the time that it happened, my recollection of events, things were getting pretty hot in the east with people looking for granite sites.

HOLT: Yes, I mean, I did not go to those meetings, but in talking with people who did, it was I think considered a very unpleasant assignment to go to these community meetings in the east. I mean, I don't think it was as bad as in France where they literally were running people out with pitch forks, but they were outraged and they just thought it was crazy. They thought there's too much rain here. You're putting it like in Maine under a lake, and all this stuff. They just didn't accept it at all.

HORNBERGER: And, so, I mean you can see that even though it violated a primary agreement, you can see politically why--I'm just curious again to relate it to currently, you say we have these lessons and we want to have Congress have these lessons to go forward, and yet the events

surrounding these political decisions are--

HOLT: Well, the main lesson would be be careful choosing a new policy, that you don't put yourself back in that position. If you choose a new policy, you've got to somehow think it through, and think of all these factors, and see if there's some way you can try to structure the policy so that maybe you mitigate some of those problems. I don't know exactly how you do that.

GARRICK: You often hear that one of the reasons the United States has such difficulty with this problem is that there has not been cultivated or created a national will to solve it, as in Sweden, Finland, and maybe France. From your perspective, and having gone through this exercise so systematically and deliberately as you have, and if you were put on the spot to make some recommendations on how to create a national will, have you got any comments?

HOLT: Well, a national will presumably would start with the existing on site locations, because they are presumably the ones that are going to bear the consequences of the default policy. And, you know, we haven't seen huge amounts of local outcry, it's more like a low level of unhappiness, you know, if you ask people, they say yes, we think the waste should go away, there hasn't been a big outcry. Of course, we haven't seen too many new sites chosen yet that might raise this problem with the local opposition. But the Public

Utility Commissioners had been one of the biggest forces, because they were very upset, mostly because they felt that they had been approving rate payers' money for this and not getting anything for it, so that they were sort of being put in a bad position, because their mission is to make sure that the rate payers only pay what is necessary. So, they typically were very unhappy with the lack of progress. I hadn't seen too much else, but that would seem like that would be the place for the national will issue to germinate.

GARRICK: Well, I don't know, I might challenge that. I might say that the national will has to start at a more basic level than that, that it has to start from the point of view of understanding the problem. If you talk to the average citizen about nuclear waste, obviously they don't think in terms of technology and the kind of science and analysis that's involved. It seems to me that we have really failed with respect to educating people on what this is, and we have allowed the stigmatizing of the waste to come about by referring to it as a dump site, and what have you, when in fact it's a pretty high tech business. So, is there any feeling among the Service that the industry and the business has been deficient in that regard?

HOLT: Well, we probably wouldn't say that anybody wasn't doing a good job, or doing what they're supposed to do. But, obviously, that would certainly seem to be a

reasonable strategy if one wanted to build a national will. I mean, that seems no doubt about it.

GARRICK: Yes. Okay, Andy?

KADAK: I'm curious as to your ideas about why reprocessing got resurrected so quickly from being really not a very viable alternative, such that even the current Administration is talking about it. Is it just an alternative to Yucca, or how do you see that playing into this discussion?

HOLT: Well, the reprocessing of course was--I mean, the vision of the closed fuel cycle never went away. It was always out there, even during the Democratic Administrations, of course, there were many many people who were pushing for that and thought that was the right way to go, and of course when the second Bush Administration took over, they didn't just invent that out of nowhere. That was part of their policy, and the people that they brought into the Administration wanted to do that. One of the reasons they wanted to be elected was to do this exact thing. So, that was a big part of their energy policy.

Now, the Obama Administration, of course being a Democratic administration, it is a little different from the past patterns, which when a Democratic administration comes in, typically, they don't want to pursue reprocessing and these technologies, and of course it's all being discussed in

terms of waste treatment and waste processes and improving the waste disposal methods. It doesn't really talk about closing the fuel cycle and producing more energy and that side of it. But, also, I mean, usually the non-proliferation community weighs in very very strongly on this issue, and I sort of get the impression from talking to some people involved in that area that it's partly because there's not that many of the political positions have been filled yet, and there's nobody that they really can weigh in on yet. So, it may still come to pass that the non-proliferation issue will become a bigger part of the debate.

KADAK: It would seem that if you think about the 1987 Waste Policy Act as the governing law, it was intact for 15 years, perhaps even longer, and you almost can kind of consider that to be a success. And, where it got tight was when they were close to a solution again, as they sort of dropped the MRS when the Mescaleros and the Goshutes proposed something, Congress said oh, no, no, no, not in my backyard. Are we in the same pattern again, or not?

HOLT: Well, I think in the case of Yucca Mountain, it may be more just a confluence of political tides that happened, and just happened to happen at this time when the application had already been submitted. But, yeah, one could imagine that instead of becoming discouraged when the site gets close that maybe the opponents just fight harder, and

that could be part of it, too.

GARRICK: Okay, any questions from the Staff? Yes, Dave?

DIODATO: Diodato, Staff.

First, I want to thank you for a very interesting and compelling presentation. We appreciate it to have the CRS come present before us.

Dr. Arnold brought up the idea of international programs. You mentioned Sweden. As a point of information Torsten Carlsen, who was the mayor of--came some years ago to our Board meeting held. He reported that the local candidate communities at the time would have an opportunity during the characterization and evaluation process to have veto authority at any point where they could back out. So, there's one key difference that may give them some confidence. So, that's one of the Swedish things that--

HOLT: I don't think the local communities as opposed to a larger entity such as a state, because typically here, the pattern has been the local communities are supportive, and the state as a whole is being the sovereign entity as opposed to local communities is the one that successfully stops the project.

DIODATO: That's correct, yes.

ARNOLD: Besides, there's a structural difference between Sweden and the U.S.

DIODATO: Of course. Now, I thank you for that observation. I do have a question about your Slide 21, this is the General Atomics proposal before 2100. So, here, it shows 1,540 tons per year of uranium coming into the system, going on to the UREX process, and then 1,498 tons per year coming back out. So, where does that 1,498 tons per year go?

HOLT: Well, they may say in the report. I think they intend for it to be either re-enriched to the extent that it can, or made into breeder fuel, or whatever. I mean, a lot of it just says storage for future use, although this is, of course, after 2100, you would think they would have figured out the future use by that time. But, usually it's something like that. But, you're right, the use of the uranium is always a big question mark. It's another of the technical issues that hasn't been solved.

DIODATO: The other part of it is so there's a 50 ton per year delta there, so do you have a--did GA produce a cost estimate on what that 50 tons per year would--what it would cost to--

HOLT: I think it was mentioned earlier, some of the, you know, a few mils per kilowatt hour, essentially a doubling or tripling of the waste fee they thought would pay for all this. Of course, it doesn't seem like much, only, you know, a tenth of a cent per kilowatt hour, but you're talking maybe one or two billion dollars per year, it's a

pretty significant income flow. And, of course, we haven't even been spending what comes in. So, it would be a huge expense increase for the United States.

DIODATO: Thank you.

GARRICK: We've got time for one more question. Go ahead, Gene.

ROWE: Okay. I'd like to follow up on that a little bit and just get an opinion from you. When I talk to the man on the street, if you will, about the waste problem, they go well, why don't we reprocess because that will get rid of it. And, my question is does Congress understand that reprocessing does not get rid of all of the waste?

HOLT: Probably not. I mean, we get a lot of questions, I mean, not that many members have focused intensively on this issue. Obviously, the ones that have do understand that. But, most have not even focused on it, so, yeah, they would really not probably venture much of an opinion. But, you do hear occasionally people discussing isn't there a technical solution to this problem. Shouldn't we be pursuing that, because they've heard from a constituent or from, you know, some outside interest group that this is the way to go and this would really solve the problem. We should do that right away. That's one of the purposes of CRS, is when they hear that kind of information, they hopefully will check it with somebody they trust, and see if it's the straight story

or not.

ROWE: It's not plastic water bottles that we're recycling here, I don't think.

GARRICK: Very good. Very good. Thank you very much.

All right, we'll take a break until 2:30.

(Whereupon, a recess was taken.)

LATANISION: All right, let's begin. My name is Ron Latanision. I'm going to serve as the moderator for this afternoon's discussion on very long-term dry storage.

We have a group of distinguished speakers to join us this afternoon as part of this panel. But, let me first add a few words of perspective before we begin the conversation.

We all know that Secretary Chu has said that Yucca Mountain is not an option, and that there are better ways of managing spent fuel and high-level waste. And, the fall-out to that is that he intends, the Administration intends, to convene a Blue Ribbon Commission to examine alternatives and to make recommendations to him and to the Administration.

Clearly, one of the recommendations that we've heard mentioned several times already today is the concept of dry storage. This is a relatively young technology that my impression is continues to innovate and improve frequently. But, the question is from our perspective today what do we mean by very long-term dry storage. And, for our purposes,

we're going to choose as a time element 120 years and up, and we do that for two reasons. First of all, while dry storage in the context of a decade or decades has been--we have experience with that to some extent in this country, and particularly in France. The question of what happens beyond when we're talking about periods of 100 years and more, 230 years and more is something in which we are uncertain as to the nature of the research that might be needed, and data which might need to be collected that deals with the question of issues that may arise during that very long-term period.

There's a second reason, and that is that the NRC's proposed revision of the Waste Confidence Rule is still in the middle of Administrative rulemaking, and we have chosen not to become entangled with that, so we set our lowest limit, higher than the highest limit in the proposed Waste Confidence Rule. That explains the origin of the 120 year time period for the purpose of today's discussion.

What we want to look at is the entire system. We want to look at the canister that holds the spent fuel, or high-level waste, if it's canisterized. But, we also want to look at the structure that houses the canister, the entire dry storage system from the pad on which these structures sit, to the change in the character of the fuel as it ages. And, to all of those kinds of issues which we believe need some form of consideration.

We have three panelists, and the approach that we're going to take is to ask each of the panelists to make an opening statement. That will be followed by a dialogue between the panelists and the Board. There will be time for questions, of course, from not only the Staff, but also from the audience.

The topics of conversation can range as you wish, from questions associated with repackaging, some of which we heard a little bit of conversation about this morning, to degradation of the fuel over a period of time, to degradation of the concrete and other structural materials, to, dare I say it, corrosion of any of the elements of these systems. So, that's sort of the framework in which we'll conduct this afternoon's conversation, or dialogue.

Let me introduce the panel. John Kessler from the Electric Power Research Institute, is the manager of the high-level waste and spent fuel management program. John has had a presence at Board meetings in the past, given his interest in TSPA and colloid induced contaminant migration, and so on. So, John is certainly known to the Board. To the point of today's conversation relating to storage, he manages a jointly funded project which investigates issues for the purpose of independent spent fuel storage, installation and licensing questions. So, we're looking forward to John's comments.

Tom Brookmire from Dominion Resources is the engineering supervisor for spent fuel storage at Dominion. Dominion owns and operates four nuclear plants with spent fuel storage installations on all four sites. So, we're interested in getting Tom's perspective from the point of view of an operator.

And, finally, we'll hear from Tara Neider from Transnuclear, Incorporated. Tara began her career at Westinghouse Nuclear Services as a design engineer. She joined Transnuclear in 1986, held various positions, left for a time between 2001 and 2004 to work with Constellation Nuclear Services, and then rejoined Transnuclear in May 2004 as senior vice-president for engineering, and was promoted to president and chief operating officer in January 2006.

So, we have a panel that has a wide base of experience in topics of interest to us today, and I'm going to ask, we'll just do this in turn, John, you're first in line, so we'll just turn the floor over to John Kessler.

Thank you.

KESSLER: Before we go onto the next slide, some of the discussion today I can't help but smile as we're talking about, you know, an alternative to Yucca Mountain might be let's keep this stuff at sites for a long time. Well, I think that one of the main reasons why that is being even considered is because we have an extremely good track record

of safety. And, that is because of the hard work both the industry and NRC does at maintaining a safe system.

I would argue that we can keep things--there was a discussion earlier about when the risk gets too high of interim storage, or storage on site, then we'll do something. My feeling is we can keep the risk acceptable. It depends on what you want to pay. It depends on what you want to do to do it. We can keep that risk low. And, if that's what happens, for good or for bad, that will be part of the equation, I think, is that we will continue to have on site storage that's safe for as long as we need it, for whatever reason.

Now, let's go on to the next slide.

My outline, I'm going to talk a little bit about dry cask storage system functions. Let's just start there. What is it that the systems are asked to do at the very highest level that's defined by NRC? I will talk next about a program we did about ten years ago that we called the Dry Cask Storage Characterization Project. And, that was to provide some technical basis to extend, or have increased confidence in the longevity of some of these systems. I'll talk a little bit about some potential long-term degradation mechanisms, and EPRI's plans for future work.

Next?

At the highest level, NRC's NUREG-1536 identifies

these functions that are important to safety, and they must maintain thermal performance, radiological protection, confinement, sub-criticality, and retrievability. The last one is NRC wants to make sure that the industry has a way of retrieving spent fuel as long as the spent fuel is in storage. All of those functions need to be demonstrated for however long the license is, that NRC won't grant a license extension unless they're confident that these functions can be maintained.

Originally--let's not go onto the next slide quite yet--originally, as was discussed earlier, the understanding was is that 20 year licenses were going to be plenty long for interim storage, and while the vendors did analysis, this terrible talk about that looked at periods longer than that, there wasn't the need at the time to do the heavy lift to allow for licenses to go beyond 20 years, and so they weren't.

So, as Tom will talk about, the first licenses were now more than 20 years ago, and something needed to be done to provide a basis to go to NRC to ask for license extensions without having to repackage and start over again.

And, so, what happened--next slide--is in about 1999, we, EPRI, along with NRC Research, DOE RW and DOE EM co-funded a study where we actually took a canister that was sitting at Idaho National Lab that had spent fuel that had

been sitting there about 14 years, and took a look at that cask. And, I'll show you a couple pictures from that work. But, the idea was was to see over that, what was essentially kind of a lead cask demonstration at the time, were there any aging issues, at least over those 15 years.

In EPRI reports, there are also NRC reports that document this, I've got the three listed there, all three of which are publicly available.

What do we do from that study? We reopened this Castor V/21 cask, or 521 cask at Idaho. We took a look to see if there were any fission products or any kind of gas release from the cladding into the gas cavity. We looked at external dose rate measurements. We were trying to determine if there was any degradation of the neutron or gamma shielding that occurred over that period of time. There was a visual inspection. I'll show you a picture or two of both the cask internals, externals, as well as every single assembly. And, we removed some rods for destructive testing.

That was followed up by rod testing at what was ANL-West, where they did some measurements to determine what the cladding looked like, whether there was any changes to that, along with fission gas release measurements, and then destructive exams were done at Argonne-East.

Next picture?

This is just one picture of the Castor 521 cask

being moved into the INL hot shop for opening and inspection.

Next slide.

These are a couple more photos that were taken during that inspection process. The upper left one shows the Castor cask with the lid off. You can see the assembly sitting down in there. The upper right one gives you an idea of one of the assemblies being lifted out, where we had recorded visual inspection of what all those assemblies looked like. We had people that were taking a look to see what those assemblies looked like. Bob Einziger in the audience did some of that work for NRC at the time, taking a look at that.

The picture in the bottom left is essentially taking a look down one of those channels at the bottom to see whether there's any kind of indications of corrosion. The bottom of the channel shows a little bit of staining that was done at the time that the internals were put in, and you can still see some of the machine works in the bottom right-hand corner of that one. The bottom right figure is where we took one of the assemblies, drilled out part of the top nozzle to get to some of the fuel pins, and what you see there is one of the fuel pins being extracted for subsequent examination at the two Argonne locations.

LATANISION: Just a point of information. What are the materials of construction that we're looking at here?

KESSLER: This is stainless, internal stainless. Tara, what's the 521 body made out of?

NEIDER: Nodular cast iron.

KESSLER: Thank you. Sorry. Okay. So, this particular picture is the stainless internals, but the outer body is the nodular cast iron. Thanks.

Next?

This is just one example of the kind of study that was done. This gives us an idea of the dimensions of the cladding relative to the as fabricated, which is the 10.72. And, what you see is the red lines being a measurement of the cladding diameter. This essentially shows the collapse down during the high pressure, high temperature part of the reactor operation, and what we would think is that if we had any kind of cladding creep due to high temperatures and internal pressures during storage, we might see some of these average diameters to be increasing up over that. And, we don't really see any evidence of creep, or at least when we took a look to try to figure out how much creep there might be, we really couldn't quantify it because it was essentially below what we were able to reasonably accurately determine.

Next slide?

Another issue is the hydrides in the cladding. What you're seeing here are some cross sections after we sliced up one of these rods to look at how some of the

Zirconium hydride has precipitated in the Zircaloy cladding. The idea is is that if it's in the circumferential direction, the zirc hydride is fairly brittle, such that if it was a lot zirc hydrided, you would get more brittle behavior of the fuel, and it could more easily break. But, as long as it's in the circumferential direction, the ductility of the cladding stays pretty much intact. And, one of the big issues now, especially for high burnup spent fuel is are those zirc hydrides, when they precipitate, going to stay in the circumferential direction, or is there something that's going to happen that will make them in the radial direction. And, you can see that for these couple pictures, they're all staying pretty much circumferential for this particular fuel under these conditions.

Next?

So, the bottom line on that four year cask effort was that we saw no cask functional degradation that was observed. The assemblies still look the same as they did when they were put in there. We didn't see any sticking, bowing upon removal. There were no visual signs of degradation. There was some oxidation there, maybe a little bit of crud spalling, but essentially no visual signs of degradations. The cask gas, the cavity gas didn't show any release of fission gases. There was no significant hydride reorientation, very small amount of creep. We did some

analyses to show that the cladding actually wasn't imminently in failure of breaking due to creep. And, the result was that this work formed part of the basis for the license extensions that are out to 60 years now that Tom and Tara are going to talk about in a little bit.

KADAK: John, what was the inert gas used there?

KESSLER: Helium. There were a couple other tests that were done back in the Eighties that included nitrogen and air, but this was helium.

And, the other thing I want to note is that the most severe conditions are generally at the higher temperatures, and the higher temperatures occur during the first 20 years, and things just get colder after that.

Next?

ARNOLD: Could I ask--

KESSLER: It's one of Tom's. Surry reactor. The burnup was about 33 gigawatt days per metric ton, which was typical of the fuel at that time that was being put in in storage.

ARNOLD: Arnold, Board

There was some work done out here at the Test Site in the Seventies with some fuel from Turkey Point under then an AEC program.

KESSLER: Well, I don't know. Okay? The short answer is I'm not aware of that. What we were interested in is what had actually been put in commercial type spent fuel casks,

and essentially under those conditions. Somebody else in the audience can probably provide a lot more detail on those particular tests. My guess is again Bob Einziger could probably help you out there.

Some examples. While we looked at a lot of issues, we didn't look at all of them, and there are still some things out there. For example, as I just mentioned, we looked at fuel with a burnup of about 33 gigawatt days per metric ton. NRC has regulations or interim staff guidance that talk about spent fuel over about 45 to 50 gigawatt days per metric ton because of their concern that some of the properties of that fuel could be different than lower burnup properties. Well, we only had low burnup fuel at the time, so that's one issue that we didn't really look at.

Long-term concrete degradation. Some of the spent fuel cask designs are concrete based. This was a metal canister system, and while we did look at the concrete pads sitting under the container for damage to it, we obviously didn't look at a concrete based system itself.

KADAK: Is it reinforced concrete or just concrete?

NEIDER: Reinforced.

KADAK: Reinforced.

KESSLER: These are all reinforced, yes.

One other issue that came up that originally the Japanese did some work on was the effect of marine

environments on stainless. We have a couple reactors here, and almost all the reactors in Japan may have some of these storage systems next to the ocean, or near the ocean, and the question was the salt spray, how might that affect the longevity of stainless steel. The Japanese did some work that we reviewed and did our own work, and we looked at the effect of marine environments, and our result was essentially we can't rule out the possibility of localized corrosion due to the effect of marine environments. So, some more work could be done there.

One of the reports that we did in December of 2002, with again I'm grateful that the primary author of that report, Bob Einziger, again, is here, and what we did was we essentially did a lessons learned from the dry cask storage characterization project, along with earlier work on data needs that, again, Bob had a hand in writing. And, what I've circled there in red are some of the things I want you to focus on. We looked at both the initial properties and what kind of degradation mechanisms we thought would occur during the first 20 years, and what degradation mechanisms might continue to occur, or might crop up that didn't occur beyond 20 years, in the extended period.

And, I've got really three that show up, of which two may be of the most relevance in terms of designing cask systems for the long period. One was the hydride

embrittlement that we did identify as something that would continue in the beyond 20 year time frame. Another was oxidation due to air ingress. If you have air ingress, you're going to continue to get oxidation, albeit maybe at a somewhat slower rate than you had during the first 20 years. Nevertheless, it would continue. And, then, if you've got an accident or fire pre or post-20 years, you still have the same potential mechanisms there. So, that's what we came up with in terms of what we thought the main degradation mechanisms were.

Next?

Okay, a lot of the degradation mechanisms tend to be temperature related. I mentioned fuel cladding creep is caused by increased cladding ductility and increased stress, and the stress is due to higher internal pressures which of course you have higher pressures when you go to higher temperatures. The hydride reorientation in the spent fuel cladding. If we have a high enough pressure and a high enough temperature, we will get some of those hydrides that I showed you that were mostly circumferential to go essential radial right through the cladding, which would really embrittle the cladding if that were to occur in a gross fashion.

Corrosion, obviously, we all know that temperature generally increases corrosion. Degradation of the neutron

shielding. The neutron shielding in many of these designs is affected by high enough temperatures, and you could have some degradation of the neutron shielding, even for concrete systems if you dried it out enough, you might lower the neutron shielding a little bit, although that's not such an issue. And, then concrete dry-out and cracking at higher temperatures. They're all temperature related issues.

Next?

So, changes as the system gets cooler, because now we're talking about well past 20 years, and maybe temperatures are down to something that--well, they're down considerably from what they were in the first 20 years. We think that it will be mostly good things. We would have reduced metal creep rates. We would have reduced corrosion rates. We'll have reduced gamma and neutron radiation, all of which makes life easier.

And, there's some potential negatives related to cladding. We will have additional hydride precipitation that could occur even past 20 years where we have more hydrides coming out of the metal solution, and potentially in the radial direction. And, just as you get metals colder, you decrease the ductility of the metal, and both of those may potentially make the cladding more susceptible to breakage.

So, while I argue that the vast majority of the effects of going to cooler temperatures and longer times are

good, there's a couple little issues out here that should be addressed for their relative importance.

Next?

Reduced degradation with time doesn't mean degradation stops. Corrosion in oxidizing environments, and I put that in parentheses to talk about--I'm thinking about the corrosion of the cladding and used fuel, that would require leakage out essentially of the helium that's in the cask body inside the canister. So, we would have corrosion beginning there in an oxidizing environment that may occur later in time. And, then, some have identified helium buildup inside the fuel rods as we continue to have alpha decay over many years might become an issue one day.

Next?

So, I know that probably Tom, and definitely Tara is going to talk a bit more about aging management options. Okay, so, these systems are getting older, what can we do about it? The initial activities, and I think that the industry has actually done quite a few of them already, are additional analyses to extend the progress of degradation mechanisms such that we can make some sort of analysis and prediction about how well we think these systems will last over decades to come. And, we will also talk about enhanced monitoring and inspection. There are certain monitoring and inspection requirements now that have been alluded to a bit

already. Perhaps there will need to be other ones as some degradation mechanisms may warrant it.

Eventually, we could go to something like canning, repackaging, or over-packaging, and I've got some pictures in a second here. And, of course, the question that everybody is interested in, including us, is when is eventually. And, that's something we can't answer today, but we're interested in answering.

Next?

So, assuming we have to do something, here are some figures that we took again out of an earlier EPRI report on data needs back in 1998, where we can look at normal loading of casks followed by--let's follow the central box there, the normal 20 year operation, after which we could continue to use the same cask, and then continue to store. We assumed a total of 80 years of storage, or a total of 100 years, 20 initial plus another 80 just to look at 100. Or, you may need a new cask and then you've got to consider whether you're going to transfer your fuel in dry fashion or wet fashion, how are you going to do that. And, there was a little discussion about that this morning.

Next?

And, of course, if you've got an accident, how are you going to deal with it when it's in extended storage period. The first thing you're going to do is you're going

to do some analysis before you do anything, and if you can convince yourself the accident was minor, you continue to store it, even if it's had some damage after 20 years. If not, you may have to unload it in a pool, if you've got a pool. You may inspect the rods, you may have to can the fuel to put it in essentially an outer can to provide protection if that fuel is now considered damaged. You may be able to reload the rods in an old or new cask. All of this is pretty obvious, but the idea is that one needs to plan all of this out if one is going to manage spent fuel and storage systems over very long periods of time.

Next?

Okay, in terms of what EPRI is proposing to do, we just got going with this program the beginning of this year, and what we're proposing is a workshop to discuss long-term aging issues of dry cask storage systems that we intend to have sometime in the fall. I'm sure we'll do some more paper analyses. And, depending on what those analyses and the workshop bring about, there may be some opportunities for experimental work that EPRI would either do by itself, or more likely, again, we would be looking for co-funders to do some work if it was needed, to provide technical bases for well beyond 60 years now, which is where we have some licenses. We'll take a look at some of the licensing issues for extended storage, as well as operational issues.

And, that's my piece. Do you want to hear all three before you--

LATANISION: Yes, what I'd like to do is just have each speaker. Thank you.

BROOKMIRE: Let me start off real quickly by stating a little bit what Dominion Resources is.

LATANISION: Tom, do we have a handout from you?

BROOKMIRE: There's one on the table.

LATANISION: There is?

BROOKMIRE: Yes. Dominion Resources is based in Richmond, Virginia. It's an energy company, electric generator, utility, and distribution, with natural gas distribution as well.

Next slide?

When Carl DiBella called up and asked us to put something together on the very long-term data needs of 120 years and up, it stymied me a little bit because that's slightly beyond my planning cycle, but I know, though, there are certain elements that we're going to have to address in terms of very long-term storage should that come about. And, certainly I hope we're talking about very long-term storage at a centralized interim storage facility or some other aging facility associated with a repository, and not on the utility side.

But, nevertheless, I can start by saying that we

have, we own and operate four reactor sites, the Surry power station, two unit PWR, North Anna, again two unit PWR, Millstone in Connecticut, two unit PWR and one boiler which is permanently shutdown, and Kewaunee, which is a single unit PWR in Wisconsin. Then, I'll get to very long-term storage needs, and what I want to do is what I would classify as a pictorial essay of what takes up much of my daily time, and try to thread some of that essay into what I would characterize as very long-term storage data needs.

Next slide?

KADAK: Could you just define--

BROOKMIRE: Well, I'm going by what was mentioned earlier here. My planning cycle usually starts around five to seven years.

KESSLER: I think we're talking beyond 60 in the sense that our license extensions go out to 60. So, we're talking about periods essentially beyond 60. When I was thinking about what I put together, I was thinking beyond 60.

KADAK: Beyond 60, below 70, or below 100?

KESSLER: What I was trying to say is I don't want to put a number on it. If it's eventually, we need to do some more work to figure out when eventually is. When do I think it is? It's probably beyond 100 years.

BROOKMIRE: Starting off with Surry power station, which is in Southeastern Virginia near Williamsburg, across the

river from Williamsburg, we have three pads, but the first two pads are site specific license. We don't need to get into a lot of detail of site specific versus general. But, nevertheless, when Surry power station was licensed, it was the only licensing option available to us, was a site specific, which basically means we license the facility separately and license--it's used for an NRC reviewed canister, or in this case a cask, which is what we call a storage system.

There's two pads with 55 metal storage casks in place that started in July 1986. Surry power station was the first dry storage installation in the country. As of right now, we have 1,470 fuel assemblies. Divide that roughly in half and you have how many metric tons of heavy metal stored there. We did experience some, and I think Tara alluded to this earlier today, some seal failures, secondary storage, or secondary seal, which is the seal between the environment and the first monitored storage space. And, what we discovered was that there was some in-leakage of some water through the environmental cover, which caused this aluminum seal, some galvanic reaction between the stainless steel lids. And, so, you had a galvanic reaction causing a seal failure.

We subsequently redesigned the environmental covers to preclude any water ingress, and we also went to pure silver seal systems on that to make it a little more noble.

And, so, the galvanic reaction will be slowed down dramatically. And, this began occurring within a couple years of when the casks were first in place, so it was a very quick phenomenon, and taking place in about 1999, 2000, and since we have gone to the new designed environmental cover and the use of all silver on the seals, we have seen any recurrence of that galvanic reaction.

These casks are monitored for pressure, and, so, we detected low pressure and couldn't determine it by troubleshooting at the pad. We could not determine what the effect and cause was, so we brought the cask into the plant, removed the lid, and examined the deal and discovered the failure.

We do have, as John mentioned, we did renew this license for 40 years, so for these two pads, the site specific license is now licensed through July 2046. I have to admit that it was a very well structured effort between the NRC and utility for working out the license renewal process. I think the fact that a lot of plant license renewals had gone through the system, this license renewal process was modeled very much like the plant license renewal. So, it worked out really very well.

And, to touch on really some of the aging management items that we have to continue, it deals largely with corrosion and degradation of the polymer resin shielding

which exists on the outsides of these casks. For the corrosion, we have some periodic inspections of the casks on the external, and what we call opportunity inspection, such that at any time they're removed, any of the covers at the pad, we will do a thorough examination to inspect for corrosion. We also have regular interval inspections due after basically every 20 years to examine the casks again for corrosion.

And, the monitoring that we do for the degradation of the polymer resin shield, we have what you want to call a routine examination of the dose rates external to the pad. We have monitored dosimeters all around the ISFSI. And, so, we'll take a look at those data on a quarterly basis, to see if there is any anomaly trends that would give an indication that the polymer resin trend perhaps is degrading.

Next slide?

Recently, in 2007, we transferred to a different type of storage system, which is the NUHOMS. You notice the other casks I showed there were storing vertically. They were heavy walled cask. The NUHOMS system is basically a thin walled canister inside a concrete module. It is stored horizontally, which is quite a bit different than obviously storing it vertically. The white cask you see on this blue transfer trailer is reusable. Inside that white cask is the thin walled storage container, which is pushed into that

opening inside the concrete module. And, then, a door is placed on it. So, it was basically a sea change for us in the type of technology we used, but we're implementing the NUHOMS system as part of a fleet at all four of our reactor sites.

We're loading at Surry power station, heat loads in excess of 33 kilowatts. It's a 32 element storage system. I believe that's probably close to, if not a routine basis, perhaps the highest heat load canister systems in use right now. And, then, there's a history to that, and what I want to get to at the end here, also with some of the data needs, the reason why we're loading such high heat load canisters now is that Surry started in 1986 when this technology was really in its infancy.

And, so, the limitations were, on burnup and heat loads, were very stringent. So a lot of those older casks that you saw on the pad had heat loads that were significantly less than what we're storing now. So, we've essentially depleted all of the cooler fuel within the plant, and now we're using what I would call a steady state type operation at Surry where we're loading as much as we're off-loading. Obviously, this fuel is being cooled for between five to seven years, but it's what we call a steady state. And, that's really true now for all our sites, at North Anna, Kewaunee, and at Millstone. We're basically putting into

storage as much as coming out.

Pad 3 is designed for 40 modules, and has a capacity to accept fuel storage until approximately 2020, at which time we'll need another pad.

ARNOLD: How does the footprint compare with those vertical?

BROOKMIRE: It's about the same--it's almost exactly the same size footprint. There's a little bit more footprint on the sides that you need for this type of operation, but it's virtually identical. So, we do get a little bit--the other storage pads hold 28 casks per pad, and this holds 40. So, we increased the capacity a little bit per pad.

KADAK: Do those also monitor?

BROOKMIRE: No, they don't. They're seal welded and leak tight systems. We do have monitoring of the inlet vents for temperature. We do a 24 hour temperature test, and then a seven day temperature test to make sure they're within the limits, and then we do daily surveillances to make sure that those vents are not blocked.

GARRICK: You may have said this, but does this design have a seismic advantage?

BROOKMIRE: It's not clear whether or not it does.

NEIDER: I can answer that one. It depends on which version you use, but for instance--sorry--he's going to get to Millstone a little bit later, but in some of the designs,

we actually tie the modules together, and then you've got a really impressive seismic advantage.

GARRICK: Yeah. Okay, thank you.

KADAK: I'm thinking more about the horizontal load, if that thing shoots out the tube--they're not attached. They're slid in?

BROOKMIRE: They're slid in, but there's also a restraint. After the loading, you have this bar of steel that goes in and restrains it.

KADAK: Remember the seismic loading at Yucca Mountain. I think the--is about two vertical, or something; is that right? And, another one was horizontal.

LATANISION: Did you have Navy experience, or you're thinking of torpedo tubes?

ROWE: I have one question. For the NUHOMS, those are welded cans, obviously. Is there any plan to have any kind of an ISI weld inspection program for those welds?

BROOKMIRE: No, it's not required. We do the NDE of the weld as it's established, and we do leak test as it's established for helium leak detection. But as far as a regular frequency, that is not yet established.

ROWE: Is there any talk of doing that in the future if you do go to longer storage?

BROOKMIRE: I don't know that. I don't know if you have any comment on that, Tara.

NEIDER: The modules, you can actually get in there with a boroscope and look around.

ROWE: I mean an NDE, you know, a UT, volumetric.

NEIDER: No, there's no requirement for that. All that the various--a couple of these systems have gone through the license renewal process as well, and basically, it's a visual, either indirect visual or direct visual from the external.

BROOKMIRE: Okay, now I'm jumping back again to the two pads that are site specific at Surry, and the reason is it's just a little bit of eye candy. The purpose of this is what you see right there represents 42 years, 42 reactor years of spent nuclear fuel, and its associated high-level waste. And, that's pretty disbursed when you take a look at, you know, there's about eight feet in between each of those casks. But, that's 42 reactor years of storage.

Next slide?

Similarly, North Anna power station has a ISFSI license, this is site specific, in June of 1998. The site specific pad is a single pad that has 27 Transnuclear 32 storage casks, and 864 fuel assemblies. All of the planned loadings are completed at North Anna, and license renewal application is due in 2016, so we're not actively working on any license renewal aspects yet for this site specific license. But, obviously, we will be within the next five

years, or so.

Next?

Similar to Surry power station, North Anna has switched over to the NUHOMS system. It began a little over a year ago for storage. We right now have four 32 PWR assembly canisters in storage. We'll be loading three more in July here. I should mention that Surry power station is also, as of right now, has loaded its eighth canister. The eighth one will be transferred to the ISFSI tomorrow.

This is North Anna. Its Pad 2 is just like Surry's. It can hold 40 modules, has capacity to accept fuel for storage until approximately 2021. These are some rare shots here of looking down the line of the transfer cask and the large blue thing staring at us is the RAM, the hydraulic RAM that actually pushes the canister into the module. And, then, a rare shot of a canister, actual canister loaded into the module. And, the reason we have somebody standing there is because there's no fuel in that can. It was during the dry run evolution. That's why it's a rare shot. Well, actually, you can stand there. We have people working in that area, once it's loaded to put in the seismic restraint device. But, it's a higher dose evolution, so we obviously try to limit the number of people in that area.

ARNOLD: What is the dose rate?

BROOKMIRE: On the surface, the back end right here?

It’s probably on the order of 50 to 60 millirem per hour right there.

KADAK: And, the cask doors?

BROOKMIRE: The cask doors is significantly less, probably around 20.

BROOKMIRE: This is Millstone power station. It has the similar NUHOMS type storage. We have two pads that are planned. This is 19 concrete modules installed on the first pad. And, as Tara was talking about earlier, this type of module right here is the same type of module that could be used in a high seismic area, and which these modules are actually tied together. Millstone in Southeastern Connecticut isn’t a high seismic activity, so these modules aren’t actually tied together, but they have the capability to be.

Next?

These are some canisters that we’re using at Millstone power station. These are under fabrication at Hitachi-Zosen in Japan.

Next?

And, right now, we have eleven of these canisters, and these are all 32 element canisters also being currently loaded at Millstone. And, these pads are designed to accept fuel from Units 2 and 3 with those units through license extension. There will be enough storage there to store all

the fuel from Units 2 and 3, assuming that the licenses will be extended from Units 2 and 3.

LATANISION: Tom, once again, the materials of construction are as in the previous?

BROOKMIRE: That is correct.

LATANISION: Stainless and nodular cast iron?

BROOKMIRE: We don't use nodular cast iron. Those are only on the Castor 5's. For this system here, this is a stainless steel with a lead shielding inside. The TN-32's are low alloy carbon steel. The baskets are stainless steel on the inside, the stuff that's actually exposed to the fuel.

The Kewaunee power station, the entire ISFSI is under general license. It's all NUHOMS. This is the first pad of two that has been constructed. We've emplaced ten concrete modules and operation will begin in the summer 2009. Again, as we speak right now, they're going through some practice evolutions. Their first storage campaign is to begin in July, last week of July in 2009.

So, very long-term storage needs. I mentioned that for 120 years plus, we really don't want the fuel on site for that long. Our sites really weren't characterized for that type of storage. So, one of the obstacles I would see as moving this fuel to a centralized interim storage facility, or some type of aging facility, would be--one of the obstacles is going to be transportation, the technical side

of it, and burnup credit. You know, I think we're going to need to get over and resolve the burnup credit issue. It's likely right now that fuel, under the current licensing framework that we have, that some of the fuel that we're currently putting in these canisters for storage may not be acceptable for transportation, because of heat load perhaps one reason, but also for required hold down capacity.

So, data are needed to change the licensing structure, and those data may exist right now, but they're not readily available.

Review of repository canister heat load. If indeed a new repository comes about and Yucca is completely scuttled, then I would think that really what I would implore the Board to look at is really what are we loading right now in terms of the operating practices currently in place. I mention right now at Surry power station, we're holding 33 kilowatts. Well, that type of heat load would be not workable inside Yucca Mountain obviously. So, either you're going to have a long-term aging facility associated with a repository, or a repository design that could handle higher heat loads than what would be proposed, or was actually designed for Yucca Mountain.

And, long-term high burnup storage characterization program, this melds very nicely with what John had to say about a similar recent DOE/EPRI program, in that, you know, I

think at some point, we're going to need to take a look at fuel, the characteristics and transportation on a real time basis for fuel greater than 45,000 megawatt days per ton. Because right now, we're discharging fuel greater than 45,000, up to 60,000. And, so, I think we need to really have a good program to evaluate those effects.

We've had a lot of technical analyses, but I think we need to benchmark those analyses with some real time programs. And, of course, it wouldn't be a short-term program. We're talking storing fuel for some period of time, and possibly even storing fuel in canisters that have known cladding defects. The previous program, there were no cladding defects. So, I think we need to understand a little better some of these environmental effects on the inside of the canister with cladding damage. And, the effect on varying storage environments, you know, what does an oxidizing environment, what are the actual effects that we've seen on the fuel, and maybe some simulated transportation incidents to see how the fuel actually does respond within a canister.

With that, I'll turn it over to Tara.

NEIDER: Okay, although my paper says Research and Data Needs for Very Long-Term Dry Storage, John and Tom and I conferred a little bit before this presentation, and I totally agree with Tom's last page as to what we need in

terms of data needs.

Instead of requesting that data, or telling you that a second time, what I thought I could do is go through what systems are out there today, kind of discuss a little bit about the evolution of those systems, and what was gone through in terms of what we found during the storage period so far, then what's been done during the license renewal process. And then talk a little bit about the design criteria, environmental conditions, and design life, the analysis performed, the materials utilized for dry storage, do a little bit about what inspection activities have been performed, and what inspection activities are planned, and then conclude.

My number is a little bit off. I was a little low. I'm sure that Rod is providing much more up to date numbers. I think I took this from an old presentation. But, we have over, I think from his slide, it was over 40,000 commercial fuel assemblies currently in dry storage in the United States. Most of that spent fuel today is contained in welded, stainless steel canisters, stored within concrete overpacks. They are both vertical and horizontal configurations, and some fuel, as Tom stated, are stored in metal casks. Some of these are transportable and some of these casks are storage only. They have bolted closures using metallic seals and over-pressure tanks to monitor and

ensure that in the event of a seal failure, no leakage to the environment will occur.

When dry storage started out, we really thought that it was going to be for a short period of time. The responsibility for transport to a final repository was DOE's responsibility. So, a lot of the utilities selected a storage only configuration. So, we've evolved from storage only to storage and transportable systems. Originally, we stored only lower burnup, longer cooled fuel, and now, as Tom mentioned, we've pushed the burnup so we're at higher burnups, and much shorter cooling times because there's no room in the pool to let the fuel cool.

We've also originally started with storing only intact fuel, and now damaged fuel, failed fuel, and fuel components are also being stored in these systems.

What we have here are both the NUHOMS systems and the concrete, the vertical concrete modules. Both the concrete modules, whether they're horizontal or vertical, are reinforced concrete systems, and inside of that is a welded stainless container. And, then, we have metal systems which are stand alone metal systems. If you were to transport them, you would transport them in that cask. With the horizontal systems, you would take the canister out and put it into a separate transport overpack.

These are transfer systems, and this is for

transport on the site only. So, there's a variety of different ways to get the casks to the ISFSI location. And, that's a picture of the NUHOMS showing the vehicle pushed up against the concrete module.

The license period was based on the Nuclear Waste Policy Act, which initially contemplated availability of a repository for spent fuel in 1998. So, the original license period was 20 years. And, in general the systems were evaluated for a design life of 50 years. In most cases, that design life has been extended up to 100 years. But, originally, the systems were licensed for a site specific license, and then more recently, I believe almost all of the sites have switched to generic licenses unless there is a high seismic requirement where they end up with a site specific license.

Utilities have successfully extended their ISFSI licenses for up to an additional 40 years, for a total of 60 years. H.B. Robinson and Surry have completed the licensing process, and Oconee and Calvert Cliffs are in the process now.

During the Dominion license renewal, the staff determined that the 40 year renewal exemption request was a policy decision and not a technical one, because the safety evaluations have indicated that there was sufficient technical information to extend the life for 40 years. So,

it was really a policy decision, and every application since then has gone for the extra 40 years as well, not just a 20 year license period.

A review of the materials utilized and environmental conditions indicate that the dry storage systems should be capable of lasting 100 years or longer without significant degradation. Beyond the 100 years, there's not really much data out there to determine the effects of the environmental conditions on the storage systems. Some of the ISFSI's, as John had mentioned, are in relatively harsh coastal environments. However, the canisters inside of the concrete modules is fairly benign because it is dry in there. You're not as exposed as the outside of the concrete modules.

Typical materials utilized are either stainless steel or alloy carbon steel with low temperature ductility for the containment boundary. Polymer shielding material, that's mostly in the metal vertical casks. Reinforced concrete for shielding, missile resistance, weather protection. Aluminum inside of the canister for heat transfer. And, borated products for criticality control inside of the canister as well, and there's a variety of materials that have been used, including Boral, Borated aluminum, metal matrix composites, and also borated stainless steel. Some of the systems have corrosion resistant coatings

inside of the canister as well.

With regard to the licensing process, the systems are evaluated for a very rigorous set of criteria. They're designed to withstand seismic events, tornadoes, tornado missile impact, very high and low temperatures, temperature fluctuations. The most credible fire that could occur at the site, the floods and burial under debris. More recently, a lot of the systems have been also evaluated for an aircraft crash based on post-911 activities.

Other than the original storage systems, most of the systems are now designed for transport. Some of those systems don't have a transport license for everything that's in storage, but they at least have been evaluated for most of the transport accidents. In a transport, there's a whole set of design criteria special for transportation, which includes a 30 foot drop onto an unyielding surface, fully immersing fire, drops onto a puncture bar, and immersion and a few other things. But, it pretty much bounds what you would expect to see in the worst case transport accident.

Beyond what the licensing requirements are, some of the systems have also been evaluated by the NRC for worst case scenarios, like the Baltimore tunnel fire, and those things.

All of the systems are passive, and they're exposed to very low stresses during normal operation. Generally, all

the systems have been designed in accordance with an ASME boiler and pressure vessel code for the steel components, and ACI-349 and ACI-318 for the concrete. So, whenever there's a standard code available, those standards are utilized.

All of the safety analyses are submitted to NRC review and approval, and those methods provide sufficient conservatism, and show that there's reasonable assurance that the public health and safety are protected, and the analysis includes structural, thermal, criticality, containment, and shielding calculations.

The license review process, renewal process for the ISFSI has followed the process for license renewal of the nuclear power plants. Scoping, aging management reviews and time limited aging analyses are performed. For evaluation of the fuel rod cladding, so far, I think all that's been referenced are the EPRI topical reports, which John talked a little bit about. There will need to be more information when we go to licensing for higher burnup fuel. And, those reports were based on the examination of fuel which was stored in the Castor cask for 15 years. The results of those examinations showed that little, if any, degradation of the fuel occurred during the storage period.

In the applications or licenses for the renewal of the concrete systems, the typical degradation mechanisms relate to the HSM itself. There could be loss of material

due to general corrosion and pitting of accessible steel surfaces. There could be cracking, changes in materials, properties, changes in color, loss of material or the concrete itself.

The aging management programs are put in place to address visual inspection of the accessible concrete and the exposed steel, radiation and contamination monitoring of the systems, and remote inspections of the interior concrete and steel surfaces on a periodic basis. Baseline inspections have been performed on a selected number of the interiors with cameras or fiber optics. So, we know that those inspections can be performed.

And, really, there's a fairly frequent surveillance required to maintain the air inlets and outlets are free from obstruction, because that's the primary way to get the heat away from the canister.

Metal cask license renewal is really Dominion is the only one who has received a license renewal for metal systems so far, and they have a variety of casks at their sites. So, it's only the metal systems that have undergone the license renewal process because the NUHOMS system is under a generic license. And, as mentioned previously, the metal casks have double seals for each closure, utilizing over pressure system that monitors the pressure between the seals, so if one seal or the other seal is to leak, you will

see a reduction in pressure. And, we did see some failures several years after the casks were loaded, but that was a design in a material issue that was changed, and we haven't seen that since.

Visual inspections were performed on those casks, and we saw only minor cases of corrosion or coating degradation, and there was no indication of cask polymer neutron shield materials become ineffective.

For all of the systems utilized for dry storage, there are ways to perform periodic in-service inspections, and most of those in-service inspections are really visual inspections that I'm talking about. For example, the NUHOMS system is fairly easy to inspect due to a large air cavity in the horizontal orientation which required no lifts for those inspections. So, you can get in there with a camera or with a boroscope and examine the exterior of the canister, at least the parts that aren't on the rails, and you can also look at the steel that's part of the HSM.

And, we did have one inspection that's been performed so far, and that was at Oconee, but it was only after five years of storage, and there were no adverse indications noted during those inspections.

So, I wanted to turn back to something that Rod McCullum had stated in his presentation, because he had a much better conclusion. What he said was, "Industry is

confident that existing dry cask storage technology, coupled with aging management programs already in place, is sufficient to sustain safe dry cask storage for at least 100 years, in support of both new and existing nuclear plants." And, I totally agree with what he said, but I also think that to assume that we can just utilize the systems that were only designed for 50 years, for an extended period, up to 300 years, is really not the best solution.

The interim spent fuel storage facilities were intended to be temporary, and we really need to be looking at beyond 100 years. We ought to be looking at what's the real solution, and that solution should be some combination of recycling in an ultimate depository

But, I also know that as long as we keep a watch on things, the systems are okay, and they'll work, and we can always replace the casks or the overpacks or refurbish them as they degrade.

I already said that. Thanks.

LATANISION: Okay, now I have an opportunity to see everybody, so we'll conduct the dialogue, and let's look for a show of hands. Any questions? Andy?

KADAK: I'm still curious. In reading the NRC confidence statements, they basically say the same thing you said, namely that the casks could last say about 100 years. But, I was trying to dig deeper to find out what the

technical basis of those conclusions were. And, as best I could tell, it was EPRI work. Do you know of any analysis or studies that show clearly that these casks could last for that period of time? I think they're assuming that they last based on monitoring, we can fix it if something goes wrong, not a big problem, but I have not seen or been able to find an integrated assessment of the fuel behavior over 100 years, the cask material degradation, or the concrete lifetime. Now, do you know of any such studies?

KESSLER: John Kessler, EPRI.

Any study that looks specifically at 100 years, I think Tara talked a little bit about some of the individual analyses that the vendors have done, so that's part of it. In terms of whether EPRI has looked specifically at 100 years and done all the analysis for 100 years, no, we haven't.

KADAK: Okay. The point of reference was the MRS. On the MRS, when they were looking to design it, the DOE claimed, and that was the basis of NRC's decision that 100 years was a good timeline, referencing a lot of stuff, referencing a lot of experience. But, does anybody from DOE perhaps know the technical basis of the MRS decision for 100 years? Maybe we can track that down, because I think that's very important, particularly if monitored retrievable storage, whether at a utility site or at some central facility, is going to happen.

NEIDER: The one thing that's important is that in every one of the storage systems, it is a helium environment. So, inside of a canister, there's really not a mechanism for additional failure of the fuel unless moisture has come-- moisture or air has gotten into the system. So, provided that the welds are still in place and working, or the seals have not degraded, there really, for the fuel itself, there shouldn't be much, if any, significant degradation. The canisters, you need to look at the welds, and that would be an aging management process.

LATANISION: Well, let's talk about that for a minute. I mean, what do we know about the stability of the seals? What are the seals in general, and, for example, Tom, what was the mode of failure of the seal that you referenced?

BROOKMIRE: The failure mechanism we saw was a galvanic reaction between the aluminum and the stainless steel lids that it was pinged in for the seal.

LATANISION: The seal was aluminum?

BROOKMIRE: The seal was pure aluminum, yes. And, these are--the containers or the protective covers that were around these lids, or the seal components, were air tight, and normally when you store one of these items in the summer months where the humidity is up to 80, 90 percent, and then in the winter, that's going to condense out, so you get a little bit of water in a very highly saturated atmosphere for

galvanic reactions to begin, compounded with the fact that this design also had a conex connection system inside that environmental cover, which was not properly installed. Our fault. And, that caused some water ingress, and then we had the water, we had the aluminum, the stainless steel, the perfect world for that type of failure to occur.

LATANISION: What about the welds? Let's just follow that up for a minute. Tara, you mentioned the welds. What do we know about weld failures? Any evidence of a problem?

NEIDER: There hasn't been any weld failures. I guess the weak link, if you will, is the final closure weld, because that doesn't have the radiographic inspection that you would have in one of the factor produced welds. But, the systems will either have UT or progressive PT examination of that weld, and there's really not much stress on that weld. The pressure inside the canister is fairly small.

BROOKMIRE: And, also, you mentioned there's no radiographic inspections performed, but it is a dual welded system.

LATANISION: Use the microphone. I'm not sure--

BROOKMIRE: I'm sorry. Even though there's no radiographic inspections on the closure welds, it is a dual welded system, so you do have some redundancy in the closure lid.

LATANISION: Gene?

ROWE: Just the first question is are the canisters N-stamped?

NEIDER: Some of them are. Generally, the canisters are designed in accordance with the code, although you can list various exceptions in your application to the NRC. So, in general, an N-stamp has not been required.

ROWE: Okay. The second question, if I may. With the stainless steel welds, there's a long long history of IGSCC cracking in those welds, and stainless steel welds, and the way the industry gets by with that is doing an ISI program, which is a periodic inspection, and every few years, the weld is--a couple years, or five years. What's your opinion about the weld integrity over 100 years? Do you have any concern on that? And, you're not able to do a visual inspection of the whole weld because of the configuration, and there are stresses on those welds.

NEIDER: I'll answer one part, and then maybe John, if you want to add to that? In regard to the NUHOMS canisters, it's about 15 psi, I think, in side the container, so stresses on those welds are not very significant. However, in some of the other canisters, the pressure is a little higher up.

LATANISION: Are the welds stress relieved in any way?

NEIDER: No.

LATANISION: I think Dave Duquette, and then we'll turn

to some other hands.

KESSLER: Just the short answer is--

LATANISION: Oh, I'm sorry, John, go ahead.

KESSLER: We want to look at that. I think it would be a good thing to look at.

LATANISION: Okay.

ROWE: I just want to point out there's going to be stress from the cooling of the weld. The residual stresses, plus, you've got thermal stresses.

KESSLER: Right.

DUQUETTE: Duquette, Board.

To paraphrase a bad phrase from an old movie, "I love the smell of corrosion in the morning." All of you mentioned corrosion as a potential problem. But, I did have a question, John, you mentioned the possibility of corrosion if you lose the helium. Is there any evidence in the ambient, even at these temperatures, that the Zircaloy would corrode appreciably? It should become passive in an oxidizing environment.

KESSLER: You're talking about in ambient temperatures?

DUQUETTE: Well, basically, you're going to, the helium, the ambient is going to get into the--

KESSLER: There have been cases where casks that lost their helium backfill removed were found to have significant amounts of degradation of the fuel in them. Those are

generally at higher temperatures. Bob, do you want to take a shot at that in terms of more worldwide experience. Bob Einziger could probably provide a better assessment of what we know about oxygen and fuel at various temperatures and conditions.

EINZIGER: Bob Einziger, NRC.

The cladding itself has a very low corrosion rate in oxygen at the temperatures you're talking about. If you get ingress of oxygen into the canister, you're big worry is if you have cladding, the fuel in there that has pinhole leaks in it, or cracks, and then you can eventually get oxygen into the fuel rod and oxidize the UO2. Depending on the temperature you're at, that oxidation process could take hundreds of years, or if you were up in the 400 degree temperature range, you could get conversion of the UO2 to U308 in a matter of 50 or 60 hours. The trouble with that conversion is you have about a 30 percent expansion of the fuel matrix, which puts stress on the cladding, and there's technical evidence that that crack just runs right down the fuel rod.

The positive thing is that you really have to get a big enough leak in the canister to have a good supply of oxygen so you're not starving the process. The second thing running in your favor is that, contrary to what people usually think, at the higher burnups, the whole oxidation

process tends to slow down considerably.

DUQUETTE: So, it's corrosion of the fuel, not corrosion of the cladding, that's the potential problem?

EINZIGER: Yeah, I mean, there's a lot of cladding to take up any oxygen, and it's going to compete with the fuel that's really the fuel oxidizing that can go as problems, of course then you're taking the fuel and expanding it. You're going from a fuel pellet to essentially a power of grain sized particulate.

ARNOLD: This will only be a few of the fuel rods, though, because most of them don't have leaks.

EINZIGER: Right now, the failure rate in fuel is somewhere in the rate of .001 percent of the rods having failures in them, and most of those rods are taken out of service so that the fuel vendors can inspect them and try to improve their product. So, yes, there's very few fuel rods that that could happen. Now, where you might have an issue, should you have an accident, and you open a leak in a canister and you happen to crack rods open.

DUQUETTE: I guess my only comment was when I heard the comment, I didn't think corrosion was very much of a problem, and I know it has to be considered, but I don't think it's much of a problem for long-term storage. You have to first of all have a leaky canister. You have to lose the helium that's inside it. You have to admit oxygen into it, and you

have to find some cladding that's in bad shape.

KESSLER: You got it.

LATANISION: Andy?

KADAK: Yes. I guess this is a follow-up to Bob's commentary, and that is storage safety for 100 years is fine. But, what happens when you have to ship the fuel after 100 years? In other words, what is the condition of the fuel itself in that storage cask relative to its degradation, and does it--you talked about hydriding, and things like that, do we need to worry about transportation after a long storage period?

KESSLER: As we just walked through here with Dr. Duquette, if the outer barriers are still intact and you have an aging management program and inspection program to confirm those things, the only thing that's really left out there is this hydride issue. And, my guess is is that by the time you pass through the first 20 years, the majority of your hydrides are going to be precipitated, and you're not going to have too much more of an issue. So, I would guess that beyond 20 years, as long as you've maintained your helium environment, it's not going to change the property of the fuel.

KADAK: What is diffusion controlled cavity growth?

KESSLER: I could try to explain it, but I'll butcher it, so I'll ask Bob to explain it.

EINZIGER: Back about 15 years ago, one of the mechanisms that was proposed for failure of the fuel rods was diffusion controlled cavity growth, and that's basically that you have--you start out with a void on the grain boundary of the Zircaloy cladding, and then you diffuse vacancies to that void, growing the void until eventually it propagates and you have a failure in the fuel rod. The mechanism has been observed in stainless steel. It has never been observed in Zircaloy, primarily because no one's been able to find the initial voids to start the propagation. Should it be found, the problem would be one that would occur during the first 20 years or so of storage, because if you do the calculations, and at the time, dropping the temperature, and diffusion being temperature controlled, the amount of diffusion you get after about 20 or 30 years is miniscule for the diffusion you get in the first few years. It's been since dismissed by the NRC as a reactive mechanism.

KADAK: Thank you.

LATANISION: John?

GARRICK: What if the nuclear renaissance was really successful worldwide, and we really saw an almost runaway nuclear power construction program, and that the uranium cost was driven up accordingly, and somebody looked at the scenario that said that, well, with the circumstances as they are, reprocessing really does increase its appeal, and as a

matter of fact, maybe if we can hold on with on site storage for 100 to 200 years in some cases, maybe we don't need any interim storage, and we can avoid some of the major problems associated with the repository as well, but not all of them for sure, because we need a repository. Is it possible that with maintenance and inspection, and what have you, that these canisters could last indefinitely?

NEIDER: I don't know about indefinitely, but, you know, if we talk about 200 years, I think that might be possible. But, the one thing about recycling, if we go to recycling, my understanding, and I'm no expert in recycling, but you're better off going to recycling early on when the fuel isn't that far from having been taken out of the reactor. So, having it sit in dry storage is probably not the best place for fuel if it's going to be recycled.

GARRICK: But it's got to sit somewhere.

KESSLER: And, then, there's plenty of economic analyses out there, as I'm sure you're aware of, that talk about how high does yellow cake price have to rise before it becomes economically viable, just on its own merits, a single reprocessing pass-through to mox in a light water reactor. We've done studies like that. I know that Boston Consulting Group, lots of people have done studies like that. I'm guessing MIT has, or is going to. So, those are out there, runaway nuclear production, wow.

GARRICK: Well, it was kind of a runaway the first time around.

KESSLER: One of the things that we did do, we being EPRI, took a look at this Yucca Mountain capacity issue, and we did look at a scenario which I thought was and still sounds fairly aggressive, which is a 3 percent per year increase in nuclear power production through the end of the century. That's one scenario we looked at. I know that EPRI as a whole has looked at essentially--we've done a lot of work on trying to meet CO2 reduction goals from the entire suite of electric production capabilities out there, including efficiency improvements, and the nuclear build is about at that rate. What EPRI concluded was that you can continue to direct dispose of spent fuel, assuming no recycling at all, through the end of the century, essentially, if the Yucca Mountain capacity were fully realized. Whether you want to do that or not is a different issue. But, that was one of the issues we looked at in terms of what was a reasonable upper limit on nuclear build rates. Because we've got a lot of infrastructure to rebuild to get much beyond that.

GARRICK: When you say Yucca Mountain capacity fully realized, you mean the capacity that could be created there?

KESSLER: Yes.

GARRICK: You don't mean the 70,000--

KESSLER: I don't mean the legal limit. I'm talking about technical capability.

GARRICK: Okay.

ARNOLD: What's your figure for that technical capability?

KESSLER: We've got two reports we did on it, and in fact I've given a talk to this Board before.

ARNOLD: I remember that. I just didn't remember the number.

KESSLER: Yes. If you want copies of the reports, we can get them to you.

ARNOLD: What was the number?

KESSLER: Four to nine times the legal capacity.

ARNOLD: Okay.

LATANISION: Bill?

MURPHY: Perhaps on the flip side of the nuclear renaissance, I wonder if in these analyses, it's required or considered or even possible to take into account the stability of society for such time periods? I saw missiles mentioned. One of the principles of geologic disposal is that ultimately, people will have to walk away, society can't be stable for as long as wastes are hazardous. Has that been studies? I'm not a sociologist.

KESSLER: That was a question that the NAS Technical Basis for Yucca Mountain standards was asked back in the

early Nineties. They weighed in and said that for a few hundred years, you can reasonably count on institutional controls, and that formed part of their basis for their recommendations for the technical form of the regulations.

MURPHY: You probably have other problems that are more serious.

KESSLER: Probably so.

DUQUETTE: Duquette, Board.

What you said is perhaps true. On the other hand, I think one of the early sociological concepts, and we're not supposed to deal with sociology, but was that you would not burden future generations with the nuclear waste. They could be burdened with their own nuclear waste, but we shouldn't be burdening them with ours. If you go 100 years, we're talking quite a few future generations that we are leaving nuclear waste to deal with. And, so, I think that part of the equation has been left out, to some degree.

I'd also like to express a little bit of cynicism that may not be valid, but when I first joined this Board eight years ago, the nuclear power industry used to stand up and say you'd better get your mountain built because we can't store this stuff on our sites for too long. When the Obama and Biden campaigns came out, all of a sudden I heard that it could be stored for 100 years with no particular problems. I believe that it can be stored for 100 years with no problems.

I think the technology is there. So, from a technical point of view, I think you're correct. But, as a citizen, I do express a little bit of cynicism on the part of both the industry and the Department because of what I think is a change in philosophy as to what you do with nuclear waste. It seemed like given the fact that we might have more nuclear reactors, and if we didn't have a repository, you couldn't build the reactors, all of a sudden, a longer tri-storage period became possible.

KESSLER: I think we've always been clear. I think all three of the speakers here, as well as others, are saying technically you can store the spent fuel for a long time, 100 years, maybe more.

DUQUETTE: And, by the way, technically I agree with you.

KESSLER: And, so, it's not a technical question at that point. There's other, in terms of where you want to store, it, how you want to store it, there are issues beyond that. What we're concerned about is can we do it technically at a site, at an MRS, at Yucca Mountain.

DUQUETTE: Yes, and that's the goal of this Board, is to take a look at the technical parts of it. So, while I can't withdraw my comments, I agree with you that technically, it can be done.

LATANISION: Well, just an observation. You know, I

think we're still stretching the limits of engineering when we're talking about systems that are maybe not intended by design to serve 100 years, plus, but are perhaps being asked to do that. The longest lasting engineering systems that are typical of our contemporary engineering would be civil structures, like bridges and buildings. You know, the reality is you don't expect them to fall down in 100 years, but you do know that they do age, and they degrade.

KADAK: Some of them even fall down.

LATANISION: And, some of them do fall down. And, in fact, some fall down a lot sooner than they should have. And, the element I'm getting to is the one of surprise. That's always the uncertainty in this process. And, you know, it is a stretch. I mean, we're asking you a tough question, and I don't think anyone has an explicit answer today. But, we are stretching the limits of what we know about engineering when we talk about dry storage for 100 years plus. It's very, I think Dave's assessment from a corrosion engineering point of view, is one that I would subscribe to, take a perfect storm of some pretty unusual events to cause me to be concerned about corrosion of the internals. But, it could happen. We've been surprised before, and I think, you know, if we really want to provide some confidence, either in the context of the public or the NRC or the regulators or anyone else, somehow we've got to, I

think, put our arms around some of these questions and get some answers that are in depth and that are defensible.

ARNOLD: Ron, I think I heard him say that they could deal with upsets, too.

LATANISION: Deal with what?

ARNOLD: Upsets.

LATANISION: And, I heard that, too, and I'm hopeful that you're correct. You know, I guess the question is do we feel confident that we have a base of information. Andy's first question was what is the technical basis for a lot of what we're talking about, and I'm just concerned that it's not clear to me that we do have that base. But, I do have-- did you have a comment, John?

KESSLER: I just wanted to say I share your concern. Like buildings and structures, we're talking about generally passive systems here. We're not talking about anything that has an active system. It all sits there, keeps things cool, air passes through it, no active system is required, and in that sense, that increases my confidence, at least farther into the future, that the system continues to function because it's a passive system.

LATANISION: That's a fair comment. John?

GARRICK: One of the specific things that Tom mentioned, and it was an area for data need, was this business of burnup credit. Can you get more specific and tell us what specific

data is needed in that area?

BROOKMIRE: Yeah, I think we have some fission product burnup data available, which would help the industry considerably. Now, there are programs in place to evaluate those data and try to get it into the licensing framework. I think, though, that in the long-term, we need to--it's still being a stronghold. But, in the long-term, we need to get over that burnup credit struggle, and use the fission product basis, and that way, we'll set ourselves up in a much better framework for transportation issues.

GARRICK: Yes, go ahead, John.

KESSLER: You've got some people from NRC who could probably weigh in on this, too. My understanding of the burnup credit issue specifically, at least in regard to spent fuel storage, but especially transportation, is NRC has concerns about the properties of high burnup spent fuel, both during storage and transportation, and they almost all go back to criticality concerns, not all of them, but a good chunk of them.

There are several arguments that could be brought to the table and the industry has tried to bring them to the table to say we have confidence that criticality, during transportation or storage for high burnup fuel wouldn't occur. The probability of having the confluence of events such that you could have a criticality is low. The amount of

fuel that gets damaged such that you would have a rearrangement of the fuel into some more critical geometry is low. If it did get reoriented, the probability would be that the criticality, the $K_{effective}$ would go down rather than get worse.

And, by the way, one of the other options is is that if we took into credit the fact that we got these fission products that are neutron absorbers, that's yet another reason why we have confidence that the criticality won't happen. And, we also have a lot of confidence that water is not going to get into these containers, and without the water, we have no moderation, and also very low $K_{effectives}$. So, the suite of arguments are out there.

One of the ideas is is that it's generally the industry is interested in okay, we're interested in getting one of those credits. There maybe the general industry interest to say we want the fission product credit, knowing we still have the capability of generally keeping water out of the container, that the probabilities are low, that the cladding is not going to rupture very much, et cetera, all of those things are still defense in depth behind the one request for adding some fission product to the calculation for $K_{effective}$.

ARNOLD: Perhaps we could ask Bob the update on the NRC view of burnup credit, not only for the--

LATANISION: Yes, I'm glad you're here today, Bob.

ARNOLD: --but also for the transport.

LATANISION: Yes, that's a good point, because it seems to me the neutronics are very well known, but the scenarios are not so well known.

EINZIGER: First, I want to say that I'm not going to talk at all about the repository. That's a different group of people, and I'm not going to speak for them. And, the second thing is that burnup credit isn't my area of expertise. So, what I'm going to tell you is what I hear, it's through the grapevine during work, is that there's still questions concerning the benchmarking of the codes for high burnup. There's still questions concerning mis-loads of fuels that they're working on. They do have some access to some proprietary data that they are looking at now. The issue is being worked by the NRC.

In terms of some of the things that John said, John is right, it may be hard to get water into the canister, but the philosophy has been if you can stay critically safe with the canister flooded, that you ameliorate a lot of potential issues that might come up, because maybe we're just not as smart as we think we are. So, that's defense in depth, and unless Bob wants to say some more, I'm going to leave burnup credit at that, with one more statement. We evaluate license applications when they come in.

If a utility or a vendor wants to come in and claim burnup credit, I'm sure we're willing to evaluate that license application. But, the burden of proof to show that they should get burnup credit rests with the applicant, not with the NRC.

BRACH: Bill Brach from the NRC. The topic of burnup credit, whether it be in storage or primarily more in the transportation arena for spent fuel, is a topic a number of us have been discussing for a period of time. I can recall a couple of years ago having a conference call with Dr. Kadak and the staff on burnup credit. We have made progress over the past few years on what NRC allows in the way of burnup credit for spent fuel and transportation. We have issued what we call interim staff guidance documents over the past few years that at this point do allow full credit for actinide. With regard to fission products, my glass on this one now is half full and getting fuller, and the staff has had recent interactions, and I say recent, over the last year, with some of our international colleagues who have certain data with regard to fission products, and making arrangements to have the NRC access to that data.

Our initial understanding is that that data will couple and fill in some of the voids that Bob Einziger has mentioned that will give us the confidence with regard to some of the total validation that we find necessary before

we're able to move to that point in our review guidance of allowing burnup credit for fission products.

I would note, too, Bob Einziger made the comment about, and John Kessler as well, raised the comment about moderator exclusion. That's a topic that we the staff have raised with our Commission with regard to moderator exclusion in spent fuel transportation. Our Commission has advised us that in certain, perhaps limited, case by case, such might be considered, but moderator exclusion is a principle on which we should continue to rely on as far as assuring the safe transport of materials, and that is with the assumption that water, in an accident, could get into a package, and, so, our analyses do require examination, and criticality considerations are the main concern, examination of those packages for water ingress, and of course material being in its most optimum criticality shape.

LATANISION: Go ahead.

KADAK: Bill, are you aware that EPRI recently completed a criticality study for waste packages full of water, without taking credit for any neutron absorbing material? And, as I recall the calculations, even in cold temperatures, they don't go critical. I mean, the margins are not 20 percent, but it's like .98 with, like I said, rigorous analysis based on real spent fuel loading.

BRACH: Personally, Dr. Kadak, I'm not familiar with

that report. I'm not a criticality expert as well. Maybe after the meeting, you can talk to John to be sure our staff, the staff that work with EPRI and our staff frequently engage and have for some time on this topic, as well as with others in the industry. But, personally, I'm not familiar with that report.

KESSLER: That may have gotten cycled through the Yucca Mountain side of NRC, because we did that analysis looking at a dual purpose canister, asking that question that was discussed earlier about could we direct dispose of some dual purpose canisters, and we specifically looked at the criticality issue.

KADAK: And, some of the findings, and this is why this is important to settle quickly, is that you can make it much better by advising the utilities about loading patterns, as you load the spent fuel into your DPCs, that would make the reactivity better in terms of the criticality. So, I think if you--I don't know where you are in the review process, but the sooner the better in terms of providing guidance to the utilities.

BRACH: That's a very good point. I would add to that as well I looked to the industry, and Tara, representing Transnuclear, one of the main cask designers and vendors, is that preferential loading of casks typically with regard to thermal loading and potential shielding of the hotter fuel on

the inside and colder fuel on the outside, for example, need to marry together those different considerations, and I really would look to the industry, too, as well, and engage and consider that in developing your loading patterns for your individual casks.

KESSLER: Andy, most of the industry, most of the utilities use one of two different software packages that optimize what should be loaded in there. There's some that use something called Cask Works, others that use something that's an EPRI product called Cask Loader. Both of them take into account the multiple requirements, the shielding, the thermal, et cetera, take a look to see what inventory the utilities have in their pool, and know what's coming down the pike, to figure out what's the most optimal fuel to put in a particular canister at a particular time.

KADAK: I would suggest another criteria would be postclosure repository criticality, because if you do it that way, you can potentially dispose of the DPCs.

KESSLER: So, you want the industry to worry about Yucca Mountain postclosure criticality for the DPCs?

KADAK: Well, I would say that if it's going to happen, it's advisable to look at it from that perspective because it saves eventually the utilities money, because it's their money that's going to be used for disposal.

KESSLER: All I can say is that was one of the many

purposes of this EPRI report, which admittedly is a very first analysis for a limited subset of the DPCs out there. Did you address that issue? In terms of formally asking the industry to do that, doesn't sound like a good idea.

KADAK: I'm not sure why you said that.

LATANISION: I put up on the screen Tom's final slide, which, Tara, if I understood your comment correctly, this represents something of a consensus of a panelists.

NEIDER: Yes.

LATANISION: Do you want to add anything to this? We've been talking about many of these issues in the last few minutes, but are there other, either from the point of view of anyone in the audience, the panel? Yes, go ahead, Bob.

EINZIGER: I've been in this game for 30 years. Somebody mentioned the experiments down at--with Turkey Point fuel. I worked on those.

ARNOLD: Back in the Seventies.

EINZIGER: Yeah, back in the Seventies; right. In all the work that I've done so far, I've seen no data that has indicated that we can't store for an extended period of time. On the other hand, I don't have definitive data testing for extended periods of time beyond the one test we did for 15 years. Remember that test for 15 years was low burnup fuel, it wasn't high burnup fuel, it was the old 17 by 17 design. It wasn't the new design. It wasn't mox fuel, which has a

whole bunch of different issues, especially since while normally uranium oxide based fuels have a decreased stress with time, the mox fuel actually has an increased stress with time because it has the generation of helium in it. So, that's a little bit different issue.

GARRICK: So, what do you mean when you say extended period of time?

EINZIGER: Whatever you want it to be. I don't have the data past 15 years, but I don't see anything that, from what I know now, that tells me I can't go out--for instance, when the creep calculations were done, and creep was one of the first mechanisms to be looked at for limiting the temperature for storage, it was basically done by saying, okay, here's the creep equation, here's the temperature decay, what temperature can we go to so that the creep levels off at 1 percent and never goes above that for time infinitum. And, I'm not saying that we should store it indefinitely. I'm just saying that was a criteria.

There's a number of international programs that are going on. The Japanese are thinking of putting a program in place where they're going to be looking at some high burnup fuel in storage. We're trying to get involved with that. I'd like to see storage a little bit higher burnups, and that they're going for 50 gigawatt days per metric ton, and I'd like to see the situation, not only can we store it for some

extended length of time, and this is not the NRC opinion, but that we shouldn't ask the question can we store it for "X" number of years, but rather can we store it for "X" number of years and still maintain the fuel in a transportable condition.

GARRICK: Yes.

EINZIGER: I think that's important because no matter what circumstances or scenario that you talk about, eventually it's going to have to move unless you want to make the sites at the reactors permanent repositories.

I also believe, like in the reactors where they use lead test assemblies to stay one step ahead of the curve, that we should have a lead cask demonstration with high burnup fuel so we're one step ahead of the curve.

GARRICK: Now, NRC used to have a research program. Are they doing anything?

EINZIGER: NRC does have a research program. We're working with Argonne National Laboratory. Right now, the issue at hand is to look at the hydride reorientation. That's our main concern. I guess it was about five years ago, NRC and EPRI and DOE at least discussed the possibility of getting such a demonstration started, and for whatever reason, because this is before I came to the NRC, that fizzled.

LATANISION: I think Andy has a question, and I have one

I'd like to ask, too.

KADAK: Just give me a quick characterization from the material standpoint of the difference between, from a materials and behavioral standpoint, from a low burnup to a high burnup in terms of degradation of say the clad.

EINZIGER: Well, well burnup cladding has 100, 150 ppm hydrogen in it. High burnup cladding may have 700 ppm hydrogen in it. You may have 20 microns of oxidation on the outside of the cladding when it gets out of the reactor. High burnup fuel could be anywhere up to 100 microns of oxidation on the outside of the cladding. The U02 pellet pretty much maintains its normal grain size at low burnup fuel. At high burnup fuel, it has a rim structure on the outer surface of the pellet that could be anywhere up to a couple hundred microns thick, where the fuel has restructured, so the grains are essentially submicron size. We don't have any idea how that rim area is going to behave in terms of when the fuel fractures, in terms of what happens in disbursal of that rim area. So, those are some of the differences in characteristics.

There is a paper out between myself and Carl Byer, it was a couple years ago, in nuclear technology that basically evaluates high burnup fuel, and indicates the changes in the fuel over time, and what are the pertinent issues with the fuel with respect to storage.

ARNOLD: How about the gas pressure inside the--

EINZIGER: The gas pressure will go up, too.

KADAK: Thank you.

LATANISION: Let me ask you a question. You mentioned an evaluation of creep. Creep is a time dependent deformation of a metal, and there are some, given the time frame that we're looking at, this is after 15 years of exposure, was there a metallographic examination done at the level of examining for grain boundary sliding or cavitation along grain boundaries as an early stage indication, or what was the basis for concluding that creep did not appear--I think you said it was not an issue.

EINZIGER: There's two different parts, as I interpret your question. One is what did we see when we evaluated the fuel that had been in storage for 15 years.

LATANISION: Yeah.

EINZIGER: That was a very difficult test to evaluate because we had no baseline on that because the test was never set up for a long-term dry storage test. It was set up for code evaluation, and the temperature was not well monitored. What we were looking at is basically what would be the profilometry that had been done on some rods beforehand, and the profilometry afterwards, and within the scope of the error, we couldn't find any indication of creep. I have to admit that I do not remember to what extent we did the

metallography of the cladding, but there is metallography that was done.

LATANISION: There was?

EINZIGER: Yes.

KESSLER: And, the issue is is that at one time, the profilometry of some of these rods before they went into storage were taken, but those data were lost, thrown away, something, after a ten year storage period.

EINZIGER: INEL had a ten year data retention period.

KESSLER: So, the point is is that we couldn't start from, you know, where the cladding had crept down to to where it is after 14 years. All we knew was where it was after 14 years.

LATANISION: Well, that's why I think the metallographic diagnostics that I was just talking about would be informative. You know, it may have been done, and perhaps the indications were that it was not an operative process. But, it would be worth examining that, and if it hasn't been examined, I would suggest doing it.

EINZIGER: Well, that's something EPRI would have to take up with Argonne where the old photos are residing. I don't think any of the samples are still available.

KESSLER: I think we're all--well, we agree that the dominant concern is probably the hydride reorientation and less so, creep. A lot of people have taken a look at the

creep issue, maybe not for all the fuel types under all of the conditions, but our feeling is is that creep issues under real storage conditions are not likely to be the dominated one.

EINZIGER: The criteria for creep comes from the Germans, who had a 1 percent creep criteria for in reactor, and that came from an insurance regulation. That was just transferred over to dry storage. Things are a little bit different in dry storage since the stresses in the inside of the cladding going outward, as you start creeping outward, you increase the volume of the fuel rod. That drops the stress considerably, and creep in dry storage is a self-limiting mechanism.

LATANISION: Why is it self-limiting?

KESSLER: As you creep out, you're increasing the volume.

LATANISION: So, you're diminishing the stress.

KESSLER: Right. So, you're decreasing the net pressure of the fill gas, and that's what causes the stress to decrease with time.

LATANISION: Okay. Other questions? Yes, Carl?

DI BELLA: Carl DiBella, Staff. I have a question for John. You talked about the experiment that you did at INL on the Castor cask, and I assume the hot shop you were talking about was Test Area North?

KESSLER: Yes.

DI BELLA: Which doesn't exist anymore, I think.

KESSLER: Right.

DI BELLA: So, actually, I have two questions for you. There were, for a time, several casks of different manufacturers there. What has happened to them, number one? And, number two, if something, if they're still there, and there's still fuel in them, how, without Test Area North, are you going to respond if there's a problem, not you necessarily, whoever is responsible for it?

BROOKMIRE: I believe we saw earlier today that those casks are still there at the facility, and I believe Gary DeLeon probably could address that if he's still here.

KESSLER: In terms of what can be done without Test Area North?

DI BELLA: Yes, you don't have that hot cell--

KESSLER: I know that we did make a plea to EM to keep it open at one time, and--

DE LEON: You're referring to the dry storage casks at INEL? They're still there.

DI BELLA: I'm the one that asked the question. The dry storage casks that are holding commercial spent fuel at INL, there's two or three or four of them? One of them was taken apart, as John described, in Test Area North, that big hot-cell, which is now gone. If you develop a problem with those

other casks of some sort, how are you going to handle that problem? How are you going to--is there a pool around, or another big hot shop that you can just open it up and dismantle it, or are you going to have to build something, or what?

DE LEON: I don't know about the hot shop is still around, but we still have the 66 Basin that we could use.

KESSLER: That was one of the arguments that was made as to why to go ahead and close it down, was that there was at least some sort of backup plan.

LATANISION: Go ahead, Carl, continue.

DI BELLA: I have a question for Dave.

LATANISION: Wait. Do you have a response?

EINZIGER: I just want to say that the one cask they did open, they eventually did move that cask over to the Argonne North Hot Cell and made it up to pull the rods out of it. And, so, it may be still possible, I can't say it is possible, to put a mating collar on the Argonne North Cell and still mate a different cask up to it.

LATANISION: Argonne West?

EINZIGER: Yes.

LATANISION: Okay. Go ahead, Carl. Carl, do you have a follow-up with that?

DI BELLA: Yeah, Dave, and this is a question from Dave. The data needs discussed so far focus on engineered systems.

Has any thought regarding additional needs for site characterization--actually, Tom might have mentioned something about this--needed for longer storage? You know, instead of 100 years, 500 years. Decades to centuries.

LATANISION: Tom?

BROOKMIRE: I'm sorry, Carl, could you rephrase that or recharacterize the question?

DI BELLA: Well, it's--

KESSLER: Are you talking about the pad itself, Carl?

DI BELLA: No, maybe what the pad sits on, the ground.

KESSLER: Okay, so geotechnical type concerns.

DI BELLA: Maybe hydrological, maybe geotechnical, that sort of thing, seismic, volcanic. Presumably, they haven't even looked at these issues for more than 100 years, decades, do they remain unchanged, or does one have to characterize them for longer periods.

BROOKMIRE: The pad didn't come up in the process. It's out of scope because it's not safety related. The pad was considered to be out of scope in terms of license renewal because it's not safety related. But, certainly evaluations of the soil structure interaction, and evaluations of the concrete structure, the pad, will have to be conducted at some point.

NEIDER: For the Kewaunee license renewal, there was a settlement of the pad to be looked at and cracking of the pad

itself as part of the aging management.

DI BELLA: Right. But, my question was really about the natural system the pad sits on.

BROOKMIRE: I'm not aware of any programs in place to look at that.

DI BELLA: Okay.

LATANISION: Do you have another follow-up to that?

DI BELLA: I'm just sort of thinking out loud, whether this would be necessary.

BROOKMIRE: It depends on the site location and the SSI. Right now, the Surry pads are three feet thick and North Anna, I think is two to two and a half. Millstone is four feet.

DI BELLA: So, they're not all--

BROOKMIRE: Well, it depends.

DI BELLA: That's what I'm talking about, they're not the pads, but what the pads are on.

KADAK: That's why they make them four feet thick.

LATANISION: He's talking about what supports the pads. I mean, you've got a geological issue here.

KADAK: That's why they make them four feet thick.

ARNOLD: I think the response to this is you in fact do have to be able to move this stuff if you get into a threatening situation.

LATANISION: Yeah. We're coming close to the end of

this conversation. I just want to get a reaction from this group if there are other items that you think belong on this list. This is a consensus document of our panelists. What's missing? Is anything missing?

STAMATAKOS: My name is John Stamatakos, I'm with the Santa Fe Regulatory Analysis in San Antonio, and I agree, one of the things that's underlying your question, and we missed it in the answers, is that a lot of the design bases were originally used to construct those are built on, for seismic in particular, floods perhaps, are built on understandings of 20, 40--

DI BELLA: Right.

STAMATAKOS: And, so, the hazards that drive those design bases will probably change that you're talking about. I think that's--and, so, underlying the design bases for seismic, and as you go to longer performance periods, you're probably looking at larger earthquakes driving the design bases.

KESSLER: Well, certainly the easiest thing to do is to go back and look at what the nuclear plants themselves had to do regarding the soil stability issues for license extension.

DI BELLA: One more thing in answer to your question. John put up something that in essence said that colder temperatures are your friend, as far as corrosion is concerned. That is true by and large. But, I can think of

one circumstance where it isn't. These canisters are, some of them, are protected by the higher temperatures because temperatures keep the outside surface above the dew point for many, many conditions, if not all conditions, in the early years. As the decay heat drops, the outside surface the corners, and eventually the entire canister, is going to drop such that you will have dew points--you will have temperatures occasionally when there's a sharp change in weather that are below the dew points, you get condensation, and now you can have localized and generalized corrosion. So, that is something to be concerned about that happens as they get older.

KESSLER: So, you're playing the deliquescence trump card?

DI BELLA: I didn't use the word.

KESSLER: You didn't use the word, but it sure sounded like the same kind of thing. That is one of the things that we looked at in the effective marine environment study. To some degree, the Japanese have looked at it a bit more. We are aware of those issues.

LATANISION: Okay. John, I think we're reaching the end of the hour. I would just like to thank our panelists and audience for this conversation. The one final observation I'll make is that in our engineering enterprise, we always do seem to ask engineering systems to perform longer than they

were intended to. You know, certainly from a nuclear point of view, we're looking at extending the licenses of plants that were licensed for an initial 40 year period. We have air frames that are being asked to perform for 70 or 80 years instead of the normal design life of perhaps 30 or 40.

So, the question, and each of those questions, each of those situations, there are engineering uncertainties associated with whether or not the extensions are going to prove to be done with confidence and fruitful.

You know, I have the same concern in a sense about what we're talking about here, in terms of extended very long storage. Tara, you made the comment that these were not intended for service for 100 years. And, whether you would have changed your design basis when you looked at constructing at the outset is an interesting question. But, it does give you pause when you start talking about the extension of the performance period for systems that were never intended to perform to that extent.

So, it's just an observation, to bring this to a close. But, Tara, you have a comment?

NEIDER: You're absolutely right. Well, five years ago, it would have never occurred to us. Now, we are looking at extending, you know, from the beginning of our new designs, we are going for longer periods of time.

LATANISION: Yes. Mr. Chairman, I'll turn the floor

back to you.

GARRICK: Thank you. Thank you very much, and thank this panel. It was an excellent job.

We've come to the point in our agenda now that's reserved for public comment. I have received no formal requests for a public comment, but that doesn't mean that if somebody has a burning desire to make a comment, that they cannot do it. I would welcome it, as a matter of fact.

GAMBLE: I'm Bob Gamble from Nye County, Nevada. And, I really appreciate the discussion that's gone on today. There were some interesting issues that have been discussed during the day. What I'd really like to do, though, is go back to the first part of the morning session and some of the discussion that followed Russ Dyer's presentation, and questions that were asked about existence of a technical basis for the administration policy decision. Technical basis, the Board has been charged to evaluate technical issues, and without getting into policy issues, I'd like to recommend that the Board seriously consider documenting any questions it may have for the Secretary, for the Congress regarding the technical basis for what has been the administration's policy decision on Yucca Mountain.

There is a licensing proceeding underway, a technical review by the NRC staff, an opportunity for litigation of technical issues on their merits in a hearing,

and that proceeding, in my view, should be allowed to go forward and should be supported so that any conclusion that comes out of it can be seen as a credible reflection of any debate on the technical issues associated with a repository and with Yucca Mountain.

GARRICK: Thank you very much. Yes?

O'CONNELL: Brian O'Connell, the National Association of Regulatory Utility Commissioners. I wasn't planning to comment, but you asked a question before about how do we get national will going, and Mark Holt said perhaps the Public Utility Commissions might do that.

Frankly, I don't expect that to happen. It's not the nature of the state commissions to be as proactive as somehow is needed in this process. But, I thought I would share some thoughts of what the Commissions are thinking about with respect to this program.

First of all, we subscribe to the principle that the law is the law, and that Yucca Mountain is the site that was approved by Congress, and it will take a law to change that. We would like to continue the license review. If Yucca Mountain is not licensed, or is licensed but not built, then we go back to the Act that says that the solution is geologic repository, which means we start over apparently.

If we do, we believe that the process should be changed, and that there should be recognition of the lessons

learned at both Yucca Mountain and in the other countries that are pursuing this. Also, there should be--which include recognition of benefits from the beginning, and the principle that if you don't want it, it's not coming. That works in other countries. We ought to try it here.

I personally am very impressed with the Academy of Sciences report on One Step At A Time, about staged repository development, rather than this 1 million year regulatory framework.

On interim storage, if we're going to wait for decades for a second repository, we believe that the interim storage of the nine de-commissioned sites is needed, and is very affordable. DOE did a study, said it might cost some $742 million for a 25 year period. Don't know if that's true or not, but it's a small drop in the bucket when you consider that the program is supposedly earning a billion dollars a year in interest on the Nuclear Waste Fund, which is otherwise inaccessible to the program.

On recycling, we support the R&D, but are concerned about the economics. Somebody eventually is going to have to make it feasible.

We would also recommend to the Blue Ribbon Commission that they explicitly recognize that the public has a confidence problem with transportation, even though most of us realize that that should not be a concern, it is,

perception is reality for a lot of people.

The last thing, that may be the hardest of all, is to settle the lawsuits in some equitable manner, recognize where we are today, it's not 1998, it's not going to be moved by that time.

The last thing I recall from a Congressional staffer is a statement that Congress only reacts to a crisis. The problem with this program is that the industry has coped too well with taking care of the fuel. We just talked about it in the case of dry cask storage.

Thank you.

GARRICK: Okay. Yes?

VAN LUIK: I'm Abe Van Luik. I work for the Department of Energy, but this is a comment from me, not from the Department. I found a lot of the presentations today to be quite enlightening, but I was wishing we had spent more time on Tara's last viewgraph, which suggested that long-term storage is not responsible behavior for a society.

There is an excellent document from the IAEA, and two recent ones from the NEA consensus documents which were mentioned this morning, that we should pay some attention to, that said it is not ethical, basically, to plan for long-term storage without also pursuing a well defined repository program.

So, I'm hoping that in your advice to the Blue

Ribbon Commission, speaking as a citizen, that you will remind them of these consensus ethical opinions which I think are quite meaningful.

Thank you.

GARRICK: Any other comments, suggestions, or what have you?

(No response.)

GARRICK: Board? Staff?

(No response.)

GARRICK: Hearing none, forever hold your peace, we are adjourned.

(Whereupon, at 4:42 p.m. 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 June 11, 2009 in Las Vegas, Nevada taken from the electronic recording of proceedings in the above-entitled matter.

June 22, 2009

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