UNITED STATES

NUCLEAR WASTE TECHNICAL REVIEW BOARD

FALL 2011 BOARD MEETING

Wednesday

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Little America Hotel
500 South Main Street
Salt Lake City, Utah

OFFICIALS OF THE NUCLEAR WASTE TECHNICAL REVIEW BOARD PRESENT

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Dr. Sue Clark
Dr. Rod Ewing
Dr. George M. Hornberger
Dr. Ronald M. Latanision
Dr. Andrew C. Kadak
Dr. Ali Mosleh
Dr. Linda Nozick
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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 back to the second day of our meeting of the Nuclear Waste Technical Review Board. Some of you are new here today, so we will have to repeat some of the things we said yesterday in the opening remarks, but they're going to be much more brief than they were yesterday.

My name is John Garrick. I'm the current Chairman of the NWTRB, and I trust all of you had a pleasant evening last night.

Yesterday, I introduced the new members, Sue Clark, Rod Ewing, and Linda Nozick, who were appointed on July 28th by President Obama. I also recognized the outgoing members, Mark Abkowitz, Thure Cerling, and David Duquette. And, as I mentioned, the entire eleven member roster is available at the back of the room, so we'll pass on introducing all the members.

For those of you who were not here yesterday and here today, the Nuclear Waste Technical Review Board is kind of a unique Board among federal agencies dealing with radioactive waste management. It's the only entity that performs an integrated technical evaluation of the entire U.S. high-level waste management program, including waste acceptance, transportation, packaging and handling, facility

design and operation, and storage and disposal.

Congress created the Board in the 1987 Nuclear Waste Policy Amendment Act. In doing so, they concluded that there was a need for independent and ongoing peer review--something that Congress deemed essential for increasing the confidence of the public and the scientific community in the validity of the technical and scientific work that was being performed by the Department of Energy.

The Act spells out the Board's duties very clearly. It's charged with evaluating the technical and scientific validity of all activities undertaken by the Secretary related to the Department of Energy's obligations to manage and dispose of spent nuclear fuel and high-level radioactive waste. So, simply stated, our job is to advise Congress and the Secretary of our findings, conclusions, and recommendations as a result of our technical reviews.

Now, yesterday, we heard six presentations from DOE's Office of Used Fuel Disposition, which is housed within the Office of Nuclear Energy. Today's meeting picks up from the final presentation and continues to explore DOE's research and development work dealing with spent fuel storage and transportation. Paul McConnell from Sandia will consider one of the impacts of the possible termination of the Yucca Mountain Project: transportation of spent nuclear fuel.

For the mid-term, or for the medium-term, the issue

is whether the infrastructure for a transportation campaign, whether it can be sustained. For the long-term, the issue is the possible degradation of spent nuclear fuel during storage.

After Paul, we will hear from John Wagner, a group leader at Oak Ridge. He will review recently undertaken engineering analyses to assess the safety impact of spent fuel reconfiguration on criticality safety as well as evaluations of strategies to ensure criticality safety under such conditions. And, he will discuss activities DOE is working on with respect to burnup credit, another subject very close to the Board's heart.

Now, these two talks will conclude the presentations from the Office of used Fuel Disposition.

The remainder of today's meeting will be devoted to three invited panels. The Board is pleased that John Kotek, we hope John makes it, the Executive Director of the Blue Ribbon Commission on America's Nuclear Future, was able to juggle a very busy schedule, and somehow get here from Denver, where he was yesterday. John will present the BRC's eagerly awaited draft report.

The board also invited Ward Sproat, who was the last Senate-confirmed director of the now-abolished Office of Civilian Radioactive Waste Management. Again, we are pleased that ward was able to juggle his schedule to meet us, and we

know he's here. His experience as OCRWM director gives him some unusual insights into what it takes to implement a controversial and technically challenging program. We expect that Ward will comment on the BRC draft report in light of these insights.

The second panel brings together three participants in the Extended Storage Collaboration Program, otherwise known as ESCP, or escape. This effort organized by the Electric Power Research Institute brings together governmental bodies, including DOE, the Nuclear Regulatory Commission, and the Board. It brings together private entities, private utilities, nuclear vendors, and industry associations along with representatives from nearly a dozen foreign countries to explore issues associated with the very long-term storage of spent fuel.

We have asked three of the participants in ESCP, John Kessler from EPRI, Adam Levin from Exelon, and Jim Rubenstone from the Nuclear Regulatory Commission to discuss their organization's views on what the critical technical issues are, and how they might be explored and addressed through structured research and development programs.

Today's presentations conclude with the third panel devoted to considering the waste management implications of using mixed uranium and plutonium oxide fuel, MOX, in light water reactors. Among other things, the Board is interested

in learning how differences in decayed heat between uranium oxide fuel and MOX might affect spent fuel packaging densities in both wet and dry storage. How cask loading operations, including occupational doses might be impacted, and how security and accountancy requirements might have to be changed if MOX is used in reactors.

To educated us on these issues, the Board has invited three experts Wolfgang Faber from the German utility E.ON, that has been burning MOX for some time; Patrice Fortier from Trans Nuclear, a division of AREVA, which supplies casks to nuclear utilities for storage of MOX spent fuel; and Dan Stout from TVA, which is exploring the possibility of burning surplus weapons plutonium in one or more of its reactors.

Now, at the end of our meeting, members of the public, as we did yesterday, will have time to comment and ask questions of the Board and the presenters. This is an important segment of the Board’s proceedings. And, if you would like to make a comment, please sign up at the sheet at the back of the room on the table. If you prefer, remarks and other material can be presented and submitted to us in writing, and we will make sure that it gets into the meeting record and is presented on our website.

Now, I would like to note, as we always have to, that the way in which we conduct our meetings is that the

Board members want to be able to speak openly and freely about their views and ideas, but we need to distinguish from the individual Board's views and ideas, and Board positions. We'll try our best to make that distinction for you. I would also like to indicate that it is very important for you to, when you are speaking or when you are questioning, and that goes for the Board as well, to speak into the microphone. They don't always pick up as well as we would like. And, to give your name and affiliation, and any relevant information that would identify your remarks.

So, without further ado, these preliminaries are out of the way, I'd like to ask you to switch off your cell phones, and for Paul McConnell to take the podium.

McCONNELL: Thank you. I'm Paul McConnell, and the Transportation Team Manager for the Used Fuel Disposition Campaign under the FCTP, and I'm at Sandia National Laboratories, and thanks for adding Transportation to the agenda.

The Transportation activities are new in FY11. The program started in FY10. There are six national laboratories on the Transportation Team, and I will identify those later. And, the program was, Transportation activity, was set up in late FY10. There were the high-level objectives that you see here on this slide, that included high burnup issues with Transportation, and those have not been specifically

addressed in the Transportation activity yet. And, also, Transportation, after extended storage, including the use of dual purpose casks that are being used for storing some fuel. Those were the high-level objectives.

Extended storage implies that transportation requirements were pushed off to the long-term, hence, there was no FY10 funding. But, recently, with the BRC recommendations for consolidated interim storage facilities, and also the need to transport fuel for T&D activities that Brady described yesterday, and, hence, thinking about emergency planning, you know, think East Coast earthquake, that sort of things, transportation has risen to a higher level of priority in the program than it initially had.

Now, I want to show just a couple of quick slides just to reorient you on dry storage, pools, and ISFSIs. These are from NRC websites. And, the types of casks that we use for transportation, truck and rail. Quite a bit different in size. So, this is the basis of what we're addressing.

Now, early in this fiscal year, the Transportation Team got together and identified that there were a range of Transportation Campaign time frames, and I will discuss the aspects of these in more detail with respect to what we're doing. What we're doing all falls within what I would call a near-term transportation need, and a transport after extended

storage need.

Near or medium-term transportation campaigns include transport of fuel to a DOE facility for characterization. That's the gray box to the left there. That's basically what Brady Hanson was talking about yesterday. So, there will be some transportation issues that DOE will have to address just to get fuel from utility to the site, possibly a national laboratory where Brady will conduct the R&D on cladding and fuel.

The red dots, by the way, that you see here indicate that the transportation task is investigating those issues either in this FY, or FY12.

Now, a more comprehensive transportation campaign in the near or medium-term would be, for example, transport of fuel currently in dry storage to a consolidated interim storage facility, the BRC recommendation.

The first fuel, this highlights the BRC recommendation. You've got fuel at commercial reactor, ISFSIs, that's the Connecticut Yankee ISFSI right there, and then you have fuel at decommissioned reactors, Trojan, for example. And, the BRC has recommended, they use the term "facilities" in their report, indicating that there may be more than one. That's the NRC regional map.

Now, the first fuel that may go to one of the interim storage facilities may be fuel from the

decommissioned reactors. All the fuel that's at decommissioned reactors is contained within canisters. There is some fuel at commercial sites that is bare, not within a canister, and all of those canisters that are at the decommissioned reactor sites are designed for transport. There are canisters on commercial sites that are not designed for transport.

So, for the BRC type recommendation, logistical and infrastructure issues dominate transportation. The fuel would be relatively new fuel, or not stored for extended periods.

Well, for post-extended storage transportation, the condition of the fuel dominates the transportation scenarios, similar to the description of the fuel in storage that Brady Hanson described yesterday. We see that there are three options for safely transporting fuel after extended storage. And, again, the transportation activities have elements that address two of these three options for post-extended storage of transport of fuel. Those are--the technical basis for transportation after extended storage can be that the cladding is intact, and there's canister integrity, basically how fuel is transported today.

You can repackage. That's an option in red that we would like not to have to pursue, even after extended storage, but it could happen. Or, you can canister call the

fuel and rely on the canisters to provide the integrity and the confinement barrier for transportation. And, even if the fuel is degraded, as John Wagner will talk about, there may be ways to provide criticality mitigation within the canister to ensure the safety of the transport.

Well, at the outset of the transportation activity, issues related to these three options were identified, and those issues were paired with expertise at the participating six national laboratories. And, due to funding, the activity just starting up, and manpower levels, not all the technical issues that we identified were addressed or are being addressed. But, those issues that we considered a high priority were selected for the work in FY11 and FY12.

KADAK: Excuse me. Could I ask a question on Bullet Number 1? These is Kadak, Board.

Develop technical bases for the assertion that UNF cladding and canisters shall be intact after storage. I'm puzzled by the cladding. Is this for transportation, or just storage?

McCONNELL: Both. But, in terms of transportation, if you can assert, can verify that both the cladding and the canister are intact and suitable for transport, you have a situation that is similar to the one that we have today. If we wanted to take some fuel out of an ISFSI, the assumption would be we would not--that the canister would be intact and

that we would not have to open the canister to ensure that the cladding--

KADAK: I guess that's what I'm trying to address, is for transportation. Does the requirement call for intact cladding for transportation? I don't think it does. Clearly, for storage, when you initially load it, you also have fuel that is not completely intact. So, the requirement for intact cladding, even for freshly stored fuel, is not a requirement per se. So, I would take another look at the cladding requirement. Clearly, canisters have to be intact for both storage and transport. But, I question the cladding requirement.

McCONNELL: Well, that is true for transportation. On the other hand, when you get to whatever place that the fuel is going to be transported to, a disposal site or reprocessing or recovery site, you'd like to have some idea what kind of shape the cladding is in. But, strictly speaking, you're correct that you don't have to rely on it.

Now, the other thing, though, is that there is fuel stored bare at ISFSIs that is not in canisters.

KADAK: Right.

McCONNELL: And, there's also fuel that's stored in canisters that are not considered transportable canisters. And, finally, there is the issue of the canisters that are considered transportable, which is the vast majority of fuel

that's at commercial sites, are they transportable.

So, one is what I would call kind of the status quo of where we are today, and if we had a transportation campaign, and three is where we may end up, depending on results from the R&D.

Now, I'm going to show a series of slides here that describe things that the various laboratories did this year, and in most cases, will continue on in the following year. And, one of the first questions we asked ourselves is what fuel is in dry storage, what might need to be transported? How is it stored, whether it's bare or in a canister? How would the system transfer the fuel from the storage systems to a transport cask? Are the canisters in which the fuel is stored truly transportable? Can dual purpose casks that are storing bare fuel, like the CASTOR casks, can they be used for transport? They were designed to be transport casks, but they don't have Part 71 licenses. And, can they after long-term storage?

Fuel databases exist. RW had extensive databases, but the details that we felt we needed for transportation campaign logistics, had not been collated in the way that Savannah River National Laboratory has recently done. We now have a database that is, we feel, is transportation specific, and we're going to continue to add to it, and there are going to be meetings later in the week with DOE teams to discuss

these types of databases.

A very different activity, this is one that I lead at Sandia, is a plan to obtain energy input to cask internals during normal transport. During extended storage or with high burnup fuel, the cladding may degrade or become embrittled. And, work is planned to measure the material properties of high burnup fuel and to try to get a feel for the properties of aged fuel, Brady Hanson's presentation yesterday.

And, up until now, it has always been assumed that based on limited data and analyses, that fuel cladding can withstand normal transportation, and experience confirms this. It's routine. Low burnup fuel has always been transported. The NRC tests that we assume that fuel at existing burnup levels can be transported after current regulatory storage periods, including those for which they're giving license extensions.

However, we do not actually know what the loads are on the cladding during normal transport. And, that cladding, as I say, may have, in the future, diminished mechanical properties, high burnup, aged. And, these loads that the cladding experiences are due to the, you know, just the bumpty bump of the truck or the rail car going down the road or the track. There are vibrations, there are some peak loads when you go over a bump, or whatever, and no tests have

ever been performed, to our knowledge, which directly measure the loads on the cladding while it is in one of these transport casks.

KADAK: Excuse me again. Are you saying that when NRC issues a license for transport of spent fuel, they do not analyze the fuel itself in the canister or cask?

McCONNELL: They have analyzed it, and the vendors do analyze it, but there has never been any actual measurement of what the actual loads are on the cladding.

KADAK: I just want to make sure that the impression is not left that there is no analysis of the spent fuel in transit during transportation.

McCONNELL: You're correct.

KADAK: Okay, so they do the analysis, but they do not have actual measurements of the strain and stresses on the cladding?

McCONNELL: That's right. It's all been done by analysis, and the limited data that we have on what the material properties are of cladding at the burnup levels that we currently have, but both the NRC and BAM in Germany, in particular, which is the German NRC, they have expressed a concern that gee, with this aged high burnup fuel, the margin of safety may be a bit different than what we now are assuming. We have cladding properties for fuel today, but we don't know what the cladding properties are going to be for

aged, high burnup.

KADAK: That's true.

McCONNELL: What Brady was talking about. So, we have a large program to generate mechanical property data on cladding that is aged and of high burnup, but we can't relate that to what the loads are within the cask. So, the plan is to take an assembly with fuel pins, instrument that assembly, and do, in the U.S. at Sandia, we would get a truck cask and we would measure those loads on the cladding. And, the current plan is that the Germans would use the rail casks, same assembly, and then we could pair the loads with the actual mechanical properties.

Again, the NRC and BAM endorse this plan to measure loads on the cladding, and the EPRI ESCP program is supportive of it as well.

Brady Hanson talked a lot yesterday about the report, the gaps analysis report that they prepared specifically for storage, and the other folks at Pacific Northwest National Laboratory have looked at those technical gaps for transportation. In most cases, Brady Hanson had shown some tables yesterday that listed the components, the cladding, the fuel assembly, the canister, so on, and had a column in those tables, called importance of R&D.

Now, for transportation, we did the same thing, and in most cases, those importance to R&D ratings, high, low or

medium, were the same. But, there were some differences. In some cases, for transportation, we felt the importance for R&D was lower. In other cases, we felt that the importance was higher.

Next year, as Brady Hanson said, there will be a revision to his gaps analysis report, and it's going to include transportation in 2012, the work that we did in FY11.

These next two slides, I'm going to go over very quickly because John Wagner is going to discuss the next two slides right after me. It's I think perhaps the most important and relevant work to the issue of post-extended storage and transportation, of aged, high burnup, possibly degraded fuel. And, as John will show, the potential exists for concerns about fuel degradation to be rendered inconsequential. In other words, the degradation of the UNF during extended storage may not preclude transportation. That was Option 3 on that slide that I showed earlier, where you rely on the canister and criticality mitigations to allow your--or to ensure the safety of the transportation. So, there's two slides that address John's work, and he will show these in much more detail in a few moments.

Now, it's assumed during transportation that a cask could be flooded. And, this leads to very conservative assumptions regarding the potential for criticality. Transport casks are designed to withstand water emersion, and

yet this water ingress assumption is required in evaluating the potential for criticality events during transportation. So, the casks are designed to not let water in, but we have to assume that water is in.

Now, this study is a longstanding bugaboo with cask designers and the NRC, but it promotes the argument that no water will be present within the transport cask. That's called the moderator exclusion principle. And, it also-- there was a means to exist to further enhance the cask configuration to ensure that no water will be present. That's called a double containment principle, a canister that gee, if the canisters are degraded after extended storage, maybe you need a canister to put the canisters in. Idaho National Laboratory has been working on this argument, and they have a report, it's coming out the end of the money, and they plan to, next year, to engage the NRC in this discussion.

That leads to activities for FY12. We're going to proceed with the test program to measure the response of UNF cladding to actual loads imposed during normal transport. That will be done at Sandia. John Wagner plans to identify the criticality mitigation measures for degraded fuel that may be in canisters. Idaho is going to engage the NRC in the moderator exclusion concept. John Wagner is also going to discuss thermal analyses of degraded used nuclear fuel. When

I use the term “degraded,” I mean possibly degraded.

We want to also identify issues related to dry repackaging of bare fuel at ISPSIs into canisters or transportation containers. There’s about 13 percent of the fuel is bare at ISPSIs. How is that going to be loaded? We’re going to enhance the database so the fuel that’s in dry storage, and then next year, we want to include--want to try to identify what the dry transfer concepts or process would be for the canistered fuel at the ISPSIs, and emphasis on how to do the dry transfer of the canisters from the decommissioned sites, based on the possibility that that may be the first fuel to be shipped to a possible interim storage facility.

And, also, we’re going to continue or organizational and international interactions. The transportation program is very tied into the EPRI ESCP program. My boss, and the guy who is the lead of Storage Transportation within the Used Fuel Disposition Campaign is Ken Sorenson, and he is head of the international sub-committee on John Kessler’s EPRI ESCP program. I work with Ken on that. Brady Hanson and Ken Sorenson just returned from NEI meetings. We’re involved with ASME. ASME has what they call Section 3, Division 3, the buzz word is NUPAC that writes the rules for construction of casks, canisters, containment systems, and so on, and there’s a couple, me and

Keith Morton from Idaho National Lab are members of ASME NUPAC. And, when we do interactions like the one that we're doing today, and then within IAEA, we participate on the IAEA dual purpose cask working group that's looking at the issues related to transport of a dual purpose cask after a period of--a licensing period, which in IAEA terms, is 120 years. IAEA also has a working group looking at aging issues, very very similar to what Brady Hanson described yesterday, and in IAEA terms, that's some period beyond 120 years.

So, those are our collaborations. And, with that, unless there's questions for me, I will ask John Wagner to come up.

LATANISION: Latanision, Board.

I'm interested in your discussion of the plans to measure the loading on cladding. Is the plan to instrument the cladding on a bundle and then transport it by rail across country, or something, and while instrumented, to determine the cyclic loads and other loads that might be imposed on it; is that the plan?

McCONNELL: Yes, that is the plan. We would use a fresh assembly. Our current plan is to get a Westinghouse 17 by 17 assembly. We will use an actual truck cask and we'll use surrogate rods, we're not going to have the UO2 in them, and we will put string gauges and accelerometers on selected rods. And, at Sandia, we actually have a road course, it's a

30 mile course that goes over dirt roads, bumps, rail tracks, city streets, gets on the interstate highway, it's a loop, and they actually use that for weapons components, doing a very similar thing in a package, and instrumenting components. And, so, we would use that for our--we wouldn't drive across country, in other words, and then we'd buffer the data and then collect data and maybe do three, four, five 30 mile loops.

The plan for the rail cask, because we don't really have any rail cask to work with here and BAM does with the German CASTORs, and BAM is very interested in participating in this, is that they would then get the assembly and do the tests. They have a place in Germany where they can do the rail tests.

LATANISION: So, if the cladding is brittle, hydrided, do we know much about what sort of stress fields would be required to actually fracture that brittle cladding? I mean, at this point, what sort of database do we have to indicate how much hydriding will cause fracture at what sort of load distribution? Do we have that correlation at this point?

McCONNELL: Well, we don't have data on heavily hydrided, if that's the correct term, or highly burned fuel. We don't know what the mechanical properties of that cladding are. Brady Hanson's program is going to try to get that data, and then in international collaborations, we're going

to try to get that data, so when we have that data, it would be nice to know what the loads are.

LATANISION: No, I agree. So, that's the point that--

McCONNELL: And, you know, we have data for irradiated cladding, and a few data points on relatively low burnup cladding, you know, the mechanical properties. And, through the analyses that you pointed out, they have an idea of what the stresses and strains are on the cladding. But, no actual measurements.

LATANISION: Okay, thank you.

KADAK: Just to clarify, Ron, they do not do aging analysis of cladding. If they have the properties of irradiated clad, that's what they use for the transportation analysis. So, when we were doing the interim storage report, I tried to confirm that that is true. There is no aging analysis done on degradation of cladding over time, which is what Brady's program is attempting to try data on.

LATANISION: Yes, that seems a very important point.

KADAK: But, if you guys are going to instrument a fresh fuel assembly, that's not really going to be that helpful in terms of understanding, you know, how an aged or an irradiated clad would actually work in transportation. You might get the dynamic motions, but again, I would rethink the value of that program in terms of the cost.

McCONNELL: Well, we would get the accelerations, we'd

get those vibrational--those vibrations I showed were taken from what you would see on a truck trailer, or a rail car. They tend to be about 1G, and in peak loads, you can get above 1G. Now, we would measure those vibrations and those accelerations, those load on the cladding. One of the things that we need to do, and it's really the trickiest part of the program, is we need to use as our surrogate rod, one that has about the same stiffness, and harmonic frequency that an actual fuel rod or an actual irradiated fuel rod may have.

Now, we are going to do some analysis first to try to optimize what material we use for that surrogate fuel rod, and we think that through analysis, if there's any differences between what we use and what an actual irradiated fuel rod might show in terms of its vibrational frequencies, that we can back that out through analysis. But, in any event, we would have raw data for rods, setting in in an assembly, on saddles within a cask. And, the data that we use right now is just the data on the trailer. What's going on inside the assembly, we don't know.

KADAK: This gets back to the basic question of what your expectations are for the cladding in terms of being intact during transportation. You didn't mention any of the drop tests that the transportation cask must meet, and no one really talks about well, once you drop this thing from 30 feet, you know, is anybody asking the question what's the

clad going to be doing. I think we're worrying about--we should rethink what we really want out of this work.

ARNOLD: You'd have to get a huge overpack and do a special campaign. This is not a normal--

McCONNELL: Right, that's the assumption if you drop it, the cladding may fracture. I mean, we already operate under that assumption.

KADAK: So, back up a little bit and you say all right, why do we need to know the vibrational frequency of a fuel assembly if in the design basis of a shipping container, you tolerate failed fuel cladding from both who knows what condition it would be in. So, the question is what is it that we're trying to--what question is it that we're trying to answer here with this research? And, if the answer is basically we don't really need to have integral cladding for transportation, and ultimately for storage. We'd like to have it. It would be nice to have, but if it is not a requirement, then you change the whole premise of your research work.

McCONNELL: I agree with that comment that you just made. But, the NRC would like to know, after extended storage periods, and they're going to approve the transport of the fuel, they would like to have some reassurance that, yeah, that cladding might be degraded, but it's--there's a margin of safety there because we know what kind of loads

it's going to experience, and we now have data on it. It's-- Brady, do you want to weigh in?

HANSON: Yes, this is Brady Hanson.

Andy, do you just want to address that, you know, what the real purpose is, you know, again under the DOE program, we're making the assumption we want to maintain things intact. So, what we're doing with Paul's test is working backwards saying, okay, once we understand what the loads are during normal transportation, accidents and cask drop are something completely different, when we understand the loads during normal transportation, we can then work backwards and say how much degradation can the cladding have and still survive intact? That way, we can inform the policy makers, and you can begin to say, you know, and I'm just making this up, you know, if after 100 years, you had enough degradation of cladding that it can't survive, suddenly now the Department and other people know we need to make a decision before that 100 year period, or we're going to have to address how to handle failed cladding on the back end. So, you know, there is a real need, in my opinion, for this to integrate the whole program together.

LATANISION: My comment would be that this is a very straightforward material, it's a mechanics problem, it may not be a straightforward policy problem, and that may be where the conversation is getting hung up here a bit, the

question of what the NRC expects or what the DOE expects. But, in terms of accomplishing what Brady suggests, I think that make imminently good sense.

KADAK: I mean, it's a nice science project.

LATANISION: Yes.

KADAK: But, is it needed?

LATANISION: The material is fragile. The question is how fragile is it? What loads will it be able to withstand? And, that's an imminently answerable question, I think.

KADAK: No doubt. But, the question is do we need to answer that question?

LATANISION: Well, that's a policy issue.

KADAK: To assure public health and safety. If the public health and safety standard is release during transport and/or storage, that's a very different question than is the fragility of the clad sufficient to withstand a drop of 30 feet or a ride over a bumpy road.

LATANISION: Yes.

WAGNER: This is John Wagner from Oak Ridge.

Maybe this is a really good segue to change out, because I will deal with some of the issues that are being brought up here. So, perhaps I can give my presentation, and then we can revisit some of these discussions.

KADAK: I'm sure we won't make much progress. I mean, all this is in the context of a limited budget, okay? We've

heard we can't do anything because we don't have enough money. The question is what can they do that's important with the money that they have.

GARRICK: I see this in an entirely different view. You're seeing it from the regulatory standpoint. I see it from the standpoint of what assumptions can I make about the long-term disposal problem relative to the history of the condition of the fuel. I want to take credit for as many barriers as I possibly can, and this is certainly critical to understanding what we can say about the likelihood of clad failure and not being a robust barrier in the engineered barrier system. So--

LATANISION: And, here it is.

WAGNER: Yes, so hopefully, I can help with this and not make it any worse.

GARRICK: Well, don't count on that.

WAGNER: Let me do the preliminary intro here. So, I'm John Wagner from the Oak Ridge National Laboratory. I'm a part of the Storage and Transportation Team in the Used Fuel Disposition Campaign. The Storage and Transportation Team is led by Ken Sorenson, as Paul mentioned.

Today, I would like to talk to you a little bit about engineering analysis and its role in the campaign, particularly in the Storage and Transportation side of it.

So, I'm going to talk about three topics, and

they're all related. The first is engineering analysis. Under Paul's leadership in the Transportation Control Account in Fiscal Year '11, this fiscal year, we initiated the activity that he briefly mentioned, and that was related to fuel degradation and the assessment of the impact. And, I'll go through a little bit, it may be a little bit redundant with what Paul said, but to try to lay out the rationale and the thinking behind what we're doing there.

I'm going to talk just a little bit about burnup credit, because I know it's been an interest of the Board, and I'll say a few words about that. It will be pretty brief. And, then, in Fiscal Year '12, we are actually standing up a formal what we call control account area in the UFD Storage and Transportation Team. And, although we haven't started it yet, I'll say a few words about our plans for Fiscal Year '12 there. And, I have the honor of leading that control account.

So, here's some preliminary remarks, and I'm not going to read them, but the idea here is that we have a lot of spent fuel to deal with. Okay? And, a lot of different aspects to it, different fuel types, different reactor histories, different storage periods, and so on and so forth. There is a significant activity being initiated, being executed in terms of understanding the behaviors of different components, and trying to be able to say that, for example,

cladding will remain intact over a long period of time, over an extended period of time. And, if we can do that, then we certainly can insure the geometric configuration of the as loaded fuel, which is part of a regulatory requirement, and we can have different things, and I'll get into some of those details.

A corollary to that is can we really assure over long periods of time that certain things will function, for example, cladding, and can we do that with the certainty to convince the regulator and convince the public that actually, for example, you know, can I convince you today that cladding will remain in pristine condition over several hundred years. You know, you would say show me, prove that to me. Okay, and of course that's what the experimental programs are about. But, proving almost a negative, proving that it won't happen is not an easy thing to do, especially given the multiple cladding materials, and the broad space that's involved.

So, the basis of what we're doing here is so what if it does fail? Okay, do we care? And, of course, then we have to go back to what are the safety requirements for the system, and can we meet them? So, that's kind of in a nutshell what we're talking about here. So, there will be some redundancy now in what I'm saying, and I apologize for that.

But, the potential for a fuel clad degradation

reconfiguration is really a key issue here with extended storage. And, then, primarily what I'm talking about, so I hope I don't confuse you, is this transportation after extended storage periods. That is the focus.

So, will the used fuel remain in configuration that it's analyzed in a current SAR? If fuel is loaded for a SAR and it's licensed that way, and, it's not licensed for damaged fuel, it is assuming that the fuel is in its intact, as manufactured form. So, that's what the licensing basis is. If it deviates from that, it deviated from the licensing basis.

And, fuel reconfiguration can affect a variety of different safety related aspects, and I just list them here. And, so, it really does have perhaps maybe the most important issue for consideration and extended storage.

So, in order to assess this, we have to address the issue of potential or potential for fuel reconfiguration. We need to understand what is the likelihood that the fuel will reconfigure. Okay? What is the potential extent of that fuel reconfiguration that may occur? And, these things have a variety of dependencies. I have listed some of them in each of the first two columns here. But, that's not even all. You know, the thermal history, as research has been done at the national laboratories, looking at how hydrogen reorients over periods of time, over different temperature

histories. It depends on how much hydrogen is in the fuel at discharge. That's where the hydrogen actually initially comes in. This reconfiguration for those of you who aren't very familiar with this, from a circumferential to a radial configuration is kind of one of the key issues.

Stresses throughout this process are going to have an affect in that. And, so, there's a large number of parameters that will affect cladding integrity, and, so, experimental efforts are planned to address both the likelihood as well as the potential fuel reconfiguration--configurations that may result in that.

And, I want to note here that there are many interdependencies to consider. Maybe I've already noted that, but I guess I want to keep emphasizing that. So, the first two columns are related to the data gaps that Brady Hanson's team has identified, or this is one of the data gaps within that. And, then, in FY12, the idea is okay, well, how do we address those data gaps? How do we get this information to assure that we will have cladding integrity?

Kind of a third prong in this approach, which I think Brady referred to as an off-ramp, is kind of what if we can't do that, then what's the safety impact? You could think about this maybe as a risk mitigation strategy. And, if the fuel does fail and we don't know anything about it, do we care? And, so, then we have to go back to the safety

regulations and the safety parameters that we're trying to insure.

Now, when you reconfigure fuel, certainly you have the potential to put it into a more reactive condition, and criticality safety is one of the things that rises to the top, not that the other issues aren't important, but certainly over extended periods of time, shielding is less of a concern as the source decays down. Thermal is less of an issue as it cools. So, I'm not saying that those other things on there aren't issues, but criticality safety kind of rises to the top. The other one that rises to the top is retrievability. And, I'll speak to that.

So, just some preliminary here, some relevant observations. Currently, it's stored, spent fuel, or used fuel, as you know, is stored in multiple assembly canisters, and we expect that that will be the case for the foreseeable future.

Right now, something that I think Andy was referring to, or maybe was referring to, is if we can show that damaged fuel is safe, that it meets the various requirements, you can put damaged fuel in what we call damaged fuel canisters right now, and license them. Okay? And, what these are, for those of you who aren't familiar with this, is you can think about your normal cask with its basket cell, and another box that assembly goes into, and

then is sealed and then put into that canister. And, so, that's an option. This approach would insure future retrievability of the assemblies, but at a cost. Okay?

That requires a slightly enlarge storage cell. It also requires a damaged fuel canister itself. So, there's operational and direct cost issues there. And, to my knowledge, the industry is not terribly interested in that approach, but I'll let the industry speak for themselves.

And, right now, there is currently no assurance that the cladding will remain intact. So, this lack of assurance exists, regardless of even near-term aging that we do, because any data that we collect in the near-term is going to be for the near-term. It's not going to be over hundreds of years. So, we will have to, I think, use some combination of modeling and analysis and experimental data, understanding the uncertainties, to extrapolate out to make predictions about the integrity of fuel cladding.

And, I apologize if some of this is redundant, but I do want to make sure that these points are clear. So, the thought here is that if we can insure used fuel and multiple assembly canisters will remain subcritical, and really maintain that they're safe, under all credible conditions, then the potential to monitor fuel in extended storage can be reduced, or maybe even eliminated. There would be no need to open up the canisters and repackage, although there's other

needs related to that that I'll just sort of park over here somewhere, in terms of what would need to be put into a disposal environment. So, there's a different repackaging issue from the one I'm referring to here.

The safety significance related to extrapolation, experimental data and modeling, to predict used nuclear fuel conditions, would be reduced, eliminated, you know, something along those lines. And, so, you could shift the focus of the experiments from qualifying the data for the safety case to basically understanding its importance in the safety case.

And, so, if safety is assured and retrievability of the fuel after extended storage is deemed of secondary importance--if retrievability is deemed of secondary importance, then canning assemblies in damaged fuel canisters may not be essential. I think one of the things, I won't speak for the Nuclear Regulatory Commission, but one of the things they are looking at is their current definition of fuel retrievability, and whether or not they--well, they are looking at whether or not they should--they are revisiting that in the context of their current definition is it appropriate in an extended storage environment?

And, I think Brady mentioned what their current definition is, but I'll repeat that, and that is that the fuel assemblies can be retrieved via normal means. So, that is an issue because again, what I'm talking about here is if

the fuel degrades, it's okay from a safety perspective. Certainly, it would cause trouble in terms of retrievability perspective on an assembly level basis.

I invite you to interrupt me at any point. I may regret that.

LATANISION: We usually don't have to be asked that.

When you say degrade, it's conceivable that the fuel could be brittle, but it's not necessarily degraded unless it's exposed to some mechanical stress that causes it to fracture; isn't that correct? Or, are you looking at it differently? What does degraded mean?

WAGNER: Degraded means, to me, it means that it is no longer in an intact condition, that something has happened to it, whether it's becoming brittle and maybe you had an earthquake later, and that it has reconfigured as a result of that. So, really, maybe I should just stick with reconfigured, is really what I'm talking about.

LATANISION: I think I would be happier with that. I mean, if the cladding is brittle, just the glass is brittle, but it's not fractured unless you slam it with a hammer, or throw something at it. So, it may be intact, but brittle, as opposed to degraded along a release.

WAGNER: I agree. I agree.

ARNOLD: Arnold. To me, it's the release. I'm with you, yes.

GARRICK: Is there reasonable data, maybe Brady answered this, is there reasonable data on the frequency of occurrence of so-called damaged fuel, some metric, some--

WAGNER: Frequency of occurred?

GARRICK: Yeah, how big a problem is, this is what I'm getting at?

WAGNER: So, in reactors, certainly there is data. But, we're really talking about over extended storage periods, and we really haven't experienced extended storage periods. And, so, to my knowledge, there is no data. Now, I saw John Kessler nodding his head around. So, if he would like to comment on that, I would certainly invite him to do so.

GARRICK: But, it would seem to me if we had good data on--from a safety standpoint and from a storage and disposal standpoint, the only thing that's important is how it performs from a waste form standpoint. So, you have to keep asking yourself what are we going to learn about that from this exercise? And, there surely must be information available that tells us how frequently a fuel assembly is damaged as a function of burnup.

WAGNER: Well, we have not experienced extended storage periods. We don't have experience with--

GARRICK: But, I don't care about storage periods. What I'm trying to get a handle on is what information do you have currently that tells you how much of a problem this is, and

that is to say how much of a problem of failed cladding do we really have? Is it one out of a thousand fuel assemblies that you might be able to have something that meets your definition of a damaged fuel assembly?

WAGNER: We're mixing things up here, I'm afraid, and that is damaged--

GARRICK: Well, I don't think so. I'm interested in the integration or the tying together of the whole thing into what we're interested in, and that is the performance of either long-term storage or the performance of disposal.

WAGNER: Let me clarify. You have damaged fuel from in reactor or maybe things that would happen in a pool. Okay? And, those are different than reconfiguration due to extended storage periods.

GARRICK: Yeah.

WAGNER: It is the reconfiguration due to extended storage periods that we are targeting. If it's already damaged going into a cask, we already know that and we will treat it as such.

GARRICK: But, isn't reconfiguration a function of the condition of the cladding when it goes into storage?

WAGNER: It is. It is. And, so, from that standpoint, it would affect that. But, if it already has some damage, whether it's a pinhole leak, or whatever, then it's already treated as damaged fuel when it's loaded.

GARRICK: You don't have any way of knowing what the margin here is of damage, how close it is to a reconfiguration condition, or what have you?

WAGNER: Well, again, if it has some damage at the time of loading, current practice is to put it in a damaged fuel canister, and to do the safety analysis with the view that it is damaged and it is reconfigured.

GARRICK: Okay.

WAGNER: The issue that we're really after here is that fuel that's loaded as if it's--that's loaded without any damage, that's assumed to be not damaged, and to assume to remain in that intact configuration. That's the part we're really after here.

KESSLER: John Kessler, Electric Power Research Institute. My head is about to explode back here.

John is describing very well the difference in terms of what we mean by damage. We do have an excellent database on what fuel is damaged, not intact, pinhole leaks, hairline cracks. We have excellent information on the frequency of that kind of information. That's the initial damage that John is talking about. Now, let me finish, John.

We do have a lot of work, and this is the other part, there is a lot of work that we have on mechanical properties of high burnup cladding with various amounts of hydrogen. Brady Hanson has done some. Albert Machiels, who

is here from our group, we've funded a lot of work in this area. We funded modeling in terms of how we would expect that the mechanical properties of high burnup cladding to proceed. We looked to see how much cladding there would be that would rupture during the required drop test, in terms of how much would survive. We have looked at reconfiguration in terms of split the cladding, you've got UO2 pellets here and there, how does that affect criticality? We looked at all those different issues. We would certainly like more data, but there's a lot out there.

Another one that my head is exploding over, the idea of accelerations and what do we know about it? We know some. There has been a lot of acceleration measurements done. Are they particularly relevant? Was the accelerometer placed in the right place? Those are certainly issues.

Anecdotal evidence. We have a letter from AREVA saying that of all of the fuel that left intact headed for LaHague, it arrived at LaHague intact. Okay? Now, whatever the accelerations were, whatever the full range of brittleness of the fuel was, at least under normal transportation conditions, everything that's gone to LaHague that left the plant, wherever it was, Japan to France, that's arrived at LaHague, has arrived intact. So, we have anecdotal and actual real data on high burnup fuels, and it is complicated in terms of the amount of hydrogen that's

picked up, the orientation, what is that an affect of. We're trying to do unirradiated samples because they're easier to deal with, because you don't need a hot cell. Active area of research, and I fully agree with John that the issue is what's damaged initially doesn't have as much relevance to what might get damaged during some sort of transportation acceleration. That is an effect, a strong effect of burnup, and may get worse with extended periods, and I'll mention that in my talk this afternoon.

GARRICK: Okay.

WAGNER: Okay, let me try to get back on track here. So, this has been an ongoing interest, actually as John just mentioned. There's been work looking at what happens if the fuel does degrade, because it's already an issue in current transportation when you know you're loading damaged fuel, you have to show that it's going to be safe.

And, so, actually some work was done back in the early 2000's for the NRC, looking at the effect of fuel failure on both criticality as well as radiation dose. You know, if the fuel all dropped to the bottom, your source term--that kind of thing, not as big of an issue, but it was looked at. And, the focus of this, though, was really--you know, this was done in the 2002 time period, where burnup credit was not permitted to the extent that it is now. In fact, I think it's safe to say in 2002, burnup credit was

not, even though the ISG was out, burnup credit had not been approved in transportation. So, the focus of this research was really more on fresh fuel, which is not terribly realistic.

And, then, also the idea at the initiation of that piece of work, it's the same idea at the initiation of this piece of work, I will tell you, is that we would get materials expertise to inform what are credible reconfiguration scenarios, and what are not, because certainly you can dream up reconfiguration scenarios that are significantly more reactive and more of a criticality concern. But, if they're not credible and they are not realistic, they should not drive what we do. And, that's an important point that we have to deal with moving forward.

So, the idea was to basically revisit this kind of work, but with burned fuel because that is what we're dealing with. The NRC has become--they have approved burnup credit, and they have shown a willingness to approve more burnup credit than they currently have, even in the current ISGA. And, so, this, basically we're redoing this assessment based on high capacity casks with burnup, looking at long cooling times, and so forth, to assess the effect of reconfiguration on criticality safety.

Then, the idea, the longer idea is that if we understand what the impact on k-effective is, then we can

look at mitigation strategies for addressing it. For example, currently if you load spent fuel and you know it's damaged, you have to do these types of analyses to show what impact on k-effective it is, and demonstrate that you are below the upper sub-critical limit allowed by the NRC. And, so, there's already mitigation strategies.

And, I mention some here because I'd be interested in reactions. I'm not saying any one of these is the right thing, but we have a variety of, say, tools in our toolbox that we could utilize. We could have a delta-k due to reconfiguration that we put into the analyses to account for this once we have quantified it. We can do package design modifications, more absorber, absorber in different places, things like that. You can use rod inserts. That's not a very good option operationally, but it's on the table. We can go back to our inherent margins and try to extract more credit out of them. That's another possibility.

And, then, the NRC has at times allowed greater than .95 for their k-effective limit for certain unlikely conditions. And, so, that's a potential option. And, I think they have even shown some willingness on this here, but I won't quote anybody on that. And, then, of course, moderator exclusion, although the NRC has not been very receptive to that, there is a clause in 71.55(c) that is a wedge for that, but they have, to date, said that it is only

on a case by case basis, and not permitted that. But, it could be something to talk about.

So, the idea here is that our results of this analysis will inform and focus our testing and experimental data needs relative to what is credible for fuel reconfiguration. What are the ones that we have to actually deal with?

So, this is maybe a complicated diagram that is an attempt to explain how our current and future constraints and our scientific and technical understanding contribute to the likelihood and potential for--they help inform the likelihood and potential for a situation that then has to go into a regulatory environment in terms of understanding the safety impacts and potential mitigation strategies for such situations. It's an attempt to show an integrated approach on how these things can be brought together to form a licensing basis.

So, what are we doing exactly? I've talked a lot about the sort of philosophy behind it and the strategy behind it. What we're looking at specifically are a number of degradation scenarios, and I won't argue that they're all credible. What we want to do initially is just quantify the impact on safety, and then deal with the credibility of them through experimental data.

So, gross rod failures. Okay? Something that

actually is considered when you load damaged fuel now. Gross cladding failure. Rod bowing, something that actually does occur to a certain extent right now. Poison degradation over long periods of time. We need to understand poison degradation issues and whether or not it's a safety impact. Degradation or failure of the cask in total in terms of maintaining the geometry of the fuel. And, then, gross assembly failure, the whole thing just rubblizes in the bottom and what happens. Okay? So, these are the kinds of scenarios we were looking at.

PETROSKI: Why do you have six? Why don't you have eight?

WAGNER: I must have deleted a couple off. Good catch. There are a couple others. I didn't put there actually for maybe controversial nature of them. We have looked at some kind of ridiculous scenarios as well in terms of the fuel all rubblizing, dropping below the absorber area, and so forth. And, actually, I did take those off because while it's interesting to know what that increasing k is, there's no basis for that, and so I don't like to talk about that. It's okay to calculate it to understand what the k is. But, to put it up here and give credibility to it, even though I'm not even giving credibility--basically, I've removed some that I thought were rather outlandish.

KADAK: I guess do you postulate any kind of gross

assembly failure where the whole thing was just crumpled down into a pile; is that credible in say a hundred years of storage?

WAGNER: So, we are not dealing with credible. We are dealing with what is the k impact. Okay? So, the idea is that when you know the impact, that's where you want to focus on what's credible. Okay? If, for example, it all rubblizes and the k doesn't increase at all, let's just say for example, then we really don't care whether it's credible or not. We're covered. Okay? The more important issue comes into if it does rubblize or reach a situation and k, and I'll show some results in a moment, and k increases dramatically, then we really need to understand is that credible. Because if it's credible, then we've got to deal with it. Whereas, if we can do some experimental testing and demonstrate that it's not credible, we can dispense with that in that manner.

So, we looked at some--three representative casks, both high capacity BWR casks, a high capacity PWR cask as well as what I'll call a lower capacity PWR cask. These are based on industry casks--names mentioned there. And, we looked at a variety of initial enrichments and burnups and cooling times to look at the effects and how these effects would vary with burnups and cooling times to try to cover our space. Again, we're trying to quantify the impact on k-

effective.

GARRICK: John, I know it's been our fault, but just to avoid a catastrophe at the end here, we don't have too much more time.

WAGNER: Okay.

GARRICK: Maybe 10 or 15 minutes.

WAGNER: That's actually a fair bit of time. But, I'll tell you what, I will go fairly quickly from here, and then questions can be asked on anything I go too quickly over.

GARRICK: Well, we've been asking questions.

WAGNER: So, here is an example of maximum increases in k-effective due to the different scenarios that I mentioned. And, so, this gives you an idea, and just to put things in perspective, currently, we design to k-effective below .95. That's a limit. And, so, anything that pushes us 5 percent, actually pushes us up into a critical point, which, of course, has to be avoided. And, so, the ones that are small, you know, we can actually deal with those with mitigation strategies that I mentioned that are actually not too problematic. It's the larger ones that we'll hone in on and assess credibility and how to basically try to either show that they are not credible, or then we have a problem to deal with in terms of mitigation strategies.

So, the next steps here are to complete and finalize the reactivity impacts that Dave just mentioned,

which is pretty close to complete and final, but that's going forward into FY12. Yes?

ARNOLD: Arnold.

The--actual displacement, tell me what that is.

WAGNER: Okay. So, this would be a case, and it's actually looked at in terms of--well, this is a case where an assembly would slip above or below the poison panel. Okay? So, when you have spent fuel, the most reactive regions are on the end regions. And, so, if you move those outside--if you move that active fuel length outside of the absorber panel, then k goes up very quickly because basically you end up with assemblies that are not separately by poison in their most reactive region. So, this is an example--I'm glad you brought that up. This is an example, we're just simply engineering such that that can't happen, is a way to get rid of that. Okay?

KADAK: Is this a flooded cask?

WAGNER: Yes. Everything that I'm looking at is flooded per 71.55(b) and (e), which requires it.

KADAK: Why don't we put them back in the reactor?

WAGNER: Pardon me?

KADAK: Why don't we put the spent fuel back in the reactor?

WAGNER: Economically, it doesn't make sense, or they wouldn't be discharging them.

KADAK: Axially displaced, of course.

WAGNER: Pardon me?

KADAK: Axially displaced, of course.

WAGNER: So, let's see, back to--okay, so, the big thing here is on these bigger ones, are they credible? Can we engineer them such that they're not credible, or can we inform and communicate with experimental programs to try to form a basis for excluding them as credible. So, that's the next step. Evaluate, for those that are credible, or that we cannot dismiss as being incredible, we would need to look at mitigation strategies. And, if they are deemed too costly, again, move back to the experimental program.

So, what we're looking at is a combination of analysis and experimental programs to try to deal with this issue. If and when we can deal with--complete the addressing of this issue, which again this is not an issue that can't be addressed, it's more a matter of at what cost, then we will move onto the next step, actually, although I've listed all these, is really thermal. We would like to look at what are the thermal implications, and then assess the safety impact of those.

So, I'll move in topics, now, so if you have a question--okay.

I'm going to talk a little bit about burnup credit. We didn't do a lot of work on burnup credit in the past year,

but we did do some, and I would like to review that. So, one of the tasks, though, we did burnup credit work under the repository criticality activity that was led by John Scaglionie, also at Oak Ridge. And, I'd list here some of our accomplishments in Fiscal Year '11. The first one refers to an activity that we led and completed, and what it is is it's an international benchmark program. We actually proposed and again led a benchmark exercise with the OECD, NEA's expert group on on burnup credit to look at inter-code, intercountry comparisons for isotopic predictions and subsequent k-effective predictions over very long time periods.

And, the crux of this issue is really that we don't have data over thousands of years. This was actually initiated towards the end of the Yucca Mountain time, and so there were questions how good are our predictions out to a thousand years when we can't validate them. And, so, when you can't validate things, one way to provide some additional confidence is to do inter-code, interdata comparisons and see what kind of spread that we see.

And, so, 15 different contributors from ten different countries participated in this exercise, and we completed the report just recently. It will be published as an NEA report, and it actually showed very minor discrepancies between all these different countries in k-

effective predictions, out to 1 million years. So, while it's not a validation, it helps provide some confidence in our ability to predict such things. And, again, that's being published.

Then, another thing that we did along the lines of sort of Lessons Learned, was to prepare a paper on the post-license application submittal work that was done related to burnup credit. It's published in DOE reports, but sometimes people don't see those, so, it's a review of what we did for the license application, and also what we did afterwards in burnup credit, so that information will not get lost.

And, in a sense, it's not only a discussion, but a bibliography pointing back to the reports that were prepared, so again, that information doesn't get lost.

Then, we actually continued some experimental validation data work that we had ongoing. What this is is it's destructive measurements of spent fuel samples. Okay? And, we use those for validating our isotopic predictions, which is important to burnup credit. There's two main components to burnup credit validation. How well do we predict the isotopic compositions of the used fuel, and then how well do we predict k-effective of that used fuel?

And, so, we continued on with that. We had an opportunity to gain access to some MOX, the MOX rods that were irradiated at the Catawba Reactor. Another program paid

for the radiochemical analysis of that, and so we are doing computational analyses to see how well we predict that as MOX may be a used fuel that we have to deal with in the future. So, that would provide validation data for that.

And, then, also we had some, under the previous OCRWM work, we had a program where we purchased access to some Spanish data on destructive assays, and we completed that analysis actually under a different sponsor, but kind of within the same vein here.

The burnup credit work kind of looking forward is really related to the reconfiguration assessment that I mentioned.

Now, where are we at? I thought you might be interested to know where we're at on the status relative to Yucca Mountain. We are not continuing Yucca Mountain work, or anything like that, so let me be very clear about that. But, it is relevant in terms of where we go forward, in terms of what the NRC has recently said about the burnup credit methodology that was part of the Yucca Mountain license application. And, while I've got a lot of words here, I wouldn't mind kind of just reading them here.

This technical evaluation report was issued at the end of July of this year, and a few quotes out of here. "DOE developed an adequate technical basis for screening out the criticality event class on the basis of low probability."

That is a direct quote, a rather strong quote that I thought you may all be interested in. They found that it's reasonable to take burnup credit for PWR and BWR fuel. I thought their assessment was very good, for whatever that matters what my opinion is, and I thought that they did a very nice job of a balanced review. And, by that, I mean things like this where they have an exception, they're saying here, for those of you who can't read this, "Taking full credit for the neutron absorptive properties of molybdenum, technetium, ruthenium, rhodium, and silver were technically unjustified due to insufficient and inadequate radiochemical assay data." Okay, so, they're saying that's inadequate. "However, DOE showed that the isotopic bias and uncertainty incorporated into the critical limit should make up for the errors and uncertainties in those." So, it's a balance approach. They're saying look, we don't like this, but on balance, we're okay with what was done.

And, for those of you--it's a well-written, very worthwhile reading if you're interested in criticality and burnup credit.

Now, moving again, kind of related to moving forward, the DOE disposal roadmap, which was talked about by Mark Nutt yesterday, identifies criticality to be low priority at this time, and so we're not going to be continuing work in the disposal side on burnup credit. And,

there's a rationale for this, and that is that burnup credit work is not deemed to be important and necessary for what they're doing now, which is site screening and selection, and keep in mind the disposal roadmap does not deal with, which is obvious, does not deal with Storage and Transportation.

So, focus going forward, I'll--I really do need to kind of go faster here--is to focus on Transportation.

GARRICK: You have about four minutes.

WAGNER: Okay. As I've already mentioned, and, so, we will do that. We've got a few activities under the analyses. We will leverage our contacts with NRC and our contacts internationally to support the campaign in this area.

And, also, an important point is that as Brady's team and the experimental teams are looking to do analysis of actual spent fuel rods, that's a great opportunity for us to try to get isotopic measurements to support burnup credit validation. So, we will leverage those activities.

So, the engineering analyses plans for Fiscal Year '12, this is--again, this has not really started. We have just been in initial planning phases, but I welcome your feedback on what we're intending to do, and that is to basically apply and develop analysis capabilities to address these technical issues and data gaps that Brady Hanson and others have mentioned. So, we want to use analysis as well as experiments to try to address these data gaps.

We have a broad scope of areas that we want to deal with, ranging from things like criticality safety to material degradation and everything in between. We will prioritize our efforts based kind of in two ways. On the priority of the data gaps that were identified in that report that Brady talked about, as well as what analysis capabilities do we actually have. Some of these things we have capabilities to analyze now. Some of these phenomenon, we do not, and so that will affect our prioritization. And, so, as that one bullet there says we'll focus on immediate needs and existing codes.

We are also already linking up with the DOE NEAMS program. NEAMS is Nuclear Energy Advanced Modeling and Simulation. For what capabilities, analysis capabilities that they can bring to the table, as well as other DOE program, the Light Water Reactor Sustainability Program and the NEUP program, and, of course, our international partnerships, which have been quite active.

So, here's how this sort of, in terms of how this fits, we talk about theory, experiments and here, we're talking about modeling. And, I think I've said largely what these top few bullets says already. Our focus will be on revising storage and R&D gap analysis report, and the priorities, basically, we have gaps, we have to figure out how to fill them. And, that's where we'll be contributing.

And, we will be preparing a report identifying the application that we'll be performing analyses on initially, and also our plans for moving forward in terms of adjusting those issues.

And, with that kind of quickly, I will also mention that we have six laboratories involved in this team, and all will be playing an important role in the engineering analysis of these phenomenon.

So, I apologize for going so long.

GARRICK: That's not your fault. It's our fault.

Henry, I cut you off before, and I know you had a question. And, that's about the only question we have time for.

PETROSKI: Okay. Well, I had a question about the testing program, but that was talked out, I think. I just would make one other comment. You talked about--it doesn't seem that the FY12 program is fixed. It sounds like you're still prioritizing and thinking about it, and yet, what, that's a couple weeks away.

WAGNER: The FY12 planning, so forth, is not fixed, but it's very close to being finalized. I mean, there's still some approvals, but what we have to get our arms around is what capabilities right now do we have to analyze these phenomenon, and respect to what the priorities are in the phenomenon that we have to address via the data gaps. And,

so, we have already connected with the different national laboratories and expertise, for example, in hydrogen reorientation, in cladding creep, in criticality safety. So, in effect, there have been--scope areas have been defined.

But, one of the things that--I mean, we will be looking at is a longer term plan in terms of where do analysis capabilities need to be developed, and how will we use those to fill those gaps. So, there is still some planning involved.

GARRICK: Okay, thanks, John, and I'm sorry we interrupted you so much.

WAGNER: Not at all.

GARRICK: We'll take about a ten minute break now, and try to get back on schedule.

(Whereupon, a brief recess was taken.)

GARRICK: Could we take our seats, please?

KOTEK: I guess I'll dive in. Am I controlling the--is it better is I stand up there? Okay.

All right, so, I wanted to give you a little bit of a brief overview about the Commission and its origins before diving into the details of the draft report.

As I'm sure most of the folks in the room know, the Commission was formed at the direction of the President by the Secretary of Energy back in January of last year. The purpose of the commission is to conduct a comprehensive

review of policies for managing the back end of the nuclear fuel cycle and to recommend a new strategy for the United States. The Commission is to deliver its final report to the Secretary the end of January of next year. The report that's just been issued is a draft report, which is called for in the Commission charter.

The Commission members, I won't go through all of them, many of them I know are familiar to you all. Our Co-Chairman, former Congressman, Lee Hamilton, who, among a lot of other things, was vice-chair in the 911 Commission. And, General Brent Scowcroft, who was National Security Advisor to Presidents Ford and Bush, Senior. And, there's the rest of our Commissioners.

Of course, nothing new to you all, but of course what the Commission has been asked to look at is the back end of the fuel cycle. So, whereas the front end, where we talk about the fuel cycle typically, you know, comprises of steps to get uranium ready for use as fuel in the nuclear reactor, what the Commission is looking at is the back end. And, the questions about interim storage, should the fuel be reprocessed in some way, shape or form, as is done in a few other countries, and plutonium and uranium, maybe other elements, separated for reuse, and then what do we do about final disposition of the fuel.

Again, very familiar to you all, this is a

presentation I'm using with audiences across the country, so there's some more explanatory material in here than you would typically get for a Board presentation, I would imagine. You all are familiar with what commercial nuclear fuel looks like. The fuel goes into pools after being removed from the reactor, where it's cooled for some period of time, in some cases, a long period of time, and then some of which has been moved into dry storage. I think the numbers I've seen tells me about three-quarters of the U.S. commercial fuel inventory is in wet storage and about a quarter in dry, if that sounds about right to you all.

Where the fuel is located, primarily at the 104 operating commercial reactor sites in the United States, shown here. There are also I think it's nine sites with ten reactors shut down, commercial reactors where there is still fuel on site. In many, but not all of the cases, the sites have otherwise been completely dismantled and the reactors, the spent fuel pools and other infrastructure are gone.

The other main piece of what the Commission is looking at is high-level waste, again, primarily left over from the reprocessing of spent nuclear fuel in support of the weapons program, although we do have some commercial origin high-level waste in the U.S. as well.

Typically, the high-level waste is put into a glass pipe form like this picture here on the left, and then put

into storage. It kind of looks something like the picture here on the right. Those are actually pictures from the UK, but we've got, of course, similar facilities here in the U.S.

The locations of that high-level waste, primarily at former Department of Energy or current Department of Energy sites at Hanford, at the Idaho National Lab, the Savannah River site. We do have some fuel there at the West Valley site as well, the former commercial reprocessing plant.

So, what has the Commission done? The Commission has really made a concerted effort to hear from a wide variety of viewpoints and to learn from the experiences in the U.S. with the Yucca Mountain Project, with WIPP, other siting of other controversial facilities, as well as experiences in other nations. And, so, the Commissioners have paid visits to commercial nuclear reactor facilities, DOE facilities in the U.S., and at least some of the Commissioners went on visits that included Russia, France, Japan, the UK, Sweden, Finland. I think I got them all. It started last year, the first meeting was in March, and those activities have continued on into this year, with the issuance of the Commission's draft report again in July for public comment.

So, an overview of the key recommendations of the report, there are seven of them, and the first recommendation

of the Commission regards the need for a new approach to siting and development of nuclear waste management facilities, be they for storage or disposal. The Commission believes such an approach needs to be adaptive, staged, consent-based, transparent, and standards and science-based. The communities involved, the hosts, tribal, local and state governments, need to be on board with it. And, one of the lessons that the Commissioners really learned from the Yucca Mountain experience was that trying to force a facility on an unwilling host state is just a recipe for taking a lot of time and costing a lot of money.

The Commission learned a fair bit from its visit internationally. For example, I put this picture in here. I thought it was kind of neat. This is from our visit to Sweden, and many of you know Claus, the man on the right there, the head of SKB, the Swedish nuclear waste management program. The gentleman on the left, and in the center are mayors of municipalities, call them mayors, municipalities there in Sweden that were part of the competition to host the repository site in Sweden. The gentleman on the left who looks grumpy just found out he’s not getting the nuclear waste. And, so, the Commission has seen at least, you know, it’s possible that working in a transparent, open and a consent-based manner, at least in this context, it was able to work.

The Commission was careful to note you've got a very different political system and a different culture over there, different demographics, what have you. So, you'd be careful not to try and draw too much from that experience, but in any event, that's an example of a place where they enjoy the type of support that I think a facility in the U.S. could really benefit from.

The second key recommendation regards the need to establish a new single purpose organization focused on nuclear waste in the United States. The Commission suggests that a federally chartered corporation seems to be the best way to go, although I think if you read the report, you will see that the Commission realizes there are other ways you could skin that cat too. And, I know the Commissioners are interested in hearing feedback on that question of the governant structure.

The organization would be responsible for the transportation, storage, and disposal of fuel. The Commission didn't think, for example, R&D on or conduct of reprocessing operations was something that, even if it was recommended, it was something that this new organization should be responsible for. The idea would be to establish a corporation with a board of directors nominated by the President and confirmed by the Senate, and which would then select a CEO to head the organization. So, that's the type

of structure that they have suggested in the draft report.

The third recommendation is provide the nuclear waste management organization assured access to funding. And, I'm sure the gentleman sitting to my right knows a little bit about funding battles, and trying to get money for the nuclear waste program. And, the Commission believes that providing the access to the fund that was envisioned when the original Nuclear Waste Policy Act was established back in 1982 is essential to maximizing the chances of the programmatic success.

What the draft report includes is a recommendation for some near-term changes on the handling of the annual nuclear waste fee payments to try and make it easier for the organization to get access to the money and also make it easier for the Congress and the Administration to ultimately make the long-term changes that are going to be required to provide the secured access.

If you've got questions about the details of the near-term changes, I can go into them later. But, I'm not sure it's of any great interest. But, let me know.

Recommendation Number 4. This recommendation really grew out of the original tasking of the Commission and the first meeting that the Commission had where the Secretary of Energy came and explicitly said look, you know, 30 years have past since the Nuclear Waste Policy Act was enacted. He

asked have we learned something, or have we developed technologies, or what have you, that really could fundamentally chance the nature of the waste problems, so that maybe you don't need a disposal facility. So, we asked the Commissioners to take a look at that, and the Commissioners really concluded no, deep geological disposal is going to be required. Even if you engage in some sort of reprocessing, you know, based on the technologies that are either available today or reasonably foreseeable, you're going to have those types of waste streams to require that long-term isolation from people and the environment.

And, so, the Commission really felt like we need to get started again with a deep geologic disposal program in the U.S. Now, the Commission wasn't asked to, and hasn't passed judgment on the Yucca Mountain Project or on the merits of the decision to request withdrawal of the license application. The Commission simply said regardless of what happens with Yucca Mountain, one, they're trying to recommend a strategy that works, whether Yucca is part of it or not, and, two, they do believe you're going to need to site new nuclear waste facilities in the United States, and we're probably going to need, you know, if you look at the law the way it is written right now, Yucca Mountain is essentially full, so you would need to get started under the law with siting the next repository. So, in any event, you're going

to need to develop repository facilities, and get started with the process.

The next piece, or the next key recommendation has to do with consolidated interim storage. And, the Commission felt like there was real benefit to be derived from establishing one or more consolidated interim storage facilities, particularly as a way of doing something about the stranded fuel that's at shutdown plants, the shutdown plants I mentioned earlier. And, the Commission really felt like that should be first in line. That's the fuel you ought to move, once you have the capability in place and not just the physical capability of a site, but also the ability, the transportation system that you're going to need in place to move the fuel around. Then, you know, the presence of that capability, the existence of that capability provides you options for managing the back end of the fuel cycle going forward. But, the near-term priority was to move the fuel from the shutdown plants.

Recommendation Number 6 has to do with R&D, and the Commission really felt like it was important to provide stable long-term support for research, development and demonstration for advanced reactor and fuel cycle technologies, and for related workforce needs and skills development.

The Commission took a look at the R&D roadmap and

the other planning efforts underway in the Department of Energy, and generally thought that that was headed in the right direction, but made a few suggestions in that regard.

And, then, finally, the Commission really felt like the U.S. needs to continue to maintain some international leadership on things nuclear, especially when it comes to addressing global non-proliferation concerns and also improving the safety and security of nuclear facilities and materials worldwide. And, so it made a few recommendations in that area as well.

Some other things that didn't quite rise to the level of key recommendations, but other things that I think are noteworthy in their report. One, the Commission looked at the question of the current division of responsibility to the NRC, between the NRC and the EPA as it regards repository development. And, felt like that division responsibility was appropriate, but that the working relationship between the agencies can and should be improved, and made some suggestions in that regard. And, that the agencies need to get started developing new site-independent safety standards, and as they do that, they really need to solicit input from all relevant constituencies.

One of the things that the Commission heard a lot about was frustration amongst stakeholders, and especially trying to work through the NRC process.

Moving on to the next recommendation. The Commissioners really felt like the jurisdictions of relevant safety and health agencies need to be clarified and aligned, that we need to have new site-independent safety standards for protecting nuclear workers.

Next item, and this was of particular interest yesterday, and I think some of you at least have seen the article in this morning's Salt Lake Tribune regarding the Commission public comment meeting that was held yesterday in Denver. This recommendation here was, of course, a big topic of conversation there because one of the things the Commission is trying to do with these outreach meetings is to hear from affected or potentially affected state, tribal, and local governments to get their feedback on the draft report. And, do they think the Commission is provided the right type of guidance and enough guidance with respect to how the new waste management organization ought to work with affected units of government.

And, so, the Commissioners really felt like the roles and responsibilities of those sub-federal government agencies really need to be part of negotiation, and that the Commissioners didn't try to provide too much specificity up front because what they heard as they went from place to place was it's hard, really hard to predict at the outset what a state or a community is going to think is going to be

in its own best interests. And, whereas, one state may want, you know, a certain regulatory function, and another state may not want it at all. And, so, the Commission kept the recommendations in this area relatively broad and are now hearing comment, feedback from, again, these sub-federal units of government, and the Commission is going to sort through that and decide is there more detail that they can and should provide in the final report that would be helpful to move this along.

But, you know, a few principles. One was that all affected governments need meaningful participation in the process; that states and tribes should have authority over aspects of regulation of a storage or disposal facility; and that also, that the local, state, and tribal governments have a responsibility along with the federal government to work productively to try and advance the national interest and get a solution in place and a new strategy in place for nuclear waste management.

Regarding spent fuel storage, interim storage on sites, as we all know, interim storage of spent fuel at existing sites is going to continue for some time. The Commission didn't see any unmanageable safety or security risks associated with current storage practices, but really feels like active research is needed, drawing on a report that you all prepared I think earlier in the year, I wanted

to emphasize the need for that research agenda.

Speaking about the tsunami, earthquake and accident there at the Fukushima plant in Japan, of course when the Commission was preparing its draft report, things were really--there still wasn't a great deal of clarity regarding what had happened over there. The Commission believes that the best thing to do in this case is ask the National Academy of Sciences to assess Lessons Learned from Fukushima and to look at what the implications are, for example, for I think the report released in 2006, looking at the safety of commercial spent fuel storage, go back and take a fresh look at those recommendations in the context of what happened in Japan, and decide whether any changes need to be made.

Regarding the new organization, as I think I mentioned earlier, the principals that apply for decision-making for disposal facilities should also apply for siting, consolidating storage facilities and other facilities that are part of the nuclear waste management system. The Commission really felt like the siting process for developing these future facilities need to include flexible and substantial incentives for host communities that are willing to help solve this national challenge that we've got about spent fuel. So, the Commissioners really wanted to highlight that aspect.

Regarding transportation, this is an area, frankly,

that we heard a lot about in yesterday's meeting from states who would like to see more detail, more specificity and more guidance to a new nuclear waste management organization regarding transportation. So, I'd be interested to know if you all have any thoughts on that subject as well.

The current system of standards and regulations governing transport works well in the view of the Commissioners, and there is an excellent safety record associated with transporting nuclear material waste in the United States. But, these transportation campaigns take a long time to do the planning necessary, and so the Commission really feels like that's one of the things that needs to get started soon is planning for the transport at the start of a project for consolidated storage capacity.

While we may not know where fuel from shutdown plants is going to go, for example, we do know where it is, and you can start working, at a minimum, with those states to start getting a transportation system and set of agreements in place.

Next recommendation had to do with the ongoing litigation between DOE and the utilities. The Commission just urges that that be expeditiously resolved. I've cribbed a chart here from the Commission draft report that talks about some of the liabilities and expenses that the government has incurred as a result of its inability to take

fuel starting in 1998. You will see, for example, there's been $168 million in litigation costs through 2010, and that's just for outside experts and support. That doesn't count the money that's been spent on DOJ or DOE staff litigating these cases. So, the Commission urges that the utilities and the government work together and get that taken care of.

Regarding R&D, again, to emphasize something pointed out earlier, the U.S. really needs to retain its global leadership position in nuclear technology. Some of the details of where the Commission thought effort could be applied was in the safety and performance of existing light water reactor technology, storing and disposing of spent fuel and high-level waste, and, then, in what the Commission sort of felt game-changing nuclear technologies and systems, things that seemed to offer fairly significant improvements over what we've got now.

Let's have the next slide, if I could. All right, thank you.

One of the things that the Commission thought was important was to assign some of those RD&D resources for use by the NRC, especially as they look at novel nuclear technologies, developing the necessary regulatory framework is going to be obviously important, supporting anticipatory research by the NRC for novel components of advanced nuclear

energy systems would of course be useful. And, this will help to increase confidence in those new systems that may be candidates for commercial investment.

All right, so where do we go from here? The Commission, as I mentioned earlier, is engaged in an outreach effort to solicit feedback on the draft. The first of the meetings we had yesterday that we're co-hosting with regional state government groups, again, was in Denver co-hosted with the Western Governors Association. We've got meetings coming up in October, one in Boston, one in Minneapolis, one in Atlanta, and one in Washington, D.C., the first three of which we're, again, co-hosting with regional state government groups to solicit their feedback.

We're also doing invited talks, like I'm doing here today, to organizations that are interested in the Commission's work. The Commission has requested the comments be submitted by the end of October so that it has time to consider them before producing its draft report. The Commission may conduct other visits or meetings as necessary. There's nothing scheduled yet, but it's possible something will come up and, of course, that will be noticed well in advance if that in fact is the case, all leading up to the submittal of a final report to the Secretary of Energy by the end of January.

And, of course, if you've got feedback, the folks

on the Board, of course, know how to get ahold of us, or anybody in the audience who's interested in providing some feedback, brc@nuclear.energy.gov. It is a good way to get comments to the Commission, and you can also do it to the commission website at www.brc.gov where you can also find all the information. We've got video, archive of all the full Commission meetings and the subcommittee meetings, transcripts from all the meetings, the presentation materials, all the comments that have been submitted to the Commission, Commission papers, and a lot of other things. So, if you are interested, that's where to find me.

So, that's a brief summary of the draft report of the Commission. Thanks for your time. I look forward to hearing your thoughts.

GARRICK: Thanks, John. Okay, let's ask a few questions before we go to the next panelist. Andy, and then Ron.

KADAK: Hi John. Kadak, Board.

I guess you mentioned, the Commission actually mentioned twice on interim storage and on disposal expeditiously. I'm just trying to get a definition.

KOTEK: Well--and that's--actually, we've heard some comments on that as well, and I know that's something the Commissioners will go back and take another look at as they prepare the final. The thought I think they were trying to convey was there is an issue that needs to be resolved.

We've been trying to--working towards solutions at the back end of the nuclear fuel cycle for 50 years, and we still don't have a disposal capability. We don't have the capacity to any great degree to move fuel off the reactor site if you need to, or clean out a shutdown site, or what have you. Let's get going with it again. All right? That doesn't mean that you race to pick the site that you get developed the fastest. It just means get going.

KADAK: As a follow-up to that, the article in today's paper, the Salt Lake Tribune basically reports on the BFS project, and the governor is opposed to it apparently. I'm not sure, the Goshutes obviously are still for it, and in the context of expeditiously, did the Commission consider that site as a way to address many of the problems that you've highlighted here relative to the obligation, government obligation for spent fuel?

KOTEK: No. The Commission is not a siting commission. They're not looking at specific sites. So, I mean, certainly we tried to learn lessons from the experience, the State of Utah, and others have had with the BFS project. But, it's not looking at specific sites.

GARRICK: Okay. Ron?

LATANISION: Latanision, Board.

John, did the Commission look at precedence for the single purpose organization that has been suggested? And,

what are the attributes of such an organization?

KOTEK: Well, I think what the Commissioners were struck by was during its visits and reviewing extremely helpful documents, like the Board's report on the survey of nuclear waste programs in other nations, that by and large, you had single purpose organizations around the world set up for the purpose of nuclear waste management. Also, by and large, and there may be exceptions to this, but I can't think of any off the top of my head, those organizations were responsible for storage transport disposal. They weren't in the reprocessing theme, so to speak. So, the Commissioners sort of looked at that experience, coupled with the experience in the U.S. of, for example, that the struggles sometimes getting senior management attention on--within the Department of Energy on important issues related to the disposal program.

You know, within DOE, of course, you've got a whole lot of missions, and I think were you running somewhere between a quarter and a half a billion a year when you were there? Round numbers. Inside a $25 billion a year organization, I mean, that's just not--you're not going to get the type of attention from the highest levels of the organization that you really need. So, the Commission really felt like breaking it out and establishing an organization where that's the mission, gave the organization the greatest opportunity for success. Not that you couldn't do it other

ways, you know, and again, Ward and others, you know, did some really good things, you know, got a license application submitted. Within the DOE system, it's, I think the Commission just felt like the balance of the evidence sort of weighed in favor of moving it outside.

LATANISION: Just a follow-up. In terms of the attributes of such an organization, I mean, it would seem that having a major social science agenda would be an important part, given, for example, what we have seen in Sweden and Britain, as an example.

KOTEK: Yes. And, one of the things that is in the report is talking about the need to ensure that you pay attention to the social science aspects of this challenge. And, I'll need to go back and maybe while Ward is talking, I'll get the specific quote out of the report where they talk about the need, for example, through the Board of Directors, or through an advisory committee, to insure that you have that sort of input into the process.

GARRICK: Okay. Henry, and then I think we'll--well, one more question after that, I have, and then we'll go onto Ward Sproat.

PETROSKI: In your first recommendation on siting and development, you have one of the bullets saying it should be standards and science based. Those of us who are engineers, think that development is largely an engineering problem. It

is science based, of course, and I respect my science colleagues here, but, getting engineering more visible at the idea of developing these sites I think is very important. Later in your report, you also mention an NAS report. There is a National Academy of Engineering also that has an interest in these problems, and that has a perspective that is a little different, but also they enjoy the same goals.

KOTEK: Great, if you want to point me to that NAE report, that would be very helpful.

PETROSKI: Thank you.

GARRICK: John, I know you don't like to speculate and you probably won't, but what do you expect to be the primary issues, or the primary differences, between the draft report and the final report?

KOTEK: You're right. I hate to speculate. No, I mean, there were certain areas, for example, the Commissioners assigned the disposal subcommittee to at least think about this issue of commingling defense and commercial waste. Okay? So, that will be an area that I expect the Commission will have more to say. The Commission is hearing a lot, and intentionally so, from state, tribal, and federal government and NGOs, you know, other people who may have some insights to offer on how you work effectively with state, tribal, and local governments to build a program that is credible and sustainable over the very long-term. So, we're certainly

getting a lot of input in that area, so that's an area that may be ripe for some changing. So, those are two right off the top of my head. But, we're getting more and more comments in every day, and I'm sure there will be other things that are pointed out that the Commissioners may decide they can improve on.

GARRICK: All right. If you don't mind, if you can hang around, we'd probably have some more questions at the end of Ward's presentation. So, I thank you.

KOTEK: I can't wait to hear what he has to say.

GARRICK: Okay. Ward?

SPROAT: Good morning, everybody. You know, it's hard to believe it's been three years since I talked to this Board the last time. And, things have changed a bit since then.

I want to make it really clear. I'm here this morning at the invitation of Dr. Garrick. I'm not here representing my current employer or any of our clients, and I'm here to give you my personal opinions, based on my review of the draft report. And, what I'm going to try and do today is kind of give you my overview of what I took away from reading the draft report, and I hopefully give you a balanced perspective on that report, both in terms of the very positive things they have in it, but I think you are going to see, I have the opinion that there are two big elephants in the room that the report doesn't address at all, and I'm

going to be pretty specific about those as we go forward. And, I'm going to give some recommendations on how I think the report needs to--what I think the report needs to address in its final version.

Go to the next slide.

So, general conclusions. I'm going to talk about each of these in a little more detail, but overall, the Commission and the process they followed I think is exemplary. They've had a very wide range of participants, both experts, non-experts. They've had hearings. They've had public meetings. They've traveled internationally. I think in terms of the process they have used and how that's been managed, I think had been outstanding. And, I truly do believe they have really tried to listen to the people who they have heard from.

I was asked, and I gave formal testimony to the full Commission. I saw in the report things I specifically felt were important that are addressed in there. So, I think in terms of what they have tried to do, and the process they have used to try and take this very difficult and multi-faceted problem, I think they have done a very, very good job with that.

They have a number of very specific recommendations that I'll cover a few of them, that I think are very appropriate, and they've got some very good potential

solutions. However, these last two bullets I'm going to talk about in a little more detail, are the two elephants in the room I talk about.

The report, I believe, generally ignores the whole issues of Lessons Learned from Yucca and what should be done with them, regardless of whether or not the repository is built. I'm not advocating that we ought to build the repository, but given we have had three plus decades of scientific and engineering work that are embodied in that program, not to have a recommendation or a set of recommendations explicitly addressing what should be done based on that I think is a major shortcoming of this draft.

The other thing, quite frankly, is this last piece, which as I read through the draft, I got about a third of the way through it and I said, "You know, I can't remember seeing the word politics anywhere in this report so far." So, I started counting, I didn't do an electronic word search, but I found the word "politics" or a derivative of it only three times in the report. And, all of us who have been involved with this program know that's a big issue, and this report has to hit it straight on. And, I'm going to be a little more specific about that as we go forward.

Go to the next slid.

So, in terms of the process itself, I think that it was very thorough and very wide ranging. As I said, they

really tried to obtain a lot of first-hand witness testimony from a wide range of stakeholders. They generally--generally did a good job at researching historical reports and the legislative record. I have some exceptions to that around some OCRWM reports I'm going to talk about here in a few minutes. But, they did a very good job, particularly in the area of the Nuclear Waste Fund and access to the Waste Fund and understanding the history of how we got from what the original intent of the law was, to how it's operating today, very good description in that report about how we got there and how it needs to get fixed. So, I think they really did try to understand in certain aspects of the program what needs to get fixed, given how we got there.

They did a lot of traveling internationally to talk to the international programs, a wide range of expertise, and I think they did clearly try to listen to what they heard. As I said, I felt that based on what I told them in my formal testimony, I saw some response to that in the draft report.

Next one?

So, I do think they did a very good job at addressing, and at least putting on the table, a number of the major issues with the program, the first one being financing and access to the Nuclear Waste Fund. The report does a very good, as I said, a very good explanation of the Nuclear Waste Fund, its history, and why it is now

disconnected from program management. It also talks about and provides some very specific recommendations about how the nuclear waste fee collection process should be changed, and how it should be managed, given the political realities of the program.

And, while there may be some tweaking that I might do, the recommendations, they've made some very credible recommendations I think are very well thought out. Part of that is they talk about the potential for establishment of escrow accounts, which is an interesting concept. However, in this area where I think the report is pretty short, is it does not talk about the adequacy of the fee or the Fund, given some of the recommendations that they make in the report, particularly regarding repositories and centralized interim storage. And, so, that is a shortcoming, and I will talk a little bit more about that in a few minutes. But, in this one area, the whole concept of fee adequacy has been pretty much ignored in the draft report.

In terms of management of the program, the recommendation to establish a Fed Corp, or something like that, kind of a model of TVA, there has been a lot of discussion over the last decade about that, and it has become more intense over the last several years. Certainly a workable solution has been proposed in the report. Obviously, the devil is in the details, and I have testified

in front of Congress on this issue, and what I told Congress was this can be made to work, but it all depends on the enabling legislation and the details in that legislation that sets that Fed Corp up, and the power it's given, the responsibility it's given, the access to the waste fee it's given, how it's isolated from the year to year political process, and that's key.

So, the Fed Corp concept, I think, can be made to work, but it's going to be really determined by the enabling legislation that sets it up.

The report also talks about the siting process, and talks a lot about an adaptive, consent-based siting process. Sounds really good. It is the ideal. And, there is a significant amount of space in the report that's devoted to that, but I really do think it has missed some of the real issues, and it has to go into the political realities of what is involved in the siting process. And, that's why I'm going to talk about that in quite a bit of detail here in a minute.

Covers R&D, which is very appropriate. This is obviously a multi-decade program that R&D is needed for as the technology evolves. Talks about regulations. The one thing it talks about, both the NRC's role, the EPA's role, the role of various state and local government agencies and tribal agencies. It may not have been the intent of the report, but when I read it, I got the impression that the

report's recommendation says, in terms of regulations, we ought to start over. I fundamentally disagree with that, but that's the--and, that may not be the intent, but that's the impression I got from the report, because essentially we have decades of a process of where the regulatory requirements for this program have developed, and we've gotten pretty much to the end point of that to see whether or not that regulatory process gave us a workable set of criteria or not. And, I think we ought to find out whether or not it did before we decide we've got to start over again. And, the report just seems to assume that we needed to start over again with a whole new regulatory framework, and I think that's really wrong.

It talks about centralized interim storage in quite a bit of detail. And, all of us who have been involved with the industry over our careers recognize that in theory, I'm underlining the word "theory," that it should be easier to establish centralized interim storage, take stuff from the shutdown sites, spent nuclear fuel from the shutdown sites, and move them to that centralized interim storage. All I will say is our attempts in this country to do that so far have been an abysmal failure. So, I don't buy the argument that it's going to be simpler and it's going to be cheaper. I just don't. The history, the experience doesn't support that premise.

And, oh, by the way, we can't afford to do that with the existing Nuclear Waste Fund. So, there's some real issues there that need to be addressed in the final report.

It talks about international engagement and the need to maintain U.S. leadership in that. I really think that is very important. Unfortunately, the report doesn't address what DOE has done over the past decade plus with the international community. There is a brief reference in the report to EDRAM, which is the group that was formed by the western countries and the leaders of their nuclear waste disposal programs. I participated in that during my time in office. And, we were seen as the leaders in driving the repository program forward. And, so, we are and we were very heavily involved with that, and I think the report needs to at least acknowledge that.

And, then, finally, it talks about the litigation and says we need to go settle that. And, some of us have been involved with that for quite a while, and we will see how that works out.

So, in terms of, I think, the recommendations in the report that are pretty specific and very appropriate, talks about forming a new organization, the Fed Corp, I think that is right spot on. Talks about access to the Nuclear Waste Fund for that organization. There is a very good discussion in there about, like I said, how we got to where

we are, and some recommendations about how we handle mandatory versus discretionary receipts and appropriations, which has to get fixed.

What it doesn't quite talk about is, so there is a huge, and John talked about it in his comments, about this huge and growing backlog of liabilities the Federal Government is looking at in terms of the not performing on the standard spent fuel contract. How that gets addressed and who gets that liability needs to be addressed as part of setting up that Fed Corp. Because if that Fed Corp gets saddled with that liability, it ain't going to be successful. So, how that gets set up, who owns that liability, how it's going to be funded, that needs to get addressed in the recommendations.

A recommendation says you need to develop a deep geological high-level waste repository. It was very nice to see that because those of us in the program have been saying that publicly and in testimony to Congress for years. But, now, it's in the Blue Ribbon Commission report, so it hopefully gets some visibility and recognizing again. Very good set of recommendations around that.

Talks about resolving the litigation. Modifying the fee collection process and gave some very specifics about using escrow funds. But, again, it doesn't address the issue of fee adequacy. And, fee adequacy is a major, major issue

for this program, because all the recommendations that are embodied in this program, and the time needed to carry them out, all have a cost, and that cost isn't going to get borne either by the utilities, the taxpayer, or both. So, it can't be ignored as part of the equation of coming up with the recommendations.

This bullet, you know, striving to use an adaptive, consultative process with stakeholders for siting, it is a very good recommendation, and there's a lot of good discussion in there, and it's based on a lot of the feedback and input from the people who talked to the Commission. It doesn't go far enough in terms of how do you make that happen, and I'm going to give you a few recommendations here in a minute about how we do that.

And, then, future nuclear R&D for novel advanced systems is also talked about in there, and I think that's appropriate.

So, let me talk about my two elephants in the room that aren't addressed in the report, at least from my perspective. First, about I think the report just ignores the whole concept of trying to get Lessons Learned, specific Lessons Learned out of the Yucca Mountain Program. The first one is so there's no recommendation about what should happen to the License Application. So, think about this, we have a law that's now almost 30 years on the books, that mandated a

process, and that law said take it all the way up to the point in time of submitting a License Application and having the NRC rule on it, and that's where we are. We followed it all the way through, and it's now stopped. And, I will tell you that I don't know if Yucca will ever be built, I'm certainly not here advocating that we need to go build it now, because I don't know. There's a lot of barriers in the way of doing that. I do know that as a country and as a lot of very intelligent, dedicated professionals over the last 25 years, or so, people have taken very seriously executing the legislative mandate to go put a License Application together to see if we can actually license a deep geological repository in this country, and that's where we are. And, we stopped.

And, so, for the Commission just to ignore that and not make some specific recommendations about what should happen with that process in terms of whether it's on one side of the spectrum, just taking the TERs, evaluating them and using them, which is a pretty innocuous recommendation, to recommending the License Application be fully prosecuted through the NRC with a final conclusion made, and then the conclusions from that taken and factored into what happens next, that's got to be addressed somewhere in this report, and it's just mute on the issue right now.

And, as a result, many of the technical and

regulatory issues that we have all wrestled with, you know, in terms of burnup credit, and all sorts of other esoteric stuff that the national labs took the leadership in trying to resolve over the years, at least we'd have some closure on the issues to know if we were on the right track or not, so just to ignore that and just to let it all drop makes no sense to me whatsoever. So, I think the report needs to hit that head on.

The second thing I found--actually, the only part of this that I found disappointing, personally disappointing, was in 2008 in OCRWM, when we were finishing the License Application, you know, we knew, I knew, that the program was going to face a set of decision points going forward, regardless of what the outcome of the License Application review was, so we made a decision that we had a group of people in OCRWM and in the national labs that worked on this program for 20 plus years, and we wanted to try and summarize all of the key issues around the program, besides the License Application, in a series of reports. And, so, we put together a formal report on the TSLCC, which is the Total System Life Cycle Cost estimate. What it's going to cost the country to take care of spent nuclear fuel.

We put together another report that based on that, what's the fee adequacy, and what are the assumptions of whether or not the 1 mil per kilowatt hour fee is going to be

adequate or not, we put together a pretty detailed report on centralized interim storage, what the legal aspects and issues were, what the political aspects were, and what the cost aspects were, and the transportation aspects were, and, with a whole report on that.

And, then, we also put together a report on the need for a second repository, and why there might be a need or may not be a need for a second repository, and what made sense in terms of how to address that issue in legislation going forward.

So, we have a compendium of reports on the record that are less than three years old that cover all of these aspects of the program, put together by the people who knew best all of these issues, and they have been, from what I can tell, they have been ignored by the Blue Ribbon Commission. And, I think that's totally wrong. They have to be at least looked at, acknowledged, and some of the conclusions in them either the Commission says yeah, we saw their conclusions, we think they are wrong, we ought to do something else, or they go yeah, pretty good conclusion, we need to factor that into our recommendations of how the program goes forward. But, to ignore them or pretend they didn't exist, I think is totally wrong.

Another part about this, about Yucca, is it ignores the history of the DOE/Nevada relationship and the

implications for future siting. And, what I mean by that is that, and I'm going to make this point over and over again, particularly on the next slide about politics, you know, when we talk about an affected unit of government, whether it's at the state level, the county level, the city level, the tribal level, we've got to be clear about who we're talking about, number one, and, number two, what time frames, and as we set up a process, we have to recognize that this process of developing a repository, or centralized interim storage, is a multi-decade long process. And, whoever is sitting across the table from Fed Corp or DOE or whoever it is, at the beginning of that process, ain't going to be the same people who are sitting there five years later, ten years later, or 15 years later.

So, in the case in Nevada, most people don't know this, but we've testified--I testified in front of Congress in this in one of my formal testimonies--but, you know, the State of Nevada legislature passed legislation back in the Eighties inviting DOE to put the repository in Nevada, in exchange for a solar demonstration park. This was formal federal--I'm sorry--formal state government, you know, passed by both houses in the state legislature, signed by the governor, saying we want the repository in Nevada. So, here we are now.

So, there is history here that says whatever

process you set up that's adaptive, that's consent-based, needs to recognize that it's a--that the time constant for the siting process is different than the political time constant. And, that has to get factored into this somehow.

Last piece was I don't think the report really gives DOE and the program enough credit, nor does it draw enough conclusions from the work that DOE did with the affected units of government, the transportation stakeholders, and the international programs. We had a lot going on in those over years. We made a lot of progress in those areas in terms of working with, you know, on the transportation side, with the affected units of government. We made a lot of progress, a lot of Lessons Learned, and quite frankly, a number of the recommendations in the draft report, we had already implemented and were implementing in these programs. Having the draft report, should take a look at what we did in those areas, what worked well, what didn't work well, and be a little more specific about what should be done differently, if anything, in those areas, given the experience that we really had. Because, you read the report, it's almost like well, we didn't do any of this, and that's not the case at all. We were very heavily involved with the AUGs and the transportation stakeholders.

SPEAKER: Do you mean to skip the two before that?

SPROAT: I'm sorry, which--oh, no, I didn't. I got so

excited about the last two.

The issue about centralized interim storage that's brought up in the report, which again talks about the need to move fuel, it got talked about very briefly this morning, but what a lot of people don't recognize is that for many of the shutdown plants that have spent fuel in casks sitting on pads, those casks are not transportation licensed, which means they've got to be repackaged. So, how you repackage them, where you repackage them, get them in, the ability to be transported to whether it's a centralized interim storage facility or a final repository, is not a trivial issue. And, it's something that the report needs to at least address, because it has implications in terms of the fuel handling facilities that are needed to be able to repackage at locations to get to that site, and has implications for cost, has implications for just the political feasibility of doing that. So, that's an issue probably that needs to have a little more clarity in the report.

This other piece here about trust, the report does, I think it does a very credible job at talking about the issues that all the stakeholders told the Commission about their issues of trust with the Federal Government. And, as a matter of fact, I think that was one of the key things that came up in the meetings yesterday, and it was talked about in the paper, where people said we just don't trust the Federal

Government to do what they said they were going to do. Very legitimate issues.

And, when you take a look at where we are on this program today, the government has gone all the way through executing the process, albeit really slow and really hard and really difficult, but we've gone all the way through the process mandated by a law that says submit a License Application and have the NRC rule on is it adequate or not, and we stopped, it seems to be a pretty big trust buster to me in terms of how the public might perceive the Federal Government. Given that the report has legitimately raised the issue of the trust factor, having it talk about, with some honesty, about the potential impact of withdrawing the Yucca License Application on the trust, that the local, states and communities have regarding the Federal Government's ability and willingness to go and execute this program per the plan and per their commitments, I think ought to be addressed in the report.

Thank you for pointing out the two I missed.

So, let me go to the political realities. As I said, I only found the word--something I could do in an electronic word search, I'm sure it's more than the three I found, but I bet it's not too much more than that.

So, the report, there's a very heavy focus on a consent-based process for siting both a repository and

interim storage, and I think it's very idealistic, because our history tells us it ain't going to be that easy. So, it talks about consent, and having consent-base, so, the first question I would have is the report needs to be a little clearer about so who gets a vote. Whose consent is needed? And, when you take a look at--and, in a lot of the discussions, it talks about the local community, the host community, which is very, very appropriate.

And, you know, the examples over in Sweden, it's the host communities, the local communities that were really the key decision-makers that said they wanted it. What's happened in this country is that host community has been expanded by stakeholders that go out exponentially to all levels of government, both at the state level, the county level, and the surrounding state level. So, when you take a look at, for example, our experience with PFS, here you had not only a willing local community, it was a sovereign nation, the Goshute Nation, but the stakeholders beyond their borders, said you know, we don't want you to do that. And, so, through a political process, they were able to stop that project.

And, so, in terms of being really clear in the report, so who gets a vote? I think the Commission needs to be a little more specific about that.

The second thing is so, how long do they get to

change their minds? So, you know, people can come in and say it looks pretty good to me, and, you know, you go through this adaptive process, how long and when do you get to a point where you say decision is now. Yes or no? And, when you make that decision, yes, it's now irreversible. If you don't have that kind of definitive timelines on your decision-making process, good luck.

You know, you have to just recognize, as I said before, the time constant of the siting process versus the political process. Like I said, who you're going to have sitting across the table from you today at the start, isn't going to be the same persons sitting across the table from you ten years from now, 15 years from now, 20 years from now, and the process has got to recognize that.

I've used this term before of a technically informed political process, and I think unless we as a country step up and really acknowledge that's the case, we're fooling ourselves. You know, because while the report talks very heavily about an adaptive, consent-based siting process, it doesn't address so how do you balance that with the technical adequacy and suitability of a site.

You know, I could just take, for example, you know somebody used the example once to me that, you know, we could have the most perfectly--the best technical geologic site in this country, it could be right under downtown Chicago. What

are our chances of putting one in downtown Chicago? Zero. On the other hand, we might have a community that goes we want it here, we love it here, it's great, and it's a swamp. You know, so how do you balance the technical aspects and the political aspects and recognizing you've got to do both? It's got to be in these recommendations somehow, because it is a technically informed political process. No doubt about it, in my mind.

I do think the report incorrectly assumes that siting and operation of a centralized interim storage facility will be easier and faster than a repository. I have seen no evidence of that. I don't believe it. And, I know that based on the fee adequacy report that we did back in 2008, we can't afford to do both under the current fee regime. So, that's got to be addressed.

This next bullet, you know, regardless of location, I think part of recognizing the process, what you have to recognize in the process, regardless of where you put it, there's going to be some core set of people, for their own reasons, are going to say we're going to stop this, whether it's because they don't like nuclear power, because they're afraid that transportation is such a big issue. We can't be idealistic and just assume if we get everybody involved and we get everybody talking and everybody plays, eventually everybody will see the beauty and the wisdom of the concept

that we have come up with, and they're going to want to let this happen. It doesn't work that way in this country.

So, the reality is is that you've got to recognize you will have a set of people, some of whom will be stakeholders, that just say no. So, what are you going to do about it? At what point in time does the national interest outweigh local potential opposition? And, that's a question I believe the report absolutely, positively has to answer, because right now, it's mute on the issue, of national interest outweighing local responsibility.

You know, if people were to ask me so what would you do about that? As I have thought about this, I kind of like there's what I recall stages of public resistance, based on my experience, both try and site nuclear power plants, and repository facilities, and you think about it there's kind of like five stages of public resistance, and somehow the report needs to recognize this and figure out a process that adapts or works with these stages.

And, you say, well, the stages, you know, the first stage is people hear we're going to go do a repository, we're going to build a nuclear plant, we're going to build a new refinery, or whatever it is, it doesn't have to be nuclear, and so the first stage is people are going to do investigation. They're going to go what is this thing, and they're going to learn about it. So, the first stage is

investigation of what is this thing that's going to come into my location.

The second stage is you know what? I don't want that. They're going to make a determination that no, I don't like it, I don't want it. So, now you've got somebody who has already decided not for me.

And, the third stage is they decide they're going to fight it. At some point in time during that process people start to recognize, you know, this is inevitable. We're going to stop it. Either we're going to be successful and we're going to kill it, or if the process keeps moving and they go, you know, this looks like it's inevitable, it's going to happen, so let's negotiate and see what we can get out of it.

And, then, when that negotiation takes place, as that goes forward, but goes well, then you get to a point where you say, you know, you've got some willingness of the people to participate, to actually participate. And, whether you negotiate their oversight, their involvement, however you do it, but they finally get to that point where they recognize the inevitability, and they go I'm willing to play with you.

And, then, finally, once they're in playing and they've got that oversight, then eventually, they get to a point of acceptance.

I've seen that process repeat itself over and over and over again, and this process here has to recognize that's part of the reality. People just don't go from, you know, from I learned about it and now I'm happy with it and I accept it. Some people do. A lot of people don't, and we've got to recognize that.

Last slide?

So, a couple recommendations that I think ought to go in the report. One is complete the licensing review of the application before we do anything about changing the regulatory regime. When I read the report now, at least as I interpret it, I may be wrong, it's like we ought to go back and start from scratch in terms of our siting criteria, our regulatory criteria, I go phht, stop that, finish the review of the License Application, let it get adjudicated, let's find out all the things we did right, all the things we did wrong, then make decisions about how the regulatory regime needs to change and then put the experts to work and let them do it then.

If it got approved, if the License Application got approved by the NRC, that's no--I have no confidence that on its own is going to let Yucca get built, or another repository get built.

The next step is all right, Congress is going to have to do something with the NWPA to implement a lot of the

recommendations that are in the report to let something get built. So, the next step I would recommend that the Commission recommend is let the LA get adjudicated, let it get finalized. If it gets approved, great. Then let Congress put together a legislative package for the next steps in the program. If it doesn't, then we need next steps in the program going back to what's Plan B. That's my recommendation, and the report I think should say that.

Number two, the 2008 OCRWM reports that I referred to before, I think need to be looked at, evaluated, and factored into the recommendations here. Because, right now, I don't think they have been really evaluated. And, what my intent was in sponsoring and getting those done was that there would be a body of work done by the experts that could be drawn upon as the program went forward. And, to have that ignored, I think is a mistake at this stage of the game.

Third bullet is around this adaptive consent-based process. And, for those of us involved with organizational decision-making, we know there's a range of decision-making models that you can make. I think the report has got to be explicit on when we say consent-based, what do we mean. You know, if you think about decision-making, you know, it ranges on one end of the spectrum of being very directive, we're going to do this, you're going to do that, go do it; to delegate, you know, where people say you've got it, you

handle it, go do it.

But, in the middle, there are a couple different ways that decisions are made. One is the consensus-based, where we say hey, look, we're going to get people together, we're going to talk about this, and we'll only go forward if we've got everybody in agreement that they can live with it, not that they're in agreement to go forward, but nobody is saying over my dead body. You've got a consensus of nobody is saying no over my dead body. Is this going to be a consensus-based decision?

Or, is it a consultative-based decision, where clearly somebody is identified as the decision-maker, and it's clear that they get 51 percent of the vote. Everybody gets to weigh in, everybody gives their opinion, everybody talks about it. But, eventually, there's one person, or one organization that has 51 percent of the vote and makes the decision. That's a consultative-based decision-making model.

This report needs to talk about is that what we're talking about here, or not? Because who makes what decisions and what authority they have to make those decisions is absolutely critical and key to this program going forward.

That next to the last bullet I talked about already about the report needs to explicitly acknowledge and recommend how to address changes in stakeholder acceptance over time, because you're not going to have the same

stakeholders playing over a 20 year period. You're not.

And, finally, the last piece is there should be some explicit recommendations about how to balance the technical suitability of the site versus the consent for the siting.

So, with that, that's the conclusion of my presentation. And, John, I would be more than happy to entertain comments or questions from the Board, or anybody else.

GARRICK: So, how do you really feel?

SPROAT: I think we did a good job.

GARRICK: Yes, thank you.

ARNOLD: I have the frustration in that past history of the Nevada Test Site has generally been ignored, and it's legacy of weapons testing, et cetera, and I think that has implications for the federal decision making process. I'm just going to leave it at that. But, I don't think either the report or what you said has acknowledged this. Yucca is only a part of a very large area in which a lot of nuclear things have happened in the past.

The second little comment is that the CIS could be in fact combined with the repository as one issue, and as you're saying, it's going to be as difficult anyway, you might as well tackle them both at once. For example, the aging pads and Yucca could have been also the interim

repository, interim storage.

SPROAT: I have left the Board speechless. Is this amazing?

GARRICK: Go ahead.

LATANISION: Latanision, Board.

Ward, I appreciate your point about the fundamental disconnect between the political time constant and the time constant to construct a large nationally important project. And, yet, you know, it seems to me the fundamental point-- there are a couple of fundamental points. One is that politicians do change their mind, and we see it in every election cycle, presidential election cycle. Whether for good purposes or not, they do change their mind.

SPROAT: Yes.

LATANISION: But, it also suggests to me that given the nature of our political process today, in a technologically intense nation and society, to have such limited representation on the part of technologically sensitive people, is fundamental to the problem you're describing.

SPROAT: Could be.

LATANISION: And, so, how do we change that? I'm not sure I can see a change on the horizon given the need that you describe, unless there's some change in the attitude of people who are elected and presumably representing societal interest. How do we change that?

SPROAT: I'm not sure I have a very good answer to that. I know this Board, I think when this Board was chartered, the intent was for this Board to have some of that influencing capability back into the Secretary of Energy and the Department under him or her, to be able to, you know, provide that technical, independent technical expertise and influence about the direction of the program and some of the technical issues in it.

LATANISION: Yes. You know, just to make one corollary comment. If you look at the NRC, the Commissioners, I mean, even there, these people are technologically smart, by and large--no comments please--and yet, you see how so hamstrung they are to make a decision and follow up--

SPROAT: Sure.

LATANISION: --on a recommendation like the one you made on following through with the License Application review. They should be able to do this. They are technologically, that's the kind of organization that should be responsive, and then some. There's something really wrong with the system, and I think we all agree with that, but how do we change it?

SPROAT: I'll leave that for Andy to answer.

GARRICK: Ali, and then Andy.

MOSLEH: Mine was a very quick follow-up on this one. I think you pointed out something that is really fundamental

and very, very important, and it really goes beyond just a nuclear waste issue in terms of how we make decisions and the time difference between the political process and then the technical progress. But, when you talk about recommendations, as Ron said, people change their mind. So, unless there is a reward and penalty kind of a system built into this, it would be hard to just, you know, change the system. Is that the type of thing that you have in mind, you are thinking about?

SPROAT: I'm viewing something not necessarily in terms of penalties, I'm thinking more in terms of definitive time frames or milestones that you get a vote--that whoever the involved stakeholders are, they get a vote up until a certain period of time. Like take, for example, in Sweden, the Swedish program right now, once the decision was made between Oskarshamn and the other town, I personally don't know what existing Swedish law says about their ability to back out at this stage of the game, but I bet basically it's a fait accompli. So, being clear about what the decision milestones are and the irreversibility of those decision milestones, or how they can be overridden, I think is really important.

I think the Nuclear Waste Policy Act tried to do that to some extent when it recognized that if DOE proposed a site, that the governor of that state had a veto right, and that veto right could only be overridden by a vote of both

Houses of Congress, which it did. So, the Nuclear Waste Policy Act put in a very explicit process for, you know, trying to put milestones and deadlines and final decision-making authority about deciding in that case.

You know, we could argue about whether that was the best way of doing it or not. I won't go into that argument now. But I'm advocating something like that needs to be done. It needs to be in place for that kind of a siting process.

GARRICK: Andy?

KADAK: Kadak, Board.

Ward, I share many of your concerns and comments. And, the surprising fact is that given the two co-chairs of politicians, and the fact that they ignored the political implications of how to get something done, is really troubling to me. And, I commented to them privately as well about this siting process, of being adaptive, consultative, and without sufficient details as to how to implement such a process, and how to make it stick. And, I think this is a real shortcoming, because otherwise, we're going to be in neutral for a very long time.

SPROAT: Yes.

KADAK: And, the whole question of siting and interim storage facility being somewhat easier than a repository, it's fantasy. When we did the report on interim storage, it

was very clear, and we did an in depth review of the volunteer siting process, and that was about as open and transparent as you could get, and it didn't work, and it was admittedly a failure. And, the problem was that who was the decision-maker? Is it the local community, or is it the state? It's always been the state that's opposed it. And, how do you balance that is something that I think the Blue Ribbon Commission needs to address in their report, because otherwise, as I say, we are just going to be stuck without having any path forward.

And, my facetious question about what is expeditious is real. Expeditious to start a process as opposed to expeditious to solve a problem, and I think that perception and that I'm going to call it urgency to do something is not there. That's just a comment, not a question.

GARRICK: Let me ask a specific question. You indicated, Ward, that you kind of favored the idea of a Fed Corp. How would you rate that approach versus a tightly highly oversight private approach?

SPROAT: Again, John, it would depend on how the two are set up in terms of--how the Fed Corp was set up in terms of enabling legislation. But, the key thing is is that in terms of our--the country's places to put this stuff, it is more likely to happen on federal land than privately held land, I

believe, number one. And, number two, the authorities that are needed to make this--to drive this process to conclusion, I believe would be almost, not totally, but almost beyond the capability, at least in the initial phases of the program, for a privately held company.

Now, I know over in Europe, you know, whether it's in France or Sweden, those are private companies that are--basically, the government said utilities, you're the generators of this, you've got to figure out how to manage it. And, they gave them a very high regulatory framework. And, you know, they've over the past 20 years or so, they've done that. Those areas don't have the same kind of what I would call political network that they have to navigate that we do in this country, number one. And, number two, given the existing legal frameworks of the Federal Government having the legal authority and responsibility for managing high-level nuclear waste and spent fuel, there are a lot of legal issues that would have to be addressed, than it would a privately held corporation.

Right now, I just don't see a clear success path, at least at the beginning of the program. If we got to a point we had a repository and now we were going to go build it and operate it, I think a privately held company could do it extremely well. But, in terms of this initial phase of where we are, getting the initial repository licensed and

sited, I think it's got to be a Fed Corp of some sort. That's my personal opinion. Plus, the aspects of the transportation, because nuclear waste transportation in this country is a federal level set of issues, and I think a Fed Corp would be in a better position to actually manage that.

GARRICK: Yes. I have one more question, and then Henry. I came out of a reactor analysis business pretty much, and I think one of the things that was really surprising to me when I got into the waste business was the lack of presence of the utilities, at least in a leadership role. In just about any role that you could think of, whether it was their activity with respect to participating in National Academy of Science committees, things like-- Boards like this, oversight organizations, or what have you, it just seemed like once the DOE, unless the waste law said that it was DOE's problem, that the utilities backed away and did not bring to the party the real expertise that was needed to establish a basis for making sound decisions.

And, you're out of that industry, what's your view of that? And, how involved are they, for example, in reviewing the Blue Ribbon Commission report, and is there any targeted or organized attempt to do that except I know through the Energy Institute, they try to do all these things, but I've never been that impressed with that as the primary mechanism for the utilities' involvement.

SPROAT: Well, I think, John, my first suggestion is hold that question for Adam Levin, because Adam is that guy for Exelon, and I think he will be able to give you a much more up to date and current answer than I can in terms of--

GARRICK: I was going to compare the answers.

SPROAT: Adam and I are friends. I wouldn't do that to him. But, you know, speaking from my own experience, you know, having been involved--I first got involved with spent nuclear fuel back in 1998 and '99 when we did the first settlement with DOE on spent fuel for Peach Bottom. And, I can tell you it's a frustrating process, because the ability of an individual utility, or the industry to be able to engage the Federal Government, Department of Energy, Department of Justice, Department of Transportation, EPA, on these issues is extremely limited. We just don't have--that capability doesn't exist, even when you're in DOE as an office director, your capability to influence some of that is actually pretty limited. But, there is not a good avenue for the utilities to actually make progress, and after a while, they just get frustrated and say, well, we're going to take them to court and maybe the court will force them to do something.

GARRICK: Yeah, not a very good approach.

SPROAT: No.

GARRICK: Not a very good approach. All right, Henry?

PETROSKI: In your presentation, on the slide that you acknowledged that the report addresses major issues, you identify one of the major issues as R&D, but you passed over it without elaboration or comment. Could you elaborate and comment on now what you see as the role of Research and Development in a large project such as Yucca, where you had direct experience?

SPROAT: Well, we had, you know, when we did the License Application on Yucca, there were a number of issues that in terms of spent fuel characterization over long periods of time, whether or not, you know, for example, the drip shields really would be needed or not, so I viewed the R&D program long-term, in terms of taking what we learned from putting the License Application together, the areas of greater uncertainty that had potential for both cost savings and being able to better characterize long-term repository performance, and making those the focuses for the areas of R&D going forward.

PETROSKI: So, basically, you are seeing the end product driving the research?

SPROAT: Yes. Yes, the research to further define whether or not, you know, we made some bounding assumptions in the repository design, like, for example, on the drip shields, that based on what I saw and what I knew and what people told me their preliminary analyses were, we'd probably

never need to put them in. We just wouldn't need them. But, the period of time needed to do some confirmatory testing and in situ testing, you know, would be on the order of decades, and having an R&D program to do that wouldn't make sense.

GARRICK: Good example. Very good example. Ron?

LATANISION: Ward, as we've been talking, I've been trying to imagine a large scale public project that has weathered a political process over decades and seemingly been successful, at least to the extent that it's ongoing today, and that is the effort to build a new water distribution trunk in the City of New York.

Now, you know, I'm not sure even how many New Yorkers understand that that's being built, but it is, and there is a need. People take for granted that when they turn on their faucets, they're going to get drinkable water. People also take for granted when they plug in their television, they're going to get sound and audio and visual. Maybe there's a message there. Maybe the need, the public's needs, they understand they need water. They also should understand that they need electricity, but somehow we're not making the same connection.

What can we learn from that? Is there anything you can see in terms of that process and the issues of concern in terms of the need to handle the wastes that we produce, when we also generate electricity?

SPROAT: I think the reality is, at least from my perspective, is you're never going to get people with enough interest and broad enough participation, so you get a consensus on, number one, it's a problem, and number two, we need to do something about it. So, what we have to do is work the specific project with the stakeholders who are involved, and I think you're going to go through a process like I talked about, these stages of resistance, of public resistance, and that recognizing that's what you're going to go through, how do you manage that? How do you plan for it, manage it, and hopefully guide it towards a successful outcome? I don't know how else to do it.

GARRICK: I like to say that the difference is the fear of anything nuclear syndrome. You know, that's a real problem. It's a singularity in the thought process as to what to support and what not to support.

I want to take advantage of your presence here, you and John, and open up the discussion a little bit, if we can, both to the staff and to the audience, give people here a chance to ask some questions. Now, I haven't done that. I hope there are a few. Yes?

McCONNELL: Paul McConnell.

You talked about your report in 2008 where you looked at the cost of the central interim storage, and I think you said a couple of times that you thought that it

would be as expensive as a repository. Did I understand that correctly?

SPROAT: No, that isn't quite right. The cost of a repository clearly would be much higher than centralized interim storage. What I said was the time needed to site it, license it, and get it into operation, I don't believe is going to be substantially shorter than what we would have to do with a repository. The cost clearly would be lower, however, I saw in the report, and I didn't recognize the site, that the draft report talks about the cost of siting, designing, and licensing a centralized interim repository at about $100 million. I'm willing to bet that at least you're going to spend 75 percent of that on litigation, if not more. So, I think that number is low.

GARRICK: Any other questions? Steve?

FRISHMAN: I'm not asking a question, I just--this is Steve Frishman, State of Nevada--I just need to clarify one point for the record from what Ward said, and that's that since the passage of the Nuclear Waste Policy Act of 1982, there has only been one piece of legislation signed by the governor in Nevada, and that was in 1989, a law opposing the storage of high-level nuclear waste in the state. In 1975, there was a resolution passed by the legislature, but not objecting to the Department of Energy or its predecessor at that time looking at shallow alluvium storage on the Nevada

Test Site, high-level waste. You are totally incorrect that the legislature has ever approved high-level waste disposal in the State.

SPROAT: I read the Bill.

FRISHMAN: What's the Bill number? In the mid Eighties

SPROAT: My point being is that--

FRISHMAN: You supply it for the record. I will supply my information for the record.

SPROAT: That's fine.

GARRICK: Okay, let's see, Dan?

METLAY: Dan Metlay, Board Staff.

I'd like to switch to a question for John. Ward suggested that this stage adaptive consent-based approach is idealistic. Did the Commission, in terms of reaching that conclusion, look at any particular studies or examples in the real world that would suggest it is implementable? And, in particular, has it looked at the situation with respect to the Ossa Salt Mine in Germany as an example that might be relevant to this?

KOTEK: The Commissioners didn't visit Germany. We learned a little bit about the German program from papers you all have done, but in fact we tried to get from Germany to speak at one of our meetings, and timing just didn't work out. You know, in terms of reports and such that the Commission looked at, obviously, there have been Academy

studies that have recommended that process, you know, looks a lot like what the Commission has recommended. Certainly, other processes, or other siting processes that the Commission has looked at certainly left in the way that, not that it was set up in the beginning as an adaptive staged approach, but, you know, you look at sort of the twist and turns that that program took, showed a need for adaptability at a number of levels to actually get to the point where the facility was open.

The Commission also had a paper, a Commission paper we had prepared by a couple of social scientists that I would recommend to you, Seth Tooler and Tom Webler from Massachusetts, and then Gene Rosa from Washington State, you can find it on the Commission website, which looked at a broader range of facility siting challenges, and other things, they looked at, for example, the process that was used to get to agreement over the clean-up standards and closure of Frenald. So, those are a few of the things that the Commission looked at.

GARRICK: Did you have another comment?

KADAK: Yes, if there's time.

GARRICK: Sure.

KADAK: I guess I'm in the question mode about the Nuclear Waste Policy Act, and thinking about what you were saying in terms of some structure. Okay? And, you think

back on it and you say well, there was an open process of siting, site selection, three sites were chosen. They went around the country. And, then things got complicated because things got very expensive. The site characterization became expensive, and then people had to say all right, how do we move forward? And, the move forward process was a political solution, selecting a site, perhaps inappropriately, but establishing a process whereby the State had veto rights with Congressional overrides should that not be--should it be found to be acceptable. And, it put in an institutional process of the NRC regulatory review, trying to identify that if this site is good, we can build it and Congress as a nation will decide whether it's acceptable.

How would you modify that in the sense of what you're suggesting in terms of some clarity in a path forward?

SPROAT: I don't have a better solution--certainly I don't have a preconceived notion we should have done X instead of Y. But, I think, you know, with what the--all I'm asking is that as the Commission has put together and given this obviously a lot of thought, that they consider that history and factor it into their recommendations as to so how would it or should it have changed, and what should the new law, if there is a new law, what should it say regarding that? And, all I'm advocating is that if the Commission in its recommendations ignored that and just said we're going to

make it adaptive and consent-based, and in fact nobody is going to get any nuclear waste site unless everybody says yes, that is not a path to success.

GARRICK: John?

KOTEK: Just one clarification I guess to offer on that. The Commission said specifically consent-based, not consensus-based. Okay? And, so, the idea wasn't--and, if folks are reading it this way, then obviously we've got some work to do to fix the language because the point wasn't to say that everybody agrees. All right? The point was that you get to an agreement with a willing and informed host state and community that are willing to sign up to be, you know, ultimately be hosts for a facility.

KADAK: Well, do you have any comment about the process that I just described relative to establishing some clarity or purpose? I mean, we gave the State, in that legislation, a right to veto. And, they exercised that right. And, then, Congress stepped in with some deliberation about whether or not this was going to be done. Is there anything that one would try to apply in legislation, which clearly has to happen, regardless of whether we go forward with Yucca Mountain or not at this stage, to make it a more certain process?

KOTEK: Part of the reason for the way that the Commissioners have set up the public comment meetings, you

know, they've been done explicitly in cooperation with these regional state government organizations, because understanding their perspective on what conditions would you want to see put in place, what sort of a process would you want to see put in place so that you could, with some confidence, in--not say yes, but at least say maybe, say we're willing to have a conversation about being a host for one of these facilities, so getting more specific than what's in the Commission report right now is something that the Commissioners are looking at. And, they want to hear what sort of feed back comes from people who have lived the process, and especially people within state government, and if there's kind of a common thread to the feedback they get that says hey, you really ought to provide more specificity and here's kind of what it ought to look like, that's very useful. And, the Commission can consider making changes in the report.

At this point, you know, what the Commission heard a lot was don't try to assume that you know up front what is going to be necessary, what sort of a process is going to be satisfactory to satisfy the concerns of a whole state. So, we have a great deal of flexibility in that.

So, there are some certain things that Ward had to say that I think the Commissioners would view are absolutely important, essential to moving forward. Is the Commission

the right place to do it, or is that something that is more appropriately left to the new waste management organization in working with a state and a community as part of a negotiation? I mean, that's an open question right now. And, that's--you know, if Ward thinks that that ought to come from the Commission report, great. Others have said you ought to leave that detail to the new organization. So, that's what the Commission is hearing feedback on right now.

GARRICK: Okay. Howard, and then George. But, let me ask something quickly first.

Does the Commission have any rules of practice about how they're going to handle comments between the draft and the final, and in particular, I can visualize two very broad categories of comments, comments on changes that could be made to the current report, and comments that have to do with new items, new issues that were not addressed in the report, but have to be added; are there any rules of engagement on that?

KOTEK: Well, of course the Commission has established subcommittees, and, so, it's going to ask the subcommittees to look at the comments that come in on the draft report and then the comments that have come in thus far on the subcommittee reports as well. And, we'll ask the subcommittees to decide, you know, what it wants to do, or what it suggests the Commission do in response to the

comments that have been received. Then, the process as we currently envision it is the subcommittees will then come forward with final reports. Because, you remember the subcommittee reports are draft; right? So, the subcommittees would come forward with final reports and would report to the full Commission here's what we think, here's what we've changed in our report and we think ought to be changed in the report of the full Commission in response to the public comment, and the Commission deliberates over the reports that have been submitted from the subcommittees, and uses those to assemble its final. So, that's the way we see it taking place now.

GARRICK: Given the gravity of the issue, I can imagine that the Commission could end up with a bigger scope between the draft and the final report than they had from the beginning.

KOTEK: Bite your tongue.

GARRICK: Howard?

ARNOLD: That was really where I was headed, too, John. It seems to me that what you're promises to do really can't be done between now and the end of January, and that there is another phase that you've got to anticipate, which is to put real flesh on what you've done.

KOTEK: Well, okay, I mean, I think the Commissioners feel like the draft that they've put out provides pretty

solid guidance to Congress and the Administration as to what changes would need to be made. But, certainly they're looking to add more detail where that's appropriate. And, then, obviously, I don't know what's going to happen in an appropriations phase, but I'm sure you all noted that the Senate Appropriations, Energy and Water Appropriations subcommittee at least have proposed to extend the Commission's charter by a couple of months so that a draft piece of legislation could be prepared based on the Commission's work. So, we'll see whether the House goes along with that.

GARRICK: George, and then--

HORNBERGER: I have a question for John. John, clearly your presentation, one of the major comments had to do with this Fed Corp and the structure. The Board members here, of course, by virtue of the fact that we're sitting here, have an interest in independent technical oversight, and the fact that--I don't know if I missed it, it wasn't in your secondary recommendations. Is that because the Commission just takes that for granted that that's going to happen, or are there some comments about structure along that--

KOTEK: No, actually that's a good point, and I should include that in my slide deck going forward. In the discussion regarding the new organization, there is a section--pardon me while I find it--in Section 7.4, there's a

discussion of oversight recommendations for the new organization, and in fact the Commission has, in its draft report, said that, you know, they basically assume that the Waste Board is going to continue on. They've seen it as a very valuable source of technical oversight and review of the program. So, there's a discussion in there I would call your attention to, and if you have any thoughts on it, let us know.

And, actually, while I'm on that subject, Mr. Chairman, I did want to thank you and your staff has been tremendous through this whole process. They have been a very big help to us and to the other staff and the Commissioners. So, I wanted to recognize their efforts through this process.

GARRICK: Thank you. We've tried to be constructive.

KOTEK: You have.

GARRICK: Yes?

McCULLUM: Rod McCullum, Nuclear Energy Institute.

Given Dr. Garrick's remarks that he's not that impressed with the efforts of the Nuclear Energy Institute, on behalf of the industry, I feel I--I once again need to make a slight clarification for the record here, and I'm not really disagreeing with that because I think to the outside world, when you see everything that's transpired with Yucca Mountain, it's easy to ask where has industry been in this.

I think that from the day we realized that the

President was going to make good on his campaign promise to the people of Nevada, and we've always realized that having no waste program is simply not acceptable, we became very active in making sure that something happened. We were very active in seeing to it that this Blue Ribbon Commission got up and running, and trying to hold the Administration accountable for some sort of schedule for that.

The recommendations, we've provided lots of public testimony and we've interacted at every opportunity the Commission and its staffers gave us. The recommendations that Ward highlighted are indeed very appropriate. Certainly the Fed Corp is something we've very big on in industry. That would allow the program to run like one of our companies. Those reflect a lot of industry input, and you've seen that in our comments we've publicly made today. You will continue to see that when we comment on the final report.

That being said, we certainly, and I'm glad you invited him here to say these things, we are certainly concerned about the two elephants in the room that Ward mentioned. It has been our consistent position and remains our consistent position that the Yucca Mountain licensing process should be completed. That will be reflected in our comments on the final report. We certainly think the Commission should also reflect that. And, you know, with the

recent decision, or non-decision, or contradictory decision, or whatever you want to call it, by the Commission, there's probably going to be a lot more activity in that area coming up.

As far as the second elephant in the room, I'd love to tell you what I really think about the politics, but I do want to keep my job, so I won't. You know, I can only say that, you know, people always over estimate the ability of the nuclear industry to influence politics. You know, I laughed, having been inside the innersanctums that, you know, how all powerful the nuclear industry is and how we can motivate Congress. We do the best we can to stand up for our interests and our own stakeholders, and, you know, again certain election results came in in 2006 and 2008 that changed the political landscape, and the 535 members of Congress and the new President just don't wake up every day thinking gee, what is the nuclear industry going to think of this.

But, I think the key thing going forward, and I really appreciate what this group is now doing here in furthering this dialogue because the recommendations of the Blue Ribbon Commission, both the ones they've formulated now, and the ones we hope that they will formulate further mean absolutely nothing unless there's some legislative action to inspire our nation to do something about it. And, I think

you will see our industry be extremely active, and again, from the standpoint of having no program is not acceptable, I mean, you know, this Board has studied all the international programs and you are now in a nation which is one of only one, maybe two nations that has nuclear energy that doesn't have a high-level waste repository program at this time. As an American, I'm ashamed of that, and now I'm starting to depart from being NEI and being me.

But, you know, you will see the industry be very active, and we think this dialogue is part of it. We thank you for furthering that. We will take to heart John's criticism and you will see us working to be as effective as we can to make sure that the Blue Ribbon Commission report just doesn't go on a shelf and nothing happen for years. So, thank you.

GARRICK: Thank you.

KADAK: Can I ask Rod a question?

GARRICK: Yes, if it's a reasonable question. I'm the one that asks the unreasonable questions.

KADAK: One of the comments was the litigation settlement. Do you see any movement at all in resolving this question once and--well, not once and for all--but just resolving the litigation so we can communicate more directly about spent fuel storage disposal?

McCULLUM: I have to be careful not to step on the

interests of, you know, any of my individual member companies, all of whom are at various stakes in this. You have a lot of settlements out there already, I think representing about 20 percent of the fleet there is a settlement agreement in place that as long as DOE doesn't perform, they will keep getting a bill every year from the utilities. You know, you have others that are continuing to pursue their cases in court, some have won judgment, some will continue to pursue their cases. If non-performance continues, you will see more lawsuits.

So, I don't think there is one universal answer to that question, there's one one-size-fits-all, you know, that every lawyer for every CEO is going to be happy with, and I certainly don't want to try to state their positions for them. But, that being said, that does not prevent us from doing things. I mean, organizations that have litigation between them do business all the time. We demonstrated that that could be done when the TAD project was--it was a success to the point where we got agreement between industry and the government to make compromises on the respective needs. You know, we want big canisters, the government wants things that work well for Yucca Mountain, and we forged a compromise even though we were suing each other. We worked together on that, and, you know, we got all the way to TAD license applications with the NRC, which ended up in the same box as the Yucca

Mountain license application to the NRC.

So, I think we have demonstrated that we can work towards solutions, even though there's litigation, and Ward highlighted that the most important thing, you know, with the Fed Corp is figuring out the liability, so that the Fed Corp is unencumbered in doing its job, that the liability monkey on the back doesn't stop it from solving the problem. But, I'm confident we have demonstrated we can do this, and we can do it going forward.

GARRICK: Rod, I just want to say that my whole point was that NEI can't do it all. The utilities have to have a presence as well, and I think there's been something lacking in that regard.

McCULLUM: Well, the utilities all participated actively, all the CNOs, chief nuclear officers, chief executive officers in our governor's committee. So, I hope you'd recognize--I mean, we're in an industry where there's a tremendous amount of peer pressure. You know, we always say an accident anywhere is an accident everywhere, and when Fukushima happened, industry at every level came together and worked very hard to come up with a coordinated response.

But, I agree that, you know, there's nothing like grassroots politics and, you know, the senators and governors from various states need to hear from the companies that operate in those states, and that will be part of the

strategy going forward, you know, as we look to get legislation off this report. Thanks.

GARRICK: Thank you. Thank you very much. Joyce?

DORY: This is Joyce Dory from the Board, and I'm taking a big step to even make a comment. This is very simple. Is it possible that the government can look at how they set up, or the industry has set up an agreement with the government, in other words, if you don't take it, we'll sue you. Is it possible, kind of going back to what Ali said, that if a state agrees to take or to have the repository, that at some point there will be a penalty assessed to them if they change their mind. If it will make it worth your while to take it, if you don't take it, there's a penalty with it. That's one.

The second point is with this environment now politically, the states are saying we don't want the federal government telling us what to do. Is it possible then if a nuclear power plant is approved by the NRC, then that particular company has a responsibility to find where the waste is going to go? That, to me, goes back to the full cycle. If you want the repository, then you need to come up with the recommendation of where the waste is going to go. Why does it become a federal responsibility? I don't know if that's something that's in the law that can or cannot be changed, but I think that going in the future, maybe it's something that they should consider.

GARRICK: Those are very good questions. The next time I testify at Congress, I'll use them. Does anybody want to comment?

KOTEK: I'll take the first one. You have the second one. You're welcome for that.

Regarding the first one, those are the types of elements I think would have to be part of a negotiation between the federal entity and a state or community, what sort of incentives, what sort of penalties, or whatever you call them would you put in place would be acceptable so that a state and a community are willing to go along with the idea of being a storage facility.

SPROAT: The issue of new plants taking responsibility for spent fuel disposal, there is no--first of all, the federal law is that the federal government has responsibility for that. But, that aside, you know, we have--several utilities got together and said we're going to take--we're going to be pro-active and go after this issue for our companies, and they generated--they formed PFS, private fuel storage. And, they found a willing host community and still couldn't make it happen because of national politics and interstate politics, and that's why no individual, single, private company can fix that problem.

GARRICK: Yes, Andy?

KADAK: Just a follow-up on that comment. Given where

we are now with PFS, it has a license, I guess the litigation is pretty much over. What would you do, or what can now be done to break this gridlock of Bureau of Land Management and a right-of-way, I guess, is the only two obstacles, is there a path forward here?

KOTEK: The Commission is not a siting Commission.

KADAK: I know. I'm not addressing that comment to you, John, but maybe Ward, who's got a little more experience in this field.

SPROAT: Well, knowing how the road blocks got put up back in 2008, I think it was, late 2007, early 2008, it would take the State of Utah and probably a couple of surrounding State Senators to agree we're willing to let this go forward, and apply that--provide that information back into the Federal Government and the Department of Interior to get the required permits issued. That's what it would take.

KADAK: So, is negotiation not an option at this point? I mean, I read some of these articles, and the input to the Blue Ribbon Commission basically bottom line it's not in my backyard. And, I didn't hear any discussion about the things that John was hoping to get input on, and that is well, what would it take to help me think about putting it in my backyard, as being publicly stated, because my sense is if that were publicly stated, the person who made that comment would probably be voted out of office. So, any thoughts on

that?

SPROAT: Well, you know, to have a chance at reasonable negotiations, both parties have to have something the other one wants. In the case of PFS, there's nothing that the PFS group of companies or the tribe have that the key political decision-makers in Utah and the other surrounding states need. That's the reality.

GARRICK: Last comment?

LATANISION: This is partly a facetious comment, but I'm thinking of your experience during the hurricane that came up the East Coast when your power was out. You know if people find they plug things in and there's no power, they might get more serious about thinking about some of the issues. And, so, I think the issue is one of public understanding and a need. Water we all take for granted. Electricity we take for granted. Somebody has got to deal with the wastes, and right now, the public doesn't--I think the public doesn't understand that. So, I'm not sure how you deal with it, but that public perception issue is a major one, I think.

GARRICK: Okay. Well, it's been a very lively session. It met all my expectations, and I'm very grateful that you two were able to participate, and we thank you very much.

SPROAT: Thanks for having us.

GARRICK: We're now adjourned until 1:15.

(Whereupon, the lunch recess was taken.)

AFTERNOON SESSION

GARRICK: The talk we're now going to hear from is on the extended storage collaboration program, which has been referenced many times in the last day and a half, and I will let John Kessler take the lead.

KESSLER: Thank you, John.

I will start by talking about some of the work that we've had started at least in the extended storage collaboration program work, but I'm going to talk a little bit about what EPRI is doing, and end my remarks with some requests or things that industry would like to see from DOE related to extended storage.

I am notorious for using a lot of slides, and I had the fear of God put in me by both John Garrick and Dan Metlay about trying to keep on time. While I keep using lots of slides, I'm actually getting better at getting through them in a reasonable amount of time, so let's see how we do here.

Guiding principles for extended storage to disposal or reprocessing are not likely for decades, are no news from what you have heard. The current regulations in the U.S. are up to 120 years of combined wet, dry storage is what theoretically we could get. 120 comes because we have theoretically 60 years of wet storage, since a lot of the reactors are now licensed out to 60 years, and we have license experience in dry storage now out to 60 years.

There aren't going to be too many utilities, however, that are going to keep their fuel from the very first discharge of their new reactor in the pool for the entire 60 years, and then put it in storage for 60 years. So, 120 is a theoretical upper limit, is how that came from.

There was a question yesterday, and you saw the national flags and one of the presentations from this morning, this is a global issue. There are very few countries that have either reprocessing or disposal, and I feel like I'm on the Kessler Road trip a lot because there's a lot of our international members, both within EPRI and outside, that are very interested in extended storage issues. IAEA has just started up and I'm trying to coordinate with them because they actually got some funding to do R&D.

Bottom line is however long we think we want to store this stuff, the storage systems are going to have to perform their intended function, and then we're looking at beyond the current licensing period. So, what I've got in the block here at the bottom, the "Technical bases for dry storage beyond 60 years are not yet demonstrated." I don't mean to imply that we have no technical confidence in the ability of these systems to continue to maintain their safety functions beyond 60 years. What I'm saying is in an NRC licensing environment, the case has not yet been made. Those two things can be very different depending on what the

requirements are.

Functions of the Storage and Transportation Systems. I think you have seen this at least twice now. I'll add to it a third time, because it really does guide what it is that we're trying to do, or what is it we think we need to do. Thermal performance, radiological protection, confinement, sub-criticality, and retrievability are all essentially required safety functions in the current NRC guidance. While there may not be specifically a retrievability requirement for transportation, there is for storage, and de facto, at the other end, requirements for being able to handle the fuel after transportation essentially means there's an interest in retrievability. But, that does get at Andy's questions earlier today and yesterday about the relative importance of retrievability is one of these safety functions.

And, of course, the bottom line question is can the existing and future systems maintain these Storage and Transportation functions for many decades?

So, one of the things we're interested in is okay, what happens between the first 20 years, things are hotter, more radiological source term, and then over periods of time, we know that goes down. So, we want to look at a lot of temperature-related mechanisms.

For dry storage systems, we may have the

degradation of neutron shielding, concrete dry-out and cracking and corrosion of lots of different parts of the storage systems.

For system internals, you've heard about fuel cladding creep caused by increased cladding ductility and increased stress. Just essentially, it's a PV equals NRT thing. Higher temperatures means you have higher internal pressures inside the rod that causes more stress. That's fundamental.

Hydride reorientation in the spent fuel cladding. You've heard about that twice, so fortunately, I don't have to talk to you about that too much, other than to say for cladding, it is the number one issue in terms of extended storage. And, then various corrosion issues that I'll talk about in terms of priorities.

So, as systems get older and cooler, mostly good things happen. We've got reduced metal creep rates, reduced corrosion rates, and then reduced gamma neutron radiation fields. But, there are some potential negatives. For the cask systems, the number one one that we're looking at, and everybody else I think has talked about as a high priority item is canister stress corrosion cracking, particularly in marine environments.

The canisters, the dry storage canisters are stainless steel in general with some of the earlier designs

being carbon steel. Some of them sit near the ocean, and I think Ron Latanision and Carl DiBella will enjoy the irony of me talking about deliquescence issues in terms of we had some big discussion with the Board about deliquescence issues related to Alloy 22 during the Yucca Mountain hey day.

Internals, additional hydride precipitation, you heard a little bit about. Decreased cladding ductility. All of those things make the cladding potentially more susceptible to breakage during storage and transportation. And, I don't want to imply, as I think there was a comment or two earlier, that I don't want you to be left with the impression that if we suffered the 34 to the 9 meter cask drop, you would have rubble inside. We don't believe that, at least at EPRI. We believe that there's probably going to be enough ductility left that it will be a minority of rods that break, but more data in that area for different kinds of conditions is always valuable. Based on the data we've got and the initial analysis EPRI has done, that's kind of where we're at right now.

Okay, onto what I'm supposed to be talking about, which is the Extended Storage Collaboration Program. Back in 2009, it became apparent with the slow death, or at least life support that Yucca Mountain was on, we were going to be talking about storing fuel for a very long time. And, I knew it wasn't a U.S. only issue, and I also knew that to do the

necessary R&D, it was going to take a lot of collaboration, and a lot of co-funding. Given that EPRI's budget is almost exactly one-tenth of the UFD budget, I knew I was going to have to rely on a lot of different people to get things done. They were going to be more expensive.

So, the ESCP program got together and came up with essentially a mission statement, which is there at the purpose. Provide technical bases to ensure continued safe, long-term, used fuel storage and future transportability. You've heard several times now it's not just storage we have to worry about, but is the system and the fuel transportable after how much time.

It's modeled on prior dry storage license extension research, and fortunately Brady Hanson went through the work that was done at Idaho some ten years ago, reopening that CASTOR cask, so I don't have to talk about that. I get one minute point for having to not talk about that.

Participants: EPRI, the Board. We are very happy to have Andy and Doug participating in that. NRC, Department of Energy, NEI, utilities, both inside and outside the U.S., the cask vendors, again both inside and outside the U.S., and significant international participation, such that my mailing list is now well over 100 people that have participated in at least one of the ESCP meetings. We have roughly three meetings a year, at least one of which is outside the U.S.,

since there is such international interest.

We set out what we call phased approach, where Phase 1 is nearing the end for quite a few of the participants, which is review the current technical bases and conduct gap analysis for storage systems. If you exclude some preliminary work we did a couple years ago at EPRI, TRB was the first out of the block in terms of providing an assessment of the gaps, and that was presented at the December 2010 ESCP meeting, and we were pleased to have that happen.

Phase 2--excuse me. And, then, DOE and NRC are in the middle of doing gap analyses. You heard about some description of their draft gap analysis report. NRC has not yet released their draft report, but they have made some presentations at the ESCP meetings that I will refer to later. And, then, EPRI has also started working again in terms of gaps, and I'll talk about that.

So, once the gaps are identified, there's some discussion about prioritization, which ones are the most important. I'll talk about that.

Phase 2, conduct experiments, field studies, and additional analyses to address the gaps. It's a nice two-line statement that's going to involve years of work and lots of money, depending on how much work we want to do.

And, then, Phase 3, coordinate research that

results in a program documenting the performance of a dry storage system loaded with high burnup fuel. That is the particular problem child, at least with the U.S. in terms of regulations.

That is what prompted EPRI to comment on one of the draft BRC reports that there was a statement, and you heard earlier about the transportation regulations working well in the U.S. And we disagree that if you have a transportation regulation system that essentially has not allowed any transportation licenses for about 45 gigawatt days, we don't consider that system that's functioning well, especially since most of the utilities are now discharging fuel above 45 gigawatt days per metric ton.

So, with all of that involved in terms of what we'd like to do collaboratively, we are set up loosely, that is, there's no dues. It's just everybody participating on a volunteer basis. The idea is to share information as much as we possibly can, preferably making as much of that information public as we can, recognizing that there will be the proprietary issue that comes along with maybe making use of certain, say, fuel properties and assessment of fuel.

But, the idea is is to share the burden. We recognize there will be some overlap. Gap analysis was a perfect place for there to be overlap, to have a couple different organizations looking at that. That was helpful.

But, ultimately, it will be nice if, you know, we could say okay, EPRI will do this piece, DOE will do that piece, GNS, the cask vendor in Germany, might do this other piece, and so on through the participants.

So, the current status is, as I mentioned, Phase 1 gap analysis is well underway, our preliminary gap analysis by DOE and NRC. Two weeks ago, EPRI put out a report that is now publicly available, where we summarized some of the recent ESCP activity, and summarized what we understood about the gap analyses, and we looked at the gap analysis that the TRB had done, that the preliminary one from DOE, as long as what we understood from NRC.

So, at the end of the December meeting, which was a great meeting, we came up with essentially three gaps that were of primary importance. One had to do with cladding integrity, this idea of hydrided reorientation for higher burnup fuel. You've heard about that. Welded stainless steel canisters, you've heard a little bit about, which is there could be corrosion, stress corrosion cracking on those canister systems. And then concrete was kind of a runner up but nevertheless because of its predominant use for both shielding and structural and its long-term use, it was added as a potential gap. We may be able to do that with library searches, but we're not quite sure yet. We certainly want to start there. We know there's a heck of a lot of information

out there about concrete degradation. We just need to confirm or make sure that we don't have any holes in that that's applied for this issue.

Okay, confinement, this is an EPRI opinion, and I think it goes along with some of the discussion we have had. EPRI considers that the number one priority. We recognize that all of the safety functions need to be maintained, but in terms of prioritization for R&D, we consider confinement the number one priority.

We think about three confinement barriers that are considered. For the bolted systems, it would be the seals and bolts, the seals being those O-rings. Adam Levin talked to you in his comments at the end of yesterday about one issue there. You've heard a little bit more about it from others.

There has been, however, quite a bit of work completed or underway, primarily in Germany and Japan. In Germany, it is both BAM, which is I guess kind of the equivalent of this Center for Nuclear Waste Regulatory Analysis in terms of a support R&D organization to the regulator. And, GNS cask vendor there that does bolted systems, and CRIEPI, center for research, for the electric power industry in Japan, has also done quite a bit of work on degradation of seals and bolts and stainless steel systems.

Second barrier, welded stainless steel systems,

particularly the welded stainless steel canister. There is a common desire for there to be an external inspection of those that are in situ. Right now, there is no formal requirement for inspection of those canisters, and given the potential for corrosion, potentially stress corrosion cracking in marine environments, it's a common desire to be able to go out there and look to see whether that kind of degradation is occurring. And, it is the very near-term focus of EPRI's particular work to develop NDE tools to inspect in situ the outside of the canisters, potentially visually initially, and then maybe with some sort of enhanced NDE technique to see if there's initiation of cracking of the welds which are not stress relieved.

Secondary barrier is fuel cladding. You heard from John Wagner and Brady Hanson and from me, for that matter, that we do know that all fuel is not 100 percent intact when it comes out of the reactor. The vast majority is, but it's not all intact. And, the cladding operates essentially as a secondary barrier. We want to keep it as intact as we can, but given that some is degraded, it's not the primary barrier. The primary barrier will be these two systems. If you can keep that primary barrier intact, you are not going to release radionuclides from the inside of the canister. You're going to maintain your helium backfill to reduce the amount of degradation that could eventually lead to issues

with sub-criticality and thermal performance, et cetera, which is why EPRI has rated this as a high priority item, maintaining the confinement of those primary barriers.

Two published, although I would say both are preliminary sets of criteria. You heard a bit about the DOE's in terms of prioritizing the R&D based on these gaps. Whether the existing data are sufficient to evaluate the mechanism and impact on the important to safety one. The likelihood of occurrence of the degradation mechanism. The ease of remediation, and significance of the potential consequences that may result from degradation mechanism.

EPRI's are similar, but not exactly the same. The importance of maintaining the safety functions, with particular emphasis on the confinement in our case. The amount of R&D that has already been completed. If it's been completed, it's certainly not a high priority for additional research. Whether the data gap is subject of significant ongoing research. Again, no need to add on to that. And, potentially the ability to fairly easily detect, inspect, mitigate that potentially would be a better way, or at least an alternative way than doing a lot of research.

So, we do have very good agreement among the people that have done analyses of what the highest priority gap is, and it seems to be that for the U.S., the welded canister, primarily stainless steel degradation. We are concerned

about the effect of marine environments, particularly stress corrosion cracking.

Oh, good timing, Ron. And, this is where the deliquescence issue comes back in.

Other high priority items that DOE, NRC or others have indicated. For DOE, they have on their high priority list, delayed hydrogen cracking that Brady talked to you about yesterday. For the bolted cask systems, they have the metallic seals and bolts corrosion on there, certainly they are important. EPRI argues there's a lot of work going on there. So, in terms of high priority for additional R&D, we're not there.

This one, however, there's not as much R&D. Granted, there's a huge amount of literature out there about stainless steel degradation in marine environments. But, the question is how much of that is relevant for the particular conditions these canisters are in in the field, and that's the part that we're interested in.

And, then, outside the U.S., again it's bolted cask and metallic seals. That is because outside the U.S., bolted cask systems are used a lot. In the U.S., as you heard earlier, we have quite a few that are bolted, but the majority are these welded canister systems.

At the ESCP meeting that we had in May and June, we realized that now when you are up to over 100 people that are

involved in the ESCP program, you can't get a lot done at the more granular level, so we are in the process of setting up sub-groups to look at specific issues. You can see them there, fuel/internals. For confinement, we've got the two different kinds systems. With the bolted cask seals and bolt system being led by primary Germany and Japan.

For bolted cask neutron shielding, that is also an international lead. Germany and Japan are doing less work in that area, but some. Concrete systems is on the list. We're going to have a panel on that led by EPRI's concrete folks that are looking at plant license extension issues. So, we think they are in a good place to look at extended storage as well.

And, then, the demonstration project, which I haven't talked about yet, although you have heard a bit about it from others.

I mentioned EPRI's near-term work. We felt we needed to proceed on our own, felt like we really didn't want to wait for DOE or somebody else to catch up to us. And, we are going to go ahead and start trying to find some opportunities for in situ inspection of some of these welded stainless steel canisters. I mentioned the options, visual, maybe looking at weld cracking.

We have initiated, Keith Walder in our group has initiated, again with our NDE group, tools for specific

casks, and we have to find the right cask to get in through the right kind of inlet or outlet or whatever. It has to be a volunteer utility or utilities. We prefer coastal sites. We would like to have a significant amount of time in storage because the criteria are you have to be in the right temperature range, you have to have had an opportunity for there to be salt deposition, and the temperature ranges mostly having to do with sufficiently high relative humidity for deliquescence to occur.

So, we're looking for some volunteers in this area. I think we've got two strong leads, which I won't mention, I don't want to jinx it because we're just now getting their management approval to go do that.

Our target timeline is to do an inspection of one or maybe two canisters by the end of 2012. We have one volunteer that has an April window of opportunity that hopefully we can peddle to the metal, get at least one NDE tool ready for that.

Okay, the last part of my talk, thoughts on what the U.S. industry wants from DOE regarding extended storage, anyway. Jeff Williams very bravely asked at our December ESCP meeting, "What is it that the utilities want," and we said okay, well, if he's going to ask, we're going to come up with some ideas as to what industry wants. And, this presentation in a longer version was presented last May, and

I'm happy to see already--or, hear already some of the incorporation of at least one of those things based on those comments.

Perspective. This is the projected curve of how much spent fuel we're going to have generated between roughly now and when the existing plants, only the existing plants that are assumed to run for 60 years, shut down by 2060, or earlier.

What you see is that while we still have, as was mentioned, about two-thirds in pools and one-third in dry storage, take a look at the slopes. They are pretty parallel, which means for every assembly you take out of the reactor and put in the pool, you've got to be taking one assembly out of the pool and be putting it into dry storage. The pools are just about full.

And, then, what you can see is is that out in the longer period of time, we have a diminishing number of spent fuel pools, as we have less and less in pool storage, we're shutting down reactors, we're going to have more and more of these shutdown, decommissioned, you know, sites with no pool infrastructure anymore.

So, extended storage aging management R&D needs, and near-term is a relative term. The goal is to maximize the life of the existing systems, but ensure transportability and make sure they meet their safety functions. Clearly, we

don't have to--the industry is not interested in having to buy new systems any earlier than they have to.

We have 1400 plus casks already out sitting at utility sites at the rate of like 100 a year additional ones being put out in the sites. So, by the time we do anything new, or there's any change in policy, we're going to have a lot of them already out there. And, if you want site specifics, fuel specifics, canister specifics, we've got lots of specifics for you. You don't have to be thinking generic for the 1400 plus casks that are out there now.

Additional analyses, we've talked about already. One of the things is is that we need to develop a regulatory framework for beyond 60 years. I mentioned that we've only had license experience out to 60. There have been newer questions coming in about extended storage and some of these degradation mechanisms coming from some of the applicants to extend storage.

We have one shutdown site, Maine Yankee, that has high burnup fuel in storage with their license extension coming up in about seven or eight years. NRC has started to hint around that they may have a concern about extending a license for high burnup fuel. Clearly, we want to be in a position for NRC to be able to at least entertain a license extension, not that I know what Maine Yankee would do otherwise.

And, then, enhanced monitoring and inspection. We're talking about stainless steel canister inspection. There are lots of opportunities for monitoring and inspection that were in the DOE draft report, that were in the TRB report, and certainly a lot of those could be thought about.

For the intermediate and long-term, evaluate mitigation/design options, two were just listed there at random. For the very long-term, this is the idea, long-term is okay, you're reaching the end of the time when you have high confidence that the safety functions are still met in these extended storage systems. What do you do? Do you just automatically say okay, we're going to replace it? Well, replacing, especially at shutdown sites, isn't so easy. I'd say let's take a risk informed view at that point. When does the worker and public dose risk of continued storage in existing systems exceed the economic and worker dose risk of transferring used fuel into a new system perhaps earlier than might be absolutely necessary? And, that's something that we'll have to address one day, hopefully not for a while.

Again, in red there, industry expects DOE to take the lead in all these areas with the appropriate collaboration with industry, primarily because, well, the whipping boy is DOE, we recognize it's fundamentally the government's lack of meeting the January 31, '98 issue that makes it the government's responsibility to ensure that

extended storage can be managed.

Okay, experimental work. Two areas, and one is survey existing cask and pool systems. That would be detailed inspections, taking samples to inspect for degradation in these issues. You heard from Brady yesterday about that CASTOR V cask that's still sitting out at INL. They are monitoring the gas inside there because if we had failure of one of the assemblies, or one of the pins, we should see a xenon, krypton signature, and we also want to see if there's some ingress of oxygen, and Brady talked about that.

This is the one I talked about that EPRI's peddle to the metal is on in terms of stainless steel corrosion. EPRI is also doing some work on extended storage in wet pools, that we want to make sure that these pool liners themselves stay intact. There is some indications that for a couple places of liner leakage, and EPRI is actively involved in trying to find the leaks and stop them.

Okay, experimental work, research area. This is the big demo that we have referred to. Brady talked about the demo for the lower burnup fuel and talked about the fact that for a higher burnup fuel, there may be additional degradation mechanisms of the fuel such that we would like to do a confirmatory demo, full scale, like was done in the Eighties through the Nineties, and then with the inspection

or the re-opening of the one CASTOR in the early 2000s.

Bottom left photo is a picture taken with the CASTOR V lid off in what was the Idaho TAN facility, test area north. It was a huge hot cell that we could move a full-scale cask into, and do this inspection without having to re-wet the canister. And, that was really nice to have.

We would like to, if we're going to do this experimental work over, we need to obtain one or more casks to do this, obviously, that are licensed for high burnup storage and transportation. Industry has identified two potential casks that are the bolted system design that I think we are holding onto, or we, the particular vendor is holding onto at one of their fabricator sites. Those are potentials.

Now, early work. We have to precharacterize "sister" rods, meaning we have to know T equals O condition of the fuel by precharacterizing some rods that are representative. Okay, that's hot cell work, and that needs to be done either at a national lab here or as we wind up doing a lot, sending a lot to Studsvik in Sweden, for a reason I will talk about in a minute.

Load the high burnup fuel at the upper limits, hopefully of the licensing conditions, highest burnup, decay heat, et cetera. We have to have a well instrumented special lid for temperature measurements and other things that are

going to go on inside there. We're actually starting to talk, Keith and I, about maybe a monitor that's totally inside the canister and sends its signal through the canister wall. That's certainly in the preliminary R&D stages, but certainly it could help if we could have such a device last for as long as the canisters.

And, then, after several years, like we did with the CASTOR cask, reopen it. Take rods for destructive exams, et cetera. And, the center picture there, I believe is also the TAN hot cell where they pulled out some rods that then were sent onto other labs for investigation.

This was a study that Albert Machiels, also here from EPRI, commissioned back in 2003. How much is it going to cost to do what, depending on the level of information you want. Option A was essentially take an existing set of measurements, send a few more rods for characterization at a lab, and you can see there even to get some preliminary information, the estimate was about $5 million to do that.

Option B is let's do the demo at a utility site, followed by laboratory investigation. We get more data and you can see the price is increasing dramatically. And, if the whole thing is done at a national lab--sorry, national lab folks, we know what you cost--and that adds additional cost. But, of course, it is under a DOE roof, which has a lot of benefits.

But, the point is you can see the dollar numbers we were talking about back in 2003. Clearly, that is a collaboration type of dollar number, which is one of the main reasons that I wanted to get ESCP up and running.

Okay, no place like that TAN hot cell exists anymore. We don't have a place to deal with, in the U.S. anyway, with a full scale cask that we can open up in a hot cell environment, and deload it or unload it or look at it. So, the request from industry was DOE needs to provide capability lost due to TAN hot cell decommissioning.

Given that they have on their agenda reopening the CASTOR again, along with one of the others, we're hoping what that means is that they're thinking about building a new system. We'd certainly like to see something like that. Otherwise, the test will have to be done using a spent fuel pool. It's not the end of the world, but if you want to get something done fast, that's where it's going to have to happen, is at a spent fuel pool.

And, you heard a little bit about the concern about re-wetting and how that may affect or complicate interpretation of the results we get if we have to put the cask back in the pool after "X" number of years to take a sample. We would rather not do that. We would rather do it in dry conditions. We just don't have a place to do it.

Maybe we can use a mini-cask and try to replicate

the same conditions such that we don't need the full TAN facility, or that size. Again, it's not ideal because it can introduce experimental artifacts. So, we would really like to have something like the TAN hot cell facility again.

Then, the real unknown that's driving us is we don't know how long the systems will last or when DOE will take the used fuel. What we would like to see is DOE develop, license, and demonstrate one or maybe more systems to repackage used fuel in lieu of a pool availability. As you saw, the farther out in time we go, the less pools there is going to be. We would like to have that demonstration done.

Full or partial repackaging. It must be a dry transfer system for that same reason, and we are very happy to hear about DOE's plans to resurrect the dry transfer system work that was done 20 years ago, Jeff? Something like that. A long time ago. We got pretty far down the road with that. That needs to be dusted off, brought up to date, and maybe demonstrated again.

Other options. Overpackaging, something else? And this dry transfer system should be developed sooner rather than later, and again, it's to maintain confidence in the long-term interim management of used fuel.

What the industry wants from DOE - specifics. Provide the majority of the funding, work with the industry

to continue to obtain high burnup used fuel properties and long-term behavior for transportation. Industry, EPRI is actively involved in collecting additional cladding property data for high burnup fuel. We are funding that work. We know DOE is funding some. NRC is funding some. That needs to continue, and potentially increase in terms of the amount of funding.

I mentioned this, providing the new facility, like the decommissioned hot cell facility. This one is actually a pretty loaded bullet here, develop ownership transfer plan for used fuel used in experiments in the U.S. What we hear is that a major impediment of doing hot cell work in the U.S. is that the national labs cannot accept fuel because according to a DOE order, there is no disposition pathway, which I find highly ironic. We have NRC that has waste confidence that there is eventually going to be a disposition pathway, yet we have a DOE order that says we don't see the disposition pathway, and, therefore, the national labs are not allowed to take fuel or disposition it.

Given that that's a DOE order, hint hint, perhaps the TRB might want to take a look at that, and see if they can make any recommendations. What EPRI is doing, we send a lot of our work to Sweden. We just can't get it done in the national lab. That doesn't mean we're dead in the water, but we could do a lot more with the U.S. national labs if we

could actually have the labs take fuel. So, that's a big one for us.

And, we must have a contingency plan, like I talked about for the dry transfer systems.

Processes, not so much in the technical standpoint, but what industry would like is to be oriented to support the timely movement of used nuclear fuel off reactor sites.

Andy, don't ask me what timely means. It's that same squishy thing you got yesterday.

Certainly, the sooner the better. We recognize that there's all kinds of impediments, but we don't want DOE to drag its feet, whoever is going to do this.

Transparency and timeliness. DOE's plans and processes should be open for public comments. Release reports without delay. We are very pleased that DOE made the decision to release their draft gap analysis report. We know that took them a while to make that decision. We're happy to have it. We are hoping that comments that have been provided to DOE have been helpful for them to produce their final report and plan. So, we're very happy to have that.

Prioritize R&D with licensing needs. I was pleased to see their priorities having a major licensing need component. And, this is that point I made about Maine Yankee. DOE's schedule has to be cognizant of some of the nearer term needs for the industry. We'd like to move things

forward so that we have data, for example, for folks like Maine Yankee to use, and they're just one of many coming down the road fairly soon that could benefit from some additional R&D.

And, the DOE extended storage program should look for synergies with centralized interim storage. This is more of a policy issue. I didn't put it up there. I'm not saying I disagree with it, but it's part of industry's requirement in the policy, a request, which is if you're going to centrally locate something due to regionalized repository recommendations like is in the Blue Ribbon Commission draft report, maybe a sweetener would be let's conduct our extended storage R&D at the same site. Perhaps when it's just not a dump, you've got some R&D going on there, let's look for some opportunities, maybe that's a good place, for example, for this full scale hot cell, dry transfer demonstration, things like that. Be a good use of that equipment because you could manage the storage facility as well as do R&D.

And, that's it. I appreciate your patience.

GARRICK: Okay. Yes, Rod?

EWING: Ewing, the Board.

So, this first question is a little bit to the side of your presentation, but are there concerns or research programs that address the issue of the changes in the fuel itself during extended storage?

KESSLER: Very much so.

EWING: Okay. And, so, that's part of this program?

KESSLER: It's part of the program, but it's not, the ESCP or the participants in the ESCP are not the only ones doing it. There are, for example, I was talking to our representative from E.ON, who participates in a different EPRI program called The NFIR Program, which is an international fundamental fuels property type of program. So, that's funding some work. There are other locations internationally that are funding the work. We're co-funding things. Albert has got co-funding work with some of the fuel vendors, with some of the national labs, with NRC. So, there's lots of other work that's going on around the extended storage issue.

EWING: But, based on your comment about the facilities in the U.S., most of this work then is done outside of the United States?

KESSLER: I don't know whether it's most. I do know that we send more stuff to Sweden than we could without this particular DOE order. And, Albert, do you have any idea of what the fraction is? I'll repeat it for--overwhelmingly outside of the U.S. is what Albert said.

EWING: Okay. And, then, the last chart, a question, you do describe doing the non-destructive analysis of the fuel when you open it back up, so I presume that's a chemical

analysis?

KESSLER: No, it's going to be a visual analysis initially. There will be a chemical part that we'd like to do, Rod, which is we'd like to take a swipe. If we're looking at a marine environment, or even some people looked at it at Yucca Mountain, we'd like to know what is it that's depositing on these canisters, and then there's the chemical analysis, part of it.

EWING: All right. So, the non-destructive is not on the fuel itself. That's on the--

KESSLER: No, this is entirely--to actually get inside the canisters and look and see what's going on in there, is a much bigger deal. To maybe in situ, fishing something in through an air inlet or outlet, and then initially just a visual inspection, maybe taking this swipe to see how much salt is deposited, and what is the salt would be step one. And, then, we'd like to develop a tool to actually start taking a look at primarily the welds that are not stress relieved for potential signs of stress corrosion cracking. So, that's all outside the canister.

EWING: Okay, thanks very much.

GARRICK: Ron?

LATANISION: Latanision, Board.

I wanted to ask about that very last point you made. Is there evidence anywhere in the field in terms of

casks that are in dry storage now that either localized corrosion or stress corrosion cracking has appeared?

KESSLER: No. But, we haven't inspected--

LATANISION: That would have been my next question.

KESSLER: There has been experimental work, and EPRI has done some studies to say is it possible? The answer is yes, it's possible. There's been some accelerated corrosion testing done by CRIEPI in Japan, a couple others, to suggest yeah, under these sets of conditions, we could have stress corrosion cracking. But, have we gone out and looked yet? No.

LATANISION: Okay. That seems to me to be the important point. I mean, I could cause stress corrosion cracking of stainless steel in ten minutes in this room under the right conditions.

KESSLER: Exactly, that's the question. Do we have the conditions?

LATANISION: Yes. So, what is the current inspection, maintenance frequency or protocol, or where are we in that space?

KESSLER: I would say not much, but, Adam, correct me if I'm wrong. I think there's only occasional visual inspections mostly to make sure that the airways are clear, you know, are not clogged with something. In terms of actual inspections of any kind, visual, swipes, NDE, nothing--

LATANISION: Of the canisters themselves?

KESSLER: Of the outside of the stainless steel canisters, nothing is required, and not much is done. Hence, our desire to get in there and look.

LATANISION: That's a really important thing to do, from my perspective.

KESSLER: Which is why it's EPRI's only high priority item.

LATANISION: Let me know if you'd like some company when you make those inspections. I'd gladly join you.

KESSLER: I'm sure we'd have quite an audience, but we'd probably need to work out a few kinks first. I mean, pushing these things through and around and making sure we get what we want is going to be a chore. And, I'm sure we're going to do it wrong once or twice before we get something useful out of it.

GARRICK: John, do you have a metric for the level of effort that ESCP has been up to this point?

KESSLER: You mean in terms of--

GARRICK: Full-time equivalence, or something?

KESSLER: Oh, I have no idea, John. In the sense that, you know, you could go back and look at the UFD program, what portion of their man hours is ESCP related versus their day job? I don't know. Same with any other participant. You know, in the sense that we're trying to do this stress

corrosion cracking monitoring, okay, that's something we need to do anyway. We're doing it as part of ESCP. It's really hard to tell, John. We've had lots of meetings. There are people going home and doing things, like developing new models that came out of discussions at ESCP. But, I really can't give you a good number.

GARRICK: Do you have any idea of the level of effort you would like to see DOE?

KESSLER: Yes. I've talked about the two biggest ticket items that we'd like to have done, dry transfer facility and the high burnup demo, both of which are going to be a multi-million dollar program. That doesn't mean we're expecting DOE or UFD or whoever it is to foot the whole bill. EPRI is willing to contribute and already is contributing. The vendors are contributing. The utilities are going to contribute at the very least by volunteering at sites, and then going through any licensing or analysis that needs to be done. NRC is contributing. There may need to be a license exemption for some of this work. NRC is going to have to process those and evaluate those. All of it's multiple contributors.

GARRICK: Sounds like it's pretty hard to do any definitive program planning, though, until you know what you're going to get as a function of time out of the program, because you don't--

KESSLER: If you have good participation, we can move forward. We got a lead on the demo program, that's Ruth Weiner at Sandia, who is part of the UFD program. We have a couple other participants. I also know that part of UFD is funding an industry planning for a demo at an industry site. So, there is planning going on. We are thinking about things like what kind of NRC exemptions will we need to do what, what kind of information we want. We're proceeding, John.

GARRICK: Okay.

KESSLER: Yeah, I agree. It's a challenge, but I think we can get there.

GARRICK: Yeah, okay.

WILLIAMS: This is Jeff Williams with DOE.

We've been working closely with them. To answer your question about resources, and so forth, we've had--I mean, Brady and our team has been working on our program, and then we come to their meetings and we share information. So, I mean, the exact resources really has to go--is focused on the meetings.

But, one other thing that we've done recently is we have put out an RFP to the utility industry--or, to our vendors that I think Bill talked about early on, we have six teams, where we have asked them what they think needs to be in a demo, and we have proposals back from them for a plan. So, we're going to take all this information, Brady's work,

the work that they mentioned about Ruth Weiner was doing on evaluating the DOE complex, and coordination with them and the industry input, and hopefully this year, in maybe six months or so, we'll try and work out a better plan that has a cost schedule and scope, and so forth.

GARRICK: Okay, thank you. Andy?

KADAK: Yes. I'm interested in the fuel inspections. It sounds like your emphasis is on the high burnup fuel; right?

KESSLER: Very much so.

KADAK: Okay. But, I don't think we should ignore the low burnup fuel.

KESSLER: We're not ignoring the low burnup fuel. But, we do have data and licensing precedent for the lower burnup fuel.

KADAK: For inspections, as I just was going to finish the sentence.

KESSLER: What kind of inspections?

KADAK: The physical inspection of low burnup fuel after a relatively long period of storage. Now, earlier, you mentioned that you had some anecdotal evidence from France when they opened the casks. But, it would be really nice to be able to get more specific information about what is the condition of the fuel that they've opened? How old has it been? Adam mentioned that he opened a--

KESSLER: That's right, that was--I was just going to mention Adam's example. That would be one data--

KADAK: But, we don't know how old that fuel was?

KESSLER: We do.

KADAK: Well, he didn't--

KESSLER: --what burnup it was.

KADAK: All right. Can I just finish before you answer?

KESSLER: I just don't like you making too many incorrect statements in--

KADAK: Well, first of all, I don't think that's very funny. Okay?

KESSLER: I'm sorry.

KADAK: Secondly, I'm trying to make a point. The point is we need to have more inspection of fuel that has been aged. Okay? Low and high burnup.

KESSLER: We do.

KADAK: Okay.

KESSLER: And, what I'm saying is is I think that we got some information out of the one we looked at. DOE is proposing to reopen--

KADAK: Where is that quantified?

KESSLER: Where is what quantified?

KADAK: The inspection results.

KESSLER: It's in the dry cask storage characterization program work that Brady Hanson talked about yesterday. Those

are 2002 error reports.

KADAK: Okay.

KESSLER: So, that reopening was documented. We'd like to document the work at Peach Bottom that Adam referred to yesterday as another data point. We understand DOE would like to do some more inspections of the fuel that's at Idaho. That's great. I wouldn't consider it my highest priority requirement, but if they want to do it, we're not stopping them. We're happy for them to do it.

KADAK: Well, what I'm really trying to get somebody to agree to do, and that's be able to put together a comprehensive results of inspection program, not that if DOE likes to do something, they can do it, or if someone else does it, they can do that too. EPRI representing the industry, I think you should have a vested interest in making sure that you get the best available data on physical inspections of aged fuel, not only, you know, can you look at it, oh, yes, it looks like the same as we put it in, but more detail about what is the condition.

KESSLER: Quite so, Andy.

KADAK: Okay.

KESSLER: Quite so. Like, you know, I could do the mea culpa, we have a limited budget, we have restrictions, so we have to prioritize, which is why most people are prioritizing on what R&D we'd like to do first, given we all have limited

resources.

KADAK: All right.

KESSLER: So, it would be great to have more information on lower burnup fuel, but if I had limited money, I would put my money somewhere else first. And, that's certainly the case.

GARRICK: Okay, are we going to hear from others? Is Adam going to make a presentation?

LEVIN: Yes.

GARRICK: Okay. Adam has a bad leg and he's asked if--

LEVIN: No, I'm going to sit, if that's okay.

GARRICK: Yes.

LEVIN: Thank you very much.

First of all, I would like to thank the Board for the opportunity to come back and speak again. I spoke to the Board a number of years back, and it's a pleasure to dialogue with everybody on the Board. I certainly learn a great deal every time I come.

And, I also want to thank John and Jeff and others that have been involved in this ESCP program, because, frankly, as a utility participant, I can tell you that it's a wonderful opportunity for us to be able to provide our insight, and hopefully to provide some shortcuts, if you will. But, I see that the utilities really have an opportunity to provide data that otherwise the Department may

be searching for.

As an example, just this morning, listening to the presentation on transportation, and the discussion about the fact that the Department has no data on fuel transport and the impacts of emotion on the fuel assemblies themselves. Well, we transport new fuel to our sites with accelerometers in the boxes, so we have that data that we can provide. So, there's some opportunities that I think that we as industry really need to stay plugged in, and through the ESCP program, we're doing so. So, I do appreciate that very much.

Could we go to the next slide, please? Thanks.

You've heard a lot from previous speakers about the structure of DOE's program and their participation in the extended storage collaborative process, so I don't want to go too much further into this. Unfortunately, being a speaker in the fourth quarter of a conference, you find that 75 percent of the time, and I leave it to you, Dr. Garrick, to tweak those probabilities a little bit, but 75 percent of the time somebody has already talked about what you want to talk about, so I will do my best to try and expand upon that a little bit.

But, just, you know, the high points as far as the utilities are concerned, focus on that DOE has in the UFDC we think is the right focus, to conduct research and development to enable storage and transportation, and also to, you know,

the particular--to facilitate all options for disposition and maintain retrievability.

The one item that I certainly was very pleased to see in the UFDC program is that we're not going to limit the options. I mean, if there's some other opportunity to put forward an idea that from a total systems perspective, result in a benefit to the program, let's do so now. We have that opportunity. We have that open door, so let's make that happen.

Next slide, please?

So, from Exelon's perspective, where would we like to see DOE focus their gap analysis? And, you know, again we've seen these storage system safety functions from a number of the earlier speakers, thermal performance. From our perspective, thermal performance is kind of an interesting one because what we want to do long-term is to be able to have cask designs that are capable of accommodating 60,000 megawatt day per metric ton plus fuel in the center of the cask, and at the same time, accommodate low burnup fuel on the periphery of the cask, the reason being the low burnup fuel on the periphery of the cask is important from cask loading operations. We keep doses to our workers down by maintaining and using low burnup fuel on the periphery, so it's a very important point for us.

I probably should have put confinement up at the

top, it really is Number one, as far as we are concerned as a utility, because we want to make sure that when we load that cask, seal it up, put it out on the pad, and to the day that it goes down the road, that those contents are confined. And, frankly, until the system reaches its ultimate destination, because even in transport, although DOE may take title to it at our fence, it's still going to be viewed as Exelon fuel until it resides somewhere permanently.

Sub-criticality, of course, is important to us. In general, the retrievability is also important. But, I think that the confinement issue is probably the most important aspect of the storage system functions. And, of course, all of this gets translated to the transportation side of things. We need to be able to assure that we're there also.

And, finally, on this, public acceptance of a very complex and highly sensitive issue must be transparent, as far as we are concerned. We as an operator recognize the need for transparence. We make no bones about that whatsoever. We need to be there, otherwise, we're not going to be successful in all of this.

Next slide?

What deserves our consideration? Well, we have a set of existing NRC regulations and the DOE standard contract that requires the waste form as a fuel assembly. Definitions of intact and damaged are not actually regulation, they are

interim staff guidance. But, we have been working to that interim staff guidance in terms of our designs of our casks and how we determine the classification of fuel before we put it into storage.

And, the standard contract, of course, talks about requirements specific to fuel assemblies, and components which become--which are an integral part of the assembly that BWR channels, inserts, the plugs, et cetera, that go into BWRs.

I know why Dan invited me here today, because he knows I enjoy the opportunity to think off-center, and question the status quo. And, in fact, when he did present me the invitation, and I started thinking about what I was going to talk about today, I said well, is it time to consider a new regulatory framework, was one of the questions I asked myself. And, I think the answer is not, and I agree with what Ward Sproat said earlier this morning. We've established a pretty good regulatory framework, and for the most part, it does what it needs to do, which is provide protection of public health and safety.

But, I have concluded that there's probably a couple of changes that we could make, and maybe now is the time to make that shift in the way we view and analyze storage transport and disposal. And, John Wagner spoke earlier today rather extensively about the approach I'd like

to present, and in fact presented some of the technical roadmap that needs to be considered.

Let's go to the next slide.

So, other options we might consider? Well, with the termination of the Yucca Mountain Program, we have an opportunity to look, to address from a total system perspective what would be beneficial. I don't want to throw the baby out with the bath water, I think many of the regulations that we have today in general, I think, serve their purpose. However, I think there is some focused changes we can make, and the focused change I think we can make which results in allowed a welded canister or existing transport cask to become the waste form rather than the assembly. I think this has the potential for simplifying the technology development necessary in order to be able to make the long-term decisions we need to make with respect to transportation and storage.

I also think it will accelerate the process of moving used nuclear fuel away from the sites. And, I do have to point out, of course, and I'm sure everybody recognizes this, that demanding the standard contract is going to be a problematic issue and will require some legislative input.

One of the considerations that was given and suggested by the DOE in their gap analysis, their draft gap analysis, was canning all of the used nuclear fuel. And, I

did want to identify that today that that is a very very expensive process. When canisters are on the order of a million dollars, or so themselves, and we add another million dollars, or so, on top of that in order to be able to place the fuel into cans, I think that's really a non-starter and not something we would want to do.

And, interestingly enough, we are in the process of loading some damaged fuel, or we're preparing to down at Dresden Unit 2--I'm sorry--Unit 3 next year. It actually is Dresden Unit 1 fuel that's being stored in the Dresden 3 pool, and we'll be--we just put it in order for damaged fuel containers. So, that's why I'm familiar with the kinds of numbers that are out there. And, to set up a cask that has 68 locations with damaged fuel canisters in all of those locations would be an expensive process. It certainly would not be an ALARA for loaded systems, if we have to bring them back in, cut them open, and put fuel into canisters, and of course, every opportunity for handling the fuel assembly just gets you another opportunity for creating a fuel assembly that has some damage, which we certainly would like to avoid.

Next slide, please?

Just a quick table here, but the structures, systems, and components important to safety, the things that certainly need to get looked at in terms of R&D going forward with storage, long-term storage and transportation. But,

considering the canister, the canister, the waste form, I think it will limit the amount of R&D that needs to be done in order to demonstrate long-term storage and transportation. Obviously, if you make the assumption that the fuel is in rubble in the cask at the pad, in transportation down the road and in disposal, a lot of the issues associated with the integrity of the fuel cladding go away.

The neutron absorbers are identified as relatively limited, but I think that there's still some work that needs to be done in that area because it does provide defense in depth for transporting. And, I'll get to that in a minute.

The welded canisters, the bolted systems, and the concrete overpacks, by making the assumption that the waste form now becomes the canister, you're going to be placing a lot more alliance certainly on those welded canisters and potentially on those bolted systems. So, you're going to be doing a great deal more research and development for those pieces.

Next slide, please?

Since the used nuclear fuel itself is no longer the waste form, then we assume the debris configurations in all storage transport and disposal considerations, obviously the canister becomes the confined boundary, and criticality controls in this case, we're going to have to depend very strongly on moderator exclusion, burnup credit, which

includes fission product poisons. And, I strongly encourage that this be pursued extensively because there's some tremendous benefits to it.

We talked a little bit this morning, and John Wagner again presented some information about different configurations of fuel inside the canister, and the potential impact on k-effective that it has. Now, 15 percent increase in k-effective can very quickly be mitigated by assuming and taking credit for burnup of the fuel.

And, I encourage, of course, that DOE expand upon and utilize the work that EPRI has already produced in reports addressing the disposal of intact canisters at Yucca Mountain, and also criticality analysis, including credit for fuel burnup.

Next slide, please?

So, just closing very quickly, the research on cladding properties and fuel structural material becomes limited. I don't think it goes away completely, but there are certainly benefits from the standpoint that we would have to do less R&D I believe in order to be able to demonstrate long-term storage and transport down the road.

The second thing is that monitoring inspections at the utility sites, if I can do them from the exterior of the canister as opposed to actually getting inside, it's going to make my life a lot easier. And, in fact, it would be very

difficult for me to go ahead and open up a port in an already loaded canister, in order to incorporate instrumentation if I needed to to do inspections or monitoring of fuel that's in the canister itself.

Certainly, though, we can take a look at what the exterior of the canister looks like. That kind of inspection work we can do readily.

And, finally, the focus of all of this is going to remain on confinement, confinement, confinement, associated with that welded canister. And, in some respects, you know, as I mentioned, the welded canister and the bolted systems are going to have to probably perform to higher standards if we're depending on them to be the primary boundary, and not rely upon whatsoever the integrity of the fuel cladding.

So, with that, I'll take some questions.

GARRICK: Okay. Go ahead, Gene.

ROWE: Adam, I just have one quick question. When you load a cask or canister, do you, when you do the criticality analysis, do you consider the flooded condition?

LEVIN: Criticality analysis is considered--the design of the casks consider or use or utilize the criticality analysis that in the case of a BWR, as an example, is a flooded condition.

ROWE: For PWR?

LEVIN: For PWR, it often assumes a minimum level of

relation in the water.

ROWE: In the cask?

LEVIN: Yes. As you're loading it in the pool, you've got borated water in your spent fuel pools. So, there's--the boration level may be some 2000 ppm in your spent fuel pool, or higher, and then the cask techspecs, as an example, may say 500 ppm is required. So, the assumption is as you're loading the cask in the spent fuel pool--and, again, remember you're not taking credit for burnup here.

ROWE: Right.

LEVIN: So, you're loading the cask with a minimum amount of boration in the water.

ROWE: I'm not talking about during the loading. I'm talking about when--do you do the analysis when it's sitting out on the--when it's sitting out on the pad, do you consider moderator exclusion at that point?

LEVIN: The canister is considered dry at all times sitting out on the pad. So, yes, moderator exclusion.

ROWE: Okay, thank you.

LEVIN: That's not considered a credible accident.

ROWE: I realize that it's under 72, but it is under 71.

LEVIN: Once the cask moved down the road, yes, then there's an opportunity certainly for it to be placed in a position where it can be filled with water.

GARRICK: Ron?

LATANISION: Latanision, Board.

Adam, just a quick question on the very last point. What does higher standard mean? A lower tolerance for any evidence of corrosion, or what does that mean, what does the final point mean?

LEVIN: Well, I think a lower tolerance for the opportunity for stress corrosion cracks to form through wall, or through weld, I should say, those sorts of things. We may want to place upon that system a higher probability of their success of maintaining confinement than we might otherwise look at in different scenarios.

LATANISION: So, given that philosophy, you know, it would suggest that thoroughly treating the welds after welding would be one approach that would add some confidence there, but that's not likely to happen, at least I don't think it is in terms of the assembly of a cask. Shockpenning the surface, is that, what's the practical implication of this higher standard?

LEVIN: Well, I think the research and development, enough needs to be done to determine if those kinds of activities actually do provide additional benefits, and do provide additional assurance that integrity of the canister can be maintained. I honestly don't know whether it would or it wouldn't.

LATANISION: Okay.

GARRICK: It's an interesting concept. I'm certainly not opposed to improving the integrity of casks, but I am opposed to arbitrary assumptions as a risk analyst. And, why would I want to give away any possible protection or barrier? From that perspective, it makes no sense to me. And, I can imagine what the regulators might do? They will, as soon as you get a pinhole size penetration, there will be assumptions that the waste is instantly mobilized. And, of course, from a risk assessment standpoint, that's completely nonsense.

And, the thing that we look to engineered barriers to do is just delay, and you might have several pinholes for hundreds of years, maybe thousands of years, and still not have any release. So, from a risk assessment standpoint, where we sort of invented risk in order to build realistic models and to get away from arbitrary assumptions, it doesn't make much sense, from a modeling standpoint.

LEVIN: Well, I understand that and appreciate it, and I--

GARRICK: I thought you would.

LEVIN: I guess the interesting balance there is, and I asked myself this question again as I was preparing for this, but are we really going to be able to demonstrate in the end that we can, with a high degree of confidence, model and know exactly what the cladding will look like 60 years from now after it's transported down the road and in storage? So, my

suggestion here is let's step back and see if maybe the balance says do we go down the path of assuming there's no cladding, as a proper way, or one way of dealing with it, or do we have high enough confidence that we will be able to demonstrate if we set up a standard that says the cladding needs to be intact, that at the end of the day we'll be there?

GARRICK: Well, we don't have to know for sure. That's why we do uncertainty analysis. And, the uncertainties should certainly be evidence driven. They should not be arbitrary. And, I think that one could conceive of a monitoring program or an inspection program and an R&D program would allow you to provide pretty substantial evidence of the condition as long as you allow for the fact and take into account that there's uncertainty associated with it. I think that we have learned just a tremendous amount about nuclear safety by allowing ourselves to embrace the uncertainty sciences. This arbitrary business I think we have seen too many--too much evidence of it getting us in trouble, because each time the assumptions become increasingly in-conservative and suddenly we're completely away from reality, that's just my impression of it.

LEVIN: Well, we certainly experienced that in the Yucca Mountain Project.

GARRICK: Except you do have to pay for a risk analyst

to come and do it.

LATANISION: Do you know any that might be--

GARRICK: No. I'm not these days looking for work.

LATANISION: Sorry, Mr. Chairman, I couldn't resist.

LEVIN: Well, again, I think that the idea here that I'm presenting regarding the waste form being the canister, I think that from a utility perspective, if this can accelerate the removal of fuel from our sites, that to me is a benefit. And, frankly, come 2010--or excuse me--come 2020, I'm going to have 72 casks of spent fuel sitting on the shore of Lake Michigan, and I'm certainly going to get a lot of heat about that. But, I also feel comfortable knowing that I can transport those things down the road, and if somebody said, you know, the integrity of the canister is paramount, then we take creditor for moderator exclusion and burnup credit, I think we're there.

GARRICK: Well, the only thing that we have to worry about is to not get into the state of mind that we were in in the early years of the reactor safety business, and based our life on a guillotine break, and ignored everything else, such as small locusts. And, any time you take a leap like this, you open up the door for those kind of possibilities. And, if you do not try to keep on course with respect to mechanistic model and the supporting evidence for that model, you know, you can sometimes have that block your view of the

real problem. And, there's a lot of experience that indicates that's possible.

LEVIN: Point taken.

GARRICK: Yeah.

KADAK: Kadak, Board.

I don't think Adam is suggesting that we ignore the characteristics of the cladding over time.

GARRICK: I'm not worried about Adam. What I'm worried about is the analysts and the regulators and the fallout from something like this with respect to the way things are modeled. That's my biggest worry.

KADAK: Again, the concept is the waste package is the canister. Okay? What's in the canister, any modeler can work on. But, he's suggesting, and I believe I agree with him, that this was a concept that we originally started on when we canistered the waste, hopefully never having to open it again as a once-through fuel cycle, which was the national policy, you know, and still is.

So, the idea of having a canister be treated as a waste form for disposal doesn't affect at all the ability to understand what's in the canister to take credit for the modeling, and do whatever experimentation you want to do on the spent fuel, should it be necessary to demonstrate that it is a suitable barrier, namely the cladding is a suitable barrier. So, he's not denying--

GARRICK: Well, I realize that, Andy. I'm just worried about how it's interpreted by the analysts and by the regulators. If, in fact, the waste form fails, then that's the end of the line in a lot of people's minds, and it's not the end of the line from the safety standpoint, and from a risk standpoint. It may be inconsequential.

KADAK: But, the challenge that he's putting forth here is to see if the Department of Energy would be willing to change the initial bare fuel requirement for acceptance from the utilities of spent fuel. If they stick with that notion, no fuel will move from reactor sites, period.

GARRICK: That's another problem.

KADAK: That is a big problem.

GARRICK: Yeah, but it's not what I'm talking about.

KADAK: I know, but I'm trying to amplify on the conversation here. That has to be fixed anyway. And, if we don't fix that, nothing is going to go, and that's the message to our friends at DOE. Now, that becomes a contractual question, and that gets us back into the do-loop of nothing every happening until that litigation issue gets settled, which is why I've let it--and, these are the kinds of priority questions that no one is really wanting to face here, as opposed to studying, you know, the integrity of the cladding for the next 50 year5s.

LEVIN: And, again, my perspective is an operator's

perspective, you know, the kinds of things that I need to have done, the kinds of issues that I see presenting barriers to success, and one of them that concerns me honestly is knowing that I have to demonstrate, without a doubt, or with high probability at least, that cladding retains its integrity over the next 60, 100 years after it's stored and transported.

GARRICK: Yeah, but you can take into account a doubt. That's my point, part of my point.

LEVIN: Absolutely.

GARRICK: Doubt is something you certainly should incorporate into your analysis.

LEVIN: Absolutely.

GARRICK: Yeah.

LEVIN: Absolutely.

GARRICK: Okay. Any other comments or questions?

(No response.)

GARRICK: Okay, next speaker?

RUBENSTONE: Good afternoon. I'm Jim Rubenstone. I'm a branch chief in the what is currently called the Division of High-Level Waste Repository Safety in the Office of Nuclear Materials Safety and Safeguards at the NRC.

And, I would like to thank the Board for inviting NRC to provide some comments on the discussion here. I think so far, it's been a very interesting and informative meeting.

And, I would also like to echo to some degree Chairman Garrick's charge at the disclaimer at the morning of each meeting that you should not, unless I explicitly state it, construe anything I say as an official position of the Commission.

But, that being said, I think I can still offer some perspectives from the staff's point of view about some of these issues, and about the ESCP program that John described very eloquently.

I would also like to thank Brady Hanson for doing a very nice job yesterday of laying out sort of a technical issue landscape that's out there. I think that's a pretty comprehensive treatment. I think there may be some differences in how different groups view the prioritization of these areas for R&D. And, just to bring the NRC perspectives, there's two things which I think everybody agrees on are important in prioritization, and that's for a given issue, how it pertains to the performance of a system in ensuring safety in the storage or transportation components, and also the state of knowledge. Certainly, there are areas which are important, but that we know a fair amount about, and there are areas that are important that we have limited knowledge on.

From a regulator's perspective, though, our main concern I think, in addition to these two, is that we know

these issues well enough that we can provide a strong technical basis for our regulations and for our guidance that we go forward in order for the applicants to meet those regulations.

So, that's a little bit different, I think, than everyone else has. The corollaries to having the strong technical basis for the regulations and the guidance is that we understand enough about an issue to determine if it in fact is an important issue for safety and for meeting the regulations, and that we know enough about the issue that when the applicant comes in with their case for that, we can evaluate it in a clear and reasonable way. The burden of proof, however, to some degree rests with the applicant to make their case.

So, let me just step back for a minute and provide a little context about what NRC is doing in this area. And, there's really two initiatives which are strongly linked, but not identical that we're doing. The first is this concern for the need for long-term storage going forward, and establishing a firm technical basis for any regulations that we have in place now that could be applied out, or any future changes and any guidance that we will issue.

And, the second aspect is really a little bit different, but the staff has been charged by the Commission to develop support for a potential extension of the waste

confidence decision. And, this was mentioned by Brady I think yesterday as well.

In December of last year, the Commission issued an update to its Waste Confidence Decision that states that they have confidence that fuel can be safely--spent fuel can be safely and securely stored into the future for up to 60 years beyond the life of the given reactor facility, and that a repository would be available for disposal when necessary.

Staff has been asked to look at the potential extension of this beyond that time period, and to see how far one could technically support that extension. And, the principal mechanism for doing this is to develop an environmental impact statement for waste confidence beyond this already decided time period.

So, we have efforts going on the EIS side, and we have efforts going on the extended storage technical side for a safety point of view, and like I said, those are very complimentary methods, but they are not exactly the same thing. And, the main difference is they rely on, to a large degree, the same sort of set of facts or knowledge, but the types of analysis that one would do to prepare an environmental impact statement are not the same as the analysis that you would do to necessarily support regulations for extended storage going out for longer periods of time.

Staff laid out its initial plans on this in a paper

that went to the Commission in February of this year, and that paper is available in the Adams System. We are refining those plans, trying to develop them in more detail, and some of the preliminary schedules that we put out in that paper will probably be slipping a bit in response to developments and especially some of our budgetary considerations going forward.

So, just to speak briefly about the EIS, NRC has established procedures for developing NEPA documents and environmental impact statements. We will follow those. In this case, what we are doing now is, as I said, trying to expand a little bit on those plans that were laid out in the Commission paper which was fairly brief, and developing sort of an internal framework for how we would go forward with the EIS. We're looking at a largely scenario-based analysis, extending this potential environmental impacts of dry storage going forward for long time periods.

We expect to begin the public scoping process, which is part of the initial phase of the NEPA, sometime in the next calendar year. We are preparing right now a report to summarize sort of our framework for preparing the EIS. We expect to have that out in draft form before the end of 2011. We're shooting for November. And, we will put that out for public comments, get the public comments back, try to finalize that report as a starting point in the spring before

we go into the formal scoping process, which is used to define the actual--what the EIS will look like.

As I said, some of the schedules, the initial proposal for that EIS anticipated that it would be done in the final form in 2016, I think. Due to some of the budgetary considerations we've seen moving forward, that schedule is going to slip somewhat.

The second effort, as I said, is on the technical basis for extended storage and transportation. I'm going to focus mainly now on the safety aspects. There are security aspects to be considered. They're being worked as well at NRC, but in a somewhat separate framework.

The first step, and John alluded to this, is we are preparing a gap, our own gap assessment. And, this gap assessment draws on a couple existing ones, we're sort of calling it a synthesis report that we hope to wrap up in the near term. Certainly, the NWTRB and the DOE reports are prime considerations in that, and as has been pointed out, there's a fair overlap in the technical areas there.

We also have done an internal report that was commissioned with Savannah River Lab that's being finalized now, and that will be part of our input for this overall NRC gap assessment synthesis. And, the key again in that synthesis report is looking at the prioritization from the regulators' perspective.

We expect to have that report done in draft form by the end of November, roughly the same time scale as on the EIS framework report. We will put it out for public comments, and we certainly encourage the Board and other parties, interested parties, to provide us comments on that report.

As we move forward in developing these technical bases, we have roughly three phases, the first phase being the development of the gap assessment. And, like the ESCP program, the second phase is actually doing the work to close those gaps as needed. And, the third phase for us would be any updates of regulations or guidance as needed from what we have learned from that research.

I should also point out that we have, in parallel with what we are doing on the extended storage and transportation process, an initiative underway currently to look at our present licensing processes and framework for storage and transportation, Part 71 and 72. We have had a public meeting in July on that. We had made some presentations at the NEI meeting in May regarding that process, and we’re seeking out comments on that to improve it. Those process improvements are changes for sort of the present lessoning framework, and there are certainly implications of the present framework for extended storage. So, they’re not disconnected, but they’re going on in

parallel.

We are working with the ESCP program, and I think ESCP has been so far a good mechanism to share ideas with industry, with DOE, and with some of our international partners. We will continue to do that certainly.

Darren asked me to provide a couple examples of things that the NRC thinks are of high importance and will probably be going forward with, you know, pushing it as areas of concern. I think none of these should come as surprises. They have all been mentioned before. The first one is the performance of high burnup fuels, especially going forward over extended storage periods. We do have reasonable data, I would say on low burnup fuels, we do have the 15 year data point, which is an important one from the CASTOR experiment that was done at INL. High burnup fuels are an increasing fraction of the spent fuel in storage at commercial reactors now, and it will only become a much larger fraction going forward.

The amount of data on those is certainly smaller than there is on the low burnup fuels. There are significant differences, we feel probably in the performance of these, but we can’t say for sure yet until we get that information.

This is one area where I think we’re going to be relying to some extent on DOE and the industry to take some of the leads, because of the natures of the analyses that

need to be done to characterize this. John talked about the cask demonstration project, which I think is an important component of that. But, I think there's also opportunities for us to be creative and clever, to be able to develop information that will help us understand the performance of these high burnup fuels over long storage periods, kind of sooner than in real time.

It would be nice if you knew how high burnup fuels behaved over 40 years or 50 years, you know, before 40 or 50 years from now. But, I think that's a good opportunity, and ESCP I think has been promoting some, as I said, creative thinking by the experimentalists who have good ideas about how to draw on this and get more information.

A secondary where NRC is actively working is this question of potential for stress corrosion cracking in canisters exposed to marine atmospheres, marine environments where you could get deposition of sale on the stainless steel or carbon steel canisters. This is actually an active issue in the present licensing framework. There is a process we have for issue resolution that we're engaged with NEI right now on this issue about the potential for it developing sort of within the near-term, and if not, then how it could expand into a longer term.

Again, there's a couple components to this that can potentially promote stress corrosion cracking. You need the

deposition of salts and the concentration and the composition of those salts are important. You need the temperature state that would allow deliquescence to potentially occur, basically wetting the salts where you could begin corrosion. And, stress corrosion cracking needs stresses, so you need some understanding of the states of stresses and particularly around welds, key part in the fabricated canisters that are out there now.

The challenge, of course, as we have talked about is there's a number of these systems, there's different sorts of systems employed today, and put out into these sorts of environments. The good news is most of the metal is not exposed to deposition of salts. The bad news is it would still be exposed to the air, but you can't actually see it.

So, as John noted, one of the challenges is to develop some methods where you could actually make some observations on these canisters in place, characterize what's out there now, compare that to some research which has been done, and we're doing some further work about the specific conditions under which this may become a problem.

There was a report NRC has from a couple years ago, work that was done at Southwest Research Institute on some of the--characterization of sale deposition, and under what conditions you could get stress corrosion cracking. We're going to enhance, you know, follow up on some of that work in

the coming year. There's a fair amount of work in Japan, both on sampling salts and trying to get deposition rates in different environments. There's certainly plenty of information in the Atmospheric and Oceanographic literature about deposition of salt materials in proximity to oceans and estuaries that we need to draw on.

There's been some other stress corrosion cracking work in these environments in Japan. Some of that data needs careful examination to decide whether--how applicable it is. As was pointed out a moment ago, one can induce stress corrosion cracking if one wants to. Are those the conditions that exist? That's a key question we're working on right now.

And, I think just one third example would be something that John touched on, and this is the monitoring and non-destructive examination question. And, certainly there's applications in the SCC, but I think this has broader implications, and I think it's another area where we should really encourage creative thinking by DOE, the labs, and industry about, you know, what's out there as methods that could be employed in existing canisters and future canisters to do monitoring and measurements without having to open casks. There is certainly no substitute on a broad scale for opening a canister and examining the fuel that's in it.

As John has pointed out, this is a non-trivial

exercise. And, it's easy to induce effects just by the opening and sampling process. The downside of that is because of these barriers to do it, one is always going to have a very limited number of these direct observations.

A lot of the processes we're talking about that could affect safety systems, especially on high burnup fuels are, you know, stochastic processes, you know, one data point is good, 1400 data points where I can remotely observe all canisters deployed are even better, and we can get a better feel. And, we have to be careful that we don't fall in the trap of oh, the only thing we need is what we could get from a full opening, and the examination of what's inside. There are aspects potentially of behavior of fuel within a sealed canister that one could detect remotely, and I don't have specific examples of this. I think this is something we need to work on.

You know, gross changes, if we have a way to say there have not been gross changes, then we can do that on a large scale without opening canisters. I think that's a useful thing to know. So, I would point out this is another area that I think is ripe for work under ESCP and through DOE and the labs.

The last aspect I want to point out, and it points to some of these other things, I think it ties them together a bit, is aging management programs. This is a well

established engineering principle, as one uses engineered systems for a protracted period of time, is you need to have a program to manage the aging of the materials, and how it goes forward.

As NRC reviews requests for extensions of ISFSI licenses, extensions for certificates for storage systems, an aging management program is a requirement now. I think this will be an increasingly important requirement as subsequent renewals may potentially go forward. And, I think it's not too controversial to say that the aging management program that one proposes to renew a 20 year ISFSI for another 40 years is not the same one that one would propose to renew that same ISFSI at the end of the next 40 years.

So, again, some clear thinking about what one would do within an aging management program. What sorts of data would be needed in order to have a strong technical basis that that program would be effective, are important things to consider as we look to the R&D efforts going forward.

And, just in closing, we have a couple public meetings coming up where we'll be rolling out some of these plans, just like I talked about today, and asking for stakeholder inputs on what's the best way to interact with various stakeholders as we move forward in these initiatives. And, you know, how can we better serve and operate in a transparent and open way?

Most notably, two weeks from today at our Rockville headquarters, we'll have a public meeting on the waste confidence and extended storage and transportation plans. That's been publicly noticed. We're working the agenda. We will probably revise the start time a little bit to accommodate people on the West Coast. But, that's, as I said, that's the 28th in Rockville.

And, then, next week, we will be speaking about some of the extended storage and transportation technical issues to the sub-committee on irradiation protection and nuclear materials of our own NRC advisory committee on reactor safeguards. That will be September 22nd. Again, that's again a rollout of the plans, and sort of an introduction as to the type of work we expect to do for the ACRS input. We will follow up that meeting, and right now, it's tentative, in mid January, come back to the same sub-committee and discuss our gap assessment, which will have been released at that point, and begin engaging them on feedback from the ACRS on that, and then we expect, if we stay on schedule, to go to the full ACRS committee in the February meeting.

So, again, thank you for the opportunity to talk, and I appreciate the Board's insight and comments on NRC's plans going forward.

GARRICK: Thank you. Thank you. We are running really

short of time, but we'll take one, maybe two questions, depending on how long Andy's question is.

KADAK: I was just wondering, this EIS, is that on the justification for the 60 years period, or for a longer period?

RUBENSTONE: For a longer period.

KADAK: Okay. And, if all these technical gaps exist, how can you make such a finding?

RUBENSTONE: Which finding?

KADAK: Of waste confidence for a longer period?

RUBENSTONE: Well, that's part of where we would be inheriting--incorporating the information that we gain from the technical work over the coming years into the environmental impact statement. Now, on an environmental impact statement, one can do impact analyses with some limiting assumptions within them. You don't necessarily need exactly the same level of technical understanding. You can do analyses that are perhaps at a higher level than one would do for--

KADAK: Okay. The other very quick question is as you look at Part 71 and Part 72, are you trying to harmonize the approach to analyses, for example, on criticality?

RUBENSTONE: I think that's an issue that has come up more than once in discussions, and that's part of our, as I said, the process improvement right now, NRC is open

certainly if someone wants to make a formal approach to change the regulations per se. There are other changes that can be done within the guidance also that could help perhaps harmonize these things.

KADAK: So, are you doing it internally, or are you waiting for others to give you guidance on how to--

RUBENSTONE: We don't have a rulemaking underway right now that would make any changes in 71 or 72. But, that's open if what comes out of our process improvement suggests that's the way to go.

GARRICK: Okay. Well, I think we're going to have to close this session. I want to thank the panel for a very interesting afternoon. And, we will take a short break, maybe a ten minute break.

(Whereupon, a recess was taken.)

GARRICK: We're to the last panel of the day, but certainly not the least, Implications for Waste Management of Using MOX Fuel, and we have, as we introduced this morning, Wolfgang Faber and Patrice Fortier and Dan Stout. So, proceed, gentlemen. We welcome you.

FABER: Well, good afternoon, everybody. My name is Wolfgang Faber, and I'm from E.ON-Kernkraft. E.ON is very much honored to be invited here, and I'm the happy volunteer.

Well, some few information about our company. We are operating currently four large pressured light water

reactors across the country, and we have shares in some others. E.ON is one of four utilities in Germany, and nuclear-wise, it's the largest one.

And, on the left-hand side, you see eight units that we used to operate, some are decommissioned, two only recently. And, you see here the metric tons of heavy metal that went through up to now, what we reprocessed from that, and what went back in the form of MOX fuel into the cores. And, the balance is summarized here. It's a total of 5,200 metric tons heavy metal, and half of that was reprocessed. That makes 60 tons of plutonium, and half of that is recycled as MOX.

In the handouts, there is a typo, it says 60 here, it must be 50.

The next slide.

This shows the licensing situation and it's only intended to show you two things. First, it's different than any of our units, and this is due to our regulators. Any state has different authority. There is no federal authority governing everything. And, the second thing that I want to point out is that--is rather difficult, it's really highly regulated, not only the fissile content is set here, but quality and the amount of MOX in the core, total amount, and to reload, so it's regulated in detail.

And, this is, so to speak, the lifeline as I see it

of MOX bundles from manufacturing to transport and intermediate storage. Our area of expertise is certainly three to seven, receiving inspection, on-site storage, reactor-physics, safeguards and post-operation storage. That's what I'm talking about, and I hope that you will not be too much disappointed.

This is showing two real MOX bundles, and not some Cosmo characterization, but those two went through our plant Isar-2, and it shows two things. It's the burnup of 60,000 metric tons, megawatt days per metric ton. It basically shows two things. The recycling effort, meaning bringing plutonium down and burning it from this number to this number, and we pay for in trans plutonium, five times as high as we have in the uranium part of the same burnup.

ARNOLD: What is Tpu?

FABER: Trans plutonium. Okay. This chart summarizes basic features that calls the peculiarities--not a word for my tongue--that I describe later. So, it's, first of all, the fission cross-section certainly, fission neutrons, and percentage of delayed neutrons. Then, the fission energy, this is describing the fission neutrons itself, not in the core, but itself. And, I would like to point out the rest here. This causes the trouble in receiving the bundles, in handling the fresh fuel, and it's the heat that is created by plutonium 238 and by Americium 241. And, it's about

typically 400 watts per fuel assembly.

Now, the in core situation, the neutron spectrum that has some effects, it's from here, this is the red curve shows the spectrum in MOX, and the blue one is in uranium, and the difference, MOX has a higher number of fast neutrons and a lower number of thermal neutrons, of slow neutrons, and this is theoretically causing material--affecting material properties, and this is affecting the transient reaction reactivity coefficients.

Okay, I'll skip that. Going through that lifeline that I showed before. On-site receiving inspection, there is a radiation dose for the staff about 50 to 100 micro severt per MOX fuel assembly. And, because it's just hot, it has to be cooled in a rack prior to going into the wet storage pond. It can easily be about 100 degrees Centigrade, and they don't to have steam going up.

I have four photographs here showing that it's just more complicated to handle the uranium fuel. Uranium fuel comes in a truck that is not like that safety truck, and the package is just very much lighter, and this is the cooling rack that the stuff has to operate close to. So, this is more complicated.

And, the reactor physics properties that are potentially affected: bundle design, reactivity versus burnup is different, power distribution in the bundle, in the core

could be different, measurement versus prediction is something that we have to look at. Do we predict our cores with the same accuracy whether they have MOX or when we have uranium core. Transients and accidents are fully affected.

Fuel rod design properties that are affected is most of all heat conductivity, fuel temperature because of that, and fission gas release also.

Now, the first thing here is fuel design. Fuel design is more complicated. On the right-hand side is the uranium bundle, more of the boring type, all over the place, only one enrichment, except for the guide tubes here. It's a 16 by 16 bundle. Now, because of the lower number of slow neutrons, the effect of moderation is higher in MOX than in uranium, and, therefore, you have to decrease the enrichment in the outer row, and enhance, bring water into the inner side just to flatten the power distribution over the bundle. So, it's just more difficult to design and to fabricate.

Okay, this is what reactor physicists like most about MOX. It's the k-infinity curve that runs flat down to high disposers, and that makes MOX very valuable. You have a high reactivity at relatively high burnup, and you have a low excess reactivity up front with low burnup.

I'm sorry, I didn't say this is burnup, and this is k-infinity. These curves are curves for uranium bundles. You see here the effect of beryline poisoning.

Now, this picture is taken out of a report that we prepared. It's about reactivity at equivalence. So, the question is how much worth is a MOX bundle compared to a uranium bundle. And, there are several ways to figure that out, all resulting in different numbers.

The first thing you can do, and an easy thing is define discharge burnup, and then you just integrate under this curve. And, if it's equal, then it's equivalent. Alternatively, you can define such a reference k-infinity that, well, takes care of the leakage, neutron leakage, and where the lines cross, those two bundles are equivalent. Those did provide some rather complicated formula, putting some weighting numbers on the isotopes, plutonium, and if you sum that up, you get the equivalence.

And we did an equilibrium cycle study, taking an equilibrium cycle with uranium, some few MOX in there, 16, and then when we were taking out the MOX, putting uranium in, increasing their enrichment up to the point when we met the cycle energy. So, then, you can say these are equivalent. And, the funny thing is the equivalence depends on the surrounding, meaning that if you put MOX into a high enriched core, the MOX is more rough than if you put it in a low enriched core.

Now, talking about reactor power distribution, does MOX have any influence on that? These are two cores from one

of our plants, and these two pictures are showing the power distribution, and I don't know whether you could guess which of those have MOX. The loading pattern described here by the burnup at the beginning of cycle is quite similar, same cycle energy. So, the only thing that you can easily identify where the MOX are is this one showing the thermal neutron flux, and it's lower. Blue means low compared to red and yellow. Where the blue colors are here, these are the MOX. So, effectively, there is no effect on power distribution of the core.

Accuracy of core simulator prediction. We had to work hard on that to prove that there is no influence on our accuracy of prediction. And, it turned out there is none. We are comparing aeroball-measurements with the predictions of the reactor simulator, and the errors are independent whether we have MOX or uranium core.

There is something that we found. We see an influence of the critical boron concentration, but this is code specific. We use AREVAs CASCADE-simulator, but with the Cosmo simulator packet from Studsvik-Scandpower that we also use, we can see that difference. So, it's code specific.

Now, we are getting deeper into the fuel rods. Transients. Two examples here for transients, where MOX has an effect. First, anticipated transient without SCRAM. All four main circulation pumps stop and the control rods are

stuck. So, the reactivity in the core is left to itself, so to speak. The core voids and reactivity comes down, and the more negative, void coefficient, and temperature coefficient and void coefficient helps bring the reactivity faster down. So, with this accident, MOX helps.

The other one where MOX doesn't help is LOCA, peak letting temperature is higher in MOX. And, talking about peak letting temperature in the U.S., ECR is important. It's not with us because our transient is faster, it's shorter than--

KADAK: What is ECR? I'm sorry.

FABER: Equivalent cladding reactive. It's what in this high temperature phase, the cladding is corroding.

KADAK: What is the difference in peak temperature between the MOX and the uranium core?

FABER: About 100 degrees centigrade.

KADAK: Centigrade?

FABER: Centigrade. There is a special criterion that we have that nobody else uses, I guess, it's the core failure rate. In case of a LOCA, we have to prove that only that-- not more than 10 percent of the core will break. I mean, there are 45,000 rods in the core, so only 10 percent of those are allowed to break during LOCA. And, it's mostly in the first phase when the temperature goes up, and this is-- this has to do with inner pressure, and, therefore, I have

this picture here. It shows for the PWR core, the frequency distribution of inner pressure, rod inner pressure, and the black line is for all rods in the core. Then, the green one is for the MOX, and what you can see is that the high pressure is only made by the MOX rods.

So, lower heat conductivity that is shown here, over the whole range of burnup and temperature, the heat conductivity of MOX, the solid line, is always lower than for the uranium fuel, the dash lines. And, together with this inhomogeneous distribution of fission nuclei in the matrix, you have in the grain of the uranium fuel, you have 5 percent about of fission nuclei, and you have about the same size of the matrix of the grain in plutonium, about. But, the plutonium is in there, not evenly distributed, so to speak. So, the inner surface is smaller, and this means that you can’t keep that fission gas on the surfaces. And, that means high fission gas release.

We have higher power at higher burnup, reflecting this k-infinity curve. That means higher fuel temperature, more fission gas, which is accommodated by additional lower fuel rod plenum reducing the fuel mass, of course.

This shows the effect in another way. These two plots, this for a uranium core, this for a MOX core, and shows in red the top 5 percent of stored energy. And, in a uranium core, it’s clearly here in the first cycle, and here

in the MOX core. And, there is a considerable contribution of MOX rods with higher burnup. Okay?

And, this is, so to speak, the influence, fission properties make k-infinity. Then we have the peak conductivity and we have the micro-structure, and those two affecting the fuel temperature, bringing the pressure up. So, this is--well, where the rubber meets the road, so to speak.

Fast fluence. I said that theoretically, there could be an influence on neutron spectrum on materials. These are the same two cores that I showed before. White is fast flux, and you can't see any difference in here. This is the MOX core. This has no MOX.

Another way to show that there is no influence is RPV, a reactor pressure vessel fluence, per day, averaged over certain cycles here over time. So, the average fluence, RPV fluence per full power day goes down, and this is due to the trend in loading scheme, in-out versus out-in. And, the average number of MOX assemblies per cycle goes up, so there is no influence to be seen here.

Control rod worth. There was no adaptation necessary in plants. As far as in French units, they had to change something about control rods when they started using MOX. Measurements can easily meet the shutdown criterion. The only thing is that control rod worth is a little bit

different. We have in MOX cores, an equivalent of 150 ppm boron per percent compared to 140 in a uranium core.

Safeguards. Additional cameras, more inspections, more inconvenient for people there.

Now, back-end, and back-end is, well, not as you understand back-end probably. Back-end is only the interim storage for us.

This is what we have now as the licensed container cask, and four positions where we can put MOX in. And, in the current license, any position has the same heat load, and it doesn't matter what the others have. So, the decay heat curve that you see here, this is for MOX of 65,000, 55,000. This is uranium 65 and uranium 55,000. To meet those criteria, you have to wait with a 65,000 MOX, 12 and something years, and with a 55,000, still, seven and a half years, compared to uranium, which is about five years, five to six years.

Now, in the new license that we expect any day, there is a little bit of a compensation method included here, but it's not really relieving, because, while we have six places to put MOX here, and we may put higher heat load on the MOX places, but we have to compensate that with very, very low heat load of the uranium fuel, so we have to keep cold ones on store to realize something like that.

So, my conclusions are MOX are more expensive, at

least for us; more difficult to fabricate; more complicated to handle on site; more closely supervised by IAEA. My fuel management people, they appreciate MOX very much, and we need longer post-operating storage time; and the higher inner pressure could cause some trouble in longer intermediate storage times.

So, this is the first part of my presentation about PWR. If you want me, I can in five minutes skip through something about BWRs, Gundremmingen.

GARRICK: Well, what do we think? Okay.

FABER: So, this is what my colleague Dr. Schrader from RWE allowed me to show. It's his presentation.

The first time MOX was loaded in Germany was in this small reactor Kahl, 16 megawatts electrical. It was in 1966, and they tried a lot with MOX cores here. This is probably more interesting. This shows Gundremmingen B. It's a 1300 megawatt electric BWR, and this shows here, the yellows are the MOX, and from 1996 on, they were using MOX there to an amount of 300 MOX per core. And, this goes on until 2010, and no MOX after that.

This is Unit C, comparable picture. This is licensing activity. This shows what I showed before, the rather complicated and detailed licensing for MOX operation. This is how the MOX core looked like with the maximum allowed amount of MOX in that core.

We did a whole lot of testing to verify all that, and here you see we are part of the game. And, about application, we talked about that. And, those during handling, those 50 micro sivert, and the total amount of MOX, of plutonium that was recycled in Gundremmingen is 5 tons fissile plutonium, 8 tons of total plutonium.

Thank you so much for your patience.

GARRICK: Thank you. Yes, Andy?

KADAK: Given all the difficulties, why did you proceed on the MOX path?

FABER: Well, we didn't--we are obliged to do that by law.

KADAK: You're obliged?

FABER: Yes. Until 2005, the law said you have to recycle and bring back plutonium. You have to recycle your plutonium. After 2005, transportation of spent fuel is forbidden, and, therefore, we are now on the long-term interim storage path.

MOTE: Can I add something to both sides of this discussion, and I can see where this thing--both know that will not come through.

Back in the 1970's, the German government passed what was called the German Atom Law, and that required the German utilities to put in place a solution for spent fuel management, at least certain years in advance of operation.

Therefore, the German utilities signed reprocessing contracts. Therefore, they have plutonium to their account, and the German government then said, recycle your plutonium. They didn't go into MOX because they wanted to do MOX. They went into MOX because they have plutonium, and a legal requirement to recycle it. And, they had to incur the additional cost penalty and dose penalty that came with meeting the government requirement.

GARRICK: Yes, Howard?

ARNOLD: Arnold, Board.

Did the RWE people draw any qualitative conclusions the way you have about advantages and disadvantages?

FABER: The same.

ARNOLD: The same.

FABER: In-core fuel management is easier. They can handle it. They could handle it. It's over now. But, the same judgment about operational MOX than we have.

ARNOLD: Okay.

FABER: It's more complicated in BWR than in PWR. The assemblies are a little bit more difficult. Enrichment--

ARNOLD: Variable enrichment?

FABER: Yes.

ARNOLD: Just a quick--is this MOX made with natural uranium, or depleted uranium?

FABER: It depends. There are some units that had no

license to use depleted uranium. So, they went with the term metro uranium. The others, most of them used tails uranium.

ARNOLD: Okay.

KADAK: What was the differential in cost for a MOX fuel assembly or fuel cycle, percentage-wise on the cost of electricity?

FABER: The commercial people factor of two.

KADAK: Favor of two? So, if you take the, say, the cents per kilowatt hour, or Euros per kilowatt hour, what would that add to the percent of cost of electricity?

FABER: I'm sorry, I cannot answer that.

KADAK: But, a factor of two on fuel cycle cost?

FABER: No, not on fuel cycle cost, it's only on the fabrication side.

KADAK: Okay.

FABER: So, it's only the fabrication that's--

KADAK: It's a factor of two.

FABER: That's a factor of two. And, the mixture--I'm sorry, I can't answer that.

KADAK: Okay.

GARRICK: Any other questions?

(No response.)

GARRICK: All right, we'll go to our second speaker. Thank you.

FORTIER: So, good afternoon. My name is Patrice

Fortier. I'm with TN International in France, and TN International belongs to AREVA Group.

The purpose today--well, first of all, I will introduce myself a little bit more. I'm involved currently in the business for transport of MOX fuel to Japan. And, in the last six years, we--the transport, the two transport we performed in 2009 and 2010 for delivery of MOX fuel in Japan, since Fukushima, so we are waiting for Japanese decision for making the next transport. And, just before 2005, I was involved in the test of--manufacture in France in Berne and Catawba for the U.S. program.

So, today, my speech will be to give you some information about the overview of used fuel transport casks in France. And, as we are specialized in--well, we are the high group assisting plan, we manage all the transport, which goes to La Hague, and all the return of--the customer, so in charge of MOX or 55 residue on the compacted waste.

So, first, I will make a brief introduction of what's--where is TN International? Inside AREVA. And, we have a company in the U.S. which is called TN, Inc. close to Washington, but I think a lot of you knows well. So, all this a company, in fact, in our AREVA Group are gathered inside what's called BU Logistics, BU for Business Unit Logistics, in AREVA.

We'll go through the description of casks which we

use for the transport of UOX used fuel, UOX fuel or MOX used fuel, as well as we present also some information about HLW vitrified residual transport cask, and will give some information about the fresh MOX fuel cask.

So, BU Logistics presents, and this is our assignment by--it's to be presented at all the stages of the nuclear fuel cycle, we mean all the transport between the CDTUR we are involved, closed or not, but whether we are or not, we try to be. And, we also, involved on behalf of AREVA, to exercise and to oversee all the transport which go whether AREVA is involved, or it's--solutions throughout the world.

So, our organization, the BU Logistics, is within the back-end branch inside AREVA, and our main scope of work is to first of all design and manufacture the cask, which are used for the transportation and storage of radioactive material, but also provide Logistics services under the best safety and security conditions all around the world. And, we also transport to Japan and receive material from the different parts of the world. So, we cover all the world.

We also--yes, our work does not stop when we design and manufacture a cask. Our world does not stop at the gate, with many from the pool to the pool, taking into account all the constraint related to the lodging and lodging of--and the fuel management.

We also ensure the transport. While not only engineers are working on design and manufacturing, we also transport. We have the feedback from the transport section about what's going where, what's going wrong, with the use of the cask.

And, we also supply dry storage systems for the TDTs in the world, in the U.S., in Europe, in Japan as well. All of this, it's around 45 years that we've performed this work.

Just a map to see our location, so, Europe, of course, the United States and Canada, and Japan. So, we cover the main countries where the nuclear is implemented.

So, our strengths, we said it would be about this, our strength of course we've got from this well since 1965, or so, so if something was wrong during this period, for a long time now, we'd--excellent management in the majority of logistics projects. And, I can tell you that the transportation to Japan of MOX fuel brings a lot of things to--not only the transport or safety aspects and security aspects, but also interfaces with the public and the government to go through the--

So, I guess level of safety are opportunities, of course we bet on the revival of nuclear power in the world, and we continue to work with existing power plants to provide the necessary products that they need.

This slide is to summarize or to pick up the world innovative, because we are not in the world, we are--every day we need to bring new solutions to our customers, so, it's work in the dry storage area, that's work also for transport of vitrified residue. New transport casks which is under design for EDF. We are working with the Japanese customer to return their compacted waste. And, so, this is always, every day, a new challenge to bring a new solution. And, I can tell you also that we are starting to--which is a preliminary study to develop future generation of cask for the transport of MOX fresh fuel.

So, for me, it's not easy to read this slide, but it's only to summarize and to show that we are present at all the stages of the transport of the cycle of the fuel, from the mining to the reactor. And, after the reactor, to the reprocessing plant, and after, to the MOX facility, MOX reconditioned facility, and the return to the reactor with the customer. So, we are at all these stages.

Now, a little bit more into the work we've performed for the transport of used fuel in France. So, TN International manages all the transport of the spent fuel to La Hague. And, so, we have developed for this a large fleet of casks to cope with the needs of the customer and also the flow of the transport. Typical casks which we use and we continue to use, it's always under permission of the TN 12

because it was designed in the beginning to load 12 PWRs, and the TN 17 for 17 BWR fuel assemblies. So, we use these casks since 1981 or--the early Eighties.

The casks arrive at somewhere at the end of their life, and we think about a new generation of casks, so we introduced in 2008 a new cask which is a TN 112 that I will explain a little bit more in detail after, which transports MOX fuel assemblies, and we have also the overcasks on the designs for European customers or TN12G3 for EDF.

After reprocessing at La Hague, all the product from reprocessed are returned to the customer under a different form. So, it’s returned to the customer or the country under the MOX form.

The MOX facility in France is about 1000 miles from La Hague, so we have to transport the plutonium from La Hague to this Melox site in the South of France. We return all the high-level waste, vitrified residue either to Japan or to Europe and customer, and we also return all the compacted waste to the country who sent before spent fuel to reprocess at La Hague. So, some of it’s compacted waste has been already returned to the European customer. For Japan, it’s not--

Some figures about the work we--or the quantity we perform over the years, we transport over the years. So, since the early Eighties or late Seventies, we can say, in

fact, we're transported a total of 3000 tons, metric tons, 3000 tons of used fuel from Japan, 8000 tons from European customers, Germany, Belgium, Switzerland, to the reprocessing activities. That represents a total of 11,000 ton, less than one-third of the spent fuel of the used fuel we receive at La Hague. The rest, the difference is coming from EDF, but EDF makes some reserve about the figures to communicate the figures about the used fuel they sent to La Hague for reprocessing.

Typical transport figures of the work we perform in 2010, so this is a result of 2010, we counted 202 used fuel casks returning to La Hague for--we shipped out to La Hague 21 either high-level waste casks or compacted waste casks to European customers, 66 MOX fresh fuel casks for after the manufacturing of the fuel at Melox, but these 66 casks were transported to the customer, and in between the facility of La Hague and Melox in the South of France, we made around 86 transports of plutonium oxide.

Coming back to the transport of used fuel, we transported around 200 casks per year, and it is our belief that it represents half of the fuel on the--in the U.S. from the reactor, just to give an idea.

So, now, this PCPCT of France, because I need to return to a little bit more in detail about TN 12 and TN 112, so this is the map of France. This is the location of the

different nuclear power plants and the different--all the reactors mentioned on this map. I think, it may mean I'm wrong, but I think France in terms of size area is less than Texas. So, it's quite concentrated, the activities. And, the different size, which are different EDF sites which are rounded with red, manage MOX fuel, and so we transport this MOX fuel either from--first from Melox to this reactor for the fresh MOX fuel, and after from this reactor to La Hague.

So, a little bit more, a technical aspect about the transport fleet for the spent fuel in France. I will just say a few words about the means of transport, trucks and wagons. And, about the casks, so we have since the early Eighties, TN 12/2, which was designed at first for the transport of UO2 used fuel, and then adapted for the MOX used fuel. And, since 2008, we started to use a TN 112, which was first designed for the MOX fuel, and after we adapted its content for the purpose of UO2 mixed with MOX.

Well, transport means, nothing new, except maybe that the trucks are five or six years old, but we use, in terms of trucks, for the short distance, between the railway station and La Hague, so it's about 50 kilometers, we use the truck to transport the cask, and from the reactor plant to the La Hague, in fact, we use the wagon, the rail wagon to deliver the cask. So, the equipment can transport casks which have the range of weight between 70 tons and 125 tons.

We use also this transport, it apparently is, but we use also this means of transport for the return of HLW vitrified residue, the compacted waste. And, so, we use trucks and wagons. For the MOX, for the purpose of return of MOX to Japan, as the Japanese have decided to use the TN 12 for the return of the MOX fresh fuel to Japan, we use also the truck between La Hague and Shabor Port to load their ship.

KADAK: How many MOX fuel assemblies are in each canister or cask?

FORTIER: I will explain. Yes, the question is--appears the TN 12, with the possibility to load in this case 12 PWR fuel assemblies. When we return, in terms of transport, MOX used fuel, we have the possibility to load four MOX fuel in the center and surrounded by eight UOX spent fuel.

This cask is also designed to support--we had that basket inside to transport BWR, so we were able to transport 32 BWR fuel, either in the array of eight by eight, or nine by nine.

So, for the characteristic, I would say--I don’t think there is a need to comment more on this. What I mentioned at the bottom is that, what I said before, just before, the Japanese have this idea in the late Eighties to return the MOX fuel using--to Japan with the stack of casks, which is not necessary in terms of shielding protection, but it was their decision. So, we applied this.

One of the big cells which we used in La Hague which works with the TN 12 and the TN 17 as well is the dry unloading cell. We can see on the right, the picture on the right on the slide which shows the cells from the internal part, where we've actually removed the BWR or PWR fuel, I don't know exactly, and we just see at the bottom, the hole, which is connected in fact with the base--the roof of this part. And, we simply put underneath the cell the TN 12 or TN 17, and so we can operate like this, dry unloading operation at La Hague, and more or less, we can unload one cask per day at this cell.

Now, as I said, the TN 12 was designed first for UOX used fuel, and in 1987, EDF made the choice to load some of the reactor with MOX fuel, and, so, we have to think about the way to transport this used fuel after irradiation to La Hague, and so we had that TN 12 with a new license for the TN 12/2. We were able to transport, and we continue to transport to La Hague MOX fuel, considering that we put the MOX fuel in the center of the cavity of the TN 12, and we, around the MOX fuel, we put UOX used fuel, which provides additional shielding against additional--of MOX fuel. And, this ratio was--is compatible in fact with the ratio and the core of the reactor, which was good for EDF and also for the transport.

In terms of--so, I'm not a specialist, but this is

our recollection about the--we used to design this license, is that in fact, the MOX assembly is equivalent to a 25 person UOX fuel. Why UOX are, in fact, we have an average enrichment of uranium 235 that freed up 7000. So, it works like this at the beginning, but the thing that changed, and EDF chose to improve the MOX core management, so this is again our recollection about the history of why we return to TN 112, I'm not talking on the behalf of EDF in this presentation, but this is our recollection, and EDF to my nature is moved to a, so-called in France, Parity MOX program, which means that for us, the MOX assemblies should have the same performance as the UOX assemblies.

So, to reach this parity, they increased, I think, the quantity of plutonium inside the MOX, reached higher burnup, and subsequently with higher burnup, we increased the natural radiation around the fuel and around the casks. At the same time, EDF had some consideration about their limitation or the duration of the cooling time of the MOX fuel inside the pool. And, it was where at that time, we discovered that we did not wait, that the fuel was unloaded from the pool, but it was--became mandatory to design a new cask, and it's why we entered into the design of a TN 112 to consider of course these new sources of neutron and we tried to load, to keep the capacity of 12 assemblies inside the cask for the transport.

KADAK: Could I ask just a quick question? How long is the minimum storage time in the pool before you can ship a MOX assembly?

FORTIER: We designed the new cask for--it's just a presentation of the cask, and, yeah, I think we have the answer for the cooling time. So, we consider the cooling time for most are 400 days for UOX, and more than 800 days for MOX.

We stay with casks which weigh more than 100 tons, which are always needed, specifically trucks and trailers and wagon to carry them.

Just a review of the cask, the components, major components, so we have the same, in terms of operation, whether the same feature, on the TN 12, we have a plug and the tightening ring and the lid. A difference was introduced with this new cask and is listed in the next slide, is that we designed a double barrier cask. And, so, this cask of TN 112 is licensed by the French authority under IAEA 96, regulation. TN 112 is a double barrier containment, double leads and double wall in the--a secondary barrier, so inside the cavity.

So, to make this, we have to adjust the design of the wall, I mean that we will have to use a compound of steel and lead to reduce the quantity of radiation put in a cask. While the TN 12/2 was first designed with a thick shell of

30-something meters thick--both of the casks are surrounded by a shielding made by resin. But, the steel components are a little bit different.

We also improved for the--we put the trunnion under the cask as much as we could, out of the active length of the fuel to reduce the dose rate for the apparent dose. Radiation around the cask, criticality of course is inside, it's included inside the design work to compromise between the different--and use the right components and the right material, and the right place to meet the criterion. And, let's get inside the cavity of the design to meet the safety criteria with appropriate material, including or not Boron, so it's a question of engineering design to use these different components.

KADAK: Do you take credit for burnup credit? Do you take burnup credit?

FORTIER: I don't think so. For the MOX, I don't think so.

KADAK: How about for the UO2?

FORTIER: UO2, yes, it's considered with a very low threshold, about 3000, if I remember, 3000 megawatt.

KADAK: Let me understand. So, you do take fission product and actinide burnup credit in your criticality analysis for transport?

FORTIER: As far as I remember.

KADAK: Okay.

ARNOLD: The bullet there says, “Criticality and containment analysis are evaluated according to the overall typical data of fuel after irradiation.” So, that would imply that they’re taking burnup credit.

FORTIER: I can explain. The fact was we wanted to--the next--is to say that there is a discussion with the ATDTs, around the fuel inside the coal, what is the result of the TP--and the intent, and after we considered this for the United States. So, because of some of the parts of the United States, we need to consider burnup and cooling time, and on the other parts such as criticality, the first thing is to consider fresh fuel for criticality, and after, we can also consider--it’s early to say that we had a discussion with ATDTs about his management, what is the overall--and then this slide, even the source was higher than 4 UOX, with the new design of a cask with slightly improving dose rate around the cask--dose rate, which is acceptable. We need not--it’s an acceptable label in comparison with the number of fuel inside the cavity.

Just a few words to say that both casks are loaded in wet conditions, but TN12 is under both condition, either wet condition or dry condition, as I mentioned earlier. Today, the TN 112 is unloaded under wet conditions, and also it’s a consequence of the design, we cannot reach all the

criteria with--first is the safety and at the end of the design, we had the TN 112. That's not the criteria of the dry unloading cell characteristics.

Many difference also is about the draining, it's about the TN 12. We have already--at the bottom, so by gravity, the water can get out of the cavity. For the TN 12, also, this was a choice to reuse the doors because around the orifices, we can increase the doors received by--so, it was a choice to remove any orifices at the bottom, and we used only what I call a diver, so we have a tube which goes inside the cavity from the top, and we put the vacuum--we poked the cavity with this device.

Difference between the fresh fuel and the irradiated fuel in both MOX and UO2, so it's a very simplistic table. But, just to compare the type of package was for the first row, when I think Type B, so I refer--Type A, I refer to the IAEA. So, for MOX, either spent or fresh fuel, we have a Type B cask. That's just for the UO2 transport. Type B is monitored for used fuel, while Type A fissile is usually--transported every day, every day we transport.

In terms of security, I put the reference to the AIEA, and that's just filled in to--because in terms of security or so-called physical protection of the--we refer to this category. And, of course, for the MOX fresh fuel, we

transport, in our case because--inside each category, but inside the TN 12, we have more than two kilograms of plutonium, so, MOX fresh fuel is obviously in Category 1, the AIS label in terms of protection. All the used fuel are either MOX or UOX used fuel, transport under Category 2. And, fresh fuel are transported usually under Category 3.

One concern, or so, which is related to the fuel integrity required at the fuel vendor, so, there is a fill-up of the vibration during the transport for the MOX fresh fuel under all the UOX fresh fuel. So far, we do not have monitoring of vibration for used fuel.

Just a few words for the TN 28, or for R10W, which is used also for the transporter of--so wherever the loading and the capacity of the cask, here it’s just to mention that we’ve got from 13 overseas transport to Japan. The 14 is underway to Japan and is from the U.K. Now, for the MOX fresh fuel, as I say, we already have the Japanese choose to get the MOX fresh fuel using the TN 12, so we are here, the operation of one of these casks at Chaveau Port and to PNTL ship.

Now, for the European needs and the--we use what we call an MX cask, so here I present to you the MX6, which is used to deliver fuel in Germany, either by transporting 6 PWRs in the cavity, or a maximum of 16 BWR. We developed a--which injured the internal basket for the Japanese for the

transport between Melox and Le Hague, and we arrived--we can transport in the Japanese configuration a maximum of 10 fuel inside the cavity.

So, we have a cask which has a weight of about 20 tons, and with these casks, we can use, I would say, trucks or of course with security, but quite--and go four years, a sister of this cask, which is called MX8, which either eight PWR, two, three years, which is in the wet conditions.

In the future, we turn to a new generation of casks with MX12 with a capacity of 12 PWR inside. Because it's also a discussion with the utilities, due to uncertainty, the common--in fact it was more convenient for them--it's convenient for them to receive each time a batch of 12 fuel, MOX fuel to load inside the car. So, with the MX8, we need to receive two casks for a total of 12, and in the future we'll turn to this new cask.

So, in conclusion, for my thoughts is that transport of MOX fuel is achieved let's say on a daily basis in Europe, and more specifically in France. It's something we do every year. We have transport of MOX used fuel from EDF to Tuli. In the big principle, transport means, and transport casks do not differ from your UOX to MOX fuel. As you can see, we are in the same type of cask, the same way, the same size, and so on.

Differences, it's where the customer wants to have

some specific condition of utilization or alteration to reduce the dose rate, so we have to figure out how to solve this issue. So, we can also--but, then in principle, we use quite a similar logistic that was built for UOX transport.

And, with the cask we use for a different customer, we always seek to find solution for the customer, reusing the cask, a new basket when it's possible. It's a question of discussion with the customer.

So, what I propose, I went for a while, but didn't find the right place to discuss this, to study acceptability of TN fleet of casks in the US, in other words, I would say we chose for--around for the cycle of the fuel. Every day, we are implementing transport of spent fuel, of HLW transport, so are updating our knowledge every day on this business. And, so, there is opportunity or so to use this for--countries. That's it for me.

GARRICK: Thank you. Thank you very much.

Any comments, questions from Board members?

KADAK: I don't want to be the only one. I'm curious, you said the fresh MOX fuel is in a wet condition it's shipped. How do you--what's the heat generation?

FORTIER: No, it's loaded and unloaded in wet conditions.

KADAK: I see.

FORTIER: But, transported dry.

KADAK: Dry. What is the heat generation rate in that cask? Maybe you said it but I just didn't catch it?

FORTIER: I did not say it. I can come back--

ARNOLD: You said 400 watts per assembly, wasn't it?

KADAK: Is that right, 400?

ARNOLD: 400 watts per assembly.

FORTIER: For the fresh, yes.

GARRICK: Okay, thank you. Thank you. Thank you very much. Yes, come on.

STOUT: I'm Dan Stout with TVA, and I'm happy to be here today.

I noticed the title on the agenda was Implications for Waste Management of Using MOX, and so far today, I found that to be pretty easy because all we've done are paper studies and paper studies only make paper waste. We know how to--we can even recycle it.

So, what I'm going to talk about today, a bit of an overview about TVA, who we are, and why we're looking at MOX, and then some of the items that we're in the process of evaluating, comparison of the MOX with uranium oxide, a little specifics about the DOE surplus plutonium disposition program, that's what we're looking at, and including the supplemental EIS, and then I'll briefly get into plant modifications, and then I'll dive a little deeper into decay heat comparison between MOX and UOX. And, then, I will have

some preliminary conclusions and summarize.

TVA is a little unique in comparison to other utilities. We were created by Congress in 1933, and we're a government corporation. We have an independent Board of Directors, nine members, and a full-time chief executive that run the company today. That was a relatively recent change. We don't take any appropriations. Generally speaking, our cash flow comes from the electric bills of our customers, and we set our rates to cover our costs.

So, we cover a seven state region. You can see it on the map, 9 million people, 650,000 businesses. The pie chart over here is for generation. So, get about half our generation from coal, about a third from nuclear, hydro 9 percent, the rest renewables. If I were to show capacity, it would be a different chart. We'd have a whole lot more natural gas and renewables, and less on the nuclear side.

So, you know, our nuke plants run with a high capacity factor. Our renewables don't do as well in that region of the country.

About a year ago, we announced our renewed vision, and that's to be one of the nation's leading providers of low-cost and cleaner energy by 2020. So, this got rolled out, you know, focus on leading the nation in terms of cleaner air, on leading the Southeast in terms of greater energy efficiency, and leading the nation in terms of more

nuclear production.

So, we currently have six operating nuclear reactors, three PWRs, three BWRs. We're in the process of completing construction on Watts Bar Unit 2. We hope to have it operational in 2013. Our Board just approved construction completion of Bellefonte Unit 1, and we hope to have it operational before 2020. We're also working on small modular reactors, but that's in the study phase.

So, a little more about our unique history. We have been operating for more than seven decades, providing affordable electricity, economic development opportunities in the Tennessee Valley, river management, and doing all this kind of stuff in a manner that's environmentally responsible.

We also support national security missions. You can go back to pre-World War II, we were into fertilizer production and munitions and then fore, the Manhattan Project, we were supplying electricity. We have been providing irradiation services to the Department of Energy to make tritium for support of the nation's nuclear weapons stockpile. And, we have supported other non-proliferation activities, including the blended low enriched uranium. So, MOX is another non-proliferation objective turning weapons usable material into something that's no longer weapons usable.

So, in TVA, we believe we can perform these

functions for the Department of Energy in a manner that's consistent with our other objectives.

Today, all U.S. commercial nuclear fuel starts with uranium oxide. And, plutonium is a normal by-product of the fission process, and we're comfortable with that. We're used to that. You know, plutonium makes up approximately 40 percent of the core's heat for a specific assembly at the end of its useful life. Plutonium is making more than 50 percent of the energy, the fission of plutonium.

Mixed-oxide fuel is a mixture of plutonium and uranium oxides fabricated into fuel and loaded into the reactor in lieu of some uranium oxide fuel. So, the form of the fuel is pretty close to what we're used to in terms of UOX, in terms of the hardware.

All right, to help understand this chart, the items in the red font are the isotopes of plutonium, and they roll up to the last line in black, which is the summary of the plutonium. And, there are two different kinds of MOX fuel, reactor grade MOX and weapons grade MOX. And, so, you heard earlier about the reactor grade MOX, and I'm going to focus primarily on the weapons grade MOX.

Looking up above, you see the blue circles are representing the fissile material that you have, and you can see the big difference between the reactor MOX and the weapons MOX is the amount of plutonium. And, you know,

generally speaking the isotopes of plutonium absorb neutrons and they don't fission. So, you know, you have a lot lower concentration of plutonium needed when you're using weapons MOX. You also have less heat.

So, some high-level comments on DOE's surplus plutonium disposition program. It began in the year 2000, or it kicked off, I should say, in the year 2000, when the U.S. and Russia agreed to dispose of 34 metric tons of their surplus plutonium. In the U.S., we decided to do that by turning it into MOX fuel and using it in commercial light-water reactors. DOE is in the process of building a MOX fuel fabrication plant at the Savannah River Site, pretty far along on that construction. And, lead test assemblies were built and tested at Catawba. They ran for two cycles. The Oak Ridge National Lab is doing the PIE. My understanding is it's almost done. Reports are going to be coming out soon. We have seen the preliminary data.

We've begun evaluating the potential use of MOX in our Sequoia reactors and our Browns Ferry reactors, and the evaluation of the MOX fuel is going to be done in a phased approach with multiple opportunities for public involvement. And, so, in this study phase, we're assessing the public health and safety through the NEPA process. The Department of Energy is the lead agency and TVA is a cooperating agency on the Supplemental EIS.

We are assessing the required physical changes to reactor, looking at our operational impacts, and we're talking to the Department of Energy about what kind of contract we'll end up with that determines the cost and risks. So, in order to proceed into the next phase, which will be engineering and licensing, we're going to require two things. That we're convinced that it's safe to our workers, to the public, to the environment, and that it's beneficial to TVA's customers. That means lower cost.

So, public input is going to be sought, and factored into the decision-making process along the way, not only by DOE and TVA, but also by the NRC.

So, we're thinking about the interactions that are going to take place at the reactor plant site. We're looking at things like when we receive the fuel, security modifications, shipping canister handling, radiation dose. And, then, you know, inside the reactor, we're thinking about things like the physics differences, the behavior during postulated severe accidents, the plant modifications, and the operating differences. And, then, in terms of the used MOX, what the implications are on the spent fuel pools and dry casks, radiation dose and decay heat. So, I put two of them in blue font because I'm going to talk about them in more detail.

We will need to make some plant modifications to

address security. The kinds of things that we're looking at include checkpoint changes where we're receiving the MOX shipments; a designated holding area for the transport vehicles; potential roadway improvements; perhaps an upgrade to the fuel pool crane; closed circuit TV surveillance, that kind of stuff.

We're also looking at, for our PWRs, conversion to enriched boric acid. And, that would provide the additional reactivity control that you would need without the implications of getting too high in your boron concentrations and having a precipitation issue and certain accident scenarios.

Modification associated with the enriched boric acid. A batching and mixing system; feed tanks; transfer pumps; piping systems, a mass spect; the ability to do isotopic analysis of boron; improved reactor makeup controls; and additional enriched boric acid sampling capability.

Now, this mod. isn't necessary, but it is necessary if we want to have a MOX core fraction that's up in the 30 percent region. Otherwise, we're probably going to be down around the 15 percent region on the PWRs. The BWRs, it looks like no additional modifications to get us up approaching 40 percent. Again, that's a preliminary.

Shifting now to decay heat. I used data from an Oak Ridge National Lab report referenced below, and the

report contains data for both PWR and BWR, for both reactor grade and weapons grade, and for various burnups. So, I tried for simplicity to focus in more on the weapons grade MOX only, particularly as it's used for a PWR, in the 50 gigawatt day per metric ton burnup region. So, you get the trends, that's what I'm trying to communicate, is the difference relative to uranium oxide of this weapons grade MOX.

The only point I want to make on this slide, the right-hand column--this is the ratio of the weapons MOX to uranium oxide, and for the first day or so, it's actually cooler, and then after that, you can see it heating up, and much cooler than the reactor MOX, but, you know, still looking at about 27 percent thermally hotter in the 27 year time period.

So, how does decay heat of the used MOX compare to the UOX and why does it matter? Well, there's three periods of interest, two of interest to the utilities and one of interest to DOE predominantly. In the near-term, and I kind of call that like first ten days, you know, this determines the performance and accident scenarios, and the conclusion in that area is it's not that much different. The mid-term, I'm looking now in the five year region, and that is where it would be a driver in terms of how long you would have to leave it in a pool before you go into dry cask, or what your

thermal load design is on the dry cask, that kind of area. And, then, the long-term, 30 year plus, you know, send it to the repository, also affect it.

So, as I was saying, in the near-term, there is little difference. You can see the MOX is a little cooler, and you're right after shutdown, and it crosses over in that period of several hours, up to about a day. And, then, further out.

So, from an accident management, accident consequence standpoint, the differences are insignificant.

In the mid-term, at year five, which is 1825 days, so you're looking in this region, again, there's just not that much difference. Doing the math, the MOX reaches the same thermal load in less than a year, compared to UOX. It's about 240 days. And, then, you know, the difference in the heat load between used MOX and used uranium oxide is not a driver in the spent fuel pool cooling requirements or in the dry cask thermal design. You just wait a little bit and you're there in terms of thermal.

So, in the long-term, this is where the ratio of MOX is on the order of 30 to 70 percent warmer than the uranium oxide. In BWRs, it's hotter, by the way, and then obviously, for reactor MOX, it's significantly higher.

So, to put it in comparison, the used MOX would need to be kept in a dry cask for about 56 years longer than

uranium oxide to achieve that same thermal load. So, it could be done, I mean, it's not out of the ballpark, but you're in the flat part of the curve at that point.

And, my point, number four, that was on the other slide says, you know, heat management is very geology and repository specific. For example, like in Yucca Mountain, fans can deal with, at emplacement, any kind of differences. You know, your driver may be in the million year period of something like that. In a salt geology, perhaps you can do easier thermal management and have relatively less significant differences. It's hard to say.

So, some preliminary conclusions. Relative to uranium oxide, the thermal load of MOX fuel is expected to have no discernable effect following a severe accident; be manageable for pools and dry casks; and needs to be addressed for repository. We have core design flexibility that enables us to vary the MOX burnup relative to the uranium oxide burnup, so we may choose, for example, to only go two cycles with our MOX. So, we manage the burnup to some lower level.

I notice that Wolfgang said they'd limit to 55 gigawatt day per metric ton compared to uranium being limited to 65. We could do something like that if the thermal load was a concern. Then, I'd see us ramping into it, you know, loading in a slow deliberative manner, stepping up towards our limits in a slow deliberative manner.

So, in summary, we believe the Supplemental EIS is going to be the process that helps us ensure that MOX use is going to be safe for our workers, the public, our environment; that the program is going to proceed in phases with multiple opportunities for public input; that the physical modifications to the plan are quite manageable. And, we expect DOE's MOX to cost TVA less than uranium oxide. Those words are deliberate. And, TVA will proceed with MOX only if it's safe and beneficial to our customers.

The decision to proceed with the engineering and licensing is probably going to be in early 2013, and the earliest use of MOX in TVA reactors is like 2018.

Thank you.

GARRICK: Thanks, Dan.

I wanted to ask, I realize you've only done paper studies, but how do you think, and I realize that reactors are different and the fuel assemblies are different, and so forth, and there's difference in power densities, and specific power, and a lot of other parameters. But, from the standpoint of heat generation, cooling times, and core fractions, and shifting, how do you stack up with what we heard from France and Germany? Did you see anything that was a surprise to you relative to what you expected as a result of your studies?

STOUT: No. No, I--you know, there's a significance

difference between the reactor MOX and weapons MOX. You know, I didn't get into that. But, you know, I appreciate Wolfgang's summary that says it's harder, it costs more, and all that. This is a good shot over the bough for us.

GARRICK: Have you done studies on cost, fabrication costs and the differences?

STOUT: No, because it's not relevant. We're going to negotiate a price that we're willing to pay DOE.

GARRICK: Yes.

STOUT: It has nothing to do with the cost to--

GARRICK: It's significant to the taxpayer, though.

STOUT: Correct.

GARRICK: Yeah. So, you have not--and, TVA has not doing any predicting?

STOUT: We're not going to have the Tennessee Valley ratepayer subsidize a facility in South Carolina. It's just, you know, we're going to be willing to buy, pay money for, I didn't say how much, less than uranium oxide, for this fuel that when we get ourselves comfortable with it, that we're willing to put in our reactors, and it's serving this DOE mission of irradiating this weapons usable materials and rendering it non-usable.

GARRICK: So, it's pretty difficult to get a real focus on reactor economics, in other words, when you do this?

STOUT: Well, I expect our fuel costs to be looking good

compared to our peers in the industry.

GARRICK: Yeah, there's a subsidy involved here.

STOUT: Well, it's open to other utilities. You know, where is Adam, he can jump in and get interested in MOX. I'm sure DOE would welcome it.

GARRICK: Yes. Sue?

CLARK: Sue. Just out of curiosity, how much public engagement was there before the decision to irradiate targets to produce tritium?

STOUT: That was back in the Nineties? I'm not sure. I know that there was a DOE led EIS that did include scoping and public confidence, but I don't know the details.

CLARK: So, there's no experience you would be able to draw from that, because you look forward to your public engagement you will have--

STOUT: Well, sure, I've got a flack jacket--

CLARK: I mean, getting back to what John was asking, so the Savannah River MOX plant, I presume just goes forward, that is independent of whatever you decide about irradiating whatever comes out of that?

STOUT: It's important to DOE to find customers for the MOX fuel.

CLARK: But, you're the only customer right now?

STOUT: Well, thank you for telling me that.

CLARK: Well, I don't know. I'm just asking. You're

the only one I've heard of, let's say it that way.

STOUT: I don't know.

GARRICK: Okay, well, I've got three here, Nigel and then Dan and then Andy.

MOTE: Mote, Staff.

Dan, you mentioned the four big test assemblies at Catawba, and you mentioned two cycles. What you didn't mention was it was intended that they would go three cycles, they were discharged early, rod growth was outside spec, and they will not go back in, not because it wasn't intended, but because they didn't perform correctly. Would you comment on what that did to TVA's acceptance and what spec changes you may have fed back to DOE in order to be able to accept MOX fuel?

STOUT: Good question. We did look into that. You know, it's our understanding that the rod growth that was experienced was the assembly structure itself, not unique to MOX. We have experienced it, and other utilities have experienced rod growth, assembly growth issues. And, you know, to put it in perspective, the growth was out of spec by the thickness of a dime, you know. So, I think we understand what was going on there. The PIE results are going to provide a little of that information that will help people understand what was observed. But, from our perspective, it wasn't a MOX pellet issue, it was an assembly growth issue.

GARRICK: Dan?

METLAY: Dan Metlay, Board Staff.

This gray hair suggests that I've been old enough to remember the Gezmo hearings, and I'm inferring, and maybe this is an incorrect inference, I'm inferring that there had been a NEPA process that had created a Record of Decision that allows TVA to burn excess weapons plutonium. Is that a correct inference?

STOUT: The NEPA process that DOE is the lead agency on, we're a cooperating agency on, we did have scoping meetings about a year ago. I expect the draft Supplemental EIS to come out probably in early 2010.

METLAY: And, it's supplement to what?

STOUT: It's a supplement to DOE's EIS to make MOX fuel, to use it in commercial light water reactors.

METLAY: Okay. The question then is does what you're doing have any NEPA implications for using MOX fuel commercially outside of the weapons disposition process?

STOUT: I don't know. You know, clearly, we have no intent to use reactor MOX under the NEPA process that's underway. It's addressing weapons MOX.

METLAY: Okay.

GARRICK: Okay, Andy?

KADAK: I guess I'd like to connect the two of you, Mr. Faber with Mr. Stout. I'm trying to understand from the

utility perspective, given the experience that E.ON has with MOX, given the list, why--I mean, I understand why you're doing it, because you're sort of a federal agency trying to help out, and doing the right thing, and if you can get a good price for it, fine. But, given the arguments and the difficulty of using MOX, why would a utility do it? I mean, you had to do it, and you're sort of--

FABER: Wolfgang Faber, E.ON.

I guess you would have to ask the French people about that, because it's expensive because we are doing it on a low scale. A small scale, yes. It could be more interesting on a high scale.

KADAK: But, from a reactor operator's perspective, it seems like it's just another, more difficult challenge to operator reactor, O&M costs being what they are, you know, this is something I don't know whether you factored into your economics as a fuel cycle cost, in other words, your fuel assembly will be less than the UO2 fuel assembly, but have you factored in all these other costs that are needed, extra security, extra--all this other extra stuff in terms of operability, storing for a longer period of time, spent fuels being clogged, have you done it to that level?

STOUT: Yes, and perhaps we can have a cost reimbursement contract with DOE for those items.

GARRICK: Howard?

STOUT: Let me, if I put my US utility hat on, MOX will never be cost competitive with fresh uranium fuel. We all know that. The only way that MOX makes any sense is in the whole system, if recycling enables you to do more cost effective waste management, disposal, et cetera, and if that whole systems economics makes sense, then it makes sense, but not until then.

ARNOLD: Just a comment on that point. I think it won't work out that way. But, my question has to do with this. You highlighted the differences between a new MOX assembly that's made with recycled plutonium versus weapons plutonium. That's for the new assembly as it goes in the reactor. At the end of the cycle, when you discharge those two MOX assemblies, I think they are less far apart in their properties and heat loads and all the rest of it. That's just a conclusion I drew qualitatively looking at some of the numbers.

GARRICK: That's what I was trying to get at.

ARNOLD: Yeah.

GARRICK: Yeah.

STOUT: Sorry, I stopped too short. That's when I put them in the cast with Adam and we'd just send it. You can figure it out. I think some of that information is in that R&L report. I mean, it's not that hard to do it, and I agree with you, I think that you--they come closer together.

GARRICK: Okay. Any other questions? Yes, Gene and then Carl?

ROWE: Just one quick one. Rowe, Board Staff.

Have you done a fuel pool reracking at any of the sites? And, even with the reracking, the higher density racks, you still don't have any thermal problems in the pool?

STOUT: I don't know. I mean, let me put it this way. I believe that used MOX going into our pools has less of an effect than post-Fukushima regulatory response will be. Fair enough?

GARRICK: I don't think he answered the question.

STOUT: You did notice that?

GARRICK: I don't know. Okay, Carl?

DI BELLA: Carl DiBella. I have a little bit of a follow-up question on Nigel's question. I take it from your 2018 earliest possible date to use MOX, that you don't feel that you need your own lead test assemblies, you can piggy back on the Catawba data and you would start slowly. But, did you--are you thinking of changing the specifications as a result of the Catawba test?

STOUT: To the former question, that's correct. We aren't anticipating doing lead test assemblies. We will start slow and ramp up. And, I don't know, I mean, again, the PIE results aren't final. We haven't gotten to that point yet.

GARRICK: Any other questions? Yes, Nigel?

MOTE: One more, if you will, Mote, Board Staff.

You said that Bellefonte Unit 1 is expected to come on line by 2020. My understanding is that you will be receiving MOX from the Savannah River plant until 10, 15, 20 years after that. And, you did say that you're going to make some modifications to whichever unit you're using for MOX. Have you thought about modifying Bellefonte 1 before it goes critical so you can take 100 percent MOX? Because it's not as expensive to modify--

STOUT: Thinking about it and planning to do it are two different things. The MOX SEIS does not assess the environmental impacts of MOX at Bellefonte.

MOTE: Can I follow up?

GARRICK: Yes.

MOTE: Why not? It seems that to be able to load more than 40 percent is going to mean less units have to be modified, and then you've got to plan which can go, if it's commissioned in 2020, it's going to be operating through 2080. There may well be more MOX coming down the line, including Commercial MOX.

STOUT: I don't mean this disrespectfully, but building a nuke plant in this country is hard enough. We don't want to complicate initial start-up. It's not on the table.

MOTE: Okay.

GARRICK: Okay, any other questions, comments from anybody?

All right, well, we want to thank you very much for your presentations. We especially want to thank the gentleman from The Broad, and taking the time to come here for an hour's presentation. We appreciate that very much. It was very nice to see some real results and some real experience with this long discussed issue and how we're going to deal with it. And, you provided a good deal of insight on many of the issues that are involved, including the transportation and handling. So, we appreciate it.

All right, now at this point, we're supposed to have public comments. I have no sign-ups for any public comments, but I'm certainly willing to open the floor for any comment that anybody would like to make.

Monica, would you like to make a closing comment or observation?

REGALBUTO: Just a general comment. You know, budget has been lean, as you probably are well aware, and we are in the process of going right now through the exercise of, you know, benchmarking the program to the House mark, and benchmarking the program to the Senate mark, which has a significant amount of money that is different. But, it also has a significant guidance of what we're doing.

In the meantime, we're also in the process of

integrating the feedback that we have been receiving from EPRI and from the different industry consortiums that we have been polling regarding a test facility for the dry cask storage. So, you will be seeing some results hopefully the next time the Board gets together, at least of our path forward. What we're trying to do is get the best bang for our money.

Then, the other thing that we truly welcome is the opportunity to get feedback more in real time. And, as our budgets have been decreasing, and everybody's budget is down, sometimes we welcome the feedback, but it comes in too late, because our appropriation is gone. So, even though we want to do something about it, the money is gone to even integrate the comments at that point.

So, I have been discussing with Nigel, and we came out with a proposal to the Board so that we can get your feedback. What I call real time, it's like, you know, six to eight weeks, or something, basically before the money is gone. And, that's really the most effective way for us to utilize the taxpayers' resources.

So, that is a proposal that we have come out to the Board, and we can't do it for everything because there's some rules of engagement. They cannot affect the course of work either; right? Because otherwise, you will be doing the work, too, so that would not be the right mechanism. So, we

have a little delay process built in, and we will welcome all the feedback in a timely manner so that at least we can influence the process and use the money a little bit more wisely.

So, the other third thing that we're doing this year is we are making sure that the university program is much more integrated than it has been in the past. And, some of you are more familiar to the programs, to the other parts of the fuel cycle R&D program, not necessarily use this position because this is--but, that is the goal this year, is to integrate that, and we're also going to continue reviews. Used fuel disposition will not be--we will not do a relevance review on this campaign because it already has the Board, and it already has the advisor. So, we will start this year with Fuels, and I don't know if Kemal is still here. There he is, and he is just sitting today. He is the campaign manager for Fuels, and then we will follow with separations.

And, the reason we're doing relevance reviews is because many things have changed in the last 12 months, and we also have fixed budgets and we like to make sure that we're doing things that are integrated with all the fuel cycle, but it's also in response to what we need to do as we move forward, post-Fukushima, and post-seismic analysis, and so on and so forth.

So, that's all I have. And, you know, we welcome

your feedback, like I said, and, not only in the area of Used Fuel Disposition. You may comment on anything else that is relevant to this that intersects, you know, with, for example, fuels intersects very closely to this area, separations intersects very closely, waste form development intersects very closely. So, we welcome feedback at any point or any time from you or your staff.

GARRICK: Thank you. The Board is very appreciative of your eagerness to get our feedback.

Any other comments, closing observations, discussion, questions?

(No response.)

All right, I want to again thank everybody that has participated, including the presenters. The questions that have been asked by all, the Board, the Staff, and with that, and unless there's further issues that somebody wants to take up, I adjourn the meeting.

(Whereupon, a 5:06 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 Fall Board Meeting held on September 14, 2011 in Salt Lake City, Utah taken from the electronic recording of proceedings in the above-entitled matter.

October 6, 2011

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