UNITED STATES

NUCLEAR WASTE TECHNICAL REVIEW BOARD

TRANSCRIPT

SUMMER 2014 PUBLIC MEETING

Wednesday

August 6, 2014

Marriott Residence Inn
Taylor Crossing East and West Rooms
635 West Broadway Street
Idaho Falls, Idaho

NWTRB BOARD MEMBERS PRESENT

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Sue B. Clark, Ph.D.
Gerald S. Frankel, Sc.D.
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PROCEEDINGS

8:00 a.m.

EWING: So good morning. Welcome to the meeting of the Nuclear Waste Technical Review Board in Idaho Falls. We are pleased to be back. Looking on our record of visits, this is our third time in four years, so clearly Idaho is an important part of the Board's efforts and interest.

Today we'll be addressing a number of issues related to the storage, transport, and disposal of DOE spent nuclear fuel and high-level radioactive waste. We note that many of the issues discussed are also relevant to the fate of spent fuel generated by commercial nuclear power plants. The presentations and discussion today are designed to inform the Board as we complete a report on the management of DOE spent nuclear fuel.

I'll go into more detail about the meeting agenda in just a few moments, but first, for those of you who may be unfamiliar with the Board and its mission, let me say a few words about the Board.

The Board is an independent federal agency in the Executive Branch. We are not part of the DOE or any other federal agency. The Board was created by the 1987 amendments to the Nuclear Waste Policy Act, and we are charged with providing an independent evaluation of the technical and scientific validity of DOE activities related to implementing the Nuclear Waste Policy Act. These DOE activities that we review include transporting, packaging, and disposing of spent nuclear fuel and high-level waste. Now, I want to emphasize that our charge and interest are specifically focused on spent nuclear fuel and high-level waste. The Board reports its findings and recommendations to Congress and to the Secretary of Energy.

The eleven Board members are appointed by the President from a list of nominees submitted by the National Academy of Sciences. The Board members serve as part-time employees, special federal employees, but we are fortunate in that we have a very talented full-time staff, and the full-time staff are located at the table just to your right.

Normally I go through and do individual introductions, but today I think I'll forgo that process simply to save time and because we have a hand-out at the back of the room, which gives you a little more detail on the charge of the Board; and on the back are pictures of the Board members with a description of our affiliations and disciplinary interests. One thing to note is that this Board has a wide range of scientific and engineering disciplines represented, and I think this is one of the strengths of the Board in that we're able to address issues from many different scientific and technical perspectives.

I want to encourage you to engage Board members and staff members during breaks and after the meeting. We value your comments and the interactions that we have with technical staff from DOE, but also from the informed and concerned public.

So that saves us a little bit of time.

Now let me say a few words about today’s agenda, and the first thing to say is, we’ve scheduled two opportunities for public comment. The first will be at the end of the morning, and the second will be at the end of the afternoon session. If you’d like to make a public comment, please sign up on the list that’s at the back of the room. In addition, if you don’t want to make a public comment but you have written materials that you would like to submit, we’re happy to receive those; and those written materials will become part of the record of this meeting and will be included in the posting that we do of the transcripts and presentations that are associated with this meeting. So you will be able to enter your thoughts into the record of this meeting.

For today’s agenda the first presentation will be made by Gary DeLeon, who is Director of the Office of Nuclear Materials Disposition in DOE’s Office of Environmental Management. Gary will describe activities underway at DOE-EM that are relevant to the management of DOE-owned spent nuclear fuel. Following Gary’s presentation, Brett Carlsen from Idaho National Laboratory and Roger McCormack of CH2M will describe the status of DOE’s work on standard canisters and multi-canister overpacks. The Board looks forward to these presentations, which will address issues such as how the standard canisters and multi-canister overpacks will be transported, whether they can be used in a variety of rock types for geologic disposal, and the status of their certification.

After a short break, Barbara Beller of the Idaho Operations Office and Roger McCormack will discuss fuel-drying activities at both Hanford and INL. Drying the fuel is necessary for preparing it for transport and disposal off site.

Following this discussion, Bill Boyle, the Director of DOE’s NE Office of Used Fuel Disposition, will describe research in support of DOE’s High Burnup Dry Cask Storage Research and Development Project. The Board is particularly interested in learning how this work can be applied to issues related to commercially-generated spent nuclear fuel.

We’ve set aside 20 minutes at the end of Bill’s presentation for our first public comment session.

After lunch Barbara Beller, Joel Case, and Lance Lacroix, all of the Idaho Operations Office, will kick off our afternoon session with a discussion of the management of spent nuclear fuel and high-level radioactive waste at INL.

Barbara and Lance will walk us through activities related to the management of sodium-bonded spent nuclear fuel and aluminum-clad spent nuclear fuel at the site.

Following this discussion, Barbara and Roger will discuss how aging storage facilities and spent fuel are being managed across the DOE complex. One of the issues of interest to the Board is how extended storage of spent fuel affects its subsequent transportation off site.

Barbara will wrap up this discussion with a presentation on the transportation of damaged fuel. The Board is very interested to understand what DOE has learned from transporting damaged fuel and how these insights might be applied to related issues within the DOE complex.

The second public comment session will then follow Barbara’s talk.

Immediately following this meeting, we have arranged an event that we hope you’ll find useful and informative. We’ll have “poster session” presentations just outside this room in the hallway. We hope that this is an opportunity for the participants in the meeting to interact with one another as we discuss the material presented on the posters. And, of course, it’s an important opportunity for you to corner and discuss issues with members and staff from the Board.

Now just a word about how we conduct our meetings.

First, you'll see or observe that the Board members are not shy. There will be a lot of questions, and from those questions and discussions you may infer the position of certain Board members, but I want to emphasize these are not positions of the Board. The Board's positions are given in our reports and letters, which are published on our website.

And, as many of you know, the Board follows up its public meetings with letters to DOE, which convey our observations and recommendations, and these are usually addressed to the appropriate Assistant Secretary, depending on the topics. All of our reports and correspondence are posted on the Board's website.

A few mechanical issues to Board members and staff. There is a button that controls your microphone, so please turn it on when you speak. And, more importantly, when you're not speaking, turn it off, because that can result in some confusion.

Also, when anyone speaks, please identify yourself, particularly speakers who come to the microphone in the middle of the room during our public comment sessions. Identify yourself and your affiliation, and this allows us to have a complete record of what was said and who said it.

Please mute your cell phones.

I'll be working hard to keep us on schedule so that we preserve the time we've set aside for discussion and comments.

So I think those are the introductory comments, and now I'll turn it over to Gary and we'll get started.

DELEON: Thank you, Mr. Chairman. I'd like to say good morning to the Board and the Board staff and also our audience. I appreciate the opportunity to speak and give an overview of the DOE Spent Fuel Management Program and also hopefully to set the stage for the following presentations for the rest of the day.

Just very briefly, I just want to mention about the mission and functions of the Office of Nuclear Materials Disposition, which are within the Office of EM. Our primary responsibility is looking at the management disposition strategies and options for our spent nuclear fuel and also our EM's surplus nuclear materials, but I am just going to focus on spent fuel for my discussion today. A lot of that requires a lot of coordination and working with other DOE program offices and also other agencies, and I'll talk more about that in the rest of my presentation.

This is just a background overview that I think most of you are very familiar with already. But as far as the spent fuel inventory, we have a wide variety of spent nuclear fuel. Most of that that we have right now is from the production days where we have a lot; most of it is at the Hanford site. And we also have--I think you've seen the tour yesterday, and you probably have seen briefly before that we also store the core debris from Three-Mile Island at the site. We also have various commercial power demonstration project fuel, including the Fort Saint Vrain fuel, Peach Bottom, and Shippingport. And then probably the relatively most active program that we have right now in terms of generation of additional fuel that we have in storage and in inventory are domestic research reactors, which are both from the universities and some government-owned research reactors that we are continuing to accept fuel both here at Idaho and at Savannah River and also the Foreign Research Reactor Acceptance Program. And I'll talk a little bit more about that in the following slides.

The Department has over 2,400 metric tons stored primarily at the three DOE sites: Hanford, Idaho, and Savannah River. We have just about every fuel type you can imagine, and I think you got a sense of some of the different types of fuels that we have on site and the challenges that it poses in terms of storage, management, and disposition of those fuels. So it has been and continues to be a very challenging effort for us to disposition all our spent fuels.

This is just a quick overview of where the spent fuel is located. Most of it is at the Hanford site in the form of N reactor fuel that's stored in a canister storage building, and then Idaho also has a good bit and a wide variety of spent fuel. We also have some Fort Saint Vrain fuel at Fort Saint Vrain that is being managed by the DOE Idaho Site Office and the Savannah River Site. And I believe the Board is going to be visiting Savannah River Site at the end of October, and you'll get a little bit more information about the spent fuel activities at the Savannah River Site.

Just very briefly, at Hanford there's been a huge undertaking to put all the spent fuel in dry storage. All of that has been moved to the 200 Area at Hanford. Most of the N reactor fuel has been dried and packaged and stored, and you'll see in the picture at the bottom right is in the canister storage building. It's an underground vault--well, the vault is below grade--where most of the fuel is being stored. And then we also have some FFTF fuel in the 200 Area that's shown in that.

I think during some of the tours yesterday you guys were aware that some of the sodium-bonded fuel were transported here, and I think it was a big success in terms of transporting that and being able to treat that fuel here at Idaho. And it's a good example of collaboration between the two sites in terms of trying to deal with a specific type of fuel in terms of using available existing capabilities at the site. But we still have some of the non-sodium-bonded fuel at Hanford awaiting disposition as well.

And just so you guys know as well, we also had some unirradiated FFTF fuel that was sent to the Savannah River Site that's in storage right now that's being managed, really, as surplus plutonium right now, and it consists of about slightly less than a ton of plutonium.

At Idaho--I'll just kind of briefly go over--I mean, we have probably the most diverse inventory of spent fuel based on all the work that was done here since the '50s in terms of all the different types of reactors, and I think you got a good sense of that in the tours yesterday. One of the things that I think Barb Beller has reinforced and we'll continue to talk about is that the Idaho Settlement Agreement really places the structural framework in terms of what we're doing at the Idaho site right now. One of the key milestones in that Settlement Agreement is that by 2023 all our spent fuel will be in dry storage, and I believe that the DOE, including Naval Reactors, is working to make sure that we meet that agreement.

The other key milestone that's coming up, I guess, in the not-too-distant future is that by 2035--January 1st of 2035--we have to get all our spent fuel out by then. And I think Barb Beller kind of mentioned in terms of kind of the thinking and planning right now in order for us to repackage all our fuel so that we could meet that agreement, because there are significant fines and penalties associated with that if we don't meet the terms of the Settlement Agreement.

I think you saw this when you were touring 603 yesterday, but this is just kind of a depiction of spent fuel. We have two NRC-licensed facilities, the TMI that's in the INTEC facility and then the Fort Saint Vrain storage facility. And you just see a variety of storage locations at the INTEC facility for our spent fuel.

We also had a good presentation and walking through yesterday of the work that's ongoing right now. It's probably one of the more active things that are going in terms of transferring the EBR-II driver fuel from the 666 Basin to MFC, and that work is ongoing. And you also got a discussion from NE yesterday in terms of how they are looking to ramp up that capability. So that work is--and I think the cooperation between NE and EM in terms of getting that fuel out of wet storage to meet the Settlement Agreement milestone, as well as trying to figure out how to disposition that particular type of fuel, I think, has been going well. And we'll continue to get that project going.

There is also some discussion and I think you guys are aware that under the FRR and DRR program that that is still continuing. Idaho continues to receive the non-aluminum clad fuel. That's primarily TRIGA fuel that is received from foreign research reactors. I think the next plan--the dates are still not firmed up, but probably the next shipment will be coming from Finland from the FiR 1 reactor. We're in the early discussions and planning stages for that.

Now, one thing that Barb mentioned during our tour yesterday is that the last shipment, I believe, that was received in terms of the FRR program was this exchange between the Vienna research reactor. And we sent some lightly-used TRIGA fuel to Vienna, and we received their core. And so when I say that the FRR program is ending in 2019, I have to put a little bit of an asterisk in that, because part of the agreement that we have with Vienna in sending them the lightly-used fuel for use in their research reactor was that I think by 2025 that they would send that spent fuel back to Idaho. So there will be a one-time shipment beyond the 2019 expiration date of the FRR program, at least for Idaho. And I'll talk more about another asterisk at the Savannah River Site later on in terms of potential receipts of foreign research reactors fuel beyond 2019.

One thing I'd like to highlight about that exchange between INL and the Vienna reactor is that that was really, I think, a very successful endeavor and cooperation, not only with our partners in Austria but between DOE-EM and NNSA, because I know that the IAEA had approached the Department in terms of needing to use that research reactor in Vienna to support some of the IAEA training activities. And so there was a non-proliferation aspect to the continued use for that research reactor. And they did approach us, saying that, hey, is it possible to do this? And I think it really--in terms of the technical coordination, the planning, and how everything went well, I mean, that was in support of an agreement between the Secretary of Energy and the IAEA to make this happen and I think, really, the NNSA in Idaho should be really commended on. And the Vienna research reactor folks really should be commended on the success of that.

And I think that was the last shipment that we had received until the--called the temporary suspension of additional receipts right now until we meet some of the milestones we have under the Settlement Agreement. We’re hoping that that would get underway soon, that we’ll be able to do that. But I think luckily for now it’s not impacting any shipments to Idaho that is planned in the near term.

Just briefly talk about Fort Saint Vrain. I think I mentioned this is under NRC license. We had the license extension granted in 2011. Part of the plan right now, we also have a Colorado State agreement, which essentially what it says is that the Department plans to get all that fuel out of Colorado by the same date. But, really, the plan is--once we develop the capabilities to repackage our spent fuel in Idaho, the plan would be to ship this fuel out of Colorado to

Idaho so that it could be repackaged using the same facility that we would build here. And when I say facility, I mean, that evaluation is still underway whether or not that's looking at existing capabilities or looking at potentially new capabilities to repackage that fuel, and I noticed some of the questions and discussions yesterday during the tour was geared on that. But we also are required to get that fuel out by 2035.

Now, at Savannah River we've consolidated all our fuel in the L-Basin. One of the key activities that was done there in the past couple years was that there has been some work done to see if we can store the fuel for up to an additional 50 years at the Savannah River Site at the L-Basin facility. And they are implementing what they call an Augmented Monitoring and Condition Assessment Program in addition to existing maintenance activities.

You saw the 666 Basin yesterday. I think it's a beautiful facility that right now we're inventorying, and I think it still remains to be determined in terms of what is the future mission at 666 Basin. And that is a stainless steel-lined basin. The L-Basin facility at the Savannah River Site does not have--is not, I would say, as relatively modern as the 666 Basin. So it was important because of the ongoing mission of L-Basin to see if we could continue to store fuel there for quite some time. The Savannah River

Site is probably most active in terms of receipt of FRR fuels and some DRR fuels. That’s ongoing.

And I mentioned earlier that you may be aware that earlier this year right before the Nuclear Security Summit in March of this year that the Secretary of Energy and his counterpart in Japan signed a Statement of Intent that dealt with dealing with nuclear materials. And also part of that Statement of Intent is to potentially receive foreign research reactors from Japanese research reactors for a potential extension for up to 2029, basically a ten-year extension for them.

Now, that Statement of Intent is still subject to NEPA analysis, so it hasn’t been finalized yet. But that NEPA analysis is going to be prepared by NNSA, and that could potentially extend the receipt of Japanese fuel for another decade. And so that was partly important why we also need to make sure that the L-Basin is in good shape to continue to store fuel for quite some time.

The one thing I’ll also mention in terms of foreign research reactor fuel is that you may also be aware that the Department is preparing NEPA analysis right now to consider acceptance of German pebble bed research reactor fuel both in Ahaus and also in the Jülich Research Center. And so that while no decision has been made to accept that fuel, that fuel could potentially go to the Savannah River Site. And if a decision is made to accept that fuel, that would be in dry storage. That would not be placed in the L-Basin. We would look at a place to put it in some pad somewhere. So that could essentially be another asterisk, if you will, in terms of receipt of foreign research reactor fuel.

We are also continuing to receive domestic research reactor fuels at the Savannah River Site primarily at MIT, I think, the Missouri NIST, and I am not remembering the other--well, HFIR. With HFIR right now, we've run out of storage capacity at HFIR, so we have suspended shipments there until we make room for HFIR fuel.

Part of that right now at the Savannah River Site we are processing--continuing to process and we hope to complete by end of summer or early fall the processing of potentially vulnerable sodium reactor experimental fuel in the H-Canyon facility, and after that--last year, March 2013, the Acting Assistant Secretary for Environmental Management signed an amended Record of Decision to process a limited quantity of aluminum fuels, and that amended Record of Decision basically said that we could process up to about a thousand bundles of spent fuel.

And there's a picture of how we store the foreign research reactor fuels in L-Basin and also up to 200 HFIR cores. And the reason for that was that--it was for multiple reasons. One, we needed to make sure that we could continue to support the Foreign Research Reactor Acceptance Program through the 2019 date, you know, with the asterisk. And based on projections I'll show later on, we were expecting to run out of storage capacity just like in HFIR. And also the HFIR reactor has continued to operate, and so we needed to make some room for that. And one thing we wanted to avoid was having to spend money and resources for re-racking the L-Basin facility to place more storage. We'd rather do that--we'd rather process the fuel and not have to add more storage capacity at L-Basin.

There is also some benefits in that, and the plan for that is when we process all this fuel is that we would basically recover the HEU and downblend it into LEU for use in commercial reactors. And we have an agreement with TVA. I think the estimated quantity that would be sent to TVA from processing all this fuel in this Record of Decision would be an additional 40 metric tons of LEU that would be sent to TVA over a period of several years, I think through the 2019/2020 time frame. And also there are the non-proliferation benefits of converting HEU to LEU.

This Record of Decision was for a limited quantity of spent fuel for the reasons I mentioned. It was also trying to maximize the planned missions for the H-Canyon facility. The thousand bundles of MTR, Material Test Reactor, that I mentioned and the 200 HFIR cores, it's roughly--it’s only about a third of the inventory of the aluminum fuel that’s at Savannah River right now. So it would not get rid of all the aluminum fuel at Savannah River. And we also recognize there is a lot of aluminum fuel here, too. That’s something that I think we need to discuss and consider in terms of what would we do beyond after we get this processing of this fuel underway.

I just wanted to talk about the FRR Acceptance Program. We really have a key role in supporting the non-proliferation program in DOE, and we work closely with the Office of Global Threat Reduction Initiative as far as securing not only foreign research reactor spent fuel, but also other nuclear materials. I mentioned about the Statement of Intent that was signed earlier this year, looking for potentially extending the receipt of foreign fuel from research reactors in Japan. But part of that Statement of Intent also included other nuclear materials that we could potentially be receiving in the DOE complex as well, including EM facilities in support of the GTRI program.

There’s 41 participating countries. This program has been going--I think I mentioned that the aluminum fuel that’s being consolidated at the Savannah River Site in terms of receipts of foreign research reactor fuel and the non-aluminum is being received here at Idaho.

The domestic research reactor program is going to continue to--right now, I mean, the thing is, like, through somewhere in the 2030s. There's no particular end date for that, if you will. However, the foreign research acceptance program is ending by--actually, it's very specific. I think it's May 12, 2019, which is based on a NEPA decision. It's going to be ending, with the exceptions that I noted earlier in my presentation, with the receipt of Austria fuel and potential receipt of the Japanese FRR program.

This is just a depiction of our storage capacity at L-Basin. The white line there shows basically the--I guess it's the normalized storage capacity. This is excluding HFIR fuel, because that's stored in a different arrangement at L-Basin. And the dash lines--the yellow and red dash lines basically shows the range of projection of FRR receipts. And based on our projections, we were expecting before the 2019 program to run out of storage capacity at L-Basin.

And so the solid lines basically depict that after implementing what was in the amended Record of Decision to process this fuel, under any scenario that we can envision right now, that we will not exceed the source capacity at L-Basin. So that's why it was important for us to issue that Record of Decision to, in part, of making room in L-Basin to continue to support the FRR program.

This line here you're wondering, okay, after 2019--I think these are based on domestic research reactor receipts, so even after the FRR program ends, we are going to continue to receive small quantities of domestic research reactor fuel right now through--for the next couple decades.

As far as the future of spent fuel management, I think most of you are aware that the Department issued in January of last year, in response to the Blue Ribbon Commission, basically our strategy for management and disposal of spent fuel and high-level waste. In summary, this report basically adopts most of the BRC recommendations, particularly with having a consent-based siting. It also talks about establishing a pilot and an interim storage facility in both the 2120 to ’25 time frame; and pending a number of things legislatively, it would have to happen that they would have a repository by 2048.

So that’s basically the Department’s official position in terms of long-term future management of spent fuel.

One of the things that I do want to mention is that we also--in the Department we are in the process of establishing a spent--actually, I apologize for a mistake here. I mean, we call it an EM Spent Nuclear Fuel Corporate Board, but I really think of this as the Department’s Spent Fuel Corporate Board. We’ve had our initial discussions with our partners within the Office of Nuclear Energy, Science, and NNSA.

And the purpose of this board is really in recognition that one--I think you heard also during our tours yesterday that resources are getting pretty tight everywhere. I mean, it’s not just the spent fuel program, but it’s the whole clean-up program everywhere. And I think one of the things that we recognize is that in order to better leverage resources across the Department and the technical capabilities that we really need to in some ways reinvigorate what we had, the National Spent Fuel Program, and hopefully do a lot of the good work that the National Spent Fuel Program has done, but also really get involvement from key program officials and decision makers within the Department.

We’re planning right now--tentatively September 16th is the first--it’s a DOE-only meeting for this corporate board. We have a draft charter, and we’re hoping to have the charter finalized by then and also how we’re going to get organized. We’ll probably have this corporate board--we’re thinking having it perhaps co-chaired between EM and NE, but that’s still to be decided, and probably have some technical staff on board. So we’re emulating a little bit how the Nuclear Technical Waste Review Board is organized.

And certainly we also--it is very key for us to have participation from the field offices and also some of our national labs. And we recognize that, in addition to just leveraging resources, we want to continue to improve the collaboration between our national labs, because we really have a wealth of expertise at our national labs, and I think it’s really incumbent for us to better improve the collaboration between the labs and also in terms of some of the R&D work. There is some R&D work that’s going on. You know, when budgets get tight, R&D also gets tight. And so we recognize that between the Office of Science, EM, and NE, I know there has been some collaboration already between EM and NE, but we want to continue to do that.

And also I mentioned about the disposition of aluminum fuels. Right now the decision that was made back in March of last year was for a limited quantity, and it dealt primarily for a specific purpose at the Savannah River Site. But we recognize that we have a significant inventory remaining at not only the Savannah River Site, but also at the HFIR and here at Idaho as well; and we really need to figure out, you know, in terms of timing, how we do that, and how do we coordinate that to support the multiple missions and needs at the site.

And part of it is just looking at what--that’s just an example of, I think, where we identify a need, and I think it’s really important for us to--and we recognize this--to look at, okay, what are the existing capabilities and needed capabilities that we have to further the missions at each of the sites? And I think that’s very important, because with resources being limited, it’s not like, you know, we need something, we just go ahead and build that.

I mean, I think we really need to look hard--and I think you’ve heard during some of the discussions during the tours yesterday was that we are really very conscious about before we--well, one, we have to identify what the need is and then looking at what are the existing capabilities, how could we maximize that complex-wide. And, granted, there are some complications when you start talking about moving this type of material, you know, across states. But I think it’s incumbent for the Department to identify, hey, you know, what is the best integrated approach for us to solve some of our near-term issues?

So more to come on the Spent Fuel Corporate Board. We hope to have things finalized in terms of the charter and the membership and how we’re going to be organized next month. And in future meetings, actually, we’d like to also invite participation from the Nuclear Waste Technical Review Board. Maybe perhaps the staff could participate in some of our meetings and even with the Defense Board or others in terms of--so more to come on that. And perhaps maybe when we meet again in Savannah River the end of October, we’ll have more information to talk about the Spent Fuel Corporate Board.

And in the meantime, we’re continuing with safe storage of spent fuel at our sites. We recognize we have a lot of challenges. And then we are going to continue to accept the foreign research reactor programs and domestic research reactor programs, and that's going to add to our inventory.

And I think that's probably all I need to say about as far as an overview, so I'll be happy to take any questions you may have.

EWING: Okay, thank you, Gary. Your presentation reminded me that I forgot to say something in the introduction, and that is, yesterday the Board and staff were pleased to have a very nice tour of the facilities at the Idaho National Laboratory. I've taken these tours many times, and I can say that this was the best that I've had in terms of the engagement and the amount of information that was provided to the Board. So I wanted to be sure and thank the people who organized that tour and participated in it.

So this is the moment when we open the--or we direct questions from the Board to the speaker. So are there questions from the Board members? Mary Lou?

ZOBACK: Mary Lou Zoback, the Board. That was a really nice overview. Thank you, Gary. The question I have is related to the Corporate Board. When I heard that term yesterday, I had a very different view of what I thought a corporate board was than what you just put up there. So the first question is, is it only going to deal with the DOE spent nuclear fuel or DOE-owned--well, I guess DOE owns all spent fuel ultimately. Is it going to deal with commercial fuel as well?

DELEON: No, this is only DOE spent fuel.

ZOBACK: Only DOE. And there's only going to be DOE and NNSA participants on the board?

DELEON: No. It would also involve Office of Nuclear Energy, Office of Science, and if there's other interests from other offices--those are the main offices that would be involved, but--

ZOBACK: But they're all within DOE.

DELEON: Yes.

ZOBACK: So EPRI is not going to have a seat at the board?

DELEON: No.

ZOBACK: And then how would this vary from an advisory board? Does the Corporate Board have voting, and can they direct funding?

DELEON: What's envisioned--and this is still to be finalized in terms of what the senior leadership in the Department would approve. What's envisioned is that this DOE Corporate Board, with representation from the various program offices and also from the field offices, as well as contractors--is that they would basically be identifying and providing recommendations to senior DOE management in terms of how we could address issues that are identified or brought to the board in terms of cross-cutting issues in terms of research and development activities. And so this board would basically be more of an advisory function to the Assistant Secretary, sort of the decision makers within the Department.

And I would say that's really very important, because I think there's a lot more--and the reason for establishing this--there's a lot more--I don't want to leave the impression that we don't communicate within the Department. I mean, we certainly do that. And a lot of our recommendations in our meetings and discussions with decision makers involve saying, well, you know, how does this affect other program offices? We do that.

But I think this provides a focused function on addressing that, because I think--me as a manager within EM and my counterparts in other program offices--I think we all try to do that, but we all--as I mentioned, this is only part of my function--we all get pulled in different directions. And so having a corporate board and having the discipline to meet regularly, whether we do that every six months--I mean, that's to be determined--I think it puts some emphasis in the need that has been ongoing. And I think it provides a better-integrated recommendation to senior management, saying that, you know, we have done this consciously in integrating with other program offices the needs or recommendations. So I think this would help put that emphasis.

ZOBACK: Okay, thanks. So regardless of what you call it, it's really going to increase the cooperation, collaboration, and dialogue?

DELEON: Yes.

ZOBACK: Sounds great.

EWING: Paul.

TURINSKY: Paul Turinsky. The commercial side for spent nuclear fuel has recognized that basically fuels are going to be in storage for a very, very long time. So they're undertaking R&D programs with DOE that basically are looking at what's happening to the fuel in dry storage, what's happening to the canisters that are storing the fuel in dry storage.

What is going on with the DOE-owned fuel that's similar to what is now going on and being planned for commercial fuel?

DELEON: Well, I can speak a little bit to the EM R&D program. I think there was some discussion yesterday on some of the aging management, I'll call it, R&D or applied technology work that's being done particular to the TMI fuel. We have--I mean, I think this kind of goes back--and I'm kind of going back to the establishment of this Corporate Board, because as part of our deliberations in looking at proposals from the sites in terms of R&D, one of the things that we looked at, as far as the decision making on that, is that, okay, within the limited R&D funds that we have within EM, how is this proposal benefiting other DOE sites, and are there commercial benefits?

And so I think there's a recognition that we need to--I mean, we certainly welcome it if there's something that is being done on the commercial side and that would also benefit DOE and vice versa. I think we certainly would welcome that opportunity. And I think there has been some work, and I think I'll defer to the Office of Nuclear Energy in terms of--I know they are doing some work that could potentially benefit that as well.

So, basically, to answer your question, is that we are looking into that in terms of some of the work that we are doing, the limited R&D that we're doing right now, to the extent that it could benefit both the DOE and the commercial. I mean, it's something that we would certainly want to undertake, especially with the limited resources that we have.

EWING: Linda.

NOZICK: Linda Nozick, Board. I want to follow up on Mary Lou Zoback's question. For the Corporate Board, what's the financial mechanism, or how much time are people going to have available? You made a comment about staff. Is this becoming a budgetary item someplace?

DELEON: Well, budget is always an issue in everything that we do. No, the Corporate Board would comprise of, I'd say, either management or key senior people from DOE. So in terms of--I mean, it's not going to be a separate line funding.

NOZICK: No, but would you have to pay for it out of your own--is this, like, donated--in some sense, additional responsibility, or is there some funding mechanism that calls support out of side so this can be done easier?

DELEON: Well, I think in terms of implementation, I mean, that's one of the things that we have to recognize is, it is within our current appropriations from each program office. That's something we'll have to figure out. But I think part of the reason for that is that we recognize that our funding is very limited.

And so if we had to, I guess--you know, we always get proposals and ideas, and I think a lot of--you know, some of them are pretty good ideas. But in terms of how do we even prioritize, if we come up with--I don't want to speak for the board until this is established, but, say, we identify, hey, we really need to do three or four items. Perhaps one of the considerations is, how do we prioritize this? How do we incorporate that with this size budget?

And it's very important to have participation from the field offices, too, because that's where the work is being done and also where the funding is provided to. And so how do we work that within the sites' target funding? Because we recognize that, you know, funding is limited, and we're going to have to figure out how to do this within the available funding. So it's not like we're looking at available funding. But one thing that hopefully the board could also provide better influence is leveraging the R&D funding. That is also a very limited resource in the Department.

NOZICK: Thank you very much.

EWING: Gary, just to follow up, I have a question on the Corporate Board, because, of course, the name in a certain way matters. It conjures up an image of the scale and discretionary decision-making that may go with that increased scale.

So certainly we learned yesterday that many of the DOE activities are constrained in Idaho by the agreements with the State. And, of course, as we go from site to site, we see another web or additional webs of agreements, which further constrain DOE activities. So will states be represented on this Corporate Board, or is this entirely internal to DOE?

DELEON: This is internal to DOE, but certainly any decisions that could affect the states through our normal public involvement and our participation, you know--let’s just say a decision is made to do something--or not a decision, but we say, okay, based on a recommendation from the board, we’re going to implement something; we’re considering that. And so we have our normal process in which we engage the states either through the existing settlement agreement where we have periodic meetings with them, and we certainly have a very active, at all our sites, a public engagement process.

So in terms of the deliberations and recommendations and ultimate decisions that would affect the states, then certainly we would involve them. But it’s not going to be--it’s not an ambition to be like a public meeting where we have state involvement, but we will obviously involve them in terms of any decisions that would affect them.

EWING: And I’ll just make the observation that, of course, DOE is interacting with the states; but that’s more on a one-on-one one-at-a-time basis. And so looking at the web of agreements, one can imagine that the states would want to discuss and maybe modify agreements in somehow facilitating things that would benefit all parties, the states as well as DOE. That’s just an observation. You needn’t agree with it or not.

Next question.

PEDDICORD: Lee Peddicord from the Board. Two questions, actually, one on the foreign research reactor return program that’s part of the Global Threat Reduction Initiative, and you mentioned the May 12, 2019, limitation or end date of that. The question--and you mentioned a couple of the caveats as well, too. So the question is: Is that tied to a wider set of agreements, and has there been an assessment done, if there would be opportunities or needs to bring back foreign research reactor, to possibly extend that 2019 date, and what would that take?

DELEON: Okay, well, I’ll respond to your question, but let me caveat my response first. I am not speaking on behalf of NNSA, because they are the ones who are in this program.

The May 2019 date was established based on the NEPA Record of Decision on the FRR program that was ending by 2019. I think there was an extension that was provided. And I think part of the reason for that is to encourage by participation of the countries to basically get rid of HEU that’s out there, out in the research reactor facilities. And so they’ve set the deadline to do that and given an extension. And for the most part, I think most but not all of it--most of the HEU fuel has been received--repatriated back to the U.S. There is still some remaining HEU in there, and actually some of the foreign research reactor fuels that we are accepting is LEU.

But that was also part of, I'll call it, agreements, if you will. I'm using the term loosely with each either particular country or research reactor in saying that if we convert you, we will also continue to--as part of the incentive for them to convert into LEU-based fuels. So their position is that most of that program is ending, and they've basically achieved most of their mission right now.

I do know that there has been multiple requests from many countries in terms of having an extension program, and the position by GTRI is right now that they are--that that program is going to basically terminate by then.

And let me caveat this a little bit, too. I mentioned about the Vienna research reactor. In working with GTRI, part of the reason why we agreed to this exchange was that by giving this--I'll call it this one-time exemption for the Vienna research reactor. It was something that had additional non-proliferation benefits to the United States and the world because of the role of that research reactor. And so they recognized that if the Vienna in situ was faced with shutting down their reactor, and IAEA was going to be left without a research reactor that was convenient right near them to train some of their inspectors. So there was a request from the IAEA.

So that exemption was given because there was a clear non-proliferation benefit to them--to the United

States, so that was part of the reason why that was given.

So I would say that similar to the Japan Statement of Intent that there was also some very high priority, and I think there were statements made in the recent Nuclear Security Summit in terms of why it was important for us to take some of the surplus plutonium and HEU that they had in Japan, and part of the agreement was to give them an extension on the FRR program.

So by exemption, I guess there have been some precedent that if there's a continuing need and a non-proliferation benefit to the U.S., that that's being considered.

PEDDICORD: Okay. The other question related to the downblended fuel at Savannah River that you talked about, I think you said 40 metric tons of LEU. Is that material going to carry some residual activity similar to the EBR-II fuel when it comes out as an LEU, or is it going to be rather cleaner?

DELEON: No. This would not be, because when it's processed in H-Canyon, most of the fission products and also the plutonium when they do the processing, that goes into the high-level waste tanks. So this is pretty clean HEU.

PEDDICORD: And is this material then constrained by peaceful uses limitations?

DELEON: Yes. We have material obligations not only for the HEU, but also the--I think it’s natural uranium that we get from--it’s natural depleted. But, anyway, the uranium we use for downblending, that actually comes from Canada, and that has foreign obligations as well.

PEDDICORD: Okay, thank you.

EWING: Okay. Yes.

BECKER: Steven Becker, Board. Gary, very nice overview. You mentioned briefly the age and characteristics of the L-Basin. Has that facility been looked at recently in terms of its capacity to deal with seismic events?

DELEON: That is part of the safety basis for the facility. So when you say recently, as part of their report--I want to say in the ’12 time frame--they’ve considered that as part of their safety basis. So I would say this has been considered. But in terms of any specific things, I would have to get back with you on that. But as far as extension of that, the whole safety basis was considered, including seismic.

EWING: Other questions? Jerry.

FRANKEL: Jerry Frankel, Board member. So a certain airline conspired against my participation in yesterday’s tour, and I’m feeling that I’ve got to play a little catch-up. And I apologize if I’m asking questions that were covered, but I also appreciated the overview.

I have a question on two slides back, your EBS capacity chart. So regarding the baseline, can you just clarify for me the increases that are seen for the next couple of years and then over the, you know, 15-year period out to ’33? What are the increases from?

DELEON: The increase is basically receipt from foreign research and domestic research reactor fuels.

FRANKEL: Isn’t that the difference between the solid and the dashed lines then?

DELEON: The dashed line is that if we did not process any of the fuel, it shows that we would exceed, depending if you look at the red or yellow, by the ’17 time frame. But, of course, we would have to take into account budget and work in order to, you know, have the needed capacity.

So this is the range in terms of if we didn’t process any fuel and then by processing fuel that we would then be basically--while we’re continuing receipts, the actual total inventory would be going down. And then once we’re done with processing the fuel that’s in the--the scope that’s in the amended Record of Decision, we’re going to continue to receive some domestic research reactor fuel.

FRANKEL: Okay, thank you very much.

DELEON: I’d like to go back also just to make sure it’s clear in your question about the--I want to make it clear about the 50-year storage at the L-Basin. I don’t want to certainly imply that we’re planning to keep the L-Basin operational for another 50 years. We're just looking at--basically the conclusion at the site is that if we implement this based on the existing safety basis and implement this program that we could keep the L-Basin in operation for another 50 years. But certainly part of our goal would be: How do we get rid of all the fuel at the L-Basin? And part of that is not only processing all the aluminum fuel in the L-Basin, but also look at, you know, what do we do with the non-aluminum fuels that we can't process? And so that's another item that we need to do.

So I just didn't want to give the impression that we're going to be storing fuel there another 50 years at L-Basin. We certainly wanted to de-inventory that as soon as we can, because L-Basin--and you'll get a lot more detail when you go to Savannah River, but the L-Basin is--it's an older facility, and it's very costly to maintain.

And we've had some potential issues that we're trying to manage, including--I mentioned about processing the SRE fuel, the sodium reactor experimental fuel, that has been overpacked. And I think we've been working with the Defense Nuclear Safety Board. They have identified that as a potential concern, so we certainly--I just didn't want to give the impression that we're planning to store there for another 50 years.

EWING: Jean--

ZOBACK: I actually had a follow-up.

BAHR: Yeah, mine's a follow-up, too. I was just wondering why the L-Basin fuel could not be moved into dry storage over these kinds of time frames.

DELEON: We certainly could do that, and that is a consideration as well. But at this point it kind of goes along with trying to de-inventory L-Basin, and that's one of the things that--some of the things that we need to decide within the Department is that it's a cost benefit in terms of we could transfer all the fuel--whether we build a storage pad, we could transfer all the fuel into dry storage. But then we also have a need to repackage all those different fuels. I mean, ideally, we'd like to handle the fuel once. Ideally, we'd like to package them in standardized canisters--and you'll get more information there--so that it's road-ready.

We certainly would try to avoid having to have a dual-capable--because we know we need to do that here in Idaho. And if we were to package the fuel or place the fuel in the L-Basin dry storage, ideally, we handle it once and put it in standardized canisters, but that means putting the capability at the Savannah River Site.

Part of the cost benefit and optimization would be, if there is a need and plan to build that here in Idaho, can we just send the fuel that can be processed in H-Canyon, for example, to Idaho, similar to what we're doing with the Fort Saint Vrain fuel, and have only one facility to do that? So it's a matter of a cost benefit and timing.

ZOBACK: Mary Lou Zoback, Board member. I want to follow up on the seismic hazard analysis, and I'm going to ask you this question. I've asked it a lot of people, and I haven't been able to get an answer, so I don't expect that you might know the answer. But, you know, I understand that the facilities are designed for a design earthquake. But one of the things, particularly with these basins and the cooling ponds at reactors, that I've been concerned about is the potential for liquefaction to do damage to piping, particularly shallowly buried underground piping. And that would take a much--that could occur in response to a much smaller earthquake than the design.

So I just wondered, has liquefaction potential been evaluated for the L-Basin and all the piping associated with it?

DELEON: I would have to get back with you on the response to that question. I mean, I can only say in general terms in terms of the safety basis at the facility and what's considered, so I'd have to get back with you on that one.

ZOBACK: Okay, thank you.

EWING: Thank you very much. We'll have to move on to the next speaker, but thank you, Gary.

DELEON: Thank you.

EWING: The next speaker is Roger McCormack. He'll be discussing work to date on multi-canister overpacks and standard canisters.

And, Roger, I presume you're splitting your time then evenly with--

McCORMACK: Yeah, I'll try to speed things up so Brett has time to go through all of his material.

EWING: Okay, thank you.

McCORMACK: Wrong presentation. Roger McCormack, please.

Thank you, Mr. Chairman. Again, I'm Roger McCormack, and I'll be speaking about the status on the multi-canister overpack. Multi-canister overpack was developed to support fuel removal from the K-Basins along the Columbia River at the Hanford site to place the fuel into 40-year interim dry storage. Subsequent to that, we initiated and completed analysis related to MCO survivability/transportability off site that were scoping analysis in nature. And we also did a considerable amount of work regarding trying to put the MCOs into the license application for direct disposal at Yucca Mountain.

I am going to basically provide a description of the MCOs, status on the MCO processing operations at Hanford, and then go into a status on the outcome of the survivability/transportability analysis and then a brief status on the fragility analysis, which was the key point related to the disposal at Yucca Mountain.

Multi-canister overpacks were designed principally to handle N reactor fuel, which is basically the central--the fuel in the center picture there. There's two different types of N reactor fuel, which is important, Mark IV and Mark 1A. Mark 1A is a slightly higher enrichment. They're both low-enriched fuels. The Mark 1A can be up to about 21 inches long; Mark IV can be 26 inches long. And so there's different basket designs in loading to go into the multi-canister overpack.

Additionally, on the left there is a picture of the single-pass reactor fuel. Those are typically 8 inches long; aluminum-clad uranium metal; N reactor is Zircaloy clad uranium metal. Both of those fuel types were stored at K-Basin, so the MCO addressed both of those types. Later we found that we needed to package knockout product material at the K-Basins for management as spent fuel also. That's basically small fragments of N reactor fuel that was recovered from a wash stream where we had damage to N reactor fuels. It was washed, and then the metal fragments were recovered from that stream and placed into multi-canister overpacks. Originally that was going to be destined for WIPP and was found not to satisfy the WIPP acceptance requirements.

On the far right, at a different facility on-site, we had wet storage of shipping Shippingport Naval Reactor blanket fuel assemblies, which was a natural uranium enrichment; and those were basically loaded into simple--with a simple cruciform, no crit control or anything of that nature, and placed into interim storage at the canister storage building.

Within the multi-canister overpack, the fuel is loaded into some different basket configurations. What you see here are Mark 1A baskets. On the left is a fuel basket; on the right is a scrap basket. About less than two percent of the inventory of the fuel is pieces of fuel that are anywhere from a quarter inch to three inches long. Those are placed in a scrap basket basically to be able to deal with heat transfer issues that are in the drying process.

Important features of the baskets is that--you see on the fuel basket that there is a screen that you see in the--there is basically an egg carton that holds the bottom of the fuel pieces, and then there is a screen that keeps any material that’s less than an eighth of an inch from falling to the area below it. There is less than an eighth of an inch--or excuse me--it’s less than about--it’s about .18 inches on each side of the fuel basket between the fuel basket and the MCO inner wall, basically also to restrict movement of material between basket levels.

And on the basket on the right, the scrap basket, there is flow restrictors on the side that actually will contact the wall to ensure that flow goes through the basket rather than along the side walls during the drying process. And only about 66 MCOs actually have scrap baskets, so the remaining MCOs have entirely fuel baskets.

On the lower right-hand side you see a single-pass reactor basket that fits onto basically a Mark 1A fuel basket structure. Because of the fuel shorter, you can stack two to three single-pass reactor elements in each one of those baskets.

The MCO itself is a 24-inch shell outer diameter, 25.31-inch diameter collar, and cover cap to accommodate a shield plug. At the top there’s a--it is a--they are ASME Section III code-stamped vessels, have a design capacity of up to either five of the taller Mark IV or six Mark 1A MCO baskets.

A real key issue, though, you’ll see in the later discussions, if you look at--basically we install a shield plug over the fuel that you see in green on that picture, sits down, and there is a helical (inaudible) seals that end up being compressed on the lower part of that against the shell. A locking ring is then basically screwed on. It’s got a threaded connection with the shell. At the point of that threaded connection the wall tapers down to about an eighth inch--or excuse me--three-eighths inch thick versus a half inch thick, and that’s been the area of concern during the transportability and drop assessments. The shield plug has four ports in it to be able to support processing and later gas sampling and pressure monitoring at the canister storage building.

A cover cap is welded over the shield plug area that you see there prior to the code stamp being applied. With the shield plug the pressure rating is 150 PSIG, and with the welded closure it’s 450 PSIG.

Just a brief look at the process. A key thing is we go through a fuel washing process to start with. You’re not going to see that in any of the later pictures. But the fuel goes through a high-pressure spray, it’s rotated in a washing machine, and experiences a lot of force during that processing.

The fuel is then loaded into baskets at the K-Basins, put into a multi-canister overpack underwater, and then transferred to a cold vacuum drying facility where the drying process takes place and then transported on site to a canister storage building for interim storage.

Just showing photos of what that looks like, and you’ll notice on site that once we load a cask, the MCOs stay upright the entire time in a vertical position for ease of operation, quickness of operation.

In the picture on the left you see at the canister storage building the first step in the process would be to put an empty MCO into a cask that's in the pit beneath it. Once it's in the cask, it doesn't come out again until it's back at the CSB.

So you see on the right-hand picture a picture of the cask being moved at the K-West Basin, being transferred to the loading pit area where it's submerged in water.

Here you see a couple pictures of an MCO fuel basket and an MCO scrap basket. Again, you can see there is a variable height. We don't load Mark IV and Mark 1A fuel into the MCO, but there is differences in the height and length of elements within each of those families, and there are also broken assemblies. So you do have variable height on the loading in the baskets.

Scrap baskets in the outer compartment. Fuel scrap is anywhere from a quarter inch to--excuse me--one inch to three inch in size, and in the inner area it's from a quarter inch to one inch.

Once you basically stack the baskets into the MCO, there is a process tube that goes down the center of the baskets to basically facilitate the later loading. And it's a nest very tightly in the shield plug so that even if the cask is--or the MCO were laid on its side, it's not going to slip loose under the normal loading configuration.

The picture on the left you see, once it’s transferred to the cold vacuum drying, access ports on the top of the MCO shield plug are accessed to support the drying operation. We will talk about drying a little bit later today. And then on the right you see the transfer cask that’s used on site.

Once it’s at the canister storage building, what you see is a receiving crane. The yellow piece on the left-hand side is designed to lift the cask off of the trailer and put it into the receiving pit at the canister storage building. That’s then moved out of the way; and, as you see, the yellow structure on the right-hand side, that’s the MCO handling machine. It will come and pick up a multi-canister overpack and either move it to a tube that you see, three vaults. Only one of them has tubes in it, and where they’re stacked two high, there are impact limiters on both the top and--oh, okay, better hurry--and there is a station on the far right-hand side where they can then be moved for sampling, monitoring, or welding of the MCOs.

Here you see one of those pits where you see a cover cap assembly about to be placed on top of an MCO cover, and you see basically the numbers of MCOs we have to date.

Real quickly, survivability/transportability analyses, we did complete transportability analyses.

National Spent Nuclear Fuel Program actually did that work. Key points coming out of that were that, in essence, for an MCO to meet the safe transportation requirements for off-site shipment in a horizontal position in rail transport cask, we basically looked at a Holtec International HI-STAR 100 system performance characteristics, looked at putting a cruciform with four MCOs transported at a time, again via rail.

And there was supplemental--if an MCO were just placed bare into the cask, we would have--it would be problematic. We would have to limit the--have external impact absorbers to limit the deceleration to 60 Gs at that point, and then we would need to provide a supplemental impact limiter within the cask--within the Holtec cask on top of the MCO, and with those features we would be able to satisfy the off-site transportation requirements.

Crit analysis, we did also look at loading of Mark 1A fuel into Mark IV MCOs, not just the--so we went beyond what we had looked at on site. We didn’t get to the point of looking at MCO scrap basket evaluations, but we did look at degraded fuel or damaged fuel loading within the cask.

Drop tests were performed at Sandia National Labs by Sandia, evaluations analyses completed by the National Spent Fuel Program. The criteria that we used were to meet the Waste Acceptance System Requirements that had been established for Yucca Mountain surface facilities.

And just quickly showing the pictures. The cask did survive in both cases. The 23-foot vertical drop looked at was the maximum damage to the fuel baskets, and we did see that the top center post and the outer post on a Mark IV basket that we would have, like, five, six inches of deformation there. And so we would have to look at the effect on the fuel damage. Minimal damage from the slapdown and on the deformation of the MCO and, I think, in the nature of about three-eighths of an inch.

Fragility analysis, basically the pre-closure safety strategy for Yucca Mountain was to ensure that, whether it was an MCO or a DOE standard canister, that pre-closure breach was not credible or beyond a Category 2 event sequence.

In 2007 licensing strategy established the use of a representative canister approach to evaluate canister drop and breach probabilities using fragility analyses. Based on that specific analysis, MCOs did not pass the requirements for off-vertical drops. And based on that, the MCOs--there was not sufficient time to do additional analysis. The MCOs were not deemed ready for inclusion in the June 2008 license application.

Subsequent to that, National Spent Fuel Program prepared supplemental analyses, considering the potential design features. They could limit the drop orientations, considering the certified material test reports for the MCO materials as opposed to minimum code allowables, and Brett Carlsen will be speaking hopefully about that a little bit in his presentation. And prior to review of the work that Brett and his folks did on that, Yucca Mountain activities were terminated. So basically you can see the results of that in Brett’s presentation.

EWING: Okay, thank you.

What I would propose is we go immediately to Brett Carlsen’s presentation, because it’s on the same topic; and then we’ll have time for questions, too, both speakers.

So, Brett.

CARLSEN: I guess, first off, I would like to thank the Board for recognizing and taking the time to address one of the unique issues associated with management, specifically storage, transportation, and disposal of the DOE on spent fuel.

Roger mentioned that I would be able to address a little bit further some of the issues associated with the fragility analyses. I have prepared a short, separate presentation on that. I don’t know that I’ll have time to get to that today. At the Board’s request, if there is time, I’ll be glad to go through that. I think it’s probably 15 to 20 minutes, but the slides are somewhat self-standing.

I will summarize real briefly to say that we looked at that, and we believe that it was an unfortunate and unnecessary decision to withdraw the MCO from the license application. It was probably the right decision at the time, given the issues at play during that time frame. But since then we've looked pretty carefully at that analysis, and we are confident that there are a number of analytical solutions that will give us plenty of margin to address those issues. If necessary, there a number of design solutions that can be implemented as well. And, again, if there is time or an interest, I'll be glad to field questions or go over that presentation separately.

The presentation I have prepared addresses the DOE standard canisters, which, in our terminology, a standard canister includes both the standardized canister and the few different variations of that and the MCO. I will focus primarily on the standardized canister, because Roger has already addressed the MCO.

I've got a number of topics I wanted to address. I think I'll address all eight of the Board's questions through this approach. Unfortunately, there is more material there than time. I took a look at the presentation again this morning and think that if we start at about Slide No. 15, I'll get the last seven, 2 through 8 of the Board's questions. The first question is addressed pretty carefully in Slides 3 through 12, so we'll just buzz through those.

And, again, I'll go back if needed.

That said, let's just start jumping ahead. You'll see that the first several slides here talk specifically about--address specifically the standardized canister. What they do is they give you a lot of detail about the standardized canister and the role that the canister plays in our transportation, storage, and our disposal strategy. It's really the cornerstone of our strategy, because it serves two purposes. The canister basically provides standardization for all the diverse DOE fuels that can be handled similarly at various facilities. There's cost savings; there's, we believe, risk reduction associated with that; and, more importantly, it provides a common barrier that we believe we can credit in the safety analyses for transport and disposal and get away from the need to have to characterize the chemical and mechanical properties of all of our DOE fuels, which would be a real costly challenge that I'm not sure would be successful even at any price.

So with that background, all the slides we skipped through was just to give you some confidence to why we believe the canister is sufficient to meet that need.

But getting to our plans for transportation, this is a model that was developed probably 15 years ago back when the National Spent Nuclear Fuel Program was responsible for transportation, the development of the transportation cask and system. In about 2002/2003 time frame the DOE's Office of Civilian Radioactive Waste Management pulled that responsibility back and assigned it to the Office of National Transportation Safety, so the national program has not worked actively on cask development since that time. But this model that we developed back in the early days of the program has still served as a good working model for our plan.

And even though we weren't responsible for cask development, we were responsible for making sure we had a packaging strategy for the fuel in the standard canisters that would be licensable for transport. And under that responsibility, in about 2004 we engaged several cask vendors. Our thought was that the cask would look something like a very--very similar to a standard commercial cask. What you see here is basically a cask with nine 18-inch canisters. The thought was we would have just a standard commercial cask with several different inserts to accommodate the different size canisters, the MCOs, high-level waste, and the other things that DOE will need to transport to an eventual repository.

We do actually have a hands-on physical model that we've placed back on the back of the table that shows a real model of this. This shows some of the different inserts that you can actually play with and see how the different DOE materials would fit in the canisters with various inserts.

In 2004 we engaged the cask vendors just to say, “Would you be able to transport something like this? What are the issues?” The general consensus was, “There’s no problem; we can handle the DOE canisters.” But when we asked them to give us a list of data needs to help get those inside their certificates of compliance, the list of data that they thought they would need to do traditional criticality analysis was daunting; and it was just outside the scope of what we thought we could provide for the wide range of DOE fuels, particularly with the quality requirements that would be expected.

However, when we talked about our canister and our package, it was recognized that we have a very unique first-of-a-kind transport package. The cask is designed and tested to the hypothetical accident conditions to maintain leak tightness under transport accident conditions. When we set the criteria for our standard canisters, we did not have waste acceptance criteria for a repository at that time. Still don’t.

So what we used for our survivability criteria for the canisters were the requirements from 10 CFR 71.73. That then means this package now has two independent barriers, each tested, each a code-stamped vessel, that are tested to the hypothetical accident conditions of transportation. It’s a very robust package, and it was concluded that if ever there was a package worthy of getting credit for moderator exclusion for transportation, this was probably it.

So we also recognized that our safety analysis for the repository, which is done under 10 CFR 63, which is risk-informed, did credit moderator exclusion for the accidents there. However, 10 CFR 71 for transportation is not risk-informed. We reviewed that carefully, and we identified that there were a couple of avenues within the present regulation that we thought we could exercise to get moderator exclusion as the basis for criticality safety. And barring that, we thought there was perhaps justification for rule-making and coming up with a new rule to specify and codify how moderator exclusion could be credited if we needed to.

So in 2006 we proposed a topical report to the NRC, requesting their approval to credit the leak-tight boundary of the canister for maintaining a moderator exclusion during transport.

Over the course of the next year or so, we held five pre-application meetings, and we eventually reached consensus on a path forward for completing and submitting that topical report. Due to subsequent events, primarily political and financial events, that initiative was later put on hold and has not been completed. But the objectives of the topical report are still very important and, I think, need to be carried to conclusion.

The first near term objective was to confirm that the DOE spent fuels, if repackaged into standardized canisters, would be acceptable for transportation. That does a number of things for us. In particular, it minimizes the data needs, so we know exactly what data we need on the spent fuel in order to get the transportation licenses approved. It allows us to design or perhaps make any design changes necessary to our standardized canister before we have a need to use them, before they are loaded and sealed. It’s a much more effective way to do business, and it would allow DOE to move forward with consolidating some of their spent fuels into newer packages and to newer facilities with confidence that they would not have to reopen that package and package again at a later time.

Longer term objectives, we wanted to provide a starting point for the future cask vendors so they would know exactly what their casks needed to provide in order to be able to credit our canisters for moderator exclusion and thus greatly simplify the amendments or changes to those certificates of compliance to transport our fuels.

So, in summary, the transportation safety approach--and this is essentially a real brief summary of what we agreed with the NRC would be included in the topical report--is this: We would use a standard transportation cask. We would credit the transportation cask for providing all containment, shielding, and traditional cask functions. We would provide them some supplemental analysis in the topical report that would allow them to credit the canister for providing moderator exclusion. And in doing that, we would specify things such as the wall temperatures inside the cask, the G-loadings for transportation impacts and such that would make sure that they protected the canister and kept it within its design envelope.

In order to get the NRC to consider moderator exclusion, this is what we agreed to with them: We would demonstrate and do a criticality safety analysis for all of our fuels in their as-loaded pristine configuration and show that they were critically safe, fully flooded, in that condition. We would then demonstrate the canisters would remain leak-tight.

Showing a lot of the information that we skipped through on those slides, and I also provided a number of references where that information can be looked at. And having done that, they would work with us for the accident conditions, and then if we would basically show that in the most reactive credible configuration, which in our case was not flooded because the canister would remain leak-tight, we would demonstrate that we were critically safe in a reconfigured but not flooded condition.

The details of this are covered in the presentation and the handouts of the last NRC meeting that we held, which was July 25, 2007. With the handouts from that meeting, there is a table that goes through 10 CFR 71 requirement by requirement and identifies how we will allocate those requirements between the transportation cask and the DOE canister and how we would expect that to be treated in the certificate of compliance. So that’s available if you’re interested to dig in a little further.

Okay. So where are we at on the standardized canister? Well, the National Spent Fuel Program under DOE-EM put together a preliminary specification in 1999, which was used as the basis for most of the analyses and testing. Later on, for the Idaho Spent Fuel Project, the DOE Idaho passed that preliminary spec on to Foster Wheeler, who included that in their design and took it through the NRC licensing process under 10 CFR 72. So we do have an official completed design that has been reviewed and accepted by the NRC at least for the storage phase. And DOE now owns that license, and they are able to make that design available to any other site--to other sites who have a need to begin repackaging.

However, there a couple of things that I need to point out. The as-designed canister, as always is the case, varies a little bit from the preliminary design. The changes are not significant, and they’re not expected to change any of the conclusions of the structural analysis or safety basis. However, they did include a shield plug, which reduces canister volume; whereas, we had intended all along to use fully remote closure process and not require a shield plug, and that will impact the number of canisters needed.

So I borrowed this pie chart from the preliminary draft of the Board’s report that kind of shows the breakdown of DOE spent fuels by metric tons heavy metal. From this pie chart you can see why it was justified in having a specific canister design for the MCO cask. That’s kind of the tail that wags the dog there in terms of the total metric tons heavy metal.

But I created another pie chart looking at the same inventory or the same population of fuel, showing it by canister count, which was one of the Board’s questions. And you can see the picture changes considerably when you look at it by canister count. And we think this is actually a more effective way to look at it in terms of the scope associated with transportation and handling the fuel. In this case the MCOs take up only about 400 or so canisters. There is another 2,900 or so canisters for the other fuels.

I did show on there--the Board asked what fuels are not intended or not planned to go into a canister. You’ll see in this commercial fuel slice up here, some of those fuels are damaged and will go into a standard canister, but those that are still intact and can be handled and treated the same as all other commercial assemblies are planned to be transferred as bare fuel, handed off to the repository or wherever their next life phase is, and be treated just as the other fuels. So the portion of commercial fuels that are still in undamaged shape we consider bare fuel transfers. There's about 160 of those assemblies not counted in the canister count today.

Sodium-bonded fuels, there's been a lot of discussion on that. Those are not included in the canister count until we have a firm disposition path.

And the naval fuels, DOE is responsible for the naval fuels, but the naval program has maintained their program quite separately. They've done their own analysis, and they have not included use of our standard canister for their fuels.

Something that's important to recognize is, these canister counts presume no shield plug; and they also presume neutron absorber and poison loadings consistent with the post-closure criticality analysis at Yucca Mountain. And because the shield plug issues, the internal configurations, the final design and technical work for the neutron absorbers is not completed, the license application specifies a pretty broad range for the canister count, 2,500 to 5,000, with our best point estimate being somewhere in the 3,500 canister range.

Now, as far as unfinished business, we talked about the shield plug being a significant impact on the number of canisters that will be necessary. Work was begun in Idaho to develop the fully remote closure process. That work was kind of put off towards the end, because Idaho had a contract to develop the waste package closure system for the repository, and we hoped to kind of ride the coattails on a lot of the remote work that was done for that development. We began this work in 2006/2008 time frame. We got a lot of the preliminary work done, but it was not completed.

Just for reference, if we look at the canisters and we use the 14-inch shield plug that was in the Idaho Spent Fuel Project design, the canister count goes up by about 500 due to that loss of space reduction. So we need to get the closure system designed. We might need to redesign the size of the canister, or we have to swallow 500 additional canisters. Canister counts have been estimated on the order of $100,000 each for procurement, loading, and storage phase of their life. The disposal phase is anybody’s guess, but I’ve seen estimates well over $500,000 per canister for the disposal phase. So the addition of 500 canisters is several hundred million dollars. Completion of this process is probably on the order of $20 million. There’s a high return on investment there.

The work was begun, not completed. There's a couple of pictures at the end of my slide presentation to kind of show some of the preliminary setups we had looked at for remote welding and remote closure.

Another issue is, the fissile loading per canister is dictated by the post-closure criticality analysis where they do a fully degraded flooded mode. We had begun some preliminary work developing a new neutron absorber material with a nickel-gadolinium alloy that we were going to incorporate into the baskets. Material spec is approved. We needed some additional work on the weld spec and basically the details for the fabrication of that. The canister count and the repository license application assumes use of this neutron absorber, but there is work yet to do to finish that. Again, neutron absorber versus no neutron absorber can vary the canister count by up to 700 canisters.

So there's really--if you take out the overlap between these two issues--welding and the neutron absorber--there is a canister count that could grow by a factor of a thousand if we don't get those fully resolved.

Looking beyond Yucca Mountain, there were specific questions asked with regard to what analysis had been done in other rock types for DOE fuel. Okay, pushing quickly here, no specific analysis that I'm aware of. However, the conservatisms that we put in our analyses for the Yucca

Mountain made the analyses largely independent to the repository medium. The pre-closure analysis has really nothing to do with the location or the specific type of the repository. Post-closure analyses, we assume fully flooded degraded condition. That doesn't change much. Elsewhere we assume things like instantaneous release for our radiological releases, so we're not too dependent on the specific repository. So we believe essentially all repository geologies, it's a small step to include DOE fuel in that once the repository is pinned down.

Just to kind of illustrate that, this shows a couple of different ways to look at the DOE inventories relative to commercial fuel. This is based on the Yucca Mountain 70,000-metric-ton heavy metal limit. But you see, if you take out the high-level waste, the DOE spent fuel shown there in blue is relatively small. Up here, when you consider the co-disposal canisters, you get a bigger slice, but only about one-sixth of the space in those co-disposal canisters is attributed to spent fuel. The rest are high-level waste canisters. Bottom line is, we just need space. There are some unique criticalities used for our high enriched fuel, but we don't think we have unique issues that are going to drive repository design.

In summary, standard canisters are a robust storage solution. We still believe there is little risk relative to transport and disposal. We think it's the right way to go. All repository concepts require a canister, and all of the alternate repository concepts I've looked at have some type of an overpack, which will serve a similar function to the waste package for analysis of DOE spent fuels.

Spent fuel would be packaged as facilities that they are currently stored in age. The question there is: Will DOE be ready? There are a number of questions here that all affect the canister count and coming up with the proper configuration, the optimal size, and the optimal internal configuration. Those questions need to be answered before we can confidently move to repackaging spent fuels for future storage, at least to have confidence that we won't have to do it again.

Last bullet, there's been several mentions today of the National Spent Nuclear Fuel Program. That no longer exists. It was established at the INL as part of the 1995 settlement agreement. Primary role was to act as a central point of contact to consolidate DOE spent fuel information and to work with the repository to make sure that their design and licensing envelope accommodated DOE spent fuel and to work with the sites to make sure that their decisions and plans for managing spent fuel were converging on a package that would be acceptable to the repository.

Since about 2009 the program has not been funded.

There were a few people carried on a few years beyond that to keep the lights on and answer the phone calls and close the program down, but it’s essentially been inactive since 2009, and all the references and reports that I’m referring to are at least that old. Today essentially all of the people from the program have retired other than myself and two other people I can find within the company. We’ve been working elsewhere in the company for the last couple of years. It was a real challenge to pull this information together.

From that, I just want to emphasize that knowledge management and preservation of information is crucial. We have a lot of records that are in boxes that have been sent to storage. It was difficult digging this information up over the past week.

That said, I also came across and was reminded of a number of, I think, very important activities that were orphaned and became kind of collateral damage. It was at the end of Yucca Mountain. I think those should be reconsidered; and I think, if anything, in the absence of a clear and defined end point, clear and strong management and somebody championing long-term strategy for the management of spent nuclear fuel in DOE’s system is very important.

So I kind of close with the question I’d like the Board to consider: Who owns this problem, and do they have the resources and the charter to make the proper decisions and take care of it? Thank you.

EWING: Thank you, Brett. If you'd take a seat with your colleague, then we'll open the floor to questions. And I want to say, I really appreciate that you squeezed so much information into the time available and, in particular, that both of you have asked the specific questions that the staff have raised in preparation for this meeting.

So questions? Okay, Lee.

PEDDICORD: So your last question was really the operable one, and so let me ask a personal opinion, if you will. If you were going to answer that question in design and approach, to address your very last--

SPEAKER: Lee, get closer to the microphone.

PEDDICORD: Sorry. First of all, Lee Peddicord from the Board. I am asking your opinion of what would be a good strategy, the ownership within the organization to take care of your last bullet.

CARLSEN: A great question, difficult question to answer. I'm probably not the right person, but I was asked to share my opinion, so I will.

Having been out of the program, my perspectives are a little bit dated, because I'm not really familiar with all of the work that may have been done since I've not been in the picture. However, I can tell you that our program hosted a phone call a couple times a month between DOE headquarters and the various sites just to talk about what was happening with spent fuel, and it was very effective, just that, just keeping everybody engaged together and to have a long-term strategy.

I think it can be handled by DOE or by any site. I think it's just important to have somebody who has responsibility for, I'll say, the big picture. The sites get very caught up in managing their own business and their own contracts and their own issues with the state, and it's easy for them to lose sight of the long-term picture of making sure that all of the different fuels at the different sites need to come together into one waste form and one analysis for one eventual end state, whatever that may be.

And so that said, I don't have an opinion on where that function needs to be or how it needs to be done. My opinion is that somebody needs to be one level above the sites and look at the big picture as opposed to just dealing with the day-to-day issues.

EWING: Paul.

TURINSKY: Paul Turinsky from the Board. Can you simplify this for me? What would be different in the activities going on at the various sites with the DOE fuel that have occurred in the last few years and that will be occurring in the future if indeed we would have seen this through to a logical conclusion? What would be different?

CARLSEN: I'll take a shot at it and let Roger add anything that he wants to.

I think it's a matter of keeping in the scope of the decisions made at the sites, all of the remaining phases of spent fuel management. I can take an example. The Idaho Spent Fuel Project years ago, when that contract was announced, it was for, I think, two or maybe three specific fuel types, so the canister and the operations were optimized to address just that scope. It was only for storage, so there was not anything in the scope of that contract to ensure transportability, although DOE, to their credit, passed off the preliminary design specs, so they used our canister, which the national program had been working with transportability on; but, I think, making sure that the sites keep within their scope, not only meeting their local requirements for minimum costs, but ensuring that they have a path forward for transportation and disposal.

McCORMACK: Again, this Roger McCormack. I think the other point as far as now versus a few years ago is that we have lost a lot of the people, not just at the national program, but even at the sites, that had familiarity with the programs to disposition the fuel. And that really shows up potentially in a lot of the decisions that are made or even the ability to resurrect work or understand what's important to the near-term decisions let alone the final decisions.

EWING: Jerry.

FRANKEL: Jerry Frankel from the Board. Can you--I don't know who I'm asking this, but if one of you could address the materials of construction of the various components in this whole assembly. So you have baskets, for instance, I mean, you can start there.

McCORMACK: Yeah, I think Brett's answer is 316 stainless steel. Mine is the MCOs are 3043L certified. The baskets, there are two different--the structural components are stainless. The egg carton is aluminum. The scrap baskets, the shroud is copper.

FRANKEL: It's copper. So you've got the fuel assemblies, which are aluminum or zirconium clad or bare fuel, and it's sitting in copper, and there's screens at the bottom; is that right? And the screens are something else?

McCORMACK: I can't remember. Nothing's carbon steel, but right.

FRANKEL: Okay. And then those copper or stainless baskets, anyway, they sit inside the MCO--

McCORMACK: Right.

FRANKEL: --which is stainless.

McCORMACK: Right.

FRANKEL: And for the copper you have something--the copper is going to be pressed up against the stainless; is that right?

McCORMACK: Yeah. And basically the material evaluation looked at basically a dry environment and, in essence, evaluated it for a 75-year period.

FRANKEL: And so everything else is stainless, except that the transportation cask is not presumably; is--

McCORMACK: Correct.

FRANKEL: What is that then?

McCORMACK: I can’t tell you.

FRANKEL: You don’t know?

CARLSEN: I can’t speak specifically of the fabrication of transportation casks. I’m sure there are several in the audience who can. But they’re typically steel with some type of shielding sandwiched between, so--

FRANKEL: Okay, thank you.

EWING: Ewing, Board. I want to follow up on one of your slides, Beyond Yucca Mountain, where your second bullet is that conservatisms in the Yucca Mountain post-closure analyses render much of the analyses to be independent of the repository. And as I read that, I take that to mean that these packages are--the answer to the question, does the geology matter, the answer is no because of the conservatisms, but the conservatism is that the waste package persists over a period of hundreds of thousands of years; is that correct?

CARLSEN: Everything from once the material is released from the waste package or whatever it may in a different repository is repository-specific.

EWING: Right, right.

CARLSEN: The analysis where we have conservatisms, we tried to do bounding analyses wherever possible. We grouped our fuels to minimize the number of analyses, and in doing that we added a lot of conservatisms to some of our representative parameters. But that said, once the material escapes from the waste package, it is a repository-dependent calculation.

But the point I wanted to illustrate is, if we're in a repository such as was analyzed for Yucca Mountain, we are a very small fraction of the total curie count and a very small fraction of the total heat input. I don't think we will be the tall nail or the factor that drives repository design with the possible exception of criticality analyses due to some of our high-enriched fuels. And because of that, we have some unique criticality concerns, and that's why some of these neutron absorber and poison loadings become something that is very important.

EWING: And, of course, you're a small part of the final results of the analysis, because there is a small amount of DOE-owned spent fuel relative to the commercially-generated fuel. But the same assumptions are made for the commercially-generated fuel; that is, the properties of the fuel don’t matter because of, I would say, a not very conservative assumption that the waste package persists for hundreds of thousands of years.

CARLSEN: Right. If I recall correctly, in the total system performance assessment at Yucca Mountain, once it was all said and done, the only property of the fuel that contributed to that analysis was the fuel matrix itself. So the conservatisms and the assumptions that are made to bracket the types of scenarios that need to be considered over geologic time scales wash out a lot of the details. But, you know, the TSPA people are the ones who really need to address that.

EWING: Right, right. Thank you.

Mary Lou.

ZOBACK: Mary Lou Zoback, Board. This may be implicit, or I may have missed it, but--so the standard canister, according to your Slide 5, I think, is really four potential sizes; and will that standard canister work for all the commercial spent fuel as well?

CARLSEN: All of the commercial spent fuel that we plan to put into canisters, yes. Basically there are four sizes to accommodate the range of fuels we have, but the design features and the performance requirements are the same, so it’s one design in four variations. As I mentioned, partly because of cost and other things, commercial fuel that is intact and can be handled and treated similar to all other commercial fuel, we felt it was more appropriate to just allow that to be part of the population of commercial fuel as far as its packaging and handling at a repository.

ZOBACK: Okay. Roger shook his head no.

McCORMACK: No, I agree with what Brett said. I was going to add that for the commercial-origin fuel that we have at Hanford that basically that will fit into a standard canister, as well as our FFTF fuel, but in both cases we would require the remote welding, because there is not enough space for the shield plug. So it's not just a matter of efficiency; it's a matter of the remote welding would be required to use that system for our fuel.

ZOBACK: And I have one related question. DOE is considering now the potential for borehole disposal, and I know at the time you guys were doing these designs that was not on your radar screen. But, offhand, are there any issues you could see with this standardized design to place it down--not drop it down a borehole, but place it down a borehole?

CARLSEN: If we did have to drop it, we'd be in better shape than most due to our impact-limiting skirt. But having said that--

ZOBACK: A five-kilometer drop that would be.

CARLSEN: Yeah, on a standardized canister, not on the

MCO. There has been some thought--I mentioned that one of the things we can't do absent a final repository design is optimize sizing. So should the borehole be a much smaller diameter, that would be a problem. But we do have quite a bit of flexibility with the 18- and 24-inch canisters to put those in different configurations per waste packages or for things that would require smaller sizes. In fact, one of the options that DOE-NE has looked at is what the ramifications would be if we needed to package all commercial fuel in smaller packages for the borehole concept.

EWING: Okay, thank you.

We've run out of time. This has been a very interesting discussion. I thank both of the speakers. And I'd encourage everyone to continue the discussion into the break, but we'll have to stop now, and we'll start promptly again at 10 after the hour, 10:10. Thank you.

(Whereupon, the meeting was adjourned for a brief recess.)

BELLER: Barbara Beller with the Idaho National Laboratory. I work for the Department of Energy. I am on the environmental management side of the field office, and so most of the fields that I'll address and speak to are managed and owned by the EM side of the house.

There's two gentlemen in the audience that I'd like to introduce if you have detailed questions. They'd probably be a good person to address those to. It's Allan Christensen, and he worked on the Three Mile Island project with us and developed a lot of the engineering design files that supported drying; and then Randy Fadeley is the chief engineer out at CWI. So either of those two gentlemen could help answer some of your more detailed questions.

I'm going to skip through the presentation rather quickly, and I didn't want to pull out slides as background, because I'd like to keep the continuity of the presentation intact. So I'll just scoot along pretty quick.

This is the Three Mile Island storage system, which you saw yesterday. There's 29 horizontal storage modules that contain Three Mile Island knockout canisters, filter canisters, and debris canisters from the reactor accident. This was the system that brought the fuel to Idaho in the 125B casks. The fuel was received between 1986 and 1990 and put into a storage pool up at Test Area North. We were pretty lucky, because TAN was still available. We had a huge hot cell/warm cell complex with a pool, and then the pool had a shielded wall that could bring fuel from the pool over to the warm cell side so that we could actually work with the fuel, and we had the drying unit and packaging system in that large hot cell area. Since that time this facility has been D&D'd.

The canisters from Three Mile Island were not opened when we put the fuel into the dry storage system, about 14-inch-diameter stainless steel canister, and the material was packaged at the reactor site and sent to us for interim storage, about 12-1/2-foot-long stainless steel canisters. I want to point out that the decay heat for our fuel is 29 watts average per canister, so that's a lot different than what you might see in commercial fuel. So that added to the challenge of drying our fuel.

These are the three types of canisters we had, and the most energy was spent on determining dryness in the fuel canister. There was a light concrete in this section, and that drew a lot of attention and analysis and how to determine what dry was and the drying times and optimization of the drying times.

This is just a summary of what's in each of the canister types. The material in the fuel canister is listed on this slide. We had to dewater the canisters before we could even begin the drying operation, so that was the first engineering feat to building a dewatering system at Test Area North. We had a critically safe ion exchange system that filtered the water from the canisters and returned that water to our pool.

We installed a drying system in an existing 125B cask, and that cask was what we used to ship the fuel to Idaho. So we were fortunate to have a large shielded cask to insert the drying system in. We could dry four canisters at a time of the Three Mile Island fuel. We received 344 canisters from the reactor site and placed 341 of those canisters into our dry storage system. The other canisters contained some research material, epoxy material, that couldn't be placed in storage under our NRC license; so that's where the other canisters went. But those are in storage at INTEC now, also not under the NRC license system.

We had 87 separate drying iterations with four canisters per iteration. The canister--the heating temperature was about 900°F, and the canister wall temperature then was 600°F, so the heated vacuum drying system was used to try and expedite the drying process. We were under a pretty strict settlement agreement requirement to have all of our fuel in dry storage by 2001, so we had to look at a way to both ensure that we met the acceptance criteria for drying to meet our NRC license and also to speed up the system and try and meet our project schedule.

We had to understand what types of water and where all the hydrogen was in the system so we could understand how to develop a system that we could measure and show objective evidence that you'd met the drying criteria, that you were critically safe and met the safety basis, and then move on from there. So it was a pretty iterative process. We had both mock-up systems. We did some drying that took up to 80 hours to dry some of the initial campaigns. We looked again at our criticality safety analysis, made adjustments throughout the project, and optimized throughout the program.

I'll just leave this slide for you to review. It was one of our initial attempts at coming up with our drying criteria, and this was the first information we had based on our criticality safety analysis. You'll see that the drying time was about 80 hours initially. After we looked again, we adjusted our criteria. Eight liters of water is what we could focus our acceptance criteria on as acceptable to have left in the canister.

We predicted and modeled our results and then took actual measurements and saw that there was good correlation between what our evaluations showed and then what we were actually seeing in the field.

This is just more detailed information.

We isolated our drying system and watched the pressure changes over time, and some of these systems are what we used to show that we had achieved drying. We had documented evidence, and we could show that there was correlation between the performance that we were reading out in the systems to our criticality safety evaluation that showed what amount of water was acceptable to be left in the canisters.

And then that's another detailed piece of information.

The work that we did is 14 years ago also for the Three Mile Island work. So, again, as Brett had said, it took a bit to retrieve and put together some of the information. Allan Christensen is probably the last person that we have left at this site that could really explain and understand the basis for our drying, so catch him quick if you want to really learn the details.

So in the end, after we had a lot of different drying runs, and over time we were able to reduce the drying times to about 25 hours per iteration, so we went from 80 to 25 by the end of the project. And it was a bit dependent on the types of canisters and the content of the canisters that were in each of the drying runs, too. As I pointed out, there were knockout canisters, filter canisters, and debris canisters. So the knockout canisters and the filter canisters really--they would have gone quite quickly in the drying process, but the debris canisters took longer, but average 25 hours per canister.

Radiolysis is, of course, what we're trying to prevent in storage, so we've measured the acceptance at--or the actual hydrogen during storage at 1.2 percent per dry shielded canister. And, of course, those are the five-and-a-half-foot-diameter canisters in storage with 12 Three Mile Island stainless steel cans in each of the DSCs, within the dry shielded canister, about 4.8 percent per canister. And these are--it's a vented system, and so we actually calculated the absorption of moisture from the atmosphere back into the system over time.

When we put our dry shielded canisters into the horizontal storage modules, our requirement for monitoring was a pretty short periodicity. Over time, as we gathered more information, we were able to change the hydrogen gas sampling and move that sampling periodicity out. This was one of the early-in-2001 measurements that we took.

And the North and South row, if you remember when you were out at the site, our horizontal storage models run east/west, so this was the South row and North row of the storage systems in that dry storage facility.

ZOBACK: Barbara, why is there so much difference between the North and South row in terms of hydrogen?

BELLER: You know, I just looked at that. I'll have to ask Allan, but South--I mean, they're in the sun more.

Do you know, Allan, why there would be such a difference?

CHRISTENSEN: The sun faces thick shielded walls on the North side; and because of that, they are a lot less affected by day/night and seasonal temperature differences. Whereas, the South row, there's a--I don't know if you saw those steel doors. That's how we access the DSCs for sampling. And they’re thin, and they have holes in them for venting. And for both reasons we get a lot more day/night--a lot of temperature fluctuations. And it turns out that temperature fluctuations help control the amount of hydrogen that’s in the DSCs.

Is that a good enough answer for now?

ZOBACK: Yes. So ideally you want them all on a North row then?

CHRISTENSEN: Yeah, they breathe.

ZOBACK: Yeah.

CHRISTENSEN: And if you can help them breathe, the hydrogen levels go down.

BELLER: Thank you.

This is a schematic of the drying system that we had. We also have a drying system in our CPP-603, which is the facility you visited yesterday. It was installed in about the same time frame in the late 1990s, and there were several campaigns run for the fuel types that are listed on the bottom of this slide. The Advanced Test Reactor fuel is the last fuel that we dried, and that was in 2010 as we moved that last campaign into 603. The drying station is still in the facility. It’s in various degrees of states of repair, but it could be rejuvenated for additional fuel drying if we needed to.

The settlement agreement required us to consolidate fuel in INTEC from across our site, and so the other fuels--MTR, Pathfinder--we had PBF fuels that came--were consolidated at INTEC, and some of them were dried in the station at 603.

The heating system in 603 wasn’t at as high a temperature as the Three Mile Island dryer. The aluminum fuel is the controlling factor for the drying furnace at 603.

And this is just an example of a curve that we use to ensure that we understand that the drying process is run to completion.

We had casks at Test Area North that were outside of the Three Mile Island project. Some of the casks that you saw yesterday at the storage pad now at INTEC, those casks were opened in the late 1990s--well, I guess 2001--and fuel from our basin at 603 was put into some of the casks that we had on that pad so that we could decommission the storage space. And so those casks were also dried before they were removed to INTEC.

So the conclusion, there has been a lot of work invested at our site in drying. Our systems are vented, so I don’t know if it’s a precise correlation with what the drying systems will be for canisters that will be sent to the repository. But we’ve learned a lot about the process of drying and the amount of data that you need to collect to ensure that you understand your drying processes run to completion. We are able to have objective evidence that we've reached our drying criteria, which is really important to understand how to show that to the regulator and to be able to replicate those results and correlate our research with the actual measured values.

And I think I'll conclude my presentation with that. If you have any questions--

EWING: Again, we have a pair of speakers. If you'd take your seat up front, and we'll go to the next speaker, and then handle questions for both at the same time.

All right. So we could go on to Roger McCormack discussing overpack drying.

McCORMACK: Thank you again. Again, I will be speaking specifically about drying of the multi-canister overpacks at Hanford. We also have additional fuels--I am not going to talk about the Shippingport canister drying that was done at a separate facility from the MCO fuel drying and is closer to a commercial fuel drying standard. I can't answer questions on that if there's any questions.

And what I'm going to be doing is, first of all, covering fuel condition, because it's important to questions--the condition of our fuel drove both the design of our vacuum drying process, and we have considerations of not just remaining free water in the canister, but again the chemically bound water and effects on later gas generation pressurization through radiolysis or thermal decomposition in storage, transportation, or at the repository.

I'll cover development of the drying process. Something very specific to our process was a proof of dryness test and a little bit on the drying process itself; and, again, contributors to internal gas composition and pressure; and monitoring that we're doing now that the MCOs are in interim storage to be able to evaluate where we're at.

First of all, as far as condition of the fuel, the fuel was stored in various canisters at the K-Basins in closed aluminum clad--or excuse me--in lidded aluminum canisters or stainless steel canisters in the K-West Basin and in open canisters in the K-East Basin. And based on the storage canisters and configuration, we do see differences in the films, the coatings on the fuel, and the extent of corrosion on fuel. The important thing is in the aluminum canisters that we do end up with aluminum trioxide coating with a significant amount of waters of hydration associated with that. We also have canister sludge in each of the canisters and uranium peroxide coating on fuel that came out of the K-East Basin canisters. Each one of those we have to look at and evaluate as to the effect both in the drying process and later on.

Also important in development of the drying process is we had to worry about getting too hot, in essence, because we have a lot of reactive metal fuel, high surface area, hydriding the fuel during storage. We had to be concerned with heat removal from the MCOs during the drying process and not heating things up too much. In fact, the reason for the copper baskets was basically to support the heat removal.

And also importantly, what you see is that basically there’s ways of, in essence, getting--there’s cracks in the fuel and a large amount of damage in the various fuel, and a very important consideration was the extent of that damage.

So for development of a drying process, for on-site safety analysis we basically determined we needed to get below 200 grams free water remaining in each MCO based on the MCO design and the storage configuration. Another important aspect was the fuel cleaning process at the K-Basins prior to loading fuel into a scrap basket. It is very important to ensure that we removed--that we didn’t exceed particulate fuel surface areas in the MCO during the loading.

And so we basically undertook a very significant effort to demonstrate the process, which included fuel characterization, both visual characterization, in the basins to understand the extent of damage, hot cell characterization to understand the types and behaviors of the particulates, the extent of the cracking, and basically thermal decomposition, reactivity rates, etc. to support the drying process. We utilized a GOTH SNF model thermal hydraulic code basically that’s a code through conservation of mass energy and momentum and that was able to deal with the various chemical reactions heats from those, etc., to understand--to basically model the drying process itself.

We performed first article testing that used a prototype drying system and looked at--with a mock-up multi-canister overpack that was instrumented to understand basically what was going on within the MCO; tried different water loadings configurations within the MCO to basically validate the GOTH SNF model; and we did single element furnace tests--drying tests using a whole element furnace system down at the Pacific Northwest National Labs that was critical and where the fuel was actually dried and able to see the water coming off of the fuel at various temperatures, conditions.

And between the characterization and the single element drying test, we were able to establish basically crack distributions in the fuel and to understand how deep the amount of cracks, and that was extrapolated conservatively over the entirety of the MCO payload to develop conservative assumptions for the volumes and depths of cracks that would be in the fuel in the MCO during the drying process that we had to contend with for drying the fuel.

So, in essence, the key thing is, once we’ve done the basic drying, getting the bulk free water out of the MCO to ensure that we’re below 200 grams, is that we basically determined that there were particulate-laden cracks that were assumed to completely fill with water after the MCOs were drained and prior to the final residual water drying. And basically the configuration of those cracks with the particulate fill and from the characterization activities we had, we understood the behavior of those particle beds, and we developed basically a porous flow model to--porous bed model to be able to establish, in essence, a way of determining that we have removed adequate water from the MCO. And that model established giving a diminishing rate of water release during drying as the water in the crack recedes, so we know the length of the dried area in those cracks. We know how much water is left, is what that basically comes down to.

And basically the validity is dependent on the maximum rate, is established based on minimum fuel temperature following a thermal reset, MCO void volume, and number of scrap baskets and scrap basket loading. And what that means is, basically with the scrap you have much more damaged fuel, so you have to compensate for that and ensuring--it changes basically the distribution that you have to accommodate. The thermal resets basically adding helium to be able to equalize temperatures in the MCO part of the drying so that you’re a steady state. It’s important to understand the temperature, because the temperature of the fuel is what’s critical to establishing the driving force for the water being driven from the fuel. So you assume saturated steam pressure at the water interface with the dried portion of the bed, and that’s a critical data point for the model.

During the single element drying test, we used argon, so the effects of helium on the calculation wasn’t fully considered. So we later modified the model to add a factor for effects of the helium impeding the diffusion, and that was--and then we had to go back and re-analyze all the MCOs that had been dried prior to that to verify that we were still good.

I am not going to go again back through the drying process so much with the time. You can read it. But one important feature is, I say one hour; that should have been less than one hour proof mode. What that was was that we had, during the drying test, established time and temperature pressure conditions that we knew that the drying would be sufficient. We later found that we didn’t need that, that the residual free water dried out much sooner; and so that step was eliminated, and we relied on basically the pressure rebound test. There was some fuel that didn’t fit within the conditions of the test, meaning like the single pass reactor fuel, the aluminum clad fuel. On those particular MCOs we did do an eight-hour proof mode.

The MCO bound water that affects things--again, I'm not going to go through this in detail--again, the largest players, the aluminum hydroxide cladding film that we find in roughly 15 percent of the MCOs, and that is kind of our bounding source as we get to temperatures where thermal decomposition is going to matter, such as in the repository itself. That becomes an issue with MCO pressurization.

The MCO internal gas composition and pressure, again, affected by radiolysis and thermal decomposition. We did perform models for storage at the canister storage building to ensure we were within the operating parameters, so the key thing for us is oxygen being beneath 1.6 percent, is the limit that we established to ensure we're below the lower limit for flammability in a hydrogen/helium environment.

And another thing we did is applying the same GOTH SNF model, slightly modified for the repository receipt/ handling, not from a standpoint of drying, but seeing what the impacts were from a non-mechanistic breach of the repository. We looked at basically the MCO suddenly losing its top, and we also looked at holes being--both top and bottom in the MCO--and found that for holes less than .75

inches in diameter, we didn't--or for the shearing of the top of the MCO off that we would not have an issue with thermal excursion from the sudden oxidation of the reactive metal in the MCOs. And we also didn't have conditions that would lead to too much hydrogen resulting in potential detonation or deflagration.

For CSB storage we have a monitoring program. There's two pieces to it, limited monitoring and long-term monitoring. Limited monitoring takes a select number of MCOs, and we take pressure temperature gas sampling for those MCOs. And those are done typically on a four-month, one-year, two-year, and every-ten-years-thereafter basis.

We have gotten to the point where some of those MCOs do have a result from ten-year sampling, and what we've seen is that our earlier model projections that's our worst case design safety basis had assumed that we could have up to a 76 PSIG pressurization. An absolute worst case was some of the aluminum trioxide cladding or film containing MCOs that we've only seen a couple PSIG--or a couple PSI increases in the MCOs to date and anticipate now that we won't see more than a couple more PSI increases over the 40-year life in the MCOs. And we have seen that the gettering process works, that any hydrogen that we've seen has been gettered, so we're actually at lower pressures than we started with in those cases. And that will continue until we get to the end.

Long-term monitoring program, the MCOs that are not sampled have a magnetically coupled pressure gauge in the cover of the MCO cover cap that is just a very low resolution, up to 600 PSIG, to see if we've got a significant problem in those MCOs.

And that's it.

EWING: Okay, thank you.

If you'd take a seat up front, both papers are open for discussion. Sue.

CLARK: Sue Clark, Board. I wanted to ask you, Roger, a little bit more about the process there at Hanford. Can you tell us what's the technical basis for this less than 200 grams of free water?

McCORMACK: Yeah, it's not magical. Basically, in the early going we didn't know where we would be at as far as pressurization of MCOs, what we would have in the canister storage building for the long haul. So it was just a working number that basically supported the safety basis to be able to stay beneath that 80 PSIG limit that had been established with the contributions from any thermal decomposition radiolysis. Nothing magical about it. It was doable also within the time frame that would be needed for the drying process. It was a workable number.

CLARK: Okay. So then my other question along the same lines is, as I understand it, helium is used to pressurize the canister; right? And the idea is that the canister remains pressurized?

McCORMACK: It depends on where in the process you're talking about, but it will--it obviously does--the canister remains pressurized to a point that you will see pressure decreasing. So, again, what we're seeing is typically 11 to 13 PSI.

CLARK: Is there ever a need to add more helium back, I guess, is where I'm--

McCORMACK: Each time they do a--the only time that they would see that is when they sample, and they do reintroduce helium at that time for the sampling process. Other than the sampling process, we aren't opening up MCOs.

CLARK: And all this was done prior to the recognition of helium being this critical resource as a gas? So the fact that helium now is perceived as this critical resource that--

McCORMACK: I don't know anything--yeah, I don't think it had anything to do with that.

CLARK: All right. Critical--I should say non-renewable resource.

EWING: I'd like to follow up on the 200 grams of water question. This is Ewing, Board. So you have the 200-gram limit for free water. But if I understood correctly, in terms of bound water, the maximum in an MCO would be up to four kilograms and, say, the average is a kilogram. It's in that range.

McCORMACK: Right.

EWING: And the concern with water, bound or not, is that in a radiation field it would be a source of hydrogen; but wouldn’t the bound water also be subject to radiolytic decomposition and hydrogen generation?

McCORMACK: Yes, it is. What we’ve been seeing is that, again, the projections I’ve talked about basically take into account--the model takes into account radiolytic decomposition. And what we’ve been seeing is the gettering by the fuel has been basically taking the hydrogen down to non-detectable levels basically.

EWING: And when you say “gettering by the fuel,” what exactly does--what’s gettering?

McCORMACK: Exposed uranium metal surfaces.

EWING: Absorbs--

McCORMACK: Hydrogen hydrides.

EWING: Yeah, it forms hydrides. Okay. So with this model, you’d presented data on these large-scale experiments showing fluctuations, depending on whether you’re in the sun or not, North side, South side, and so on. But is the model supported by, let’s say, well-controlled bench scale experiments where you know the surface area, and you measure the exact hydrogen generation for certain radiation fields? Do those types of data exist?

McCORMACK: The hot side--the cold side was a TMI degree issue.

EWING: Right. Okay.

McCORMACK: I think just the general thing is--one thing we do when we load a multi-canister overpack was to ensure we had set limits on the amount of reactive surface area, etc., that we could have in an MCO. And so there was inspection that took place during the basket loading to make sure we didn’t exceed those limits.

EWING: More to my question is this GOTH spent nuclear fuel model. Is that based or supported by bench scale experimental data? You’re saying the GOTH SNF model--

McCORMACK: Yes. We basically use two things, one, the overall system operation with the MCO, the drying process, etc. That was validated through the first article testing activity. The single element drying tests were used to validate a lot of the other drying information.

EWING: Barbara, did you want to add to the answer?

BELLER: One important distinction between Roger’s system and the ones that are in Idaho is, our systems are designed and we were dried to meet storage criteria only. And both the systems we have in 603 are vented, so we dried those fuels to comply with our moderator restriction requirements in our dry storage facility, and our Three Mile Island storage system is vented, so we’ll have another chance to handle that fuel and, if we need to, dry it again or do something to meet transportation and repository criteria. So our pressures in storage aren’t the same requirement as yours.

McCORMACK: --not the same pressure ratings.

BELLER: Yeah, we don’t, because they’re vented systems obviously.

EWING: But still the question I have is about this model and trying to envision the basis. So if the uranium is the getterer and uranium hydrides are forming, are there bench scale experiments where you have identified the uranium hydride?

McCORMACK: We basically in the model didn’t credit the hydrogen gettering.

EWING: Whether you took credit or not for it, I’m just wondering, are there experiments that show this and that support the model?

McCORMACK: I can’t tell you the full scope. There certainly are experiments with oxygen gettering. And we certainly--there’s, you know, certainly a body of information out there on the relative affinity of oxygen water, hydrogens. I can find out for you and get back as far as anything that would have specifically been done. I’m not aware that we did anything specifically on hydrogen gettering, though, in any of our lab work.

EWING: Because in the literature there are a lot of at least computational studies that try to explain well-controlled experiments, and it turns out the simple sorption of water onto UO2 is not so simple. The water can disassociate. And so it's a level of complexity that may not be required for your models, but it's a level of complexity that suggests the models need a stronger experimental basis.

McCORMACK: Yeah, and we're dealing with uranium metal versus--

EWING: Right, right. Okay. I've taken too much--other questions? Okay, well--sorry, Nigel, I should have asked about Board questions from the Board.

MOTE: This is Nigel Mote, Board staff. On Slide 5 of Roger's presentation is a reference to helium impeding diffusion, and I take it that means in the diffusion of water?

McCORMACK: Well--

MOTE: And my question is--

McCORMACK: The issue is its impact on the--basically you have a porous bed, in essence, the effect on the water transport through that bed.

MOTE: You'll know that the standard drying technique for commercial spent fuel includes vacuum drying and then helium filling, but nowadays there is a move, certainly with Holtec, towards pressurized helium for drying. Can you say if there is any impact of what you found on the efficiency of that sort of drying technique used in the commercial world?

McCORMACK: I am not familiar with what Holtec has done, so I'd have to--

EWING: Okay, thank you. Other questions from the staff?

All right, thank you both very much.

So the next presentation, the last presentation before lunch, and then--I should say after this presentation--(recording stopped).

EWING: --Bill Boyle concerning the High Burnup Dry Storage Cask R&D Project. Bill.

BOYLE: All right. Thank you for this opportunity to talk about the research and development we're doing in support of our High Burnup Dry Cask Storage Project.

But before I get into the slides, a couple of topics, one dealing with the people. Monica Regalbuto, who had been responsible for the fuel cycles research and development activities in the Office of Nuclear Energy, about in mid-June she stopped doing that. She became a full-time federal employee over in DOE Environmental Management. Prior to that, she had actually been nominated by the President to be the head of Environmental Management. She has had her Senate hearings, but they haven't had a vote yet. She is not acting as EM1 right now. It's a different position. But once the Senate votes--assuming they will positively someday--she’ll become the head of DOE-EM.

Monica had a deputy when she was with the Office of Nuclear Energy. His name is John Herczeg. I don’t think he’s ever made a presentation to this Board, but when Monica went over to Environmental Management, John was given--now he’s in charge of the fuel cycle R&D on a permanent basis. And for the deputy position he was in, I think a week ago Monday Andy Griffith, who is here in the audience today, and he made a presentation to the Board in November--Andy is the acting deputy for fuel cycle R&D.

So something else I want to bring up that gets back to the very first presentation today, there’s different kinds of nuclear spent fuel out there. EM has spent fuel; the Navy has spent fuel; there’s commercial spent fuel. Our R&D I’m speaking about, commercial spent nuclear fuel. Fully aware of what the Navy does. You know, to the extent that we have a need to know, we get along quite well with the Navy. EM, we get along quite well. We and NE, Nuclear Energy, get along quite well with EM.

There’s regularly scheduled meetings, monthly or more. Pete Lyons, the head of the Office of Nuclear Energy, participates. Dave Huizenga, when he was the head of the Office of Environmental Management, he participated. Now the acting head of EM is Mark Whitney; he participates. Andy and

I participate in the meeting. There is a lot of coordination on common issues between EM and NE.

Now, as I start to get into the talk, last November you heard a presentation by Mike Billone of Argonne National Lab that was work he was doing for my group. And this fiscal year the work he's doing represents approximately $700,000 worth of effort. Not counting the contract we have with Electric Power Research Institute for the high burnup demo, we spend about $10 million on R&D related to storage and transportation, so Mike's work represents about one-fifteenth of what we spend. So this is my way of saying I will not go into the same level of detail that Mike Billone went into last November, because I've got to cover fifteen times as much money.

And to put it--another way of looking at it, we and DOE meet approximately quarterly with the NRC staff from the Office of Research and the Office of Nuclear Material Safety and Safeguards responsible--those staff members are responsible for storage and transportation. And when we meet we typically--we met a few weeks ago, and it was scheduled for four hours, and it went long. It took longer than fours. And even in those meetings we didn't get to the level of detail that Mike Billone did last November.

But we're very happy to have presentations with that level of detail on other topics if the Board and staff want it. Two years ago in October when the meeting was here in Idaho Falls, I remember two of the presentations, one by Ernie Hardin of Sandia--he went into great detail on temperatures of dual-purpose canisters--and Harold Adkins of Pacific Northwest National Lab. So any time you want to have more detailed presentations, whether it's at meetings like this or panel meetings or separate meetings by some Board members and staff members at national labs, we're happy to arrange that.

So what I hope to cover today is: What are our objectives of doing the R&D related to storage and transportation? The request was to talk about the R&D that supports the dry cask storage project; so before I get to the work that supports it, I will have some slides on the storage cask R&D project itself, and then I'll get into the supporting R&D as well.

Now, yesterday's tour was a wonderful tour. For those of you who weren't there, if I refer to the tour yesterday, I'll try and say enough so that, you know, it's not just of benefit to people who were on the tour. But the picture in the lower right-hand corner, that's all commercial spent nuclear fuel, but it looks in many respects very similar to what we saw in the Navy's building. Those are tall right circular cylinders, concrete overpacks. They have welded cans inside them with spent fuel inside. So even though Navy fuel and commercial spent fuel are different in the details, the solution--this is one of the standard solutions--the Navy uses it; a lot of utilities use it--these concrete overpacks around metal welded cans. But, again, these are outside. The Navy's were in a building. The Navy is not the only one who used buildings. Typically the utilities store outside. I'm sure each group has their own good reasons for doing it the way that they do.

All right. So here's our R&D objectives, and you can read the words; you have the slides. It's basically to increase the knowledge base about these materials, particularly high burnup fuel. And in the subsequent slides I'll explain why the high burnup fuel is of particular interest.

But, in short, it's the picture on the left that gets at the heart of the matter. And this is a cross-section through a piece of cladding, and the cladding we're talking about, the material--most of the material is zirconium metal to start with. There are other alloying agents in it, but it's mainly zirconium metal. But during the course of its life in the reactor, changes take place, including the formation of zirconium hydrides; and that's what these little squiggles are. And it's the amount orientation of these hydrides that, being a different material, they change the properties. And we're doing R&D to figure out, well, how do those different properties affect the long-term storage and transportation?

Now, on the right, just so that people know, we’re using the same terminology. That’s a fuel assembly; right? And you can see that there’s these individual rods; people also call them pins. And if you were to count them, I think this is a 15 X 15. They come in all different shapes, sizes, 15 X 15, 17 X 17; and it gets at the commercial industry in the United States.

At your meeting in November, one of the participants was Andrew Sowder from Electric Power Research Institute. And he made an observation that in the U.S. there is not a single fuel cycle; there is approximately a hundred. You know, each individual utility chooses to do what it does all the way from what fuel am I going to use, which assemblies, which storage devices. And so in contrast to what we saw--I think one impression visiting the Navy facility yesterday was a lot of uniformity and standardization. Even though their fuels--ultimately there are some differences, but that is a difference between the commercial side and the Navy side is that there are a lot of different variations on the commercial side.

So this table on this page and the next page, it’s taken from a report that we produced in January 2012. And the Board and its staff produced a very similar report that got at, well, what are the R&D priorities related to spent fuel? And, in addition, the NRC staff produced a similar document. And amongst those three documents, they're not all perfectly exactly identical, but they, generally speaking, pretty much identified the same sort of priorities with minor differences.

On these next two slides, highlighted in pink are those that were labeled in our document as high priorities, and it's these hydrogen effects, which it's the zirconium hydride--the effects of the zirconium hydride on cladding behavior was identified as a high priority. And so that's directly related to high burnup fuel, and I'll get back to that in a later slide.

Now, down here on the canister, aqueous corrosion and atmospheric corrosion, they happen somewhat independently, whether it's low burnup fuel inside or high burnup fuel. So the way I view that is, we would be doing this research if we only had high burnup fuel or we only had low burnup fuel. It is tied to high burnup fuel. We need to do this research related to canister corrosion and similarly for the bolted, the all-metal casks. The atmospheric and aqueous corrosion apply equally as well to low burnup and high burnup fuel. So it's in that sense that essentially all the R&D we're doing has some tie to high burnup fuel. One way or another the $10 million outside of the EPRI contract is all related to high burnup fuel.

And then there were some cross-cutting issues. You always need to know, well, what's the temperature involved? And some of these are high priorities for us as well. So these--it's the identification of these priorities that are driving, well, what particular tasks are we doing?

Now, a brief discussion of high burnup from a non-nuclear engineer. Right here, gigawatt-days per metric ton of uranium, that's a unit of measure. Just like a meter is a measure of length or a kilogram is a measure of mass, that is a measure. And those are the common units used, gigawatt-days per metric ton of uranium, but what it really means--what you could tell from those units is how much electricity was generated by the amount of uranium you had in your reactor. And another way to think about it is, the bigger that number becomes, the longer the fuel assembly was in the reactor and was able to generate more electricity. So that's the way I think of it is, the bigger that number is, that assembly was in a reactor for a longer period of time.

But that just begs the question: How does one assembly get to stay in longer than another? And it's the way they manufacture them to start, and it has to do with the amount of Uranium-235 that they put in to start with, that if you look at a history in the U.S. industry of what percentage enrichment U-235 was, you go back in time, as a round number

I'd say 3 percent. But what we're looking at now for our high burnup demo, all the assemblies started at more than 4 percent, and most of them actually started at more than 4-1/2 percent U-235 initial enrichment.

And so it's that higher amount of U-235 to start with that allows the assemblies to stay in the reactor longer, and by staying in longer you start ending up with some of these effects. First bullet I've already talked about, stays in there longer, and whatever's going to happen to it while it's in there, because it's in there longer, more of it happens.

One of the things that happens is that you can call it corrosion or just view it as an interaction with the zirconium metal. The water in the reactor disassociates, creates oxygen and hydrogen. The oxygen does what it always does with metals; it oxidizes; there is zirconium metal to zirconium oxide. But the hydrogen reacts as well and creates those zirconium hydrides that I showed you in that cross-section of the cladding.

And the presence of the hydrides is important, because the more hydride you have, they have different properties, and it may reduce ductility and fracture toughness, which neither one of those are good. This embrittlement effect is complicated in that it's temperature dependent. And back to that photo I showed, if the distribution of the hydrides is not uniform, some of the--it can actually be worse for you.

Additionally, in addition to the hydriding issue, because you started off with more U-235 to start with, there’s more fission products in the end. And, you know, when the U-235 splits, it gives you the fission products, which tend to be--those fission products produce a lot of the radioactivity, and they produce a lot of the heat. So, because you have more of them, it’s actually more radioactive and hotter, which then requires different management techniques.

And the last reason we’re doing research on high burnup fuels, others do. The fuel vendors do. But their data is proprietary. I think Mike Billone discussed this at the November meeting as well. There’s a lot more data out there, but we’re not entitled to it. But I do want people to take some comfort, although we might not be able to see it, to the extent that any of the licensees are relying upon that proprietary data to make their safety case with the Nuclear Regulatory Commission, the Nuclear Regulatory Commission does get to see that data. So we might not get to, but the regulator can.

So, in the interests of finding out more about the high burnup fuel in storage, we wanted to go down this path of this demo. And it’s going to start off just like what those of us on the tour yesterday at the Navy facility heard that the Navy does, that you start off with your empty container, you put it in your spent fuel pool, it fills with water, you put the spent fuel in, you then take it out, get all the water out, and put helium in. And the reason they use helium--there’s two reasons why they use helium to backfill the gas. One is, it’s non-reactive, but there are other non-reactive gases they could use. The reason people choose helium is its better heat conduction properties compared to argon or some other non-reactive gas. Whether that’s a smart thing to do or not, people will sort that out sooner or later.

So even though there is differences between the details of the Navy’s fuel and differences in the details of the Navy’s processes, what the utilities do in principle is exactly what the Navy described yesterday on the tour what they do. And I would say both the Navy and the utilities, they go to great lengths to figure out what ends up in those sealed canisters. They know exactly what fuel they’ve put in there and what conditions the fuel had been exposed to. They go to great lengths to get the water out, and they go to great lengths to get the right amount of helium back in.

And the drying process, that’s getting the water out. And we’ll use the typical process at the utility that’s involved in our demo. And then after we load it, the cask will be stored at the dry cask storage site, which, in the background here, that is the North Anna storage pad right there, and these are existing--they're most likely AREVA Transnuclear storage containers similar to the one we're going to use for our demo.

As was discussed somewhat yesterday, as you'll see in the next slide, for ten years after it's loaded, our demo will stay at the North Anna storage site. But someday after ten years we want to take it somewhere and reopen it. We don't know where the somewhere is yet, and there are two challenges there. The first challenge is, we've got to find the right facility in terms of does it have a thick enough concrete floor, big enough crane, tall enough, you know, walls, all that sort of thing.

But the second complicating factor--it came up in questioning this morning--I'll use the State of Idaho as an example. There is an agreement that the government signed with the State of Idaho limiting the amount of material that comes in. So there are complicating factors. Even if we had a perfect building here in Idaho, there is that other hurdle to get over, you know, that--and I'm not saying it can't be got over or will be gotten over, but it is--that is a challenge. And so, as I stand here right now, we do not yet know where and how that cask will be opened at a later date.

Now, back to what we saw at the Navy facility yesterday, and there was some discussion about it. This bullet right here, our demo, this is the thing that really will make it different from all these others out there or at any other site or different even from the Navy's, that based on experience and knowledge, whether it's the Navy or the utilities, when they put the fuel in, there is no instrumentation left inside with it; right? There'd be questions about how could it withstand the radiation, the heat, and all that. But no instrumentation goes inside. And as we heard on the tour yesterday, again because of existing knowledge and experience, they don't do a whole lot of monitoring and measuring after that either. We heard from the Navy that they measure the air temperatures as exhausts out of the containers. We heard from Barb Beller, there are some radiation sensors near the Three Mile Island facility and that, but not a whole lot of measurements are made. But that is the distinguishing characteristic of our demo is, we will make additional measurements.

Now, here is the schedule for our demo, and some of you may be a bit surprised at the specificity that we know today exactly all these days out to 2018. And if you have any experience with an operating nuclear utility, you wouldn't be surprised at this specificity. They go to great lengths to manage their facilities such that they want their reactors up and running as much as they can, and they go--

they’re well-run organizations. So this detail in terms of the date, that is largely driven by the participation of the utility Dominion, that it’s their site, their fuel, their license. And so we are working with them to meet all these days.

The TN here, that’s Transnuclear. They’re part of AREVA. They’re a big vendor for all things nuclear, if you will, from fuel to storage and transportation. And Transnuclear and Dominion, they are partners with the Electric Power Research Institute in the contract with us, DOE.

So that’s the schedule.

So it was in November when I made a presentation on this. We had our draft test plan out for public comment, and I encouraged people then in the audience, if anybody had any comments whatsoever, please submit them; and people did. And we did modify our test plan in response to the comments. Our draft test plan that was out last autumn, the increase in measurements and data that we were going to get out of our project was mainly that: temperature. We got comments along the lines of: Are you sure you can’t get something on the gases as well? And we took that to heart.

So we got people from the national labs together and the other organizations, and we looked at various ways of getting information on the gas inside our cask. We considered remote sensors. One of the ideas people used is, we'd put a sapphire enclosure in the top of the lid and shine a laser through it, and we could figure out the gases and what was happening to the gases.

To make a long story short, it goes back to the schedule. Anything we wanted to do of that sort that involved modifying the lid, AREVA Transnuclear needed every detail by June 1, a couple months ago, which that effectively, for this demo, ruled all those things out. But the good news is, Dominion, the utility, has offered up the possibility of sampling the gas periodically as the cask sits out on the pad. Gas sampling on the pad is still to be investigated. That is not a hundred percent done deal yet, because ultimately that would have to--Dominion has to convince itself--and I think they're well down that path--that they can do that. But, ultimately, they would have to convince the NRC staff as well that this would involve periodic--in a sense, if you will, the ports that are used to get the water out and the helium in, they could be reopened, and you could get a gas sample out of it. This is typically not done. These are usually--they're sealed, and that's it, they're done for.

But we'll work with Dominion and ultimately Dominion with the NRC, and hopefully we'll be able to get information on the gas during the ten years that it sits on the pad.

Okay. Now, this is where the other work that we're doing to support that comes in. I showed you the assembly. I think it was on my third slide. And that was, I think, a 15 X 15, so that's 225 rods right there. A 17 X 17 would have 289, you know, and whatever, so you can always do the math yourself. But we're going to pull from assemblies, either from the assemblies that actually go into our demo or from similar assemblies. We will pull up to 25 rods, and then we will take those rods, and we will--and that will happen--the schedule is given down here. We will do a lot of testing and monitoring on those so that we don't have to wait ten years to find out what are the properties.

But it begs the question: Why 25? Well, yesterday when we were in Building 603 and Barbara Beller--she turned on a video, and we watched a video at one point. In yellow letters there appeared on the video, "NAC LWT." NAC, N-A-C, that's a vendor. It's a vendor for storage and transportation services. The LWT is an acronym for Legal Weight Truck. NAC sells a device such that for our PWR rod, the maximum we can put in there so it can go down the highways of the United States as a legal weight, no more than 25.

Now, Barbara, what she was talking about yesterday in the video, it wasn't PWR fuel; it was something different.

So her number was not 25. But, for us, we can get no more than 25 in there and still be a legal weight truck, which then gets back to the tour yesterday. At the Navy facility all we saw were trains; right? And there is a reason why. They weren’t shipping anything this small.

And I’ll put--we’re going to use a Transnuclear-32, and the 32 stands for 32 assemblies where each one of those assemblies is 17 X 17 or 15 X 15. You can do the math. If it’s 17 X 17, that’s 9,000-plus fuel rods in a TN-32 versus the maximum we can use for legal weight shipping by truck in the United States is 25. That’s why the Navy uses rail. That’s why the proposed repository at Yucca Mountain, their proposed method is rail. It’s a whole lot more.

And this gets back to this bullet. I’ve already discussed that we don’t know yet where the TN-32 is going to end up so that we can reopen it. We also have not yet decided where we’re going to send these 25. Now, on the tour yesterday in the afternoon we split into two groups. The group I was in, there was some discussion. The existing facilities in Idaho, perhaps with some modification, probably could take these 25 pins; but then you’re right back into that, okay, even if it’s physically okay, is it okay according to the Batt agreement and that sort of thing. So we always have that two-part test to get through.

And so now I’ll go through the--again, this is all related to high burnup fuel, and I'll talk about experiments, analysis, other fuel measurements. And this--Mike Billone might have shown this slide or something very similar to it. And the important thing to get out of this slide is, it's this dashed line right here, that if you're above it, the cladding material is still ductile; if you're below it, it's brittle. And, as you can see, everything else being equal, if you can minimize the gas pressure inside the fuel rod, you're better off, because then it'll stay ductile for all temperatures.

But, as Mike explained in November, we do a lot of lab testing related to the hydrides because of the hydrides' effect on this brittle/ductile transition. But there is other things going on besides the hydride and the effects they cause. Radiation damage. As these fuel rods sit in the reactor that long in those radiation fields, the radiation itself tends to cause changes that we need to have insights to. And while--the cladding itself and the fuel pellets don't--you know, at some level they look the same when they come out, but in detail they're not the same. The 235 has split; you've generated gases. It's a complicated problem, and how it affects storage, we look into certain aspects of it.

So Mike, who works at Argonne, he talked in November, we're doing ring compression tests to find out at what temperature and under what conditions this transition takes place. We do testing at Oak Ridge. I think this device right here is actually at Oak Ridge where they do bending tests. And the bending tests--it’s a complicated problem. It’s not just a hollow tube you’re bending. It’s a hollow tube which has had fuel in it, but the fuel then underwent all these changes during the months in the reactor, and there get to be complicated interactions between the fuel pellet, you know, rubbing against the wall as you bend it and that sort of thing. So we do tests at Oak Ridge to gain insights into that.

And the gold standard, I think, for a lot of our tests is using the real McCoy, which is irradiated fuel out of a reactor. Well, that’s the toughest stuff to work with, because it’s radioactively hot. So for many of our tests we try to use substitutes and understand the differences that come about by using substitutes. So, because we have a great interest in hydrides, Pacific Northwest National Lab has come about with a way of introducing hydrogen in unirradiated cladding so that we can create these hydrides in it and then do the testing on that without all the complications of having radioactive fuel inside as well.

And I had already mentioned that there is some radiation damage, and I’m told that--the results to date indicate that the high temperatures associated with the high burnup fuel tend to cure, if you will, some of the radiation damage effects.

So those were experiments in a lab. We also do work out in the field. Now, this--that’s a photo from Diablo Canyon in California, and even that looks somewhat similar to what we saw at the Navy facility. They had holes in the bottom and holes in the top for the air inlet and the air outlet. And this is an area of research for us. In order to get information on what’s going on inside, we have to figure out ways how to get cameras in or how to put a device in to get a sample out. So that’s at Diablo Canyon, and that’s what they’re doing there, making an observation of some sort.

This down here in the lower left-hand corner, this is from Calvert Cliffs where a camera was put in. What we’re looking at here is--this is horizontal storage similar to the Three Mile Island facility we saw at Idaho. And through one of these air ports, they’ve put in a camera, and we’re looking at the rounded surface, the top of the storage canister. And this brown-colored material, that’s dust on it. I believe we heard on the Navy tour yesterday that critters--you know, dust gets in there. And my guess would be, one of the advantages for the Navy approach of putting it in a building, there’s probably less dust. At Calvert Cliffs these are outside, and there’s probably more dust outside than there is inside in Navy’s building. We are interested in dust and particularly if the dust contains chlorides, if you will. I've been told that this is actually not labeled correctly. That should be magnesium sulfate, not magnesium chloride.

But we view this as our field-related activities. We have worked with the utility at Calvert Cliffs. We were involved in this work. Diablo Canyon we were involved with, and we're involved with others. And with respect to the salts and that sort of thing, we're interested in seeing--okay, Calvert Cliffs, it's on Chesapeake Bay, which is not an ocean, it's brackish water--how much salt is present there versus Diablo Canyon, San Onofre--they're both on the ocean--versus Duane Arnold in Iowa, which is not on an ocean or even brackish water. What does that mean in terms of the conditions that the storage units see?

And this in the middle, this procurement is underway. It's a typical stainless steel--in terms of storage unit--in terms of its diameter, but it's only three-quarters of the length, it's that corrosion problems very commonly happen on the welds. So this is--we wanted to get typical welds. So we've got full-diameter welds and also these longitudinal welds that we will then investigate with respect to stress corrosion cracking.

We do a lot of modeling. Back to my observation on the commercial side, there's all kinds of variability in terms of the fuels, the storage. We can't possibly test every variant out there directly, so we've put--we do do a lot of tests, but we put a great emphasis on our analysis such that we can appropriately, you know, by having tested this, nevertheless have some understanding of that, because we do have so much variety.

And this figure--Harold Adkins may have shown something like this two years ago at the meeting here. This is PNNL's work. And they're looking at--this is actually a model, I'm pretty sure, of the Calvert Cliffs horizontal storage units and the temperatures that they would see.

And so in terms of modeling, we're interested in thermal analysis. We have models for hydride reorientation, structural analysis, and CIRFT. That device I showed you, the testing device from Oak Ridge, that is the cyclic integrated reversible-bending fatigue tester. And so we do modeling and compare the modeling results to the test results from that device at ORNL to help ensure that our modeling results are making sense.

We also do work on transportation. Again, this is a surrogate. This is not real spent fuel. There is no spent fuel in there. I believe Sandia used--they did a study that believed the fuel was mimicked by lead, and they also used mainly copper tubes rather than Zircaloy, but there were reasons why they chose the materials they did. And initially put it on a shaker table, but then also--and the shaker table test was to mimic a 700-mile trip. Somebody had data from an actual 700-mile trip. But we also did a test where it was to be driven around the Albuquerque area; it was 50 miles on a real truck.

So there is the shaker table; there is the surrogate assembly. But this slide, which you may not--I'm certain the people in the audience can't read--this is a typical stress-strain plot. The Y axis is stress. The X axis is microstrain, and so it's deformation parts per million. And this is the behavior of the cladding material. And that nice straight line shows that it's linear; right?

But the fact that it ends abruptly shows that it's brittle, which is--if we change the units and that sort of thing, that's what glass looks like in a test, whether it's window glass or anything like that. Glass is as brittle a material that we have common experience with. And this is the way glass or any other brittle material typically behaves in such a test. You put load on it, it deforms, it deforms, it deforms, nice straight deformation, and then it explodes; right? It just shatters to bits.

And that's what this cladding material does in a lab, taken up to those levels of strain. But what's important here is--here is the shaker--the shaker test results are way down here in the corner. And here are results from an earlier test, not our shaker table test, but you can see, as said here, they’re greater than ten times below the yield strengths.

So that leads to this bullet here. Our investigators are becoming convinced that under normal conditions of transportation, the high burnup fuel is no different from low burnup fuel in that, you know, it’s--the fact that it’s more brittle doesn’t matter, because you’re nowhere near the yield strengths. There are questions about, okay, does the added brittleness affect other than normal conditions of transport if you have an accident? So we will continue to do some testing to gain insights into that.

Field demonstration, other than our large cask demo, we’re really interested--it’s this--what we’re interested in: Is there any way we could put something inside future canisters that could communicate to the outside over some period of time to give us information, whether it’s temperatures, gases, whatever? And, again, that’s a particular challenge because of the heat and radiation.

But we’re also looking at, well, is there any way we can interrogate it externally? And for any of the earth scientists here, people do that with the earth all the time. You can’t see into the earth, and various geophysical techniques are used all the time to infer, well, what’s actually down there and what’s actually going on? And so I tend to view this, having a degree in geology, is: Is there any way to use similar techniques to find out what's actually going on inside? So we try, but it's still a bit of a challenge.

Now, these are our major reports on storage and transportation for this fiscal year. These aren't the exact titles. These are more like--the title of that document is not "Develop a UFD Storage and Transportation Plan." It'll probably be--that'll be the actually title. But this gives you an idea of the work that we're doing. Here is one related to management. We have lab testing right here. We have analysis results. So it's a mix. Here is the--I mentioned we did an over-the-road truck test. Within the next few months that report will come out as well.

And then my last slide, these are all--the Office of Nuclear Energy takes 20 percent of its R&D funds and sets it aside for universities. And I know a fair number of you are university professors. I hope you're all aware of the NEUP, Nuclear Energy University Program, and the ability to get research funds from the Office of Nuclear Energy.

So here are awards for 2011 and 2012, and these are across disposal, storage, and transportation. Most of these, other than this one right here, they tend to be multi-year, like three years, $700,000, $800,000 awards. But then this one is different. That's multi-year too, but that was more--

I forget the exact--it’s multi-million-dollar. It’s on the order of 4 million. And it’s called--so, in general, across all of the Office of Nuclear Energy, whether it’s for the reactors or storage and transportation, there are these smaller ones at 700,000 to 800,000.

But then there are these much rarer ones that are much larger in funds, and they’re called Integrated Research Projects, IRPs. And so we have one on storage. I don’t want to mislead anyone. It’s Texas A&M University, but they have a bunch of other partners with them. Other schools are involved. And that’s true for others of these. We only listed the lead school on these.

So universities are actively involved in our R&D as well, and the burden falls on us to integrate their results in with the bulk of our work, which is done by the national labs and that work done by Electric Power Research Institute and their partners, Dominion and AREVA Transnuclear.

So I’m done.

EWING: Thank you very much.

So I’ll start with the first question. When you last discussed this, you invited the Board to comment on the test plan, and we weren’t able to meet that schedule, but we did submit to NE a letter in early June. And part of the reason for the delay is there have been many presentations on the proposed experiments, and so we tried to gather up everything that was said and comment on them.

Some of our recommendations included things like, why not go ahead and open a cask now. You have the high burnup fuel in the system; and so rather than wait ten years, start the process. Other recommendation was, we had great interest in the separate effects testing and the small-scale testing.

BOYLE: Right.

EWING: So what’s the status on some of those suggestions?

BOYLE: Okay. These back here, these are the separate effects tests. So they are--we are doing that. They are ongoing. The suggestion on, there is high burnup out there, why don’t we open up one of those? And we can. From my point of view, that’s one of the--another complicating factor besides, well, where would we do it, and is it in violation of any agreement with anyone? It’s simply a question of money. This fiscal year we’re in now, this demo, in and of itself, it’s getting more than $3 million. Next fiscal year it’s $6 million. So it’s an expensive thing. I wish we had more money.

But I think with respect--it would always get down to where are we going to open it and how are we going to open it. People--they don’t want to open them in pools, and so it’s back to, well, how are we going to do it dry?

EWING: Right. So, in fact, you can't do this work now because you don't know where to do it or have the infrastructure to--

BOYLE: Right, right. I'm not saying that's impossible. It could be potentially done, you know, not tomorrow; but it would take some work to do it.

EWING: But there's no intention to pursue the possibility of opening one?

BOYLE: I wouldn't characterize it that way. It's just that in some way I would characterize it--we're going down the path with this work right now and that it just didn't come up to the same level as--we've got our hands full with this one. And there are competing interests. For every dollar we're spending on the storage, the disposal people are upset and things like that. So we try and reach a balance across storage, transportation, and disposal R&D.

EWING: Other questions? Mary Lou.

ZOBACK: Mary Lou Zoback, Board. My question is a simple one. Since you're going to load the canister specifically for your experiment, if some of the fuel rods you pull to put in it have visible damage, will you exclude them from the experiment, or will you go ahead and put them in?

BOYLE: You know, I believe as a condition of--if it's known to be damaged, it might have to be handled differently by NRC rules and that sort of thing. There are special containers for damaged fuel rods. So I think we're probably going down a path of, there aren't any flaws in it, which people can check; right? You know, if they're flawed, you can usually do a measurement and determine, oh, yeah, I shouldn't be seeing that gas and yet I am. So I think by definition ours are not flawed.

ZOBACK: So it may not necessarily be most representative of the sample?

BOYLE: It certainly wouldn't be representative of damaged fuel rods, that's true. And they do exist, right, so--

EWING: Further questions? Jean.

BAHR: Jean Bahr from the Board. You've mentioned the possibility of some type of geophysical testing. Are there projects being funded to explore the feasibility of that, or have those been unsuccessful? I saw one that was labeled sonic or ultrasonic testing or something.

BOYLE: Yeah, we do--in the general sense, yes, we fund R&D on remote sensing. Whether any of them have any particular tie to the standard geophysical techniques, that I'm less sure of. Based upon my education and background, to me the problems seem similar. That's why when I put the challenge to these people who are interested in knowing what's going on inside, I typically say, "Well, the earth scientists do something similar. Isn’t there something we can do?”

ZOBACK: And so what has the answer been to that question?

BOYLE: People are trying to work on it. There are certain things--like if there is water present, even though they go to great lengths to get it all out, if it was present, it was discussed, well, we actually might be able to see that. And I forget what technique they were going to use, but there are, you know--by sending currents through things or sound or--you can get insights into some aspects. There’s no one-size-fits-all for all information.

ZOBACK: But in the currently funded project there isn’t a specific group of people that are working on that for this large dry cask experiment?

BOYLE: I’d say most of them are more involved in these sorts of aspects, which, with the limited access we have to the exterior of it, trying to get as much information as we can, looking inside the completely sealed parts are much tougher. But people are working on that.

PEDDICORD: Lee Peddicord from the Board. Back to your slide on which you refer to the 25 rods--and maybe you touched on it and I just missed it--these are going to be an additional rods not coming out of the storage canister, but rather you’re going to withdraw and look at--did I understand that correctly, or do I have it wrong?

BOYLE: No. What we’re going to do is, for some of those assemblies that are going to go in our TN-32, we might pull--

PEDDICORD: Prior to their opening?

BOYLE: Yeah. Some of these 25 might be pulled from some of those assemblies. More of the 25 will be pulled from assemblies that are very similar to those going in our TN-32, but they’re actually not going in. So--

PEDDICORD: So is it correct that the history of the 25 rods--and what I mean by that, the radiation history and the storage history--will duplicate or get close--

BOYLE: Yeah, that’s the idea. At least they will be duplicates up to the day of the loading in the TN-32 or the pulling of these pins, you know, because then they’ll be separated and see a slightly different thermal history.

PEDDICORD: And then on your priority list earlier, you identified the possibility of the delayed hydride cracking--

BOYLE: Right.

PEDDICORD: --that may arise, interestingly enough, because of the long-term temperature profile that was—

BOYLE: Yeah—

PEDDICORD: -- particularly in long-term storage that they go through. So is the program--well, let me ask, what is the objective of this program that you’re trying to get to, the delayed hydride cracking effects?

BOYLE: I don’t know the details. My suspicion is, if it really is something that takes a long time to actually see in reality, that we are working on ways to accelerate some part of the process and realize that we’re not actually looking at the same thing anymore, but hopefully gain enough insight.

EWING: Paul.

TURINSKY: Paul Turinsky, Board. I just don’t remember the answer to this question in reading the report. Are you going to have both the M5 and the ZIRLO claddings in there, because their hydrogen pickups are dramatically different.

BOYLE: We have on our side tentatively identified the 25 assemblies and the cladding and everything else, and it’s not final yet, but there will be four cladding types: M5, Zircaloy 4, ZIRLO, and one other that doesn’t have such a short, snappy name but it’s characterized by low tin and various other things in its name. But those are the four with M5, I think, being the--M5--hold on, I’ve actually--I think M5 is the most common, that low tin is the least, and then it’s, I think, the ZIRLO. M5 and ZIRLO are the majority.

EWING: Mary Lou.

ZOBACK: Just a follow-up question. As a geophysicist and seismologist, as you are well aware, we do interrogate the earth and get data remotely, but I have to say a lot of times our interpretations are very non-unique; and once you get to electrical methods, they are extremely non-unique. So that's a challenge, and, you know, it always is.

I guess I just want to put in a plug--not necessarily a plug--maybe not the right term--for in situ monitoring. There is really no replacement for actually measuring inside the environment. So you talked about using the ports. If you guys can come up with something--I can't imagine the geophysical technique that would give you--or a remote measuring technique, not necessarily geophysical--that would give you the details of gas composition that you might really want. So I hope that you can work out to do in situ.

BOYLE: People did have ideas on how to do it. It's just that we couldn't do it in the time frame to meet the schedule we had.

But back to what we're doing with this particular cask. The temperature measurements, we're going to use thermocouples, and they call them lances. We will not put the thermocouples directly on the fuel assemblies. Instead, we'll put them on sticks, if you will, the lances. And we'll have seven lances, and each one will have nine thermocouples. So we'll have 63 temperature measurements inside the cask at different elevations and different XY locations on the periphery and in the center. So that's the bulk of the information that will come out of the--

ZOBACK: And that will be transmitted out somehow?

BOYLE: Yeah, yeah, it’s these--again, back to--our tests will be different. For these seven lances, there will be seven holes put in the cask lid that typically are not put in standard lids. And there are acceptable ways to the NRC for sealing these, and that will be used. And it begs the question, well, shoot, if you can do it for a thermocouple lance, why can’t you do it--

ZOBACK: That’s my question.

BOYLE: And that’s the path we were going down with these other methods and simply ran out of time. The thermocouple lances were known from the start. This connection is actually the manufacturer’s. It’s a standard thing. That was very acceptable to AREVA and Dominion. It was a known thing. These other changes to the lid to accommodate gas measurements were new to them and just didn’t know enough about them to make it in in time.

EWING: Bill, just a follow-up question on these experiments. I think from the Board’s point of view, this is an important experiment; and, you know, it’s a long-term experiment, and it’s a costly experiment. It’s at the cost of other programmatic needs. But the issue is at the end of ten years opening the cask up and doing a full characterization. So how quickly will DOE settle this issue of where the work can be done? How far will you go along with this experiment without having a definite solution to where and how this work will be done?

BOYLE: Two things. Before we even put the request for proposals out that EPRI ended up getting the contract out of, we turned to the scientists and said, look, we know that you want to do this dry, but you guys have to do some work, that just in case everything goes wrong and we can't do it dry--oh, yeah, it's this one. It was on two different slides, but it's easier, I think, for me to find here--the PNNL work fuel transfer options--we gave them a task of, all right, worse comes to worst and we actually do it in a pool ten years from now--

EWING: All right, but that's not my question. I'm asking how long--

BOYLE: No, I'll get to that, yeah. That work is going on right now, looking at what would it take, at least at this facility--and we're looking at other DOE facilities as well, but the 603, that work is under Jeff Williams. I don't know his exact details. I do know that he's getting a presentation by some of his vendors later this month, so it's well before the end of the ten years, some of which would be eaten up by modifications to the structure.

EWING: But, as you pointed out, there are two hurdles.

BOYLE: Oh, yeah.

EWING: One is where to do it and how to do it and whether you're allowed to go where you want. So how long is DOE prepared to pursue this project without settling where they're allowed to do the characterization?

BOYLE: You know, I think the first part, you know, is the building appropriate and, if not, what needs to be done, that's sooner rather than later. Again, I don't know Jeff's exact details on his schedule, but that's in the near time frame. The other issue about when will it be--you know, the discussions on, okay, there is this agreement; if it's this date, what are we going to do about it? I'm not involved in those discussions. I don't know--I have no personal knowledge of any of the scheduling related to that.

EWING: Okay, thank you.

Other questions from the Board?

FRANKEL: Jerry Frankel, the Board. So back to the shaker experiments--

BOYLE: Yes.

FRANKEL: --for the hydride fuel rods. I understand how you're pleased that the strains are small and hopefully not a problem, but you shouldn't be happy about having your cladding behave like glass, as you said. The properties of glass, let's say, depend to a huge extent on defects on the surface that can act as stress concentrators. So, you know, it's remarkable--this is almost impossible to read even here.

BOYLE: Yeah, yeah, yeah.

FRANKEL: You have a huge reduction in the ductility of this material. It’s really brittle after this irradiation. And, you know, it’s not what you want to be containing things in. So I think that, for instance, it would be interesting--I don’t know how these experiments were done, but if you had notched samples, for instance, that were hydrided and see how low a strength you’d need to propagate that.

BOYLE: Well, here’s my--I didn’t choose irradiated Zircaloy. That’s what I get; right? It’s more on Andy Griffith’s side. People are looking at different materials, largely as part of the accident-tolerant fuel research and development they do. But this is what I get for storage, transportation, and disposal. That’s what it is. It is what it is for me.

FRANKEL: You were just saying--your bottom bullet says that you can take pressure off of things if you’re happy that there’s not going to be any problem with the hydrides. I just would urge you to investigate that fully before you decide there’s--

BOYLE: Yeah, yeah, yeah. But I want to emphasize again, that’s for the normal conditions of transport for the reason you’re bringing up, you know, and the one I brought up earlier, other than normal conditions of transport. We will continue to do testing.

FRANKEL: Right. I'm saying even for normal conditions of transport, you could have problems.

BOYLE: If it's notched or it has a defect, you know, I understand.

EWING: Other questions from staff?

LESLIE: Bret Leslie, staff. Slide 5.

BOYLE: Slide 5. Yes.

LESLIE: The drying issues, how do they play out into your table? Can you identify whether there are separate issues? You know, you've identified the system components, but--

BOYLE: Yeah, the issue--there's two issues related to drying that are of interest to people. One is--I think it came up in one of the earlier presentations here--leaving the water behind is not a good thing. So it's convincing yourself that, yes, we actually did get it out.

But the other thing, the techniques used to get the water out caused the temperature to go up, and there's any number of components in this system that have various temperature limits that you're not supposed to exceed, in particular related to hydriding, that reorientation that, as you get to the high temperatures associated with drying, although they're transient high temperatures, they do occur. The question is: Do you cause the hydrides to, if you will, become uniform temporarily, and then when they cool down again, they rearrange themselves in a very bad way? I mean, the problem during the drying is, basically the hydrogen goes back into the solution, and now you have a high internal rod pressure from the fission product gases when you cool down and then goes back in and you get the radial hydrides. The original--I mean, during operation they've done a texturing of the cladding not to have radial hydrides. They have hydrides forming, but it's not the radial hydrides. And they've done that basically in manufacturing the cladding.

And back to those fission gas pressures, that's what's driving these curves. As the pressure increases, they go this way, and so you become brittle at much higher temperatures. So that's the bad aspect of that.

There is some good news here, though, in the sense that there's the temperatures in reality, and then there's the temperatures that our models show. And licensees very commonly use--if you're afraid of high temperatures, they will typically bias the calculation such that the models produce high temperatures, because they want to stay away from them. They want to build in some cushion. And that's probably been done by many of the licensees. When we turn our labs on thermal analyses who don't come with the mentality of a licensee necessarily but more a scientist, we get different temperatures, and they tend to be lower. So whatever benefits there are to lower temperatures, they may actually be--there may be some benefit there that they may be lower somewhat in reality than what the models show.

EWING: Last questions?

All right, thank you very much, Bill.

I just checked. We don’t have anyone signed up for public comment, but we’ll have another--oh, question, Bob?

EINZIGER: I didn’t sign up, but I’ve got a comment.

EWING: Okay, please.

EINZIGER: I’m Bob Einziger. I’m the senior materials scientist in the NRC Division of Spent Fuel Storage and Transportation. First off, I want to commend DOE for even getting this test started. We’ve been hoping that it would get started for a long time. Is it a perfect test? No, it’s far from being perfect. But there were some drivers in it that limited it to what it is. One of them is that we have licenses coming up for renewal that include high burnup fuel.

Now, based on the work that was done that supported ISG-11, Rev. 4, we have every reason to believe that there’s not going to be any problem with high burnup fuel. We’ve seen nothing since the issue of that document that indicates that there’s going to be a problem with high burnup fuel. But, that being said, before we issue licenses that go beyond the current 20 years, we want some confirmation that the predictions that were made in ISG-11 based on short-term tests are confirmed when the stuff is in storage for a long period of time. And so the 10-year period for looking at things and voting it at this point is somewhat biased by that.

Would we like continuous monitoring of the fission gases and the moisture, etc.? Yes, we would like those things. It would give us a lot more data. In fact, knowing how the fission gases evolve and how the moisture evolves in that cask tells us a lot about the way the fuel is performing, even if we'd never open that cask up and look at the fuel itself. Obviously if we get to look at the fuel itself, we get even more data, but we can go ahead with license renewal. So it's important that we have some indication of the moisture in there.

If you remember, ISG-11 is predicated on there being drying of that cask; and if there is not drying, then we have to start looking at mechanisms such as galvanic action and any that weren't considered before. So we need to know that.

As far as just opening a cask and looking at what's in there now, you don't have the temperature information there, so you don't know how to apply that to other situations if the fuel is higher temperature or lower temperature. We had that problem when we opened up the low burnup cask in Idaho 15 years ago, is that we never had any pre-characterization data. We had some temperature data.

And so there was a lot of finagling what kind of error bounds do you have on things to interpret the data.

So, once again, I really want to commend DOE in going ahead with this. If per chance they never get a facility to open this thing up and they can continue to get gas data, that's a plus. I mean, the big challenge with opening this thing up in a pool is if you want to take this back out on the pad again and then proceed to get additional data. Remember, there is no reason to ever stop this test until somebody comes up with a place to put this thing once it's finished.

In terms of the brittleness of this material, actually, this stuff isn't as brittle as you think coming out of the reactors. I thought that was the case back 30 years ago when I first got into this game, and I went to the Battelle Columbus Hot Cells. And we took a rod, and we bent it in half, and we couldn't get it to fracture. You do get quite a bit more brittle with the high burnup than you do with the low burnup because of the radiation; but until you get to about a thousand ppm hydrogen in that cladding, you don't see a precipitous drop in the yield strength.

Now, once you get to radial hydrides, that's a whole 'nother story, as indicated by this work that was done by Mike Billone, and then it's a very temperature-dependent thing, and it depends on how much radial hydrides that you have.

So things aren’t as bad as we think, and I think that the programs at DOE going ahead are quite good.

Now, Bill brought up a chart there that showed a lot of mechanisms, and he gave priorities to them. Those are the DOE priorities, and probably they’re the right priorities. Those aren’t the NRC priorities, because we have different goals in these programs. As I tell people, DOE does research to find out if there’s problems--rather, NRC does research to see if there’s problems, and DOE has to do research to solve the problems. And so a lot of these things we have much lower priority on, because we already know there’s a problem.

EWING: Thank you.

Other comments? Identify yourself, please.

GRIFFITH: Andy Griffith, Office of Nuclear Energy. I just want to comment on your question regarding a place to open up the TN-32 at some point. As Bill said, we are actively working on that. It’s just that we’re not at a point in our investigations to share any of our conclusions or results with you at this point, but be assured that we are working actively on it; and when we do reach that point, you’re going to be some of the first folks we share the information with.

PEDDICORD: Lee Peddicord with the Board. I have a question back to Bob. I think Bill had mentioned that the NRC gets to see other pieces of information that may be proprietary information from vendors and so on, and you also have a lot of very active international collaboration in the regulatory community.

So the question to you is: Is there any insight to come out of either of these sources or any others that you help to inform the DOE program or you see things going in maybe some other direction that would be of interest as you try to get your arms around this long-term storage question, because you just published a rule that says you have confidence?

EINZIGER: NRC has confidence, because we'd be able to repackage this stuff if anything goes wrong. Yeah, we have access to it. Obviously any of the fuels that are being irradiated have to go through a program through the reactor regulatory part of NRC that gets proprietary data on the way these fuels behave, and so we sort of get a feeling for it. We can't use that, just having the insider information, when we actually do licensing. We can't tell an applicant, You're making an argument. You don't have anything to support the argument, but we know something someplace else, and we think your argument is good. We may think that their argument is good, but they still have to produce the data before we can go ahead with it.

In terms of the vendors, the fuel vendors do have a lot of information. For instance, Mike Billone is trying to put together data on the internal pressures of the rods, and he’s got some data that’s from the open literature. And there’s a lot more data that’s in the closed literatures, and we know that it’s sort of supporting what Mike is saying, but we can’t put it on the graphs.

There are some international programs that we have access to, and there are other international programs that we don’t have access to that they are collaborations between various groups of the industry that put the money into them. They’re getting conclusions from them. They don’t want to share those conclusions at this time, so we don’t have them.

But, for myself, I meet with the fuel vendors, each of them, about once a year where they give us the--what’s the update information, where they’re going in new claddings, what the new performance material is. And so it helps us ask the right questions, but we don’t say, hey, we know something, and you’re going on the right path or something. We’re more interested, are they giving us information that says, you know, where you’re going isn’t quite the right place, and we try to nudge them in that way.

In terms of with the DOE, we meet, as Bill said, quarterly. We tell them what our concerns are. We tell them the research that we’re doing. For instance, we sponsored a lot of vibration testing down at Oak Ridge, and we got fatigue curves. And we feel that the data looks pretty good in the sense that the fatigue appears to be about--if you look at what kind of impulses we're expecting, they're about an order of magnitude less than where the fatigue says we should have any failure.

But with that said, those were done with high burnup rods that didn't undergo hydride reorientation. Now, if you look at hydride reorientation, everything tells you that when you look at the relative direction of the stresses concerned in the fatigue that you should have no effect. But, you know, before we go out and say, hey, there's no problem, well, we want to test out that hypothesis. We've been fooled too many times by what we think is the case, and then the data when it comes in-- nothing intended bad for modelers, but I believe in experiments more than I believe in models.

You know, I like to know that it's the case; and as a result of that, we're spending over a million dollars this year at Oak Ridge to take some high burnup rods and reorient the hydrides with the fuel in them and do the testing and see if it gives us the same results. And then DOE is committed to follow that up with, if that's the case, do other claddings to show that it's the result. So we don't take things for granted.

Let me just say one thing. You asked a question about delayed hydride cracking. Yeah, we both came up--DOE and the NRC came up with it. DOE gave it a much higher priority than the NRC, and basically we took different approaches. The NRC approach to delayed hydride cracking is, we can make delayed hydride cracking occur; but before we're going to go ahead and put money into doing any experiments, we want to know down the road whether there's really any stress to drive it. And so we've done studies to look at what happens in terms of fuel swelling and in terms of gas release, because you're going to be generating helium in there, and pretty soon we're going to be publishing something that basically says at least 100 to 300 years down the road we don't think there's a stress that'll drive it.

EWING: Okay, thank you.

Let me declare an end to this session, and the conversations which started should continue. I will remind the Board members we'll have an executive meeting just down the hall with our lunch, and we'll reconvene at 1:25.

And my thanks to all the speakers and the audience and questions.

(Whereupon, a lunch recess was taken.)

AFTERNOON SESSION

EWING: All right. We'd like to begin in just a moment, so if you could find your seats, please. And I should look for the rest of the Board.

(Pause.)

--the afternoon session, and we'll have three speakers, and then we save the questions and discussions for a package at the end. And the first speaker will be Barbara Beller on the management of spent nuclear fuel at Idaho National Laboratory.

Okay, it's all yours, Barb.

BELLER: Welcome back from lunch. We're ready to get going. I'll start with a review of the Spent Nuclear Fuel Storage Program, and I'm going to talk about it from the Environmental Management perspective; Lance is going to cover the Nuclear Energy section; and then Mark Shaw will talk about the calcine high-level waste.

We have two different regulatory or several different regulatory drivers, but we have fuel that's regulated by the Department of Energy and also three different NRC licenses. So we are in compliance with the NRC 10 CFR Part 72 set of regulations for our Three Mile Island Storage facility and also our Fort Saint Vrain Fuel Storage facility in Colorado. The DOE orders are typical 10 CFR 835, which are codified orders, and, you know, an entire series that are now codified. At INTEC we have an air permit also that governs the 666 storage facility.

And you've heard probably ad nauseam already about our Settlement Agreement. That really governs the work and planning and what we do at our site, so we have to--we need to be out of dry storage by--or out of wet storage--I'm sorry--by December 31, 2023. And that's the 666 storage basin, which is at INTEC. We should have all our fuel out of the state by January 1, 2035, which is also a Settlement Agreement date. And years ago when we negotiated the Settlement Agreement with the State, they were mainly concerned with protection of their sole source aquifer, which is under a majority of our site. So that's what our actions are taken is to protect the Snake River Plain aquifer.

We have an agreement with the State of Colorado and the State of Idaho, and they both state that the Fort Saint Vrain fuel that's currently stored in Colorado cannot come to Idaho for repackaging in compliance with the repository requirements until a repository is opened or an interim storage site is opened somewhere outside of the State of Idaho, and that facility is receiving fuel from our site. So the intent was to take the Fort Saint Vrain fuel, bring it to Idaho for repackaging, and then send it from here, which we are prohibited from doing until the repository or some other storage system is opened.

And I need to also mention that, again, when I am talking about the EM population of fuel, the Navy has a Memorandum of Agreement in other sections and work with the State that’s been done to cover their program. So I’m not addressing what their agreement is with the State or what their deadlines are or schedules are.

This is a list of our storage facilities, and you saw 2707 yesterday, which is a cask pad with six casks on the pad. We’ve renamed one of our facilities to Outdoor Fuel Storage Facility. That is also known as the Underground Storage Facility, and we’ve renamed it to be more representative of the fuel that’s stored there, because we’re going to move the West Valley casks over to be co-located with the casks on the pad. So the safety basis covers all those different storage configurations, so we’ve renamed that to Outdoor Storage Facility.

Irradiated Fuel Storage Facility is 603, which we toured yesterday. Three Mile Island is one of our licensed storage facilities and then Fort Saint Vrain, of course, in Colorado.

This is just an orientation map.

The 666 Fuel Storage Facility was commissioned in 1984. We began fuel storage operations in 1992--or I’m sorry--we discontinued fuel dissolution in 1992, so the mission for that facility was focused on fuel storage. Shortly after that we looked at reracking the fuel storage basin, which we did, and at that time we did a new seismic analysis to support the reracking effort. After that we've been focused mainly on getting out of wet storage, so only 70 percent of our basin is empty; 30 percent of the storage positions are filled.

We start Navy, Advanced Test Reactor fuel, and EBR-II fuel. We continue to receive ATR fuel. We've moved about 2,008 elements of ATR fuel to dry storage, but we continue to receive some ATR fuel for the NE program. The Navy fuel population is being moved back to NRF for their dry storage work, and EBR-II fuel is being moved to MFC for processing. And you had a tour of that facility yesterday.

We have two casks. The 125B casks were used to move Three Mile Island fuel to our site years ago, and they were empty casks, stored on a pad without any future disposition. So we had quite a collection of fuel cans and pieces, and they were underwater stored. Some of them were flooded, real cats and dogs we like to call them, bits of fuel. And we were able to build baskets, some of them criticality safe baskets, and reuse the 125B casks as storage containers, which are located in the 666 facility. So it's kind of an odd combination. It's fuel that could be flooded, wet fuel, but it's in dry storage, so it won't prevent us from the closing the basin at some future point in time.

The storage basin is about 30 feet deep, has six independent pools, great crane capacity, hook height; it’s stainless steel lined. We have a cooling system that we don’t need to use because our fuel doesn’t demand that of us anymore. But, anyway, it’s a wonderful facility.

The main work that we do is surveillance and maintenance and then fuel transfers from the 666 facility. EBR-II, we have 217 shipments to accomplish between now and the 2023 date that would comply with this Settlement Agreement. We’ve moved 10 shipments so far, and that’s mainly due to the receiving end, the MFC end, of the operation. We’ll process the material when it’s received.

So they’ve worked hard to make improvements in their processing rate there, hired people to support expedition of the work. So our end in 666 is to retrieve fuel from storage, load a cask, and ship it to MFC; so we are in a position to far outpace the receiving end. But I think we’re syncing up pretty good now, so we’re going to get some good fuel shipments done in the next few years.

We continue to receive 15 shipments a year of ATR fuel into our basin for continued cooling of that fuel, and there’s eight elements per shipment that comes. We have about 850 ATR elements right now in Pool 6 of our basin.

This is just a quick schematic of the work that EM does to prepare the fuel to go back up to MFC. As you can see, there’s eight bottles, and we moved those bottles into a specially designed can, which can hold obviously the eight bottles. That can is stacked on another can, put in a cask, and shipped down the road. So that's our scope for the NE program to return their fuel.

749 is our outside storage facility, and there are two different generations of storage wells. The first generation was commissioned in about the 1970s and was built for Peach Bottom fuel storage. Over time there was dampness, water infiltration. There was a question about the integrity of that storage in the first generation wells, so we built second generation wells, and we moved six Peach Bottom elements to the second generation well. And then it was determined through continued evaluation of the first generation wells that we didn't need to move the balance of the Peach Bottom fuel over.

So those storage positions are not all filled in the second generation wells. We have five fuel types stored out there; and if we needed to move some out of 603, that would be a candidate facility to move fuel to this location.

This is the fuel storage pad, which was commissioned in 2004. We decommissioned our Test Area North facility and needed to relocate the test casks that were in place to support the dry cask storage project for EPRI and the NRC that developed the technical basis for the initial 20-year licensing period in dry storage for commercial fuel.

We built the pad at INTEC and consolidated fuel storage at INTEC, so we moved the six casks that you saw to our pad at INTEC, and there they sit.

The casks up in the corner here are from West Valley, and we plan to move those casks to the pad by the end of 2014. And the advantage of that is, we can remove the impact limiters. As the casks sat on the rail cars, they were under a transportation safety analysis report. We didn't do a separate analysis for on-site storage. So now we've completed that work, we can move the casks, remove the impact limiters, and in subsequent modeling evolutions not have to rent a crane to take the impact limiters off to do monitoring and put them back on. So it accomplishes a couple things. Our Settlement Agreement requires consolidation of fuel storage, so we've completed that task and reduced the cost of fuel storage by not needing to rent a crane periodically to do our sampling and analysis.

The 603 facility we toured yesterday, it's commissioned in 1974. The section that we're most interested in, I guess I should say, was commissioned in 1974. The basin is about a 1950s vintage. In 1974 this section was added for receipt of Fort Saint Vrain fuel. We received about a third of the core--or a third of the material from Fort Saint Vrain, and then we discontinued receipt of that material, do we had other storage positions available. It's currently at about 91 percent capacity as far as the storage is filled 91 percent.

But, as we talked yesterday too, we could do further safety analysis, consolidate fuel, physically repackage or recan--not recan--move fuel into different storage buckets and gain a lot of storage space through optimization of our storage array.

The mission at 603 is receipt of domestic and foreign research reactor fuel, and Gary talked quite a bit this morning about the longevity of those programs. And our planning basis in Idaho is to discontinue foreign research reactor receipt in 2019, except, as he noted, for the Austria fuel shipment. So in 2025 they owe us an answer. Do they want to send us their fuel that we exchange with them so that we can have that fuel received in Idaho and packaged and have it out of our state by 2035? So that’s why 2025 was selected as the notification date from Austria to the United States, whether they want to return it or keep it, which is an option too for them.

And I just--also, Gary touched a little bit on the aluminum fuel that could be consolidated at Savannah River Site. We don’t have it currently in our funded portion of our baseline in Idaho to send our aluminum fuel to Savannah River, but periodically we reevaluate that option and price and see if it’s an advantage that the government would have to send the fuel down to Savannah River for processing there. So it’s not off the table, but it’s not a very near term funded activity for us.

At Three Mile Island facility we have 29 of 30 horizontal storage modules filled with Three Mile Island core debris, filter canisters, and knockout canisters. And the canisters were used to filter the water from the reactor vessel, and the knockout canisters just took out the larger water particles from the debris pool.

One thing I need to point out is, most of the Transnuclear storage systems have stainless steel dry shielded canisters. Our dry shielded canister, which is the five-and-a-half-foot-diameter canister that holds 12 stainless steel Three Mile Island canisters, is coated carbon steel. So as we go forward through licensing, that’ll be a unique question and a unique bit of technical evidence that we’ll have to build specific for our project to ask NRC to consider licensing in the next 20-year period. So that’s some work that we have to do between now and 2017.

SPEAKER: (Inaudible.)

BELLER: It’s--I can’t remember. It’s like a--I don’t know, I can’t remember. I’ll take a note and I’ll send you—

This is the Fort Saint Vrain license. The Fort Saint Vrain facility was licensed to Public Services of Colorado in 1991. It was later--the license was later then transferred to the Department of Energy. We have 244 vertical storage positions filled with Fort Saint Vrain high-temperature gas core reactor fuel. It’s a graphite fuel type. The initial licensing period was 20 years, and in 2011 we were granted a 20-year extension, so we’re licensed through 2031.

So the program--the NRC licensed program really is focused on maintenance of compliance with our safety documents as they are defined in our license basis and the three licenses that I’ve listed here. Three Mile Island license expires in 2019, so we need to submit a timely renewal application in 2017. So by May of 2017, we need to have all of the documentation and the license renewal application to the NRC for their review, which is allotted a two-year period of time. And we expect the extension to be granted for an additional 20 years.

So you’ll note that 2019, a 20-year license period would take us to 2039, and how does that sync up with 2035. But the license period also covers D&D, so it made sense to us to request an additional 20 years.

We have a technology development effort that’s been funded through the EM program, and it’s helped us do some up-front investigation of the horizontal storage module internal condition and the dry shielded canister. So we were able to procure a borescope and take photographs of the internal components in the Three Mile Island horizontal storage modules. We're also interested in understanding retrievability of the dry shielded canisters, so there's some additional work on the carbon steel DFC interface with the rails that the dry shielded canister sits on. There's been a little bit of modeling in the carbon steel dry shielded canister that we need to do further explanation and research, technical evaluation, and we'll do that for the 2017 license submittal.

So it's good to start those activities so that you have enough time to evaluate and find all the appropriate answers that are required to support a request for an additional 20-year license period. So that'll take up quite a bit of energy in the next two years here to put that information together for a license application.

We also have a project on the books. It will be funded--the plan is to fund it in 2016-2017 time frame, and that project is to construct a facility that would allow receipt of fuel from our existing facilities for repackaging and compliance with the Yucca Mountain acceptance criteria, the waste acceptance system requirements. We've used the Yucca Mountain requirements as our bounding assumption for our planning and budgeting purposes. And we realize that may not be the eventual disposition site for our fuel, but affords a good bounding set of assumptions, and so we have maintained our baseline to include the standardized canister, although you heard from Brett’s presentation this morning that there are aspects of that assumption that aren’t sound unless we invest in poison material for our baskets and seal welding those canisters. So that fits with his presentation.

We submitted a mission need document, and it was supported by DOE headquarters in 2007. And you’ll notice that we haven’t been funded until 2016 time frame, so the mission need means that it’s still supported by headquarters. They know that we have a mission gap in Idaho, and if we’re going to prepare our fuel to be packaged for transport out of our state that there has to be a capital investment made in Idaho to accommodate that work.

We’ll need to look at reuse of our existing facilities. Back years ago when we first implemented the project, 666 wasn’t available. It was full of fuel, and by 2023 that facility should be emptied of fuel. So is there a reuse for the basin area or any portion of the 666 facility? That’s something we’ll have to look hard at.

The other thing that we’ve thought about is adding a hot cell capability to the South side of 603, which is where the big roll-up door was where we receive casks. That would really help expedite our fuel transfer from 603, because fuel retrieval from that building is somewhat of a pinch point in our plan to repackage the material. So if we could rework fuel transfer from 603, not load it in a cask, and drive it across our facility to a new building, that might improve our schedule. So, you know, we're wrestling with a lot of different options, and we'll start putting pen to paper on some of those ideas in 2016.

And that's the end of my presentation. We'll go to Mark Shaw.

EWING: All right, thank you.

So we'll have all the questions after the three presentations.

Mark.

SHAW: Well, that's an awful slide. Okay, are we good? I've got to tell you, this reminds me of--normally I have someone come up, tap on the mic, go, "Check 1, 2, check 1, 2." I saw a thing where Warren Buffett came up to the microphone at one of his meetings, tapped on the mic, he went, "Check, one million, two million, three million, check." I've always wanted to do that.

Joe Case was supposed to be here to do this presentation, but he got called out of town and asked me to fill in for him and basically get you caught up on the Calcine Disposition Project.

When we talk about calcine, we're talking about solidified high-level waste. Calcination is just a standard industrial process that's done all the time. You basically convert a liquid into a solid. The fertilizer that you spread on your lawn in the spring starts out as a liquid, it's calcined, turned into a granular solid. We use basically the same process here, except you don't want to spread this on your lawn probably.

This is a great process. We got about a 7 to 1 volume reduction. Started out with about 8 million gallons of high-level waste, liquid high-level waste, that was calcined into about 4,400 cubic meters of a granular solid. From a regulatory perspective, high-level waste--it's a RCRA characteristic and listed waste, which makes it a mixed waste. Like I said, it's a dry powder. It kind of looks like Tide detergent--that's what we typically say-- stable, non-corrosive. If you're going to store this stuff for a while, this is a good form for it to be in.

When you were out at the site yesterday, I think you looked at the calcine solid storage facility. Let me say, if you ever call it that, we'll know that you ain't from around here, because we just call it the "bin sets." There are seven bin sets, one, two, three, four, five, six, and I think number seven is over here. Calciner was in this building. Liquid waste tank farm, which you also saw, I believe, sits over here, that liquid waste into the calciner, and then the calcine solids into the bin sets.

There are seven bin sets. You'd think if you were going to build seven of something, you'd make them all the same. We made them all different. These weren’t all built at the same time. You build one, you learn something from it, apply that to the next one, learn something, build the next one. So we actually end up with six different versions. And, actually, I think these two are a little bit different. Five of them are full, the sixth one is half full, and the last one is empty, basically used as a spare. If I count correctly, there’s 43 individual storage locations for the calcine.

Calcine Disposition Project, the scope really is pretty straightforward, easy to explain. Make it road-ready to ship out of state by 2035. But how you get there is pretty complicated. Back in--well, let me just go through this first bullet. A big part of the project is to design and construct a treatment facility to treat the calcine to meet liquid--or sorry--land disposal restrictions before it can be disposed of. We have an environmental impact statement from 2009 that specifies hot isostatic pressing is the treatment technology for that.

The issue with that is that hot isostatic pressing is not BDAT per the EPA. Are you all familiar with what BDAT is? That’s Best Demonstrated Available Technology. For certain types of waste EPA will specify the treatment technology, and in this case for high-level waste EPA specified that vitrification is the treatment technology, so vitrification is BDAT. It is the best demonstrated available technology. So if you want to treat high-level waste, you have to vitrify it. If you want to do something different, which we wanted to do, hot isostatic pressing, you have to go through a process and basically prove that your process is as good as vitrification. And that's what we mean by the whole BDAT process. What that involves is basically building a full-scale HIPping unit, doing testing with surrogate wastes, sending those results off to EPA, and convincing them that our waste form is as good as vitrified glass.

That process, six years, best case, since it's never been done on high-level waste, may take as long as eight, nine years. Part of that also we obviously have to remove the material from the bin sets, get it over to the treatment facility, treat it, package it up, and get it ready to go by 2035. And what's driving that 2035 date is the Settlement Agreement court-ordered milestone.

So as you, well, may or may not know, I guess, our current clean-up contract expires September 2015. And the way we plan on addressing the Calcine Disposition Project beyond that point is to handle it, and the spent fuel repackaging is a separate contract. It will likely be an A&E-type contract with a nine-year period of performance, which would hopefully get us all the way through that BDAT process. And the scope for the calcine portion of that would be to do a dual path approach. What the dual path is, one is the HIPping process. The other is to look at direct disposal to see if that’s a viable alternative or not.

We’re in the middle of this procurement, and I really can’t say any more about this at this point.

And that is all I have for you. Lance.

EWING: All right, thank you. We’ll go to the next speaker.

LACROIX: One billion, two billion. Okay, if I got the training right, we’ll go to the next slide.

I’m here to talk about the Wet to Dry Initiative that we have with the Office of Nuclear Energy. Of course, as most in the room probably are aware, if you’re not, we run the Advanced Test Reactor Facility out here, and we continue to generate spent nuclear fuel. Barb kind of alluded to sort of, I would say, on her side of the fence, as the fuel gets delivered--and I’ll kind of go through that towards the end of this presentation. But in years past, obviously with the running of the EBR-II reactor, we generated a significant quantity of EBR-II sodium-bonded fuel.

In this particular case, you see a picture of the spent fuel pools in the FAST facility or CPP-666. I believe you all got a chance to see those yesterday. And primarily, I believe, our fuel is located in this area here. So we also store the Naval fuel there and the--I should probably start again. The Office of Naval Reactors actually has a set of fuel inside the FAST facility that I am not going to address here today. It’s really not--I don’t have any control over what they do. They’ve made arrangements through the State of Idaho on how to do that. I think Barb addressed that earlier.

So primarily what I’m going to talk about is the ATR spent fuel that we continue to do irradiation activities; and then as we remove the fuel from the reactor, we cool it down, and then we transfer it when it reaches the thermal limit that we need over to this pool for some further cooling. And we’ll talk a little bit about that in a minute. And then the other--of course, the large majority of the fuel that we own in this facility, or at least that we set the process, is the EBR-II spent fuel.

So most people are aware, we’ve obviously been at trying to get rid of or at least consolidate our spent fuel on the site, and we’ve managed to empty several--wrong button, sorry--several of the locations across the site, as Barb was talking about, used to have spent nuclear fuel in them. We are essentially now down to storing our spent nuclear fuel that’s wet in the 666 facility. And as of about June--this says June 6, 2010--I believe at that point is where EM got most of the fuel that they are responsible for out of the wet pool and into dry storage in one of the dry storage facilities located at INTEC. So what this slide is really trying to depict is that it’s been a long process, and we have methodically started consolidating the fuel, and then now we’re starting to work on the fuel that’s inside the basin at INTEC.

So I think I’ve probably kind of covered this, really, with what I’ve said so far. But I’d like to point you to the last slide, and I’ll just re-emphasize it again. There is essentially about three types of spent nuclear fuel remaining that we have to address: the Naval spent nuclear fuel, which Naval Reactors and the State of Idaho and working with our EM counterparts, they have addressed that, and I won’t talk about that--the EBR-II spent nuclear fuel and the ATR spent nuclear fuel.

So the way we--first of all, I should say I’m from the Office of Nuclear Energy. I work here locally at the Idaho Office, but I am the facility’s Infrastructure Support Director, so I’m responsible for the operation of most of the facilities out on the site as the lead PSO, and spent nuclear fuel is within our purview of making sure that we take care of.

Now, we’ve kind of divided up the spent nuclear fuel and, like to say, campaigns. And, really, our goal, of course, is to empty 666. And we have an agreement with the State of Idaho, as you, of course, are aware, that by the end of 2023--December 31, 2023--we will have removed all spent nuclear fuel from wet storage and placed it into dry storage; or we'll process it at the Fuel Conditioning Facility at the Materials and Fuels Complex.

Now, EM, of course, has done their portion of the pre--I think it's 2005--fuel that was designated, and that fuel has been removed. The Naval Reactor spent nuclear fuel is addressed in a different venue. Our campaign--we say 3 and 4, so Campaign 3 is the EBR-II spent nuclear fuel campaign. Now, we're in the process of doing that. Since about, I want to say, 2010 we have re-commenced doing EBR-II spent nuclear fuel driver fuel in the Fuel Conditioning Facility. And we are also in a planning stage for the ATR spent fuel and what we're going to continue to do with that.

This, of course, is a good picture of a fuel cluster of EBR-II fuel. And what I want to talk about in this particular slide is, okay, we have a considerable amount of the EBR-II fuel that we must treat in accordance with the Record of Decision that was issued in 2005, I believe it was--or no, I'm sorry, 2000. And the preferred method, of course, is for the electrochemical processing that is available at the Fuel Conditioning Facility.

Now, as you can imagine, with the number of fuel elements that we have there, we have a considerable amount of shipping activities that are going to have to occur, as Barb mentioned, and we work closely with EM to coordinate and schedule shipments. They have to retrieve it from the basin; they get it into the cask; they ship the fuel over to our facility; receive it; it’s then put into the argon cell that we have at Fuel Conditioning Facility, where, when it’s taken out, it’s inspected to make sure there is no moisture in the fuel canisters. Once that’s been determined, then there’s a few things that can happen to it. It can stay right there in the cell, or it can go into the air cell, or in some cases we could place it somewhere else.

But our intention is to continue to treat that fuel as what the Department has signed up for so far. I mean, lots of things are still being evaluated, but that’s the method and the approach that we intend to take unless somebody changes our mind for us.

In the past year we had scheduled six shipments of fuel from the INTEC facility over to the Fuel Conditioning Facility. We have received four of those shipments so far this year. We had a preventative maintenance issue that we had to deal with with our cask. That kind of slowed us down for a little bit, but we still think that we’re going to get two more shipments by the end of this year. So we think we’re still kind of on track there.

We commissioned a study internally to evaluate alternatives, how we would address fuel, and we still believe, through a variety of waste, through treatment, and through potential interim dry storage, that we will certainly meet the 2023 milestone as agreed to with the State.

Just some of the considerations as part of that study and what we consider from a programmatic perspective, all the things we're always dealing with, is whether or not the fuel is suitable for treatment. Sometimes that fuel may or may not be suitable for treatment, and that will have to be further investigated. That's evaluated by the personnel at the Fuel Conditioning Facility when they examine the fuel upon receipt.

Our shipping schedule, of course, Barb alluded to it. It's going to get fairly aggressive here in the next few years. Right now what's scheduled and what we've been planning is to ramp up our treatment of the fuel that we receive. In this particular year we're treating, what we would say as a batch, about three batches in the year. It's good to point out that--and I think Mike must have discussed yesterday with some members of the Board that toured the facility that the FFTF fuel campaign that was done relatively recently, they got as many as 24--is that right, Mike?--24 batches in a year. So it was proven that that capacity exists.

And some of the things that Mike and his crew--I would like to acknowledge that they do a fantastic job. But

Mike and his crew have been able to actually improve some of the efficiency of those various pieces of equipment in the Fuel Conditioning Facility, and we anticipate probably greater through-put, which will help us in the end reach our goal, we think, before 2023.

Of course, I sort of addressed the processing rate, which is always important to understand, and then funding from a high-level DOE perspective. Our integrated priority lists and the budget formulation activities that we do currently show that we were sitting in the neighborhood of about $7 million this year that’s been allocated for these activities, and it’s actually ramping up to a much more significant value to work with Mike and him hiring more operators so that we can actually increase the through-put and operate that facility at a greater rate.

So funding, of course, is important in any activity, and it’s certainly important here. But we believe, at least through--you know, through these years that we will see that funding. And if that changes, of course, we would have to regroup and figure out what we’re going to do.

Of course, I think yesterday Mike probably spoke to this a lot better than I can, but essentially in the end, when the fuel is processed, that we end up with an ingot of uranium; and that’s disposed of--or I shouldn’t say disposed of--but that’s kept in one set ingot. They downblend it to a certain enrichment. We also have some ceramic waste that we work with with the electrorefiner salt, and then we have some cladding hulls that become a metal waste form later on.

So current and future plans for the EBR-II, I kind of alluded to that. We're essentially ramping up our activities in the Fuel Conditioning Facility so that we can accommodate the increased capacity that we need to make our 2023 milestone. Every indication is that we should be able to do that by well in advance of that milestone, and we don't think we're going to have any problems with that.

We are also at the same time evaluating some of the activities, always looking for efficiencies that we can gain, because we have a fixed date, and we have to meet it. So we look for efficiencies. And there is continued research and development in some of the waste forms that are potentially being generated as a by-product of the process. And I think probably Mike spoke to that a little bit yesterday when he was touring around the Board.

So I've talked a little about the Advanced Test Reactor. Of course, as you know, the Advanced--or you don't know--the Advanced Test Reactor, we intend or have every intention of operating in this plant beyond 2023. Because of that, you know, we will be continuing to generate spent nuclear fuel beyond the 2023 date. We owe the State of Idaho some more information, and we have committed to do that. And at the appropriate time we will meet with them and discuss the continued operations of the facility.

That being said, just for your own benefit, when the fuel comes out of the ATR and it's defueled, it sits in the canal. There is a working canal right there at the fuel, and essentially we move it into the canal for it to cool down. It's very hot, not just radioactively hot, but it's thermally very hot. And so the integrity of the fuel would be at risk if you took it out of the pool too early.

So at that point we--now, on average--these are, of course, averages-- we let that fuel sit in the pool--in the canal, the working canal, for about a year, a little over a year. It has to meet a certain thermal output. And then once it meets the appropriate requirements for transfer, that's when we can put it in a cask and transfer it to the FAST facility over at CPP-666 and place it in the pool there.

When it gets into that pool, it's actually cooling more. On average it takes about five years after sitting in the working canal to cool down to the thermal limit for it to go into dry storage. So not only does it need to cool in the canal, it also needs to sit in the FAST pool for a period of time to cool down as well.

So one of the things that we're trying to do--as it says, we're trying to, you know, hey, is there a better way? Is there something that we can evaluate? Can we do some more studying and engineering to say whether or not our cooling times are appropriate? So we want to look and see if there's ways to eliminate some of the steps that are in between. And so that's a very difficult technical challenge, but I think that's something that we're going to potentially do and look at in the future.

So I kind of covered a little bit of these. We consider lots of things. We're looking at reduced cooling times in order to address the ATR spent fuel issues. We're looking at: Are there existing dry storage places on the site? Certainly there are, and we can do that. Barb mentioned the Record of Decision that talks about moving spent nuclear fuel from ATR to the Savannah River Site, and that's being evaluated in accordance with the ROD.

Of course, the funding profiles from the Office of Nuclear Energy and the Office of Environmental Management, to get through what we need in order to address the spent nuclear fuel is an important consideration.

And then, finally, the need for cooling post-2023, I had kind of alluded to that just a few minutes ago. The reactor has every intention right now, you know, as best we can plan, to operate beyond 2023.

So what I'd leave you with was Advanced Test Reactor. We are continuing to evaluate that particular set of spent nuclear fuel. I have somebody on staff who has been working for several months on evaluating all the potential alternatives and what is the best and most--and potentially the best cost-effective way in order to meet the milestone. In the end, we believe we can meet the milestone. It’s just a matter of what is the best way and the best use of the taxpayers’ dollars in order to achieve that.

And that’s all I have.

EWING: Okay, thank you.

So we’ve got plenty of time for questions. I’d open it up to the Board. Questions? Jean.

BAHR: Jean Bahr from the Board. This is for Lance. The high-level waste products that come from the reprocessing of the EBR-II fuel, will they need additional treatment in order to be transported and finally disposed of, or will they be in a form that itself is ready for disposal? And also where is that being stored on site now?

LACROIX: Okay. This is Lance. I was asked to say my name when we to try to answer the questions for the recording.

That’s a very good question. I’ll have to--the best I can say, most of that stuff is kept within the Fuel Conditioning Facility’s argon cell right now. Sometimes the cladding forms that go to the metal waste furnace over in the Hot Fuel Examination Facility. Once they go through a metal waste furnace, I believe they--are they stored there, Mike, once they sit there? So all the salts--there are no wastes generated from salt. We haven't changed out the salt yet, and so we don't have any of that except in the electrorefiners themselves. And then the cladding hulls, I believe, are stored either in HFEF or FCF.

And there is continued research on that to see whether or not it actually can be evaluated for even potentially, I think, WIPP storage maybe. There's a lot of different technical things that I'm not necessarily aware of, but I can find out.

EWING: Okay, thank you.

Steve.

BECKER: Steve Becker, Board. This is also directed at Lance. At least that way you don't have to say your name again.

LACROIX: One billion, two billion. Exactly.

BECKER: Having seen the Materials and Fuels Complex yesterday, it was fairly cramped in there. Just wondering, as you consider the process of greatly ramping up operations, what challenges do you envision in terms of personnel, equipment, and other issues?

LACROIX: Thank you for the question. This is Lance again. I would say the idea to increase staffing at the facility is to actually go to what we consider a seven-12s rotating shift. So most of those people won't be, like, doubled up when they’re at the facility the whole time. As far as the equipment is concerned, it’s been in cell obviously since it’s been commissioned. Recently Mike and his group have actually basically rebuilt the--I would like to say rebuilt the Mark IV electrorefiner, and we anticipate seeing actually increased efficiency out of that piece of equipment.

So one of the things that we make sure, at least from the IFM program management, that they have sufficient funding in order to continue to address either material condition issues of the facility. For instance, not a lot of people think about roofs. We’ve spent money on roofs just to make sure that we’re not going to have issues. You know, there could be other issues if you start leaking water in a facility. So material condition of the plant, we certainly have programmed what we consider adequate resources to address those issues.

And as far as the challenge for space, there’s not a lot we can do, as you saw, with the structure; but I think the way Mike and his team will be working is, I don’t think they will necessarily all be in there at the same time, because in a 7/12 shift they actually start at different times of the day so they can work a longer day. That’s the whole idea behind that.

And one of the efficiencies I think we’ll see with additional staffing, which we anticipate ramping up to, is the ability to--because, as you can imagine, there's going to be a lot more cask handling activities going on, upwards of--what is it, Barb?--30--yeah, about 30--

BELLER: 30 a year.

LACROIX: Yeah, 30 shipments a year once we get into these higher activity rates of receipt of the crews. So we're going to need more people. If we were to do that today, the people that are actually operating, you know, like the electrorefiner out there on the floor, would have to stop what they're doing and go do cask handling evolutions. So we're trying to increase the ability to do things simultaneously.

Did I answer your question or--okay.

EWING: Mary Lou.

ZOBACK: Mary Lou Zoback, Board. And I want to thank all three of you for giving great presentations that really stuck to the questions we asked, so appreciate that.

My question is just to clarify what I think I've heard multiple interpretations of. The 2035 date in the settlement, is that to have the fuel and waste off the site or road ready, I think was the term I heard?

BELLER: This is Barb Beller, and I'll answer that question, because for the EM population of fuel, which is legacy fuel, it includes all of the fuel that was in the 666

Basin by September 30th of 2005 my program was assigned to disposition. So we need to have that fuel packaged and out of the State of Idaho by January 1, 2035.

ZOBACK: Okay. That’s the EM?

BELLER: I’m just speaking for myself. That’s what my mission and my assignment is.

LACROIX: So for the NE side of the equation, of course, alluded to that we’re going to continue to operate the ATR. So that’s something that we still, frankly, need to address with the State. We have to come to an agreement with the State to make sure we can--you know, both sides of this can work together and continue to operate the facility.

Now, the EBR-II fuel, we hope, will be gone, you know, it’ll be in ingots at that point. So we won’t have EBR-II driver spent fuel. We’ll still need to manage EBR-II blanket fuel, and there are some--we have some paths for it on that as well.

ZOBACK: Where are the ingots going to go?

LACROIX: That’s a--I don’t know if I know the answer to that question, to be perfectly honest. I think right now--

ZOBACK: It’s an anticipation--

LACROIX: The Record of Decision says that we’ll store them on site until a waste path is actually developed and generated. That’s what the Record of Decision says.

ZOBACK: I heard road ready. Did I just mishear something? I heard somebody use 2035 and then road ready.

BELLER: That was for the calcine material, needs to be road ready. The spent fuel--and I think maybe my answer to your question was a bit misleading, because I was addressing 666 fuel stored in the basin. All of our fuel in 603-749, which is the underground dry storage, the entire EM population of fuel on site today needs to be out of the state by January 1, 2035.

ZOBACK: Now I'm confused. What about the calcine waste?

BELLER: The Settlement Agreement states that calcine needs to be road ready by January 1, 2035.

ZOBACK: Okay. So calcine is road ready, everything under EM that was in the other basins that got moved is out, and you've got to figure out who's going to take your ingots and what to do to extend--okay.

LACROIX: Yes, ma'am.

ZOBACK: It's not simple.

LACROIX: No.

EWING: Just to follow up on the calcine, I have a question. Ewing, Board. And this is to Mark. This BDAT process, best available technology, and the definition that vitrification is the answer or the standard, and the fact that it takes six to eight years to go through this process, so, I guess, could you say a little more about what "best available technology" means? As an example, vitrification as a technology may be a good answer for liquid high-level waste; but when the starting product is your calcine with a high zirconium content, that would be very difficult to vitrify; right? So where does the definition of "best available technology" come from?

SHAW: Yeah, the regulation specifies that BDAT for high-level waste, I don't believe it specifies the form. Whether it starts out as a liquid or solid, it's vitrification, period. And if you want to do something different, you have to convince EPA that what you want to do is as good as vitrification.

EWING: So the fact that the technology would be very difficult to apply wouldn't be part of that discussion?

SHAW: No. And it's very prescriptive.

EWING: And so in terms of best available technology, do you demonstrate that by showing that the waste product you get from HIPping is equivalent to the glass? Would that be--

SHAW: Right, yeah, that's what you would do. You get a glass ceramic waste form when you HIP, which isn't a whole lot different than glass made through vitrification. But you would have to go through and use a full-scale--you can't just say we did this on the bench and scaled it up, look, it works. You've got to build a full-size, full-scale HIPping unit, run it on surrogate waste, use the additives that you would add to it, get your recipe right, all of that. And then EPA reviews that, and they actually change the law. They do a rule-making at the end of this, and they'll specify--if they accept it, they would specify HIPping as BDAT for our particular waste. So it's a long, ugly process.

EWING: So the fact that you have a program to HIP waste and all, this is just the first step; it's not as if you're--

SHAW: Right.

EWING: It's not a pilot plant leading to the final step.

SHAW: Right.

EWING: Okay. So just to explore it a little further, I can imagine a way to vitrify the calcined waste, which would require a high temperature. And so cesium volatility would be an issue; right? But that wouldn't count in this determination in terms of--I mean--

SHAW: Yeah, I don't believe so, no.

EWING: Okay.

SHAW: Like I said, it's very prescriptive.

EWING: Okay, thank you.

Mary Lou.

ZOBACK: Just to follow up on that, I assume that EPA in the end wants to know that the final product would behave in a similar way that the vitrified material would. Are there natural analogues that you could use to look at--I'm just thinking it sounds a lot like the kind of compression that happens in some kind of volcanic flows that start out with ash.

SHAW: They want to see results from a HIPping unit.

ZOBACK: Itself, not--

SHAW: Oh, yeah, oh, yeah.

ZOBACK: Okay.

SHAW: They're not going to take an analogue for something like this.

EWING: Okay.

FRANKEL: Frankel, Board. I just wanted to follow on HIPping. So HIPping is typically done for a complete densification. Why is that important? This isn't a structural member.

SHAW: I think it gives you a glass ceramic waste form volume reduction probably cheaper than vitrification.

FRANKEL: Well, you could reduce the volume other ways without reaching complete densification anyway in a--

SHAW: Yeah, I wish I was in on those discussions.

FRANKEL: So you HIP, and then you have to put that form into some crushed can into another can or something; right?

SHAW: Yeah, it would have to be put into some kind of form that you could transport to a repository or until you transport to a repository.

FRANKEL: You could just press it and get it mostly dense; it’s still calcined.

SHAW: Yup.

FRANKEL: HIPping is difficult.

SHAW: Yeah, I agree.

EWING: So just to pursue this a little more, if you just take--just leach the calcine, this powdery material, it’s not so much less curable than the glass; right?

SHAW: You’re over my head right now on this.

EWING: Okay, right. Other questions?

PEDDICORD: Lee Peddicord from the Board. A question to Barbara Beller. I wanted to see if I understood the transfer of the TRIGA fuel at the Vienna Research Reactor correctly. And if I recall, this started off as--was it a highly enriched fuel coming from that reactor to Idaho, and then you replaced it with the lightly-used, low-enriched TRIGA fuel?

BELLER: What we received was both high-enriched uranium and low-enriched uranium from Austria.

PEDDICORD: And then this falls under this caveat that they might have the option of returning it after the date?

BELLER: Yes.

PEDDICORD: The other question I had is--well, two--is: In the inventory of TRIGA fuel, are there other TRIGA fuel rods that would fall in this category of lightly-used LEU fuel that could find application someplace?

BELLER: Yes. And we keep a good history of the prior use of the fuel that we've received. We have records and data from the reactor operators, and we have a spreadsheet at--there's a lot of different fuel types, of fuel versions or models of TRIGA fuel. So we have a list of all of the different fuel elements by element number, by enrichment, the days in the reactor; so we know the burnup history of that fuel. And so there are other low-enriched fuel elements in the 603 facility, which would be candidates for reuse.

And if anybody is interested in that, you know, we're happy to talk to them about that and offer them a look at our spreadsheet and come shopping.

PEDDICORD: How many total TRIGA fuel elements do you have in the entire inventory, including the HEU, the LEU?

BELLER: I do not know how many elements.

PEDDICORD: Okay.

BELLER: I can find out. I have it sitting home on my--or at work on my computer, but I don't have it right with me right now. I don't know if--I don't think Randy or Allan would know, but--

SPEAKER: No.

BELLER: Okay.

PEDDICORD: So you could have a--

BELLER: You know, based on the number we have, there's only a certain number that would be efficient to reuse, too. So we have breaking points on our spreadsheet that we could recommend, you know, at a certain number of--a certain point of burnup, that and more, probably wouldn't be attractive to future reuse, so--

PEDDICORD: Well, but you would have options the way you designed the TRIGA core. I mean, if you had some use lower at risk, you'd have to go a larger number of fuel rods to get criticality or the performance and so on. You would have lots of options of approach, so--

BELLER: Yes, uh-huh. And there's a quite difference, you know, of course, when you take some of the HEU elements out of the equation; or if you've changed from aluminum fuel to stainless steel, you have to accommodate all those changes with more fuel in the reactor then. So, yup, we can--

PEDDICORD: In the HEU TRIGA rods, is there some path forward? You're going to do some processing of that eventually and convert it or downblend?

BELLER: The disposition for the high-enriched TRIGA fuel rods is packaging in a standardized canister and disposal at a repository. That's our baseline assumption now.

PEDDICORD: Thank you.

EWING: Other questions? From staff? Audience? Bret.

LESLIE: Bret Leslie, Board staff. And I have a number of questions, so I'll look at you to cut me off.

EWING: All right.

LESLIE: This first one is for Barbara. When you were talking about why CPP-749 was renamed to the Outdoor Fuel Storage Facility, which is just going to be one more acronym for me to try to remember, you seemed to indicate that the West Valley casks were going there. And then in a later slide you said they were going to the pad.

BELLER: Yeah, I did confuse you. The difference is, there's different facility numbers and names, so 749 and 2707, but they're all collected up under one safety basis document so that SAR includes the underground storage facility, the West Valley casks, and the pad. So we took all of that and tried to make it easier and more descriptive by renaming it. So in the end I confused you.

LESLIE: Bret Leslie again from the Board staff. When you were describing CPP-666, a fuel storage area, you talked about the 125B casks that are in dry storage. I thought I heard you say that they are filled with water still but are considered dry storage; did I hear that right?

BELLER: The casks themselves aren't filled with water. We removed cans of miscellaneous pieces of fuel that had been packaged, and some had been stored in 603 Basin and then in 666 Basin. Perhaps not all of those packages had integrity that would have kept water from infiltrating the cans, so we couldn't say that those cans were dry. Some of them may be; some of them may not. We could have implemented a drying iteration before storage in dry storage, but we're going to build a drying station when we do build the Idaho spent fuel facility, so it wasn't timely to build a station just for those cans.

So we were stuck with the dilemma of, how can we move those fuel packages to dry storage, not put them outside in 749, because there's literally 208 different items to consider that are in those packages. So how do you do an evaluation to show that you can put those packages in storage outside in a freeze/thaw cycle in 749, for example, underground? It just didn't make any sense.

So in lieu of that, we could reuse our 125B casks, build specific baskets to accommodate the criticality concerns with some of the fuel, and then leave the fuel in storage indoors in 666.

LESLIE: Bret Leslie, staff. So your NUHOMS® for the Three Mile Island unit, you say, is a little different than all the other NUHOMS®. Was the version you used part of the original NUHOMS® general certificate of compliance that's undergoing renewal, or is it a separate--

BELLER: We have a specific--

LESLIE: Okay, okay, thank you.

BELLER: Yes.

LESLIE: And this is Bret Leslie again from the staff. And this is going to be for Lance, and you may or may not be able to answer this, but Mr. Patterson had a great answer yesterday, which is a mass balance of--you know, you're focused on reaching the 2023 deadline, and so my question was: You have about 56 metric tons of sodium-bonded fuel at the site; can you go through and tell me how those 56 metric tons either end up in high-level waste road ready or--you know, you're ramping up to meet 2023. How many metric tons is that that you're going to ramp up in 2023, and how much more would you have to process between 2023 and 2035?

LACROIX: This is Lance. I'll have to express my ignorance there. I don't know the answer to your question. We can get back to you on that.

EWING: Is that the end of your list? Okay. So I'll check again. Questions from the Board? Staff? Public?

Okay. You need to go to the microphone and identify yourself.

SIEMER: My name is Darryl Siemer. I used to work at the site, retired eight years ago now. Anyhow, I used to be in the waste management part of the site at that time. I used to--before then I was in the reprocessing. But, anyhow, I've HIPped things, and I've made quite a number of glasses and even concretes out of the kinds of waste that we're talking about here.

Now, I know a decision has been made to hot isostatically press the calcines, and it looks like they're going to start next year sometime, October 1st I think. This is before a BDAT determination has been done on what’s going to be made. So I think this is about as realistic as their finishing the sodium-bearing waste calcination by the end of this year. It isn’t going to happen.

Anyhow, I guess when this announcement first came out, there were going to be two ways of HIPping this stuff. You’re going to do it with additives or without additives. Is it now with additives? Are you going to make, actually, an insoluble material equivalent to glass, or are you still keeping the raw calcine HIPping option open?

SHAW: This is Mark. I believe it’s with additives.

SIEMER: You don’t know?

SHAW: I’m sorry, I can’t help that I’m new to the project.

SIEMER: Okay, I guess everything else I have is a statement rather than a question.

EWING: Okay. And there’s time for statements at the end.

Okay, next question?

SHEWMAKER: My name is Darren Shewmaker. I’m with Huntington Ingalls Industries. On Slide 15 and 16 we talk about two different kinds of storage facilities or two different kinds of facilities, I think. I’m looking for clarification. On 15 we’ve got an Idaho Spent Fuels

Facility, and I think that is the same one that's the NRC licensed Foster Wheeler facility. And then on page 16 we talk about a conceptual design or, it looks like, CD-0/1 for the alternatives for fuel disposition. Is this a separate facility?

And then, lastly, one that's not discussed here is one that I've seen in the news, the Interim Storage Facility. Is that one of these facilities, or is that a third facility? Because, as I understand it, they haven't determined a location for that facility yet.

BELLER: Okay. This is Barb, and I can respond to that.

SHEWMAKER: Okay.

BELLER: On page 15 I have listed three separate licenses. Two of the facilities physically exist. The third license, the 2512, is for the Idaho Spent Fuel Facility, and so that is what we had hired Foster Wheeler to design. And so that license was transferred to the Department of Energy, and we hold that license. But the project itself will be opened for redetermination and alternative analysis. That will be one of the alternatives that we'll evaluate before we go ahead with our project in 2016-17 time frame.

And the Interim Storage Facility is not one of these three facilities. That's separate and apart from this local EM effort for fuel storage.

SHEWMAKER: Okay. So just so I understand, the Idaho

Spent Fuel Facility, along with the facility or proposed facility on the next page, all of those are up for determination to figure out what the best path forward is in the 2016-17 time frame?

BELLER: Right. And the Idaho Spent Facility that's licensed will be one of the alternatives that we evaluate for the new project for packaging spent fuel to leave our state.

SHEWMAKER: Okay, thank you.

EWING: Other questions? Bret.

LESLIE: This is for Barbara. You talked about a spreadsheet for tracking fuel. Is this the spent fuel database that was being run by the National Spent Fuel Program, and what's the status of that database, and--this is a long question--is there a single database for all the spent fuel, and is it being kept up-to-date?

BELLER: Okay. The TRIGA fuel spreadsheet that I alluded to that tracks the history and types of the TRIGA fuel that we have in storage in 603 is our own program's laundry list of what we have that could be useful to somebody someday. That fuel population is included in the National Spent Fuel Program database up through 2011, and the 2011 update was the last formal update that we made to the National Spent Fuel Program database.

So the people that used to be the National Spent Fuel Program are aware that we continue to receive fuel in

Idaho and in Savannah River. We haven’t funded a formal update of that database, so the database hasn’t gone away, but it’s not being actively updated or managed at this point in time. So it’s kind of locked in on the last 2011 update. And we’d love to continue to update so that that information that it took so long for us to develop can be maintained as a useful tool to DOE.

So there’s a plan in the future--although, you know, we have to wait and see if the money comes with the plan--to periodically update that database again. So the problem that we run into as a program is a Quality Assurance Requirement Document, or QARD. Our commitment is to do that type of work to the quality assurance program that was submitted with the Yucca Mountain license application. So when the national program was not funded, all of the QARD procedures and business that would have supported an update went away too.

So nothing is an easy oh-quick-go-do-this-now type of question, but that’s the answer.

LESLIE: Sorry, Barb. This is Bret Leslie from the Board staff, a follow-on. So that database includes not only EM fuel, but it also includes Office of Nuclear Energy fuel?

BELLER: It includes--yes, uh-huh, and other field offices also. It’s primary use was to organize the Department of Energy’s fuel population so that we could be prepared to send material to the repository. So after they went to the effort of collecting information and all the fuel data they could, then years ago they did the grouping and down select, and all the good work that went into the application is really summarized and captured through the database.

LESLIE: Thanks, Barbara. And can I ask one more?

EWING: Sure.

LESLIE: You mentioned the Quality Assurance Requirement Documents. And when there was an Office of Civilian Radioactive Waste Management, the Office of Environmental Management was subject to all of those requirements in terms of generating waste that would be acceptable for disposal. That framework never included the Office of Nuclear Energy.

And my question is to Lance. So what does that mean for the pedigree of any wastes that you are creating? How would DOE or some future organization determine whether it would be acceptable for geologic disposal?

BELLER: Well, I can answer a little bit of it, probably not completely. But we knew that--“we” being the National Spent Fuel Program--that there would be a waste form generated as a by-product from treatment of the FFTF fuel and then the EBR-II fuel also.

So a past member of the National Spent Fuel Program, Jim Lenhart, went out and did, like, an assist study for the MFC facility, the NE program, and developed a paper that they could exist in a parallel universe to the QARD. And if they should choose to follow that system, the likelihood of being able to say that they had a quality assurance program that they lived to and generated a record that could then go to--and they don’t know yet if they’re going to the repository or not.

But this would be the best fighting chance you had of getting your arms around the records and the information you know now. I don’t have that program, so I don’t know if they’ve implemented all of the recommendations and ideas, but I know that they had that type of thought in mind before they went ahead and started producing that by-product.

LACROIX: I don’t have anything to add to that.

EWING: All right. We’re a little bit ahead of schedule, but I think we’ve questioned our panelists in detail. And I thank the panelists for their presentations and their responses.

So let’s take a 20-minute break. We’ll reconvene at 3:05, and this means we’ll be able to get to the poster presentations a little earlier this evening. Thank you.

(Whereupon, the meeting was adjourned for a brief recess.)

EWING: So let’s continue with the afternoon session, and my thanks to Barbara, because here she is again. She’s really working hard for us.

BELLER: I work with a whole bunch of people, though, and a lot of them are out of town. And so there are others of us.

So this afternoon in this presentation I'm going to talk about our aging management system. And we have two different aging management systems driven by the two different regulatory strategies that we have on site, one being the Nuclear Regulatory Commission and the other under the DOE regulatory authority. So there are distinct differences between the amounts of information and, really, the approach toward the analysis for the aging management of those facilities under the NRC or under DOE.

And I think you've seen this a few times.

And this is another map showing each of our on-site dry storage facilities highlighted in yellow. This is the 666 fuel storage basin, the 749 Underground Storage Facility, which, as I stated, was renamed to incorporate not only the underground storage, but the West Valley casks and the pad; the casks are there on the pad. So all that is now the Outdoor Storage Facility.

This is 603 dry storage. This is the Three Mile Island facility that's NRC licensed, and the other is, of course, down in Colorado, the Fort Saint Vrain facility.

That's a complete list of their names and the facility numbers. I'm going to begin the discussion with the NRC method of managing aging of existing storage facilities. We're licensed under 10 CFR Part 72. There is a requirement for a deliberate and specific relicensing activity for each of those facilities that we hold licenses for. Our initial license period for both Three Mile Island and Fort Saint Vrain was 20 years. We will request a 20-year extension for TMI, and we requested and we were granted a 20-year extension to the Fort Saint Vrain license in July of 2011.

Under NRC system, there is a requirement to generate a time-limited aging analysis. So, of course, you start with your safety analysis report. You look and understand right down to a component level of those facilities what are the important safety aspects of the facility to maintain safe and compliant functionality of each of those components for the license period that you're requesting.

So we had to do an analysis that looked at what the condition of the facility was, what did we expect it to be at the time we were doing our evaluation, and project forward in time for 20 years to say, yes, we have enough data, enough understanding, enough evidence that we can understand that those components are going to function properly as expected and as designed for the 20-year license period; compile that information with the evidence that we have through analysis or examination; and send that to the NRC two years ahead of the expiration date of our license. And then their technical experts can review our position that we’ve presented to them and ask us questions, and we need to answer them. And at the end, if we’ve resolved their questions, then they’ll consider granting the extension for the period of time that the licensee has requested.

If the time-limited aging analysis would lead you to see a component that you may need to keep your eye on and study further, then that would be appropriate to enter into an aging management program. So I’m going to give an example in the next couple slides.

And in that you would predict what you would expect to see as you examine that component throughout your license period; and if there is any deviation from that expected condition, then there would be other actions you’d need to take and certainly communicate and let the NRC know if anything is off track in what your component and the behavior of your system is over the license period.

This is our Three Mile Island facility. We had a significant crack in the roof of our horizontal storage module, and this is one of several that we had. We had a severe freeze/thaw cycle out on the roof of our horizontal storage module, which is a Transnuclear system. There was a countersunk area that collected moisture, and it caused the concrete to crack, as you see. The photograph on the left was prior to repair; on the right is following repair. But this system is entered under our aging management program, even though we haven't submitted our license renewal application for the TMI facility yet.

So we identified the problem. We tried to get to the root cause of the cracking problem, so we hired a variety of different concrete experts in Chicago and Utah and around the country. They had good ideas, but for the most part we had a somewhat indeterminate conclusion other than moisture collecting in some of the locations and cracking the concrete. We had to track back through our quality assurance records to understand if it was a problem with the fabrication of the concrete.

So you have to be quite diligent in answering those questions and coming up with the root cause and tried to prevent and communicate with industry what you may have learned from all your research. We recommended a corrective action, evaluated it, and then implemented the corrective action, which is the repair of the cracks with a grout material. And then we also seal-coated the walls and the roof of the horizontal storage module.

In addition to that, in the locations that had this cup that could catch water at the roof of the horizontal storage module, we filled that in and then covered it with a stainless steel fixture so that moisture wouldn't accumulate in that area.

So this system will need to be photographed annually. We go out and make sure that the cracks haven't--that the condition hasn't changed. It's as we repaired it and as we expect it to be, so we take photographs and measurements and document its condition. So that's an example of what is expected of us under an aging management program for our license facility.

We were able to request and obtain some funding from the Environmental Management Program, and with that funding we really focused on trying to develop interrogation systems to develop more information about the condition of our dry storage facilities, both NRC and then our other DOE-regulated facilities also.

So we first purchased a borescope. And as I mentioned this morning, we were able to enter one of the horizontal storage modules through a drain port and fish around in there and get some pretty good photographs of the interior of the horizontal storage module, the exterior of the dry shielded canister.

So one interesting thing that we learned is, mapping is critical so that we can go back in and find the precise location. If we had a question about a blemish or anything that you may see that you need to check back a year later in the future and confirm that its condition hasn't deteriorated or to gain more information and data for further analysis, you have to find that exact spot again. So, you know, everything is more involved and a little more difficult than it looks like on the surface. So there's quite a bit of data collection that goes along with these systems.

I'm going to step aside for a second.

(Pause.)

I forgot to leave these on the table, but I will put them back there. This is a short summary, a write-up, of the technology development project that CWI implemented for us. And they actually were also given an assignment to try and figure out how to examine the condition of a dry storage cask without interrupting the internal atmosphere, so it invalidated a study that we may need to implement.

So I know that you talked or heard about other people may be considering putting casks back in a pool. Well, we don't want to do that, because then what would the research problem be? I mean, you'd invalidate your study or could. So they came up with a pretty exotic kind of, to me, a simple and nice way of getting information from the interior of a cask. They thought about putting maybe a desiccant in the cask also through this method of entering the cask, thermocouples, temperature gauges. We could do some additional work. On our site we could--we have a different compliance strategy than a commercial reactor site would have in that we can build a tent or something that we could perform work in that would be adequate double containment for our work. That may not be acceptable to the public near a license facility.

So that’s the type of work we’d like to continue and advance with to solve some problems that we have and then also could be shared with--you know, the solution with the commercial industry.

So I’ll leave these on the back table, and you can pick up a copy.

The other advantage to our system--these are photographs that we were able to acquire, using the borescope. The other advantage we have with our system is, we have more access to our horizontal storage module than a lot of other Transnuclear systems.

So in the DOE-regulated environment, it’s a little bit more difficult to explain, and it’s kind of a complex matrix of what drives our decisions and our evaluation. So we have a life cycle baseline. Our life cycle baseline describes what our mission is, and it includes the milestones that are in our Settlement Agreement. So in that case, when we look at our storage basin, we’d expect that the mission will expire in 2023. When we look at our dry storage facilities for spent fuel, we assume we have to be out by

2035. So that isn't always perhaps realistic, you know, we don't know where we're maybe going to go. But that is our baseline, that's what we're committed to, that's what we're working to, and that's what we're funded to complete.

CWI, who is our on-site contractor, does system health reports; and that generates enough information and data from the monitoring that they do on site so that they can give us and have assurance for both their company and DOE that the systems that they manage for us are performing adequately. They focus somewhat on their contract performance period. They go beyond that also, and they'd certainly give us any warning if something wasn't going well. But they're committed to their contract performance period.

The next piece is really important to me, and that's the risk management plan. So, in that case, DOE can take the Settlement Agreement date and set it aside--not in reality, but in engineering land we can--and then look at the contracts and say, okay, these contracts don't bridge beyond 2015, but what do we need to worry about and think about and have assurance that we can provide safe and compliant storage if some of these plans don't come to fruition?

So in our risk management plan, there's evaluations of what if our fuel has to stay here till 2048. Not that it will, but, I mean, that's a date that's out there that would show us that the repository may not be available till then.

So, I mean, we can't just throw our hands up and say, sorry, fuel didn't go in 2035, on the day after that our facility doesn't function, sorry.

So we do have this other mechanism to provide evaluation and analysis and request--it isn't funded, but send the system notification if there would be a significant cost out there in the future if one of these risk elements was realized. So there is also that opportunity for the government to kind of get its arms around its long-term view of what could happen.

And I think we've gone over that plenty.

So I'm going to go over the specific facilities and what we do to manage and collect data that really informs our risk management and our aging management program and systems. Start with the 666 fuel storage basin. Of course, it's stainless steel lined, 3-1/2 million gallons. We have storage racks in Pool 6--or storage racks in Pools 1 through 6, mainly stainless steel racks. In Pool 6 we also have aluminum fuel storage racks. There are 30 percent of our fuel positions that are filled in 666.

We have an active corrosion monitoring program in 666. So we look at the pool liner itself. We have corrosion coupons that are in place that we retrieve and evaluate every three years. We monitor and manage the water quality in the basin, and that's an example of something we've had to manage and fund in the last year or so, and it’s an example of what we do with our contracting too. We extended CWI’s contract at the end of 2012 for three additional years.

When we extended their contract, CWI came to DOE and said, “You know, we’re starting to see a trend here. The water quality in the 666 basin is trending so that it’s going to be out of its acceptable levels and limits, and, you know, we recommend that you implement a project to change out that resin bed.”

And DOE at that time told them, “Well, we’ll just keep monitoring, and we’ll keep reading your annual reports. We understand the trend, and you’re predicting that we will need to do something soon, so this is the year.”

So we saw that the chloride level in our pool was increasing, and we had a pretty good debate with ourselves over at EM, knowing that our EM material is out of the basin, how much did we invest in that pool, but we have a lot of other good customers in there that wouldn’t appreciate us letting the water quality degrade.

So between that and then as a risk management investment also, 2023 is our date, but who knows if somebody else may have a future use for that pool, and wouldn’t it be too bad if there would be someone and we wouldn’t let them-- they wouldn’t be able to use it because their resin bed is short of being able to move a program in there. So for a lot of different reasons, we are investing $7 million and changing out the resin. So part of that is disposal of a resin that we changed out in 1998 and did not dispose of and then the current resin we also need to disposition. So it’s quite an effort.

And if you could tour the plant and see where the resin bed is, the ion exchange columns, the tanks that hold the resin, and then the outside of the building and where we have to transport the resin to, those $7 million would make more sense.

We have monitoring of the two 125B casks that are in dry storage in 666, and that’s that NuPac cask, is another name for the 125Bs that has the 208 miscellaneous cans of material. We do hydrogen and gas sampling for those every 17 days in one and every 42 in the other. And that’s driven by the difference in the material that’s contained in each of the casks.

These are the specific ranges that we keep our fuel water quality in these specific ranges. And annually in the report that we get from CWI, they provide trending information to us too, so we haven’t exceeded any of these limits; but we manage to the trend and make sure that we don’t exceed a limit, so we’ve taken action to avoid that by changing out our resin bed.

This is the Underground Fuel Storage, which is now the Outdoor Fuel Storage Facility. There’s 61 first generation storage positions, which, as I stated earlier, was mainly constructed for Peach Bottom fuel storage, and 157 second generation wells, which have a variety of different fuel in them, including some Fermi, some Shippingport, PWR. I think there’s one piece of LWBR Tory fuel, so there’s five different fuel types in the second generation wells.

The monitoring program there mainly consists of hydrogen gas sampling and purging every two years. We do visual analysis of the integrity of the storage position. On the bottom right-hand corner, this photograph shows a picture of what we found in some of the first generation wells, which caused us to take action to build the second generation wells.

So, subsequent to that, we were able to understand where the moisture had come from. We could see that further degradation was not occurring. And with the presentation to the Defense Board to keep them informed of the condition of Peach Bottom fuel storage, we were able to decide to leave the Peach Bottom fuel in the first generation wells rather than go to the risk associated with moving the Peach Bottom fuel and the potential exposure to our workers for not so much benefit. So now we can reuse those second generation wells for other fuel types if the need arises.

The Tory-II fuel, we talked a little bit about that on the bus yesterday, and that’s that odd crushed beryllium oxide fuel that could be saturated. We don’t know. It was in aluminum fuel cans in 603, and those cans degraded over time. We still thought we could figure out how to reprocess the material, or not really figure out, but have time and have funding to implement a flow sheet to process that fuel. It never happened. We repackaged it in another aluminum can in hopes it could. By the third time we put that material in a can, we put it in a stainless steel can and moved it to the 666 basin. Now we had to move it to dry storage, and so it’s in dry storage in Underground Storage Facility, which is 749.

But this has a special accommodation, because the material in that can could be wet. Now, we’re not worried about the fuel integrity, so that’s why we could store that fuel outside, and the freeze/thaw cycle doesn’t mean so much to that fuel. But we did have to fit the lid on our 749 facility with a new lid so that it’s HEPA filtered, so we have a requirement to every--is it every month or week or how often--go out and make sure that the HEPA filter unit is cleared of birds’ nests and leaves and other things that could fly in, so it’s a cleared system.

So the results of our monitoring program show that we’re operating our facilities within acceptable limits. We look at 749, just general maintenance and housekeeping which can help the facility, which is fix paint if it’s chipping, pull weeds if they're there, just maintain a good, clean, well-managed facility, and then, again, hydrogen gas sampling also.

The casks on the pad at 2707, there's a variety of different material in those casks, so we do hydrogen gas sampling. But the frequency, as noted on this slide, changes based on the material in the cask; and to some extent, like the REA cask, the material was put in that cask as recently as--I believe it was 2002. So we emptied some material from the Test Area North Basin and added that material to our cask; so, of course, that's probably--we have to have a more active program. We don't have the data collected to back off on the periodicity of our measurements and surveillance for that specific cask. So that's why you see the different range in the monitoring requirements for the different casks on the pad. The West Valley cask, we also see the presence of Krypton-85, but that fuel is disrupted fuel, so that's not unexpected.

So in 603, this is the indoor dry fuel storage facility and, with 636 storage positions, has a very, very large variety of different fuel and different conditions in the facility. It's quite an array to analyze for criticality safety, so someday we're going to get around to unleashing a criticality safety engineer on the array and see what he can do to optimize it. But it's a Ph.D. dream come true, so we’re looking forward to having that done someday.

We have aluminum, zirconium, and stainless steel fuels stored in the facility. Quite a bit of our Advanced Test Reactor fuel is in this building, about 2,000 elements. The TRIGA fuel, aluminum and stainless steel, both high-enriched uranium and low-enriched uranium are in this facility, among other fuel types.

We have visual examination using a remote camera technique to examine the surfaces of the racks in the storage canisters every four years, and we haven’t seen any degradation that would cause us to need to take action to change out any of the baskets or buckets or racks in this system.

We also about two, three years ago had an event that was kind of interesting to us. We had a rainstorm, and folks came into work one day and saw rain coming into the storage array in this cell. Well, that’s terrible. It’s a moderator exclusion area, and that just can’t happen. So we quickly implemented a replacement or a repair of our roof on 603, but now we are left with a tech spec requirement to really closely manage that system, that roof. We weren’t in any jeopardy of having a criticality issue. The water itself going into the bottom of the facility near the racks wouldn’t be cause for concern. It would be, though, if that water would get into a storage position where the fuel is, and then the--anyway, that's what we would have had to worry about. So they quick fit the storage positions with a compensatory measure, and then we fixed the roof, and we have items to keep track of and to manage that more closely, which we have done since then.

This is an example of some information that would be presented in an annual report, and the graph shows, you know, just a change or an increase that seems to be affected by the month of the year. And so in reports that they sent that CWI or other contractors would send to the Department of Energy with that report, it's an analysis of the data that they send and the raw data, an explanation of why we see what we see, do we have to worry about or take action to correct whatever seems to be an anomaly, or in this case it isn't an anomaly. It has a good technical reason for presenting the way that it does for us.

So I just wanted you to see one example of the reduced data that we are usually reported by the contractor to DOE. And these reports are annual reports, so the corrosion monitoring system, the hydrogen gas sampling, we have reports that are completed for the NRC license facilities, and we send those reports to the NRC.

So that concludes my presentation.

EWING: All right, thank you.

Let's move on to the next presentation. We'll group the questions afterwards for the two of you.

The next presentation is by Roger McCormack.

McCORMACK: --I guess repeat too much. All of our systems fall under the DOE safety requirements. Also, we do not have any of the NRC licensed systems, and so we're required to do the safety health activities just as they're done at Idaho. So I'll just kind of flip through the Hanford systems and kind of hit some high point on what some of the bigger questions/issues are that we deal with.

Again, just briefly, we have 2,100 tons of N reactor fuel in storage at Canister Storage Building, along with a smaller amount of Shippingport fuel stored in multi-canister overpacks. In addition to that, though, we do have an interim storage area that has sundry casks from different facilities around the site that were packaged at different times based on what it basically required at the time at those particular facilities. And, in essence, those systems were all required to conform to the safety authorization basis that we have in the 200 area.

You saw before kind of a picture of the Canister Storage Building. We initiated operations in 2000. Both the CSB and the MCOs have 75-year design lives. There is retained maintenance on various components that we do do vital system safety reviews, annual inspections, on the above grade of components. We do not have an active corrosion monitoring program for, say, the tubes, which probably might be the limiting component as far as long-term storage as far as the facility itself goes.

We basically have--the safety basis has been developed based on analyses for 40-year storage, so we will have to come back at some point in time when we know what the period we really need to be looking at will be and do formal analysis at that time, but at this time those have not been done. So you see a picture basically of what the tubes look like below grade. They are carbon steel. So the analysis would basically say that they should last, like, 130 years.

The Interim Storage Area, which is the cask storage area adjacent to the Canister Storage Building that stores the other fuels, initiated operations in 2002. Storage casks have a design life of 40 to 50 years. With that said, some of the casks actually started their life at other locations as early as 1995. Particularly on the left you see an interim storage cask from FFTF. It does have mechanical seals. We basically have requirements of and enough time to replace seals if it were to come to do seal evaluations for the systems that do have potential replacement. Most of the systems we have are welded, however.

In the middle picture you see a Rad-Vault. We have multiple Rad-Vaults that hold different types of small storage containers. In some cases the containers are welded;

in other cases they have mechanical seals again that we have to go through seal evaluations for. Those systems are opened up, the Rad-Vaults, and physical inspections and rad surveys are done on an annual basis to basically determine if we see additional degradation. One thing we have had to do at a regular frequency based on inspections is basically repainting interim storage casks.

On the right-hand side is basically--what you see is ISO containers. Inside the ISO containers are old NAC NAC-1 shipping casks. Within those shipping casks are welded containers that contain commercial-origin spent nuclear fuel, so we maintain our seal integrity through that inner canister. Again, on a routine basis we will open the ISO containers up, ISO containers actually being the component that tends to need the maintenance, and have to do rad surveys and inspections of those casks on a routine basis.

So that's basically, I think, the thrust of our program. The biggest thing is, we're waiting to see what the long-term holds. Currently we have authorization bases analyses and programs to maintain things through the 40-year period. And that's it.

EWING: Okay, thank you. I'll start with a question to Roger. So are there any restrictions on the fate of spent fuel at Hanford in the Tri-Party agreement?

McCORMACK: No. Spent nuclear fuel does not have a--is not technically a waste, and so it doesn't fall under the purview of the tri-party agreement, the Hanford Federal Facility Consent Order. So there is no requirement from that perspective of having to remove the fuel from site by a specific date.

EWING: And are there restrictions on fuel coming into Hanford?

McCORMACK: There are that relate, I think, more to other waste-related restrictions. I would have to get the specifics for you on what those are, though.

EWING: But you don't operate under a deadline, or are the restrictions similar to what we've seen for Idaho?

McCORMACK: No.

EWING: Okay.

McCORMACK: I mean, we do have to comply with NEPA and all those good things, and currently there is no decision that would have us receiving any additional material. In the past there's been other issues with other waste materials that has been used as leverage to keep other--even spent fuel inventories coming into the site.

EWING: Okay, thank you.

Board questions? Jerry.

FRANKEL: Jerry Frankel of the Board. Barbara, so having missed this tour, I'm struggling to understand the design of the different facilities. This Irradiated Fuel

Storage Facility is indoor?

BELLER: It’s an indoor dry storage facility, so--

FRANKEL: Is it underground?

BELLER: No, it’s above ground. So there’s storage racks, and in the racks there is--

FRANKEL: In air?

BELLER: In air. And the cans are not sealed in this storage horizon.

FRANKEL: So what does corrosion potential of racks or canisters mean? How is it measured? I mean, what is--these things are exposed to air.

BELLER: They are exposed to air, so we have cans that were in that atmosphere for years that we can retrieve and look and measure and see if there’s been any corrosion over the years that that can is sitting there. And now we’ve--it was probably two or three years ago--we have one storage port that we have fit with actual corrosion coupons that replicate the condition in the balance of the storage array, and then those coupons we can retrieve and analyze periodically.

FRANKEL: Right, right. The coupons I understand, but the corrosion potential, you talked a lot about corrosion potential. So I don’t understand what that means for samples exposed in air.

BELLER: Well, there wouldn’t be much, but we’re kind of duty-bound to--

FRANKEL: You’re not the person to ask on this, so let me move on to--

BELLER: Well, I can--if Allan can help me--he’s here. He can probably explain better than I am able to--if you want to, Allan--or if there’s someone else, we can take the question and take it home and get you an answer.

CHRISTENSEN: Allan Christensen. And what we’ve done for all of our dry storage facilities is to really take a hard look at the environmental conditions that could increase corrosion rates there. And a lot of it has to do with the materials of construction and the kind of humidity, moisture levels, that they can see. We go to a lot of effort to try to find out how corrosive these things are, and then what we’ve done is we’ve developed corrosion monitoring plans based on that potential.

So we have plans for all of our facilities. All of them involve corrosion measurements, various types, inspections of certain coupons that we do not destroy and return back to their, you know, storage place. And then we also do inspections. And then what we do is we look at those based on our original estimate of the corrosion potential for a facility. We’ve done that for 749 and the IFSF.

FRANKEL: So, sorry, when you say corrosion potential, that’s like the potential for corrosion to occur?

CHRISTENSEN: Yes. I’m sorry, but what we do is--

FRANKEL: Okay, so that clarifies everything. Thank you.

CHRISTENSEN: What we do is we just say what could happen, what are the corrosive media, what are the temperatures. Temperatures plays a huge role, so we look at temperatures of storage as well.

FRANKEL: Thank you. That’s clarifies everything. But I have a question about another facility, so the Outdoor Storage Facility, OFSF. So they’re in the ground; right? So--

BELLER: Yes.

FRANKEL: But somewhere you’re talking about cathodic protection.

BELLER: Yes.

FRANKEL: What are you protecting then?

BELLER: The ports that are actually underground that the fuel is then stored in. They are carbon steel. And so we have a corrosion--

FRANKEL: Which is buried in the ground?

BELLER: We have a cathodic protection system that--

FRANKEL: I see.

BELLER: Yes.

FRANKEL: Okay. So it’s not the canisters but the ports, the structure?

BELLER: Yes.

FRANKEL: Right, right. Okay, thank you.

TURINSKY: Paul Turinsky, Board. Are you monitoring anything with regard to the fuel performance in dry storage other than off-gases? Do you ever open something up and actually look at it and see--

BELLER: We could because our canisters aren’t sealed.

TURINSKY: Right, but, yeah, it isn’t--you could, but have you?

BELLER: Our hobby in life, it appears, is moving fuel from one facility to another ad-nearly-nauseam. So we have handled, like, 3,1886 units between 2005 and ’10. So we have a lot of opportunity in just normal course of doing business to look at the fuel and understand the condition of the fuel.

But as far as what our disposition is for fuel, it is all going into a standardized canister, and so we don’t worry as much about the integrity of the cladding and other things as maybe a commercial fuel site would. A lot of our fuel has been intentionally disrupted or, you know, it’s--I know that there’s a lot of differences in the commercial fuel, but you wouldn’t believe what we have.

McCORMACK: Part of the view we’ve had is that we will inspect the fuel when we put it--the fuel that stay in the storage cask outside will go into standard canisters under the current plans. The fuel will be inspected at the time they’re loaded into the standard canisters.

BELLER: So we're worried about, from a budget and a schedule and a timing for fuel handling in the future, to get it into a can. So when we were looking at development of the Idaho Spent Fuel Facility, the first group of fuel that we assigned to the contractor was--well, it was the Peach Bottom, TRIGA, and Shippingport fuel, and it was high-integrity fuel that we had really good records and paperwork for. We thought if they picked up the piece of fuel, it wasn't going to fall in half on them or any of that kind of--but there's fuel in the future that's going to be extremely time-consuming and difficult for us to package, so we had an area in the hot cell that we could envision having a sorting table or some type of a process to handle in the future.

And so what we worry about as far as fuel condition is the time it's going to take to disposition it in the future, not so much what is happening to it while it's sitting there. It's contained, and we have criticality safety evaluation that cover the eventuality of it being disrupted in place. So--

EWING: Mary Lou.

ZOBACK: For Barbara three, I think, easy questions, straightforward. When you were--and I can--the CPP-749--I don't know what its real name is--you show, to me, a dramatic picture of gunk on the bottom of the canisters. And you said that you transferred some, but you said, no problem, it's not going to happen again, or it’s no longer occurring; how do you know that?

BELLER: We continue to inspect those locations. And the issue that--or the moisture that infiltrated those storage positions, you know, the reason for that is well understood. The integrity of the system, well, as I said, we monitor and continue to evaluate.

So we did build in the 1980s a second generation of storage wells that is a bit of a different design than that first generation was. Once those were completed, we demonstrated that we could move some of the Peach Bottom fuel over to the second generation of wells and then, after we did some other things with the first generation, decided that it wasn’t necessary to move those fuels.

ZOBACK: Okay. So these are things that are stored outside to be--

BELLER: They’re below grade outside.

ZOBACK: Below grade, but to the elements. And whatever allowed the water to get in in some of those first generation will never happen again anywhere else?

BELLER: Never happen again. 10^{-6}?

ZOBACK: Never answer “all” or “never”.

BELLER: Okay. You know what, I can ask Randy or Allan to answer that, too. They’re in a stable condition and--

FADELEY: Let me try--we actually assume the presence of water in that storage--I’m sorry, this is Randy Fadeley. I’m the CWI/INTEC chief engineer. Yeah, we assume the presence of water in that storage location. And the picture you saw was actually the storage rack; and when we removed them--you know, we had that picture, and, you’re right, it does look kind of ugly. But when we did remove them and we took an up-close-and-personal look, we went, gee, this really isn’t as bad as what we thought.

So we were able to gather some real data and convince ourselves that it was okay to leave them there, that it was not going to be a problem to remove this material just based on that corrosion in that period of time. But we anticipate that there is going to be water in that area.

ZOBACK: Okay, I think that’s the answer. Okay, then my next questions are related to CPP-2707, which is the piece of concrete with six casks. Oops, nope, I have a Three Mile Island question first. That’s the one that had the cracks in the roof, the concrete roof?

BELLER: Yes.

ZOBACK: Is that roof flat? I seem to remember it was totally flat.

BELLER: It’s a flat roof, yes.

ZOBACK: I wouldn’t build my house that way, but okay. Let’s go on to the six casks standing like sentinels on the concrete pad. What’s the purpose of that? What’s the experiment that you’re running?

BELLER: The casks were from a variety of different vendors.

ZOBACK: Right.

BELLER: And the experiment was run for EPRI and the NRC. We demonstrated dry fuel storage of commercial fuel in a variety of different casks. So they were instrumented with thermocouples, and we collected a lot of information and data on the fuel in storage. And it was a technical basis for the NRC initial 20-year license period for commercial dry storage systems.

ZOBACK: So it was to show that they stood up to the weather, they stood up to the internal heat inside, they didn’t let water in?

BELLER: That the fuel in dry storage could be safely stored in a dry cask for--and then they were trying to set a period of time, a conservative period of time, so that they could issue a license to commercial fuel storage facilities and have assurance that they knew what the performance of these systems would be to ensure public safety.

ZOBACK: So the experiment is completed now on the data that you needed?

BELLER: Yes, uh-huh.

ZOBACK: Okay, thanks.

BELLER: And the fuel that we had years ago was low--or it wasn’t high-burnup fuel, so other people talked about high burnup fuel experiments and the need to do some more work. So, you know, it’s kind of an extension of that original question we answered. But the fuel is a bit different or how the fuel has been used in the reactor is different than with those original experiments.

ZOBACK: So I understand it’s low-burnup fuel, not high-burnup. Was there ever any discussion of, okay, we’ve got them, they’ve been sitting out there for a long time, why don’t we open one up and just see what it looks like?

BELLER: I think there’s a person that has an opinion back there.

EINZIGER: Bob Einziger from NRC. Those casks were originally loaded in order to confirm the radiological and thermal codes. There was a variety of fuels put in, and there was a variety of cover gases, and they were put into various configurations to determine thermal and radiation profiles and to benchmark codes.

They sat out there on the pad for a long while; and when the storage looked like it was going to be extended, they decided it would be a good idea to open one of these casks up and look at the fuel. And each of the casks were looked at, the records that were available. And I say “were available” because at that time records retention was only ten years, and most of them had been thrown out just prior to when we decided to look at them. And those casks--one of them, the CASTOR cask, was opened up, the fuel was looked at, and, as was mentioned, that cask was--that was the basis for the licensing for the low-burnup fuel.

ZOBACK: Okay. So is there a report somewhere that we could see?

EINZIGER: There is a NRC report; there is an EPRI report; and Mike Billone and myself have a paper in the Journal of Nuclear Technology describing those experiments.

TURINSKY: Bob, where did they open it up?

EINZIGER: Oh, boy, let’s see. I think it was in the mid-’90s.

TURINSKY: No, where? Where?

EINZIGER: Idaho. At that time--

TURINSKY: No, no, but, I mean, you don’t open a cask and shove your head in, right, with your instruments?

EINZIGER: Oh, actually, I know some people that may try that. No, at that time the DOE had this beautiful facility called the TAN facility, which had a big hot shop where they could actually take the cask and drive it in and open it up and pull the fuel out and examine it. But that facility, I think at $2 million a year preservation, was deemed unnecessary and destroyed, so we don’t have it now.

ZOBACK: Can I just ask, Bob, that you get references to us on that, like where we’d find the paper and stuff?

EINZIGER: I’ll send something to Rod.

ZOBACK: Yeah, thank you.

EWING: Okay, thanks, Bob.

Other questions from staff? Okay, Bret.

LESLIE: Barbara, this is Bret Leslie from the Board staff. My understanding was that the Fort Saint Vrain facility is very similar to the 603 facility; is that a fair statement?

BELLER: Generally, yes, uh-huh.

LESLIE: So in the license renewal for the NRC facility, they asked you or they required you in that renewal license to look at things that aren’t readily visible like you are doing in 603. So the technology for looking at the degradation of the charge faces, which is the roof of the vault, so to speak, is that being done at Fort Saint Vrain? Is that same technology applicable and could be used at 603? And maybe you’re not the right person to answer that question.

BELLER: The actual structure, the charge face, at 603 is different--or I’m sorry, at Fort Saint Vrain--is different than what we have at 603.

LESLIE: So you don’t have a comparable geometry where you can’t really observe the degradation?

BELLER: But there is a need to do visual inspection at both of the facilities; so with the borescope system that was funded by the Environmental Management Program, we actually took it down to Fort Saint Vrain and went in through our collimator and were able to see underneath that charge face some of the fuel storage canisters. We weren't necessarily looking for anything when we used the equipment to go in. We just needed to demonstrate that we could get in there and look, so if we had a future need to or after that technology was further developed, you know, we would use it for both visual examination of our casks on the storage pad, the V/21 in particular. We could use it at 603, 749. You know, once we had that capability and as we continue to keep fuel in storage, there's a lot of opportunities to need to look and examine the condition in storage.

LESLIE: I'll ask another question while Jim gets Barbara's presentation up.

Could we get Slide 8 of Barbara's presentation?

And in the meantime while he's doing that, I'll ask you a different question, Barbara, which is, you talked about system health reports being an initiative of looking at aging management for extended periods of time, but you said it was tied to the performance of the contract period. Well, at this point that period is only looking at three years; is that right?

BELLER: Yes. They're mainly, of course, you know, more concerned with their own contract performance period. If they would note a trend, I mean, that type of information is given to us so that we can have plenty of time to react. So they don't just arbitrarily cut off and say good luck with this on October 1st of 2015.

LESLIE: Okay, so--

BELLER: But I just needed you to understand that there's different focuses that are driven by our contract, by our life cycle baseline, and then by a risk management plan. So you have to really understand what question you're asking of what document and why the answers might look a little bit different depending on what system is answering versus the NRC, which is an intentional plant a stake in the sand out here 20 years or 40 or whatever number in between zero and 40 you might choose and analyze to that point and convince us you can get there. So the approaches are different between the two.

LESLIE: And you kind of described a few things on here. The borescope is obvious. What are each of these little figures showing? I thought the one next to the borescope might have a baseball in it. You know, there's a round thing. I mean, I really don't understand what I'm looking at.

BELLER: Okay. The borescope is at the top left. The photograph next to it is the light on the tip of the borescope so we can send it into dark crevasses and inside the horizontal storage module and get photographs of what we may see in there. So the left-hand side, really, is the borescope. The top right-hand picture is a mock-up of a system that was developed by CWI for interrogation of the internals of the cask, and we actually did a demonstration of the mock-up system on the V/21 cask out at the site.

And so they were able--they have a port in the cask, so they were able to show that they had designed a system that would allow them to put thermocouple or desiccant or any number of small tools into that cask for interrogation of the internal of the cask. And you can get data on both the cask performance and--oh, thanks.

And then this system--I didn't point out--this is the rear portion of our Three Mile Island horizontal storage module, and this is different than you'll see in Transnuclear systems, because we have a HEPA-filtered system. We inspect that system, the gaskets, to ensure that the off-gas is filtered through the HEPA filters that are affixed to the back.

But that might be an opportunity to do examination of the internals of this system as we head toward relicensing that other systems and commercial industry may not always have.

LESLIE: And the one on the bottom left that looks like water running down the inside of a horizontal module?

BELLER: That is inside a horizontal storage module, yes.

LESLIE: Thank you.

EWING: Thank you very much. I think we'll move on to Barbara's next presentation before she expires.

BELLER: I like sitting.

EWING: You can give the presentation there.

BELLER: Maybe I will sit.

So we are asked to talk about transportation systems. And, really, transportation for fuel out of the State of Idaho isn't an assignment that EM has. What we need to do is package our fuel so it can be transported out of state; and somebody is going to come with a transportation system, more likely rail-based than not, and what we have to do is load our fuel into that storage system, and off you go to somewhere.

So I thought it would be interesting to let you know what we do for TRIGA fuel receipt in Idaho, and then there might be something you can take away from the work we do and the documentation we collect to receive fuel for interim storage and then, really, to collect up enough information so that we can know what we're packaging in the future and then design a system for that.

So, really, the cornerstone of our program, as we've talked about several times today, is the DOE standardized canister. So, as Brett explained this morning, that's a key component to the Part 71 future system. It's critical for an interim storage system and then also important in our baseline for disposal. It's in the Yucca Mountain license application, and we'll continue with that assumption for the DOE population of fuel.

So I'm kind of switching gears now. We perform a fuel examination of fuel--TRIGA, foreign and domestic research reactor fuel--before it is accepted at our 603 facility for storage. And the reactor operators have a lot of information about their fuel. Before we go, they can tell us that some of the fuel has failed. It doesn't mean it's in a heap on the bottom of the pool or anything, but the cladding has been breached maybe through a sip test or some other method. They are able to inform us that that fuel is disrupted.

So we place that fuel in a failed fuel can, which we build and is specifically intended for storage in our 603 facility and is compatible for shipment in the NAC LWT cask. So it's also included in the certificate of compliance for that cask.

We usually take a couple trips to the reactor operator site, and the first trip is usually just to acquaint them with the documentation that will be required of them before they ship their fuel to us, so help them get into their file cabinets and pull out all their operator records. And we have become--I can't think of a better word to use, but we love documentation. And we know that if we don't get it now, we're never going to have it. So the more, the better. And so we collect all of those records and bring it with the fuel.

The other thing that we understood when we started working on the Idaho Spent Fuel Facility is how many packages will it take to package TRIGA fuel. You can do a criticality safety evaluation. You can understand, if we're fortunate enough to be able to build poison racks, you know, you can do all those calculations, but in the end it might be a physical constraint, you know, bowing or some other problem with the fuel that would restrict how many fuel elements would go into each individual can. So we started to understand and need to know the condition of all the fuel that we receive.

So part of the inspection trip we take is something as simple as a straightedge. We have a camera system, and at each of the reactor sites, before we receive their fuel, we take a camera, and every single element has a videotape associated with it with a narrated version--which is really a thrill to hear--of every fuel element going the entire length of the element and 360 degrees so that they can describe that element by element number, so in the future we have a good reference for what we're going to run into and what we need to package in the future.

And the other interesting part is, even though the certificate of compliance for shipping that fuel may define that fuel element as good to ship, we have our own criteria, which is a lot of times more stringent for storage, because we project out into the future and say, “That scuff on that element, you know, what’s that going to look like in 10, 15 years?” So if we have any doubt in our mind, we package that in a failed fuel can, too.

We ensure that the individual fuel identification number can be read, and every now and then there is an element that you can read a couple numbers and not all, so you have to go back into the records and give yourself certain assurance that that element that you’re picking up, by process of elimination or better scrutiny or cleaning the element off a little bit, has been identified and the record for that element is also transmitted with the fuel shipment to Idaho for us to have.

And I talked a little bit about projecting into the future. I have some photographs at the back of the presentation, which are examples of elements that were not called failed fuel by the shipping vendor but we packaged as failed fuel for interim storage at our site.

We work a lot with the reactor operators in making sure that they understand why we need to collect all the data about their fuel that we need to. We do independent calculations; in fact, we have BEA help is with some of those calculations to support our own safety basis in our 603 facility.

The only cask that's available in our safety basis right now for 603 is the NAC LWT cask, but that's only because that's the only one we need to use right now. The facility has been evaluated and has received much larger casks in the past, and we could introduce those back into our safety basis. So don't think of that as a limiting factor for our facility. We could analyze other things for receipt.

Before the shipment is sent to Idaho, there is a tamper-indicating device that's affixed by the Material Control and Accountability group, which is with another contractor with BEA. And then when that cask arrives at our site, that same individual comes and takes the tamper-indicating device off and records that it was affixed to the cask, which gives us assurance nobody took anything out or slipped anything else in that shipment. So that's what the reason for the tamper-indicating device is.

And then these are just some photographs over all the years that we've received fuel, the types of damage that we've seen. It looks worse than it is because these are blown up. But if we see any indication of a nick or a gouge, that would be--that fuel element would be a candidate and has been put in a failed fuel can for storage in Idaho. And the TRIGA fuel is both aluminum and stainless steel, so most of the damage to fuel that we see is aluminum fuel.

So these are just photographs of what the inspectors saw. That’s a little bit of a bowing in a spot. And you can see next to this fuel element there is a straightedge ruler, so you can identify the exact location on that fuel element where the imperfection is so that in the future we can--if we need to understand or want to analyze that fuel element and how it performed over a period of time in our storage facility, we can go back and find that location and see what it looks like 5, 10, 15 years from now.

And they make note of what they thought they saw, you know, if they can figure out probably what that problem was caused by. You know, maybe an element was dropped. A reactor is a pretty brutal environment for fuel to be in, so it has--it’s marred up sometimes in just normal operation. That’s another example of the specific location on the fuel element that there was some damage.

So we also bring back all of the information that we’ve gleaned from that site to the analysts back at our facility so they can look at the safety analysis report and our current safety basis and see if there is anything that’s out of the ordinary with the fuel that is intended or scheduled to ship to our site. So, of course, the earlier we can go and begin to talk to and build a relationship with the sending facility, the more time it gives our analysts to be able to do all the work to--sometimes we have to change our safety analysis report. Most of the time whatever we receive is already allowed in our safety basis, and we don’t need to change our safety basis. But the sooner you know that, the better.

They look at any special needs at the facility. We help and suggest and work closely with NAC and help the reactor operators understand how to load the fuel. We don’t do that work for them; but because our people have gone and done this several times, sometimes we can make some real helpful suggestions that can save those sites quite a bit of money.

Any special equipment that’s required you can arrange to have fabricated and take with you when you go so the operation at a domestic or foreign research reactor can be scheduled and done in a more efficient time. A lot of times if we go to a university, they want us to get in and out during spring break or, you know, some set amount of time. Don’t come during a football game, and don’t come final exam week. So you really have to work hard and it’s best and very much appreciated if we can do all this front-end, helpful, lead-in work to the actual day that we do the fuel loading.

The other thing is, if there's any changes that need to be made to our procedures, we can make that ahead of time. We receive about, oh, one foreign or domestic research reactor shipment a year; so our operators need to be reacquainted with the procedure. I imagine that when we start receiving fuel again--we can't receive any foreign or domestic fuel right now, because we have a Settlement Agreement requirement to treat our sodium-bearing liquid waste. Because we haven't done that in accordance with our Settlement Agreement, we suspended fuel shipments into the state. Once we've completed that processing, there are some reactor sites that are kind of lining up to need to send us material. So the year that we start back up, we might have two or three shipments in that year. But a typical year is one or two shipments.

And, generally, one cask load is about one storage port in 603, more or less; and it's about a week or two to receive the cask, unload it, and put that fuel in storage.

And that, I think, is the last you're going to hear from me.

EWING: Thank you. You made it.

So questions from the Board? Yes, Jean.

BAHR: Jean Bahr from the Board. Barbara, could you describe what a failed fuel can is physically and how it's handled differently once it gets to you and those sorts of things?

BELLER: So it’s the cladding on the TRIGA fuel element has failed, which is--it’s a term that--it isn’t hard to achieve failure of a fuel element.

BAHR: And I understand what you mean by what is failed, but the can that you put it in, what does that look like, and how do you--

BELLER: It’s actually just literally a can.

BAHR: What’s it made of? What’s its diameter? How do you seal it? Do you ever open it up again? How does it go into the baskets with other fuel?

BELLER: It’s sealed during shipping, and that’s in compliance with the NAC LWT cask requirement. When we receive the failed fuel can in our 603 facility, we vent that can for storage in 603. So there is an operation required at the lid of the can to open up--it’s like a set screw on that can--and allow the venting to take place. But it’s just literally a piece of channel made into a can with a lid. It doesn’t have a--

BAHR: Is it made out of stainless steel or--

BELLER: It doesn’t have a screened bottom. Years ago we were able to ship failed fuel with a screened bottom in the can, but the NAC certificate of compliance won’t allow a screened can anymore. It’s stainless steel, I believe.

BAHR: But does the failed rod stay in that particular can forever, or do you take it out and move it into other things?

BELLER: It stays in the failed fuel can; in fact, the failed fuel can, there's a basket that the fuel is received in. Other non-failed fuel elements can be placed in that basket. The failed fuel can takes up a little more space in the basket than if it wasn't in a can obviously. When that fuel is received in our facility for unloading from the cask, we take the whole basket with the failed fuel can in and move it to our dry storage facility. So we don't take the fuel out of the failed fuel can. They're in storage in our facility in those cans.

BAHR: Thank you.

EWING: Paul.

TURINSKY: Paul Turinsky. Can you describe what infrastructure you're going to have to develop for shipping all this fuel that you're supposed to have out of here by 2035?

BELLER: In the scope of work for our Idaho Spent Fuel Facility, which we're going to have a relook at and another run at in 2016, we'll need to provide part of a rail system from our central facility area to INTEC, which is the site that you went to yesterday. So that's a couple miles of rail. So that's an important piece of infrastructure we'll need to supply. We need to have cranes. But the system that we would need for offloading into a new shipping cask supplied by others is about the same type of system that we would require for receipt of on-site casks to take the cask from our existing facility off a truck and process the fuel from it through a hot cell.

So over the course of a few years we've looked at this building, and in the last review that we did a year ago we--up until then we had shared the ship-in and ship-out portion of our facility, because we could improve our schedule by separating those two and allowing those two unique functions to have separate cranes and separate bays for shipping in and shipping out. We have added to the project baseline. So, I mean, what you really need is a cask to put the standardized canisters in, a good crane to get them in place, and a rail system to efficiently ship the cask out.

We also look at the first few shipments maybe by truck, so we'd be able to load those casks, too, but, again, just enough room with a big enough crane to be able to lift a cask and put the standardized canisters into that storage cask, put the cask lid on, and off you go. So--

TURINSKY: And when would you have to start shipping to get all this stuff off site?

BELLER: Well, first you have to repackage it all. And we have, oh, I can't remember how many canisters, 1,100 or so. But there's a lot of fuel that can go in each of the standardized canisters. If we have to have it all out of state by 2035, it really is dependent on how many casks is the system going to be able to afford to procure. I mean, if you had several--you know, a lot of rail casks, you could ship a lot of fuel off of our site. Then it goes back to how fast can we process the fuel to have a rail cask shipment ready to ship.

So part of our dry storage--part of our project is to have 300 dry storage positions so that when our project gets up and running, we can have enough fuel that's packaged that we have a little bit of lead-in to the shipping cask timing so we have fuel staged and ready to go when they show up so the shipping cask doesn't outpace our ability to package the fuel for shipment.

FRANKEL: Jerry Frankel. So, Barbara, you showed examples of and discussed procedures for fuel rods that have small dings or bulges or pits or gouges. So have you had cases that are much more severe, so damaged fuel where the cladding is severely compromised, and are there procedures for that?

BELLER: Not the TRIGA fuel population that we've picked up. That's a pretty representative example of what we've seen and needed to repackage. Our own fuel on site, of course, is a different story, because some of them we've intentionally destroyed.

FRANKEL: So are there procedures in place for handling those kinds of fuel rods?

BELLER: Yes, uh-huh. And those are--well--and I always get out the same example again, because it really represents the most disrupted end of the spectrum, and that's the crushed beryllium oxide fuel. And that was crushed off site, and it was put in a can, and it's been canned in a different can with higher integrity stainless steel. And that fuel is in storage in 749.

EWING: Other questions? Mary Lou.

ZOBACK: Yeah, Barbara, questions about the photographs, and this is just my lack of knowledge about a TRIGA reactor. Are these fuel rods--photographs of individual fuel rods?

BELLER: Those are the fuel elements, yes.

ZOBACK: Okay. And so in a TRIGA reactor they're not bound together in some kind of a--

BELLER: Oh, they are, but this is an individual element that has been removed from the reactor that's being prepared for shipment to us.

ZOBACK: So they remove them one at a time? They don't just pull out a whole assembly?

BELLER: Yup, one at a time. They take the fuel from the rack, and then we examine it in their pool.

ZOBACK: In their pool?

BELLER: Yes, in their pool.

ZOBACK: Oh, okay.

BELLER: And so before we receive or before we allow that element to be shipped, it has to be packaged so that it meets the requirements of our 603 receipt facility. Once it's received at our facility, we only move it from the cask into storage. We don't do any other work or repackaging or we don't rethink the situation. Once it arrives at our facility, it's all prepared to be received at the reactor site.

ZOBACK: So every foreign or domestic research reactor that's going to ship to you, you have personnel that go there, and one by one you look at--you pull out each individual--

BELLER: That's correct.

ZOBACK: Okay.

BELLER: And the fuel that we ship to Austria, it was very lightly irradiated. But before the Austrian reactor operators accepted our fuel shipment, they came over to Idaho, and we said, "We know what you're going to want to see. We can help you understand the condition of the fuel before you accept it for us." So, of course, this wasn't in our pool, so we had a viewing window and set up something similar to what the same people do at a reactor site in a pool with a straightedge, and, boy, they could get any view of that piece of fuel they wanted. And once they said yup, we tagged that one and put its number on their sheet of paper, so--and they spent a good month with us.

ZOBACK: Wow, really?

BELLER: Uh-huh.

ZOBACK: Thank you.

EWING: Questions from staff?

LESLIE: Bret Leslie, Board staff. Sorry, so many questions. So can you remind us who had the responsibility for providing the transportation casks? Was that the Office of Civilian Radioactive Waste Management? And if it was, then who currently has that responsibility in the DOE structure?

BELLER: Originally, years and years ago, that responsibility was assigned to Idaho, and the National Spent Fuel Program had a part in development of the cask system. And we were looking for the exact program document that changed the responsibility and moved it from Idaho to a different office at headquarters, and we got in the--I think the 2003 time frame--but I'm not sure that's the right date, but in that neck of the woods--that responsibility was moved from Idaho to headquarters and to the OCRWM program. My understanding is, once the OCRWM program was dissolved, the assignments that were originally given to that program went to the Nuclear Energy group. So I would imagine that's where it resides now, but I only know it’s not mine.

LESLIE: Thank you, Barbara, for all your answers.

EWING: Other questions? Board? Staff?

BELLER: I think Brett had one.

CARLSEN: I want to get to the private citizen area.

EWING: Okay, we’ll have the public comments in just a moment. So other questions for Barbara?

So, Barbara, I want to personally thank you for your perseverance and cooperation today and yesterday, and I want to thank all of the Idaho staff who have hosted us and been so responsive to our many questions. So thank you very much.

So now we’re still ahead of schedule, but that will allow us to have a look at the posters. And so we’ll enter into the public comment section. I don’t have the sheet, but you’ve signed up, Darryl; right?

CARLSEN: I have one comment--

EWING: One comment? Okay, please, and identify yourself, please. It’s just the one?

CARLSEN: Right now this is Brett Carlsen, a private citizen, speaking. And I have to ask the question that I think needs to be asked. Does anybody have any idea where this fuel is going to go to meet the 2035 agreement? And I think I know the answer to that, but I have to ask the question. And the follow-on question is: Assuming that that place will be available and that’s the assumption we’re making, has anybody looked into when do we need to start shipping in order to achieve that date and what infrastructure will need to be in place in order to make that happen?

EWING: Okay. The Board won’t provide answers today, but I think your question--

CARLSEN: Well, I guess that question can stand; or if anybody from DOE would like to take it, I would be interested in their insight on that.

EWING: Thank you.

Are there any takers?

(Pause.)

All right, thank you. I mean, your questions are right to the point and certainly framed the thoughts that the Board will--

CARLSEN: And I don’t ask it facetiously. We’re all trying to get there, but it’s hard to put a legitimate plan together without addressing the obvious.

EWING: Okay, thank you.

So, Darryl.

SIEMER: I guess I’ve introduced myself before. I’m a private citizen these days.

EWING: Give your name so that--

SIEMER: Oh, Darryl Siemer, right, yes, okay. Now, I gave you a rant, I think, two years ago about the sodium-bearing waste facility, predicting pretty much what happened. By that time it was about thirteen times over budget and well behind schedule. Well, it’s two years down the road now, and apparently DOE is--it’s extended the contractor--the responsible contractor’s contract by three years so that it could take another shot at it. The deadline now is the end of this year, and it hasn’t started yet. I don’t know that anybody is going to have enough courage to actually pull the handle on it, because once that thing goes hot, then all of a sudden it’s another giant boondoggle, a nuclear facility decommissioning facility. It’s not something you can work with anymore.

So it looks like the rest of the--I’m getting to the other part of high-level waste, and that’s the reprocessing waste. And there’s a reason for it. If you look outside right now, there is no sun, and there is no wind. Now, we don’t have fuel beds right here, so we can’t frack our way into free energy here. And we are absolutely dependent on fossil fuels, and the world seems to be getting more and more dependent on fossil fuels. We are fighting wars over it. I think the latest figures would come to about $7 trillion, maybe $8 trillion, to support our presence in the Middle East, which is all about protecting our oil. This creates wars, of course.

In the 34 years I've lived in Idaho, I've seen the climate change. It's really changing. The river behind my house--I live north of town--doesn't have trout in it anymore. It gets a little too warm during the summer. You hear the magic--you know, there is a tipping point in nature; and when you reach it, things change suddenly. I think we're seeing a tipping point in Greenland. It's really going down in a hurry. So is the Antarctic.

We can be--our children, let's say--I'm old enough, maybe great-grandchildren by now--might live in Mad Max's world, and it'll really be driven by the fact that we have become totally dependent on fossil fuels and refuse to do anything about it. Windmills won't solve the problem. When we sail a ship across the ocean, it's not a windjammer anymore; it's powered by diesel fuel. We don't have a substitute. And as far as I can see, we're not even looking for one.

As far as generating energy within this country, it's a cross between coal and now fracked natural gas. Now, one of the things about fracking is that we used to feel fairly confident--at least I did--that if we had a borehole down in the earth somewhere, we could put stuff down there, and nobody would bother it. I'm not confident about that anymore, because the way we behave, we're probably go down there--regardless of what we put and where we put it, somebody is going to go down there and crack up the earth and free up whatever is down there for their benefit. Maybe they have forgotten that that's where we put our repository.

Again, the other part of high-level waste, it's that which is generated when you implement a sustainable nuclear fuel cycle. And we need a sustainable nuclear fuel cycle, not more of the same. It has to be fundamentally different than the one we've got.

There's two ways of doing it. Both involve breeder reactors. There is the way that the DOE has spent something like 96 percent of the resources devoted to sustainable nuclear fuel cycles, and that's the liquid metal fast breeder reactor. The other 4 percent was spent on molten salt breeder reactors that didn't work on a plutonium-uranium cycle; they worked on a thorium cycle.

And they don't generate long-life transuranic waste. They're not dependent on spent fuel or on solid fuel elements that have a limited lifetime in a reactor crack. You get these little cracks in the darn things, you have to pull them out. They're not mostly uranium, which, of course, grows in plutonium and other minor actinides, enough to make waste disposition very difficult, but not enough to make reprocessing worthwhile.

The world has--well, some countries have reprocessing facilities. They're non-economic with today's fuels. We need to totally switch the system, and it has to be much bigger than today's. Right now this country has a hundred nuclear reactors. To replace its energy demand, we'd have to have something like 1,500 of the same size. Now, we could be totally clean and green; and if we're done with the right sort of reactors, it really would be green, and it really would last forever. But we're not doing anything about it.

Now, any breeder cycle, whether it's molten salt, whether it's liquid metal fast breeder--we call that the IFR--it's going to require reprocessing. You do have to take the fissile that you're generating and put it back in the reactor. That's reprocessing. There's easy ways, and there's tough ways. What we're going to be seeing in there is the tough way. That's what the presentation is all about. But that's what the money has been spent on, so that's what you're going to be hearing about.

But in the long run, if we're actually going to address these problems, live in a clean green world where the power is cheap enough that everybody can live with a high standard of living, and we quit polluting the atmosphere, then we're going to have to have lots of reprocessing, which means we are going to have to address reprocessing waste management efficiently and honestly. To this point, we haven't done it, and this site is a prime example of it.

Now, I've sent a rant, I guess--but, anyhow, it's a slide set--as if I had an hour to present everything I want to say, but you guys can look at it at your leisure. But the bottom line is that the DOE's approach--and it's aided and abetted by the people that are supposed to advise it, that do whatever DOE wants them to do, puts on whatever blinders people want to wear. Today the blinders are, let's only look at the disposition of dry spent fuel. I mean, that's what we heard all day. There were hardly any technical questions or answers in the whole discussion today, and this is a technical review board. I didn't see it.

But sodium-bearing waste is not fundamentally different than the other waste that was calcined before we shut down the calciner. The approach that was implemented or--well, they're trying to implement it--turned into a gigantic boondoggle, and it was sold to people for reasons that you'll read when you look at my slides. And it's turned into--I mean, it started off at 45 million. The last figure the DOE committed to was 571 million. That was over two years ago, so it's probably--it's going to be a billion by the time they get done.

This is for a million gallons of sort of a medium radioactive waste. It's toxic, and it's mixed, and it is radioactive. It's similar in radioactivity to the stuff that's already been calcined. But it needs to be dealt with, and you should think about it. Likewise, the calcine. The calcine and the sodium-bearing waste, being fundamentally the same, both should be converted into a competent waste form. And the logical way to do that is with vitrification. That is BDAT. And it can be implemented efficiently, not the way they're looking at it, of course, because they want to make borosilicate glass out of everything.

Now, the zirconium that happens to be in this particular waste goes fine into a phosphate glass. The Russians made 4,000 cubic meters of phosphate glass. They had a similar program to us. They had a defense system. They generated the same kind of waste. They made a different decision. They went ahead and they're already done with that kind of waste.

Meanwhile, we're stuck on a decision that we made 25 years ago, which hasn't worked out at Hanford. They're stumbling along at Savannah River. It's costing $2 million a ton to make that glass; and when you add up all the costs at Savannah River, extremely expensive. Glass is so cheap you can't even recycle it here in Idaho.

But the way that we do things, the way we insist on separating things and then trying to work on all the different fractions and then, of course, the way bureaucracies do everything, it's all cost plus, done by contractors that make money by spending money. The more they spend, the richer they go. And the longer the project, the longer your career. I worked for the guys. I was a whistleblower and survived ten years after declaring my intentions.

But I've never been on a board like this that has the authority to actually make a difference, and it actually has a mission and a title that suggests it should be able to do it. And that's all I can say is that I hope that you go ahead, take a look at the big picture, the long-term picture. This radioactive waste management thing is not just what are we going to do with a, let's say, failed business model, which is what the LWRs are for producing commercial power.

What are we going to do with that fuel? Eventually something will happen to it, but that's not the big problem. It's getting DOE back on track. This site used to be--I mean, its last mission was DOE's lead lab in radioactive waste management, and it made very bad decisions. It's going to pretend it's going to be HIPping this stuff, but that depends on them getting the sodium-bearing waste out. And they're going to miss the second deadline, too. And once that facility goes hot, it's going to be very hard to do anything that's reasonable or logical or affordable.

And you can stop them. You should really think about it. There is much you can do about this spent fuel in casks. It's not really a technical problem anyhow. Once it’s dried out and in a cask, you can probably go out for 200 years. By that time Mad Max may be the civilization that our grandkids see unless we address the problem. And you can do it. Thank you.

EWING: So, Darryl, everyone--I’m sorry. Just to let you know, everyone on the Board has the material you sent just a few days ago, so that’s been distributed. Thank you.

Other public comments?

All right. Again, I’d like to thank everyone, particularly our hosts in Idaho and the audience and the public, for participating with us this day. Again, I very much encourage you to join the poster sessions. This is not only to see the posters but so that the discussions of the day can continue. And the Board members who will be there, we look forward to being engaged with you.

Thank you very much.

LESLIE: Rod, the poster session was relocated. It is now in the hotel lobby, and so--

EWING: All right, which must cause confusion for people who are checking in. They may lose business.

But, still, we’ll see you in the hotel lobby around the posters. And thank you very much. This session is closed.

(Whereupon, 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 Summer Public Meeting held on August 6, 2014, in Idaho Falls, ID, taken from the electronic recording of proceedings in the above-entitled matter.

August 16, 2014 ______________________________

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