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NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

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JAPAN LESSONS LEARNED PROJECT DIRECTORATE

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PUBLIC MEETING

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WEDNESDAY, SEPTEMBER 18, 2013

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The meeting was convened in the Commissioners' Hearing Room, One White Flint North, 11545 Rockville Pike, Rockville, Maryland, at 10:00 a.m., Lance Rakovan, moderating.

PRESENT:

BRIAN SHERON, Director, Office of Nuclear Regulatory Research

JENNIFER UHLE, Deputy Director for Reactor Safety Programs, NRR

HOSSEIN ESMAILI, Senior Reactor Systems Engineer

STEVEN JONES, Senior Reactor Systems Engineer, DSS

JOSE PIRES, Senior Technical Advisor for Civil Engineering

KEVIN WITT, Project Manager, Japan Lessons Learned Project Directorate

NRC STAFF PRESENT:

LANCE RAKOVAN

SCOTT BURNELL

KEITH COMPTON

LYNNE FINCH

LAUREN GIBSON

A.J. NOSEK

FRED SCHOFER

RANDY SULLIVAN RALPH WAY

T-A-B-L-E O-F C-O-N-T-E-N-T-S

P R O C E E D I N G S

10:02 a.m.

MR. RAKOVAN: Hi, good morning, everyone. That is Roy, who is going to be assisting us with the phone lines today.

My name is Lance Rakovan. And I'm going to be assisting with the facilitation today, in that I hope to make the meeting productive for everyone involved.

My associate, Lynne Finch, is going to be helping me out from time to time with that, especially given that we are scheduled to have such a long meeting today.

The purpose of today's meeting is to provide stakeholders with information on, one, the NRC staff's activities regarding whether regulatory action is needed to require expedited transfer of spent fuel to dry cask storage.

And, two, the use of the spent fuel study and other sources of information in the staff's assessments.

Our agenda is fairly straightforward. We're going to have some welcoming opening comments from

the NRC staff.

We're going to go through, hopefully, a brief presentation that covers some of the information so that anyone here who isn't well read on these materials can at least get a brief overview of what the topics are today.

And then we're going to be opening it up for questions and comments. Now, we do have a number of people who signed up ahead to speak. And so we'll give those folks a time at the microphone first, asking if folks can limit themselves to ten minutes or less when they have a chance at the microphone.

Hopefully, that'll give us a chance to get through everyone today. Again, we have until 5 o'clock.

And if we're able to open it up again and give folks another chance once they've had their initial time at the microphone, then we'll certainly be willing to do that.

We are using numerous participation technologies today. As you can tell, we have a telephone line. Lauren is going to be running our webinar, and so she's going to be helping us out with that. And we're also webcasting today.

So it's very important that we make sure that everyone who's participating in this meeting can

hear and follow the discussions.

If anything's going on, especially in the room, that's causing additional noise, Lynne or I will probably step in and ask you to take a side conversation outside.

If you didn't turn off or put your electronic device on vibrate, I suggest you do it now. We shouldn't have any problems with the phone systems, because we are going to be keeping folks on mute until we open up the phone lines when we give them the floor.

We will be taking breaks, especially a break for lunch and then probably a break or two in the afternoon, depending on how folks are doing and what the energy level is like.

So we'll be going into those and then formally taking a break for those. For those of you in the meeting room, if you haven't been here, restrooms are just out the door here and then to your left. There's also a little café over there. Emergency exits are on pretty much all sides of the room to the right or to the left. So in case anything happens, please proceed quietly and orderly to one of the exits if you would.

We do have copies of NRC's talk at both sides of the door. And we also have sign-in sheets and public meeting feedback forms. For those of you online, you

should have access to those through the public meeting website or notice site. Kevin knows we're posted, correct? Yes, okay. Just wanted to check.

I'd like to introduce our speakers who are at the table today. Brian Sheron is our director of the Office of Nuclear Regulatory Research at the NRC.

Jennifer Uhle is our deputy director for reactor safety programs, Office of Nuclear Reactor Regulation.

Hossein Esmaili is our senior reactor systems engineer. And he'll be presenting the slides specifically involving the spent fuel study.

Kevin Witt is the project manager in the Japan Lessons Learned Project Directorate. He's going to give the background for the activity. And he's responsible for coordinating staff activities involving this issue.

Steve Jones is as senior reactor engineer in our division of safety systems. He's going to be addressing some of the spent fuel questions.

And finally at the table we have Jose Pires. He is a senior technical advisor for civil engineering, and he's here to answer some of the spent fuel study related engineering questions.

So having said all that, what I will do is I will turn it over so we can give a welcome. I will be

back once we are done with the NRC presentation.

Again, we ask that you hold all your questions and comments until we're done with our presentation. That way, we can open it up and we will start with the folks who signed up previously to speak. So Jennifer, if you would?

MS. UHLE: Thanks, Lance. Welcome, everybody. Good morning. We're looking forward to answering any questions you may have at the end of our presentation and certainly interested in hearing your comments.

Just to give a bit of a background, the agency has done numerous studies on spent fuel pools safety since really the 1980s.

Now, post-Fukushima, there was enhanced public concern about spent fuel pool safety. And the agency took a number of actions to address those concerns.

Now, the Fukushima events did not result in any loss of inventory or caused any kind of heat-up in any of the spent fuel pools affected. Nonetheless, we still wanted to study this to determine if any regulatory action was warranted.

So Brian Sheron, to my left, the director of the Office of Research, initiated work to determine

if there was any benefit and, if regulatory action was warranted, to expedite the movement of spent fuel into ISFSIs or dry cask storage.

And we'll be hearing more about those results of that study. And it's called the spent fuel pool study. Now, we also did a bunch of lesson learned activities after Fukushima to look at our regulatory framework.

And we have numerous actions underway. The staff added another activity to also address whether or not the expedited transfer of older spent fuel from the spent fuel pool was warranted.

And we plan to use, we are using the results from the spent fuel pool study that was focused on a particular reactor design that was very similar to the Fukushima Daiichi reactors.

But we recognize there are other types of reactors across the fleet in the United States. So we've expanded some of the analyses and did additional studies to determine whether or not any regulatory action is warranted across the rest of the fleet.

So we will be talking about that activity as well. And we've referred to that as the Tier 3 activity. The reason why it's Tier 3 is when we looked at all of the actions after Fukushima we binned them into

three different tiers. And this additional activity on the expedited transfer of fuel is in the Tier 3. So we used that.

And I just want everybody to be comfortable with that term to distinguish between the Tier 3 activity, which is broader and is looking at all of the reactor designs across the fleet using a number of data points, including the spent fuel pool study that Brian will be talking about, in addition to the other studies that we had done, again, since the 1980s, like I talked about before.

And then that is, again, in contrast to what we call the spent fuel pool study, which is a detailed study focused on the BWR Mark I, Mark II designs, which were at Fukushima.

So at this stage, I'll turn it over to Brian. And he can talk a little bit more about the spent fuel pool study that was done in the Office of Research.

And then we will open up and start with the more formal presentation. We hope to finish that quickly so we can get to your questions as well as your comments. Brian?

MR. SHERON: Thanks. I'm Brian Sheron, the director of the Office of Nuclear Regulatory Research. The question we wanted to answer, as Jennifer

had said, by the study, was is there a substantial increase in public health and safety, or conversely a substantial decrease in risk by the expedited transfer of spent fuel to dry casks.

The regulatory analysis that Jennifer mentioned that her office will be doing, or has been doing on this, used information from our study, as well as from past studies, to answer the question within our regulatory framework to determine if any regulatory action is needed or recommended to our Commission.

Staff briefed the ACRS, both the full and the sub-committees, multiple times on this study as it proceeded. Following the meeting between the ACRS and the Commission, the Commission directed the staff to add several additional items to the study.

These included a human reliability analysis, a comparison between the results of the study and the previous -- I'm sorry -- included a human reliability analysis, a comparison between the results of this study and the previous large seismic events affecting Japanese nuclear power plants as well as a comparison of the results of previous studies on spent fuel pools.

These have been completed and were added to the report over the past year. Following a detailed

review of the draft report and a final briefing by the staff in July of 2013, the ACRS concluded that the spent fuel pool study had been performed in a thorough and systematic manner.

The study demonstrated that the health effects from a seismically initiated spent fuel pool damage scenario are very low for both low density and high density pool loadings.

They agreed with the staff's conclusion that the expedited transfer of spent fuel from the pool to dry cask storage does not provide a substantial safety enhancement for the reference plan. They concluded that the spent fuel pool should be issued. And they concluded that the spent fuel pool provide sound approaches, tools and insights for a broad evaluation of the consequences of severe seismic events on spent fuel pools of different design and will be valuable in determining whether expedited transfers to dry cask storage is a substantial safety benefit for U.S. PWRs and BWRs.

The same draft report was provided for public comment during the month of July 2013. My staff is reviewing the comments and will provide responses in an appendix that is being added to the final report.

The final report will be provided to the

Commission on or before October 11th. And my staff and I look forward to your questions about the study. Thank you.

MR. WITT: Good morning. My name is Kevin Witt. I'm a project manager in the Japan and Lessons Learned Project Directorate in the Office of Nuclear Reactor Regulation. I'll be going through the slides on the Tier 3 analysis.

Second slide, please. During our meeting today we intend to go over the objective for this meeting, give a brief background on these activities, talk about the spent fuel pool study, which is the research activity that Brian has spoken about.

And then we'll talk about the regulatory analysis, which is the generic analysis that we've conducted for this Tier 3 issue for all spent fuel pools. And then finally we'll talk about the next steps.

Next slide, please. The objectives of the meeting today are to talk about the spent fuel pool study which was conducted by the Office of Research. In the slides we'll be referring to this as the study, shorthand for that term.

Subsequently, we'll be talking about the activities on the Japan Lessons Learned Tier 3 activity on expedited transfer of spent fuel. This is the generic

analysis that we've done for the Tier 3 issue.

In addition to that, we'll talk about how this study's analysis and past studies were expanded upon to make it applicable to all spent fuel pools.

And finally, at the end of the presentation, we'll provide extended time for stakeholders to ask questions or provide any remarks. Next slide, please. The spent fuel pool study was initiated in July of 2011 following the Fukushima event in March of 2011. Subsequent to that, this Tier 3 issue was established as a Japan Lessons Learned item.

And we established a plan to address this issue in a memorandum to the Commission. Subsequent to those issues being initiated, we received several direction memorandums from the Commission known as staff requirements memorandum.

As Brian mentioned, one of those SRMs, staff requirement memorandum, directed the staff to do some additional research in the spent fuel pool study. Another staff requirements memorandum from the Commission directed the staff to do an international comparison of spent fuel management practices.

So subsequent to that, we sent an updated plan back to the Commission which includes a consideration of this information in addition to

consideration of the ongoing Waste Confidence activities in our schedule so that we can provide the information to our stakeholders to allow them to be engaged in all of these activities.

Next slide, please. This slide gives a brief overview of all of the activities that we're talking about today.

The first issue is the spent fuel pool study, which we've spoken about numerous times. And this study was a specific consequence study on a specific boiling water reactor, a Mark I design reactor for a specific scenario, and that's a seismic event.

Subsequent to that analysis, we did a regulatory analysis, which was contained in the spent fuel pool study in Appendix D of that document.

The regulatory analysis, it takes the consequences that were calculated in that consequence study and applies it to the regulatory framework. It also takes additional considerations into account, including other types of initiating events to expand it out slightly for that study.

Subsequent to that document, we did a more expanded analysis which applies to all spent fuel pools. And that's the generic regulatory analysis. That's the Tier 3 analysis that we'll be speaking about later.

I'll turn it over to Hossein now, who will talk about the spent fuel pool study.

MR. ESMAILI: Good morning. My name is Hossein Esmaili. I'm with the Office of Research. Slide 6.

As was mentioned before, the objective of the study was to determine whether accelerated transfer of spent fuel pool from the pool to dry cask storage can significantly include public health and safety.

To this, site gives updated publicly available information regarding the consequences where beyond design basis earthquake that can affect a spent fuel pool.

And we did the analysis for both high density and low density loading conditions. The study will be used as one input to inform the regulatory decision making process.

Next slide. So what do we mean by reference plant? We started with a specific spent fuel pool. At the reference plant we chose the BWR with the Mark I containment, which is similar to what Fukushima has. It has an elevated pool design.

There were a number of reasons we chose this plant. It was availability of information, availability of models and similarity to Fukushima.

Going from a high density to the low density, we assumed that there's a high density pool raking. But in the low density case we removed the fuel that was older than five years.

The study was specific for a BWR. And the BWR have channel boxes, so the BWR operation with the channel boxes would impede any crossflow, even with the open rack system.

The initiating event was a severe earthquake. This was found, that the previous study consistently showed that this was the largest contributor to risk. So we chose that as our input for the study.

It's a very rare event. It's expected to occur about once in 60,000 years. And during the past six years the earthquakes in Japan -- there are 20 Japanese nuclear reactors and spent fuel pools were subjected to these severe earthquakes. But none of them have leaked.

Next slide. In order to provide the initial and boundary condition for any accident progression, we had to do a detailed structural analysis for the earthquake that was studied.

This was to determine the potential leak sizes. We determined leak sizes to be up the order of

small leaks that can take tens of hours to large leaks which can happen on the order of hours and the location of the leak.

The study found out that the potential leak is due to the liner tearing at the bottom. So this leads eventually to a complete drain-down of the pool.

And the analysis showed that there is no liner failure at any other location. And so partial drain-down was not credible for this particular event.

We used MELCOR and MACCS, because they are the state-of-the-art computational tool for accident progression and consequence estimates. These codes have been in development for decades. There have been comparisons and experiments, "comparisons, et cetera." So we feel that the codes are on a par for this analysis.

Regarding mitigation, we assumed scenarios with and without successful mitigation. This, we felt, that reasonably characterizes the range of releases that we can get.

For the truncation time, we chose a three day truncation time. And once the question comes up, we'll get into that a little bit later.

Slide 9. Following the structural analysis we found out that there is a low probability of damage to the pool. Ninety percent of the time the pool

is going to survive. Ten percent of the time the pool is going to develop a leak at the bottom of the pool.

And the accident progression analysis showed that even if a leak occurs, the spent fuel pool is hot only for the first few months after the fuel is moved. Otherwise, it's going to be cooler for at least the 72 hours that we did the analysis.

Regarding the frequency of release, there are releases occurring whether it's going to be a high density and low density. It's dominated by the newly discharged fuel. But, of course, high density loading has higher inventory, so you have higher, larger releases.

Slide 10. At the conclusion, it has been stated before the public health and environmental effect estimates are generally the same and were smaller than aerial studies.

There's a section in our study that does a comparison with earlier estimates. And so the study, together with the previous research, confirms that spent fuel adequately protects public health and safety. And the regulatory analysis for the reference plant indicates that expedited transfer is not cost-justified. Going back to Kevin.

MR. WITT: Thank you. On Slide 11, we have

another repeat of the previous slide where we talked about an overview of all of these activities including, as Hossein just talked about, the spent fuel pool study.

Now, as I mentioned before, the regulatory analysis in that study indicated that expedited transfer for that reference plant did not indicate a substantial increase in public health and safety.

The generic regulatory analysis, which we'll talk about on Slide 12 -- I guess we could go to Slide 12 here. So the analysis that we did on the spent fuel pool study was expanded slightly in Appendix D to include consideration of another initiating event to do a more holistic look at what could potentially impact a spent fuel pool and how that would be considered under the regulatory framework.

This includes the consideration of issues such as a cask drop, which is a situation where a plant may be loading a cask in a spent fuel pool and the cask somehow drops and causes damage to the pool, a loss of power, which may be a situation where the heat removal capabilities of the spent fuel pool may be lost.

So we considered what would happen in that situation, including a partial drain-down scenario. We included that in our analysis by looking at cases where the loss of water in the pool may be limited to somewhere

in between the bottom and the top of the spent fuel assemblies.

From that analysis that we did on the spent fuel pool study, we expanded that out to all operating reactors, including new reactors. And by operating reactors, I mean all boiling water reactors and pressurized water reactors.

And we also looked at new reactors such as the advanced pressurized water reactor, which has a combined operating license.

The security events were not addressed in this Tier 3 analysis as they had been assessed outside of this Tier 3 analysis. So that was not included in our regulatory analysis that we conducted.

Next slide please. The preliminary findings that we've determined from our analysis are that expedited transfer of spent fuel to dry cask storage does not appear to provide a substantial increase in overall public health and safety.

That means that we have the criteria for determining whether to proceed with a regulatory action based on risk numbers or public health and safety criteria. And the analysis did not leap to that level.

In addition, we looked at the safety benefits and the costs. And it appears that the benefit

does not outweigh the associated cost.

The staff's current position is to not pursue expedited transfer of spent fuel to dry cask storage. And we are still finalizing this analysis, but this is our current position based on the expanded analysis that we've conducted.

And it appears that we will recommend to the Commission that we close this Japan Lessons Learned Tier 3 activity. And now I'll talk about steps that we'll take following this meeting.

Next slide please. So after this meeting, we plan to release the analysis that we've conducted for all spent fuel pools to the public for their review by next week. That is undergoing final review by the staff at this point, staff and management, and we expect that to be released next week.

Following the release of that document, we have a meeting with the Advisory Committee on Reactor Safeguards. That meeting is open to the public, and that's scheduled for October 2nd.

Following the advisory committee meeting, we'll be sending these papers up to the Commission. And that includes the Tier 3 analysis and the spent fuel pool study. And those papers will be sent to the Commission on or before October 11th.

The Commission has also indicated that they plan to hold a meeting on this issue by the end of 2013. And that would be a meeting on spent fuel safety. So there will be plenty of opportunities for the public to be involved in these issues.

That concludes the presentation. I think we can open the floor now to questions.

MR. RAKOVAN: Okay. Thank you all. I think what we'd like to do now is start going through the list of folks who signed up to speak. I again ask that people take ten minutes or less if it's possible.

If we get through everybody who wants to have some time at the microphone, whether here in the room or on the phone lines, and we have a chance to rotate again through or give people a second chance at the microphone, we're willing to do that.

I'd like to start with Diane Curran. I believe you, and you had a group actually that would like to speak, if you guys want to go first, please.

MS. CURRAN: Thank you very much. I represent 26 environmental groups across the country that are very concerned about the issue of spent fuel storage risks and high density storage pools.

And so this opportunity to talk to you is very important to my clients, many of whom are listening

on the telephone. This is the second go around of a meeting with you all, and we appreciate your taking the time to have another meeting.

I have some questions in general about how this study was done. I think you're all familiar with the comments that my clients submitted, prepared by Dr. Gordon Thompson, which are very critical of this study and the scope of the study, the assumptions used in the study.

And I would just like to get a better idea of how it came about. The first thing I want to ask, it looks to me, based on the introductions, that there's only two of the authors of the study that are at the table this morning, is that right, Mr. Esmaili and Mr. Pires? Is that right?

MS. UHLE: Yes. So we have a number of staff available in the audience. So if you have specific questions, if we need to then we can go to the staff here in the room today.

MS. CURRAN: Okay, terrific. And of course, one of our concerns is the assumption that, well, this study looked at total drainage of a spent fuel pool. And we're really concerned that a more severe case is posed by partial drainage.

And today was the first time that I focused

on the issue, I guess it was raised here, that in Appendix D the staff did say something about partial drainage.

And my understanding at the August 22nd meeting was that the draft consequence study was prepared by the Office of Research and that Appendix D was prepared by NRR, reactor regulation. Is that correct?

MR. WITT: That's correct, yes.

MS. CURRAN: So the research group didn't -- I just want to confirm -- they didn't look at the issue of partial drainage to try to understand it better, that sort of thing.

MR. WITT: Well, there's a broad history of research into spent fuel pool safety. And what we did on the regulatory analysis in Appendix D was take a variety of studies that we've done over the years to inform the analysis that we did in the regulatory framework, which includes a partial drain-down.

MS. CURRAN: But the people in the Office of Nuclear Regulatory Research were not involved in the preparation of that part of the study, right. Is that correct?

MR. ESMAILI: No, we were not. And as was said before, this was when we started the project there was no regulatory analysis. This was added on after we started the project.

So as ACRS said, the study was done in a very systematic manner where we looked at the assumptions, we looked at -- more specifically to your question, looked at the damage state to the pool.

And Jose Pires was sitting right next to me. He did a very, very detailed analysis of the structural response of the pool. And he found that the partial drain-down was not credible for this scenario, for the specific scenario.

And so to that effect, and then that provided the input and boundary conditions for what we do for accident progression, which we did. And so it was a very, very systematic manner in which we did the study.

The regulatory analysis was done after the study was almost actually completed. So it was not influenced by anything in the regulatory analysis. We stand by the fact that for this spent fuel pool, we don't think a partial drain-down is credible.

MS. CURRAN: Okay. And in the slides this morning, it was made pretty clear that the objective of the study is very broad, to determine whether there's, as you were saying, a safety benefit to be achieved from expedited transfer of spent fuel.

My question is how was it decided that in order to make that evaluation that the subject, the

scenario evaluated, would be a severe earthquake? Who made that decision and how was it made?

MR. ESMAILI: Well, this was based on previous studies, previous studies have consistently, NUREG - 1738, NUREG - 1353, have consistently said that the biggest contributor to risk is a severe accident. This is, by far, the orders of magnitude higher than the other initiating frequencies.

As a matter of fact, in Appendix D, in the regulatory analysis we do list the other initiating events with the frequencies associated with them. That was taken directly from 1738.

So we chose the severe earthquake because we wanted to see if it's going to cause damage. We knew that other less severe earthquake is not going to provide damage, so we wanted to push it to the case where we do damage the pool and see what the consequences are.

MS. CURRAN: So you didn't start with a question of what could cause fuel to burn. You started with the question of what could cause effects on the pool, a crack in the pool.

MR. ESMAILI: That's right. Because that's --

MS. CURRAN: Okay.

MR. ESMAILI: Yes.

MS. CURRAN: And this is in a -- I'm just looking at the assumptions on Page 19. The first one is the beyond design basis earthquake is assumed to occur. I'm just trying to understand why, when the purpose is to figure out what are the risks of fire in a pool --

MR. SHERON: Let me --

MS. CURRAN: -- why, I'm sorry?

MR. RAKOVAN: Brian, if you could identify yourself.

MR. SHERON: Go ahead and finish.

MS. CURRAN: Why then was that not the question that you technically analyzed? Instead you technically analyzed what would be the most severe accident that would damage the pool. I'm just curious. How does decision that made?

MR. SHERON: Well, what started this, and maybe I can help a little bit. Right after the accident at Fukushima, the NRC received a number of letters from members of Congress, from members of the public, all sort of saying, gee, why aren't you requiring licensees to move all their fuel to dry casks immediately.

It wasn't clear, even though that may appear to be an obvious improvement, it wasn't clear necessarily from a risk standpoint. And we've learned in the past that a lot of times things you think are safe or safer

really may not be, or they may not be providing the increase in safety that you think.

I proposed that my office look at whether there was a substantial benefit, reduction in risk, from the expedited transfer. The way we approached it was to say, okay, what events, how do damage a spent fuel pool? How do you cause a radioactive release from a pool?

When we went back and we looked at previous risk studies, everything indicated that in order to get a release from a pool you have to overheat the fuel, which means you have to drain the pool. You have to somehow lose the coolant in there.

MS. CURRAN: By losing all the coolant?

MR. SHERON: Huh?

MS. CURRAN: All the coolant?

MR. SHERON: No, not all the coolant, not necessarily.

MS. CURRAN: Is it not now understood that the partial drainage accident is most dangerous for a spent fuel pool because of the loss of cooling capacity? Is that now not understood?

MR. SHERON: It's understood. But the point is what is the likelihood of getting a partial drain-down, in other words, failing the pool at some intermediate location versus where it did fail.

And I would have to defer to Jose. He can explain that when they looked at, and they postulated, and they went through and they explained the scenario that they postulated. In other words, how can I crack the pool?

Well, I postulated an earthquake. And they postulated an earthquake that they felt was substantially large, well beyond a design base. And then they analyzed it using state of the art techniques. And the failure occurred where they did. Now, Jose, you can maybe add on if you want.

MR. PIRES: Yes. Once we assumed that a seismic event is going to happen, a very strong seismic event, the seismic event that we considered in the study, then you calculate what are the loads that the event applies to the pools.

MS. CURRAN: But I'm just trying to get at why did you make that assumption. You're in charge of figuring -- did you have free rein to look at this problem of how is the fuel most likely to be compromised? What is the most likely cause of the fire?

MR. PIRES: Right.

MS. CURRAN: Did you have freedom to do that?

MR. PIRES: Yes. We had it. The staff,

they had technical discussions among themselves when the study was starting to see what scenario do we need to analyze.

And by scenario, it's not partial drain-down or full drain-down. The scenario is what is there out there that can lead to a condition in which you start losing water.

This could have been partial water loss or complete water loss. We didn't know a priori was going to be. We just knew that we needed to lose water to have releases.

So we said what events can do that. We examined the past studies, and the conclusion was overwhelming that the seismic event would be the contributor to risk. So we have also separately chosen what pool to analyze. And the pool that we chose to analyze was a Mark I.

Then we started the process of analyzing that. Like I say, what is going to be the loss of coolant. Is it going to happen even? Is there going to be any loss of coolant? If there is, where is it going to happen?

So these will be, then, the initial conditions for the accident progression analysis. That is, now that you lost the coolant, it is total or partial.

We didn't know a priori what it was going to be.

Then once you get to that situation, out of the accident progress, does the fuel assembly seat that. Do you get the zirconium fire? That was the analysis that Hossein did. So in the structural analysis, we get the loads from the earthquake and then we proceeded to the structural analysis.

It very quickly was easy to realize that the intersection of the walls and the floor was where we were going to have the major cracks in the concrete developing and also the largest strains in the liner. So it was very obvious from the results.

MS. CURRAN: Well, let me just ask you, one of your assumptions is that you weren't looking at a concurrent reactor accident. So you were just looking at seismic, it sounds like. You decided we'll look just in an earthquake.

We're not going to look at a reactor accident. There's nothing here about intentional attacks. So where does it say in here how or why those other causes were ruled out? Where --

MS. UHLE: I don't want to cut you off, so if you want to finish your question.

MS. CURRAN: Yes. Okay.

MS. UHLE: Okay. So let me just try to put

this in context. If you remember the slide, I'm going to be answering your question.

MS. CURRAN: Are you a member of the research team. I'm asking --

MS. UHLE: I'm the deputy director of the Office of Nuclear Reactor Regulation.

MS. CURRAN: Yes. And we're here to question the people who did the research, not the people who are managing the study.

MS. UHLE: Well, we all work as a team here at the agency. So this question, the study -- you're exactly right -- the study looked at one specific example of this particular spent fuel pool, what is going to happen under a severe earthquake.

And the Office of Research calculated those results. And you're right, exactly right, that partial drain-down was not analyzed in that study.

MS. CURRAN: And was that under your direction, that the research people were told we're not going to be looking at partial drain-down. Here's your instructions.

MS. UHLE: No, we asked. The Office of Research did a study with the sole purpose of coming up with what they thought would happen at that spent fuel pool, the model spent fuel pool.

But we didn't stop there. That's not how we would make regulatory decisions, because we recognize that this is only one analysis. And this is only one spent fuel pool. And we realize that there are over 100 reactors in the United States and over 100 spent fuel pools. And they're all somewhat different.

MS. CURRAN: Is there any new research being done or that's going to be done before this decision is made about partial drain-down accidents and how they could occur.

MS. UHLE: Well, I can explain how we analyzed partial accidents in our regulatory analysis. We did something very conservative. We recognized early on that partial drain-down is more limiting.

Now in the case that was analyzed in the Office of Research, that didn't occur at that postulated spent fuel pool. But we know it could occur under other scenarios.

So when we looked to see if there would be a substantial safety increase we assumed, when we looked at the partial drain-down, that 100 percent of the time after the seismic event, 100 percent of the time, that a partial drain-down would cause a release. So when we did that, we didn't bother analyzing the details, because we assumed the most conservative, the largest

impact from a partial drain-down.

And when we compared the health and safety effects of that partial drain-down, and 100 percent of the time causing this large release, it does not cross the threshold of a substantial safety increase by precluding that by any regulatory action.

MS. CURRAN: So you're saying the most conservative part of the study is in Appendix D, that's where the real conservatism takes place, and that the draft consequence study is an outlier, not the most serious problem.

MS. UHLE: I personally wouldn't -- you can look at it that way, perhaps.

MS. CURRAN: I think that's what you just told me.

MS. UHLE: This is part of our regulatory decision making, that we get a good understanding of, in this case, one such scenario. And then we look to see if we need to continue that detailed analysis or we can make conservative assumptions.

And if we can make conservative assumptions that are technically justified, like in this case being the most conservative assuming 100 percent of the time you would get a large release if you have this large earthquake, we showed, in our mind, that by precluding

this partial drain-down we don't cross the threshold for substantial safety improvement according to our regulatory process.

MS. CURRAN: I have a question about one more assumption. And that is on Page 23 it says, "For the low density loading situation the high density racking will be used as opposed to low density racking."

And the comment about why that assumption was made is that re-racking the pool would represent a significant expense along with additional worker dose and was not felt to be the likely regulatory approach taken based on consultation with the Office of Nuclear Reactor Regulation.

Are there any data that were used there? There's no reference to any documents. I'm just curious how that was, on what basis that -- I would like to ask the researchers to speak first. And then if NRR has additional comments, would you please --

MS. UHLE: We are all on a team here. So sometimes the questions, one person may have more knowledge in a particular area. And you may think research should answer.

But the way we approach it is we coordinate very closely so there is really no demarcation between the Office of Research and the Office of Nuclear Reactor

Regulation.

MS. CURRAN: You seem to know more about this study than the people who did the research. Is that the case?

MS. UHLE: The regulatory analysis part was done by the Office of Nuclear Reactor Regulation. And as the deputy director, I'm very familiar with the regulatory analysis piece. So it depends on your question.

MS. CURRAN: Well, where's the documentation for this assumption?

MS. UHLE: On the fact of the -- I'm sorry, if you could repeat your question.

MS. CURRAN: The high density racking was really, when the study talks about low density racking it really is referring to high density racking. And that was a decision that was made based on consultation with the Office of Nuclear Reactor Regulation.

MR. JONES: This is Steve Jones. And I'm in the Office of Nuclear Reactor Regulation. We did have working level meetings in development of this study between research and all the other offices that have relevant input.

And one of them was looking at how the fuel is stored, what the characteristics of the fuel are. And

in particular, for the BWR fuel, it is in a channel box during reactor operation.

And those typically are not removed for fuel storage. So those, in fact, constrain any crossflow benefit that would be obtained by changing out the racks into some design that would allow crossflow and would have to be in a lower density configuration.

And also, there's also modeling impacts as far as determining if you change out the rack design you have to look at different flow patterns and things that may not be as well supported by the experimental stage. I'd have to defer to research on that aspect.

MS. CURRAN: Does the Office of Research have a comment on that?

MR. ESMAILI: Yes. I was just going to extend that. We think that with the channel boxes you are going to impede the crossflow. But in the case of this SFPS it doesn't really matter that much, because we show that during the first two months that is based on the damage state to the pool during the first two months, that we do get the zirconium fire.

Even though you establish a natural circulation, the fuel is still hot enough that causes a zirconium fire. After that time, you are not going to get any zirconium fire anyway.

So the fact that we did not look at an open frame is not going to change the overall conclusions of our analysis. In other words, we can speculate about this three-dimensional natural circulation pattern that could happen.

The fact is that in natural circulation a pattern did develop in some of the cases that involved them moderately. And the fuel still was hot enough to cause a zirconium fire during the first two months.

We do document all of those analysis that show that you are potentially getting zirconium fire and very large releases. But after that time, even with the racks in place, even with the channel boxes in place, we do not get any zirconium fire and any releases.

MS. CURRAN: So you did do an analysis of fire risk in open frame pools. Is that in the study?

MR. RAKOVAN: And if we could try to wrap up this discussion. It's all we can --

MS. CURRAN: I'm just finishing this one --

MR. RAKOVAN: Understand.

MS. CURRAN: -- and I'll be done.

MR. RAKOVAN: Just --

MS. CURRAN: I just want to understand. I don't --

MR. ESMAILI: My point is that we did not.

MR. SHERON: Yes, we did not assume that the channel boxes were removed from the BWR fuel so that there was an open crossflow of air available.

MS. CURRAN: But it sounded, from what you were saying, as though you did some analysis, if you had.

MR. ESMAILI: No. I did not say that. I said even with everything in place -- see one of the cases that we have, you empty the pool in about six hours. So you establish a natural circulation to the pool.

Still, you get zirconium fire by about 15 hours or so. So that means that even there is natural circulation, the fuel is hot enough that it can go to a zirconium fire and potential releases.

So this if the point. So any additional benefit of air cooling is not going to help you much. Because you already have established a natural circulation pattern.

MS. CURRAN: Right. And that's assuming the channel boxes are still in place, right?

MR. ESMAILI: Channel boxes are still in place. That would help, actually. That would be a more coherent one-dimensional flow to the assemblies.

MS. CURRAN: Oh, and isn't it possible to remove the channel boxes?

MR. ESMAILI: Yes, it is possible. Yes.

MS. CURRAN: But you didn't look at that?

MR. ESMAILI: No. What I'm saying is that it didn't matter that much. Because we did establish a natural circulation pattern, even with the channel boxes, even with the rack cells in place. And we still got a zirconium fire during the first two months.

When you go past two months, even with the channel boxes in there, even with the rack cells in there, you do not get to a zirconium fire. This is because of the damage state to the pool that results in either a very rapid drain-down or a very, very slow drain-down.

I just want to clear one point about this partial drain-down. One of the scenarios that came out was a small leak. In the case of a small leak, it could potentially be even worse than a partial drain-down. The results are in the report for the people who want to look at the details of the results.

And this is because you go through, during this small leakage, you go to steam oxidation. It's by far less energetic than an air oxidation. So you do heat up the fuel.

At some point during this small leakage, the base plate clears. And once the base plate clears, once the water level goes down, then you have a rush of air.

MS. CURRAN: Right. And wasn't that in 72

hours, within 72 hours?

MR. ESMAILI: Before 72 hours.

MS. CURRAN: Before. So it wasn't a prolonged period. It was --

MR. ESMAILI: So you get the releases before 72 hours. But the point I'm trying to make is that you've already got the fuel hot enough. Once you bring the air in, you're not going to be able to cool it. You are going to actually make the matter worse. You are going to have a huge release.

I think we have enough figures in the report to show that -- and it goes through a steam oxidation, which is representative of a partial LOCA followed by a rush of air -- things go south. And you get large releases, you initiate a zirconium fire.

This is because the interaction with air is much, much more intense than interaction with steam. So the small leak scenario actually could potentially have higher releases than had the accident progressed without having a late ingress of air.

Having said that, the partial drain-down, which is not what we predicted in this study, because we did a detailed analysis, if you do a partial drain-down, you could change the coolability.

Right now we are expecting that we have,

after about two months or so, the fuel is cool enough so that when air comes in it's going to cool it. That's because you get air in there.

But if the air is partially blocking it, then you are not going to get that cooling later on. But the releases are going to be much less than if the air comes in. The air is, and sometimes it is worse because the oxidation that has taken place in steam is going to make if worse.

So we have looked at scenarios that approaches what a partial drain-down looks like. And it can be even worse than that.

MS. CURRAN: Okay, thank you.

MR. ESMAILI: Yes.

MR. RAKOVAN: All right. Ms. Curran, you had some associates that wanted some time at the microphone as well?

MS. CURRAN: Yes.

MR. RAKOVAN: And if I could ask the NRC staff, before you speak, if you could identify yourselves. We do have a number of people who are participating by various technologies where they can't see you or maybe they don't know who you are. So if you would introduce yourselves each time you begin a conversation or answer a question, I'd appreciate it.

Please.

MR. LOCHBAUM: My name is David Lochbaum. I'm with the Union of Concerned Scientists. Prior to the NUREG-1738 study, there was an email dated September 19th, 2000, from somebody in the Office of Research that transmitted a report that was done for that study by NRC consultant Robert Kennedy, titled Response to Questions Concerning Spent Fuel Pool Seismic-Induced Failure Modes and Locations and Expected Level of Collateral Damage.

I want to read a couple of quotes from that consultant's study and then ask a question. The consultant wrote, "The critical failure mode for the gross structural failure of the pools is an out of plane shear failure of the pool floor slab.

"With this failure mode, the liner will be breached and a large crack will develop through the concrete floor slab within a distance equal to the floor slab thickness from the pool walls."

Later in that report he writes, "My judgment is that for BWR pools it is as least equally likely that the critical failure mode will be an out of plane shear failure of one or more of the pool walls.

"With this failure mode, the liner will be breached and a major concrete crack will form along the length of the wall from a wall thickness distance from

the top of the floor slab. Water will quickly drain out of the pool, however as much as four feet of water depth will likely remain within the pool."

He says later, "I believe that either of these two shield failure modes reported above for BWR would also be the critical failure mode for some PWR pools."

There's also an email that was released by FOIA dated August 29th, 2000 -- and I'll email this material to Mr. Witt so you get the email numbers and all that so you don't have to write it down -- from Goutam Bagchi of the NRC's Office of Nuclear Reactor Regulation that says -- and he was addressing the point of if you have such a large earthquake, what other collateral damage might occur by that same magnitude earthquake.

And he wrote, "Based on discussions with staff structural engineers, there was a high likelihood that there will be building damage that leads to blockage of air flow. For heavy load drop consequences, the staff assumed a 50 percent partition to the high flow case."

He goes on later to repeat what the consultant Kennedy said saying, "Failure of the spent fuel pool walls due to earthquakes is predicted to occur due to shield failure of the side walls. The critical shear plane is at a distance equal to the thickness of

the wall."

Were the authors of the draft study aware of these prior NRC staff and consultant reports on the likely location of the pool failure?

MR. PIRES: Yes, certainly. We reviewed those reports. Those are appendices to NUREG-1738. We reviewed them very carefully. And the analogy that we did for our spent fuel pool very clearly indicated that shear failure mode on the walls did not develop.

Indeed, that makes sense too, as why the walls are pretty much same thickness as the floor. And the loads are smaller on the walls, because the floor carries all the gravity loads. All the self weight is higher on the floor. So it's pushed down more.

And it turns out that when you have a 90 degree angle you have a vertical wall and a horizontal floor. And you have pressure of both sides. What you attempt to do is open that angle.

In this case, the critical location was a reflection of failure at the bottom of the wall. It was very obvious from the results of the analysis.

In some other structures, for instance in the pressurized water reactors where you can have the slab on the ground, it's sitting on the ground, then it's not pushed down as much as in the BWR.

In that case, the shear failure on the wall is more likely. And so that's why, in the regulatory analogies, we provided the input that they should consider a partial drain-down in that case, even though there are simply BWRs in which the failure may also be at the bottom of the walls.

But the information we provided to the regulatory analysis was it would be prudent, in that case, to consider it as a partial drain-down and proceed according to that assumption.

MR. RAKOVAN: Jose, if you could remember to introduce yourself, please.

MR. PIRES: I'm sorry. I was Jose Pires from the Office of Research.

MR. LOCHBAUM: Just a follow-up question. You said it was obvious that the pool failure would be at the --

MR. PIRES: In this case, yes.

MR. LOCHBAUM: Just curious, I know since you weren't involved in that, but why wasn't it obvious ten years ago when those NRC staff and consultant looked at it then? Has it become obvious in the last decade? Or was it well hidden back in those days?

MR. PIRES: He probably did not get as much information as we had or probably was thinking about some

other pool dimensions of the walls and the reinforcement. He might not have done an analysis as careful as we did.

I'm not excluding that there may not be a pool there in which the walls would be sufficiently thin for that to happen. But in this case the walls and the floor are both equally thick. And the floor has far more load.

MR. LOCHBAUM: I guess a follow-up would then be, so there's no chance there'll be something obvious ten years from now that's hidden now based on new information or the same thing that led to this iteration or evolution of what we think is going to happen.

So we got it perfectly right now. And there's no possible chance that it's going to be refined in the future. Is that where we're at today?

MR. PIRES: Do you want to answer that?

MS. UHLE: Well again, this was one analysis that was done for this one spent fuel pool in a regulatory analysis that then broadens out the applicability of some of the results.

We made very, again, conservative assumptions with regard to partial drain-down. And, of course, that is directly affected by the location of the breach in the liner.

And what we did is we assumed that in a

partial drain-down situation -- as if the hole, the breach, was higher up as you're, I think, pointing out, the consultant back in 2000 had suggested -- we assumed that the probability of the release was 100 percent.

And so the probability was that after the seismic event of a large magnitude that we would get, 100 percent of the time, what we would say just a complete release of the inventory. So we felt that we have bounded the situation.

Now part of our reg process, and I know you're very aware, is that we are constantly evaluating to make sure that our regulatory positions remain sound in light of new information.

We have a very robust research program. We look at operating experience domestically, internationally. And we constantly evaluate whether or not there is new information that we should analyze and go back and look to see if our regulations are appropriate.

So I agree that things may change in ten years, I don't know in which direction but as far as our understanding, and we'll be there to take a look at it.

MR. LOCHBAUM: Was the office of the draft study aware of this collateral damage to the building that might block water or airflow to the pool? Or did

you only look at the damage to the pool and the water drainage effects resulting from that.

Because in the earlier study, there was concern that an earthquake of that magnitude caused the building around the pool to suffer some damage as well.

MR. PIRES: Right. We read very carefully that appendix and the author of the NUREG-1738 and that led for us to consider those possibilities.

And for instance, in the case of the Peach Bottom Nuclear Power Plant, this plant was analyzed very carefully during the NUREG-1150 study. So there was a probabilistic risk assessment done for the plant.

And they provided fragility functions for the reactor building there. And the median fragility of the reactor building was higher than the median fragility for the pool. So we felt confident that we will not have damage from the reactor building that would cause blockage of the airflow in this case.

Also the roof of the reactor building for these reactors isn't very likely to -- so it's not the type of structure that is likely to fail during an earthquake.

It's also the columns are off that, and the truss beams on the roof are very strong because it's also a crane bay. The columns are rated for a 120 ton crane.

So it's an unlikely situation that will collapse by the seismic event.

MR. LOCHBAUM: Okay. I appreciate it. So you did consider in the ways that you just described.

MR. PIRES: Well, we considered, we provided thought on that, yes.

MR. LOCHBAUM: Okay. I appreciate that. Thank you.

Turning to a different topic, a related topic, we're concerned about -- we advocate accelerating a transfer from pools to dry cask, not only for this imaginary earthquake, but also for the more realistic criticality concerns that could occur. We think that thinning out the pools restores geometry as a criticality barrier. And that was basically totally neglected from the study.

There's a June 21st, 2010, letter from the NRC to the Turkey Point licensee where a $70,000 civil penalty was imposed for, "The finding involved the failure to properly manage known degradation of Boraflex, a neutron absorber material used in the Turkey Point Unit 3 spent fuel pool."

Later in the same letter, the NRC concluded that licensee's data are insignificant to support the conclusion that when accounting for identified

degradation of Boraflex panels in the Turkey Point Unit 3 spent fuel pool storage racks. In effect, would have been maintained less than 1.0 for all cases when flooded with unborated water as required by -- and it's cited as a technical specification.

More recently, just last month, August 22nd, 2013, the NRC issued a letter to the Comanche Peak licensee involving the proposed removal of over 200 fuel assemblies from the Unit 1 and Unit 2 spent fuel pools to address criticality concerns where they had also messed up the administrative protections against criticality.

And unloading the spent fuel pool into dry cask was the way to restore the necessary criticality protection margins.

Attached to that letter was a June 13th, 2000, letter from the licensee that committed to that plan that said, "Nine dry cask canisters will be loaded during the campaign (288 fuel assemblies)."

Fuel assemblies loaded into the cask will be chosen from the candidate list of assemblies currently residing in the spent fuel pool. The vast majority of the fuel will be loaded from Region 2 locations.

The reason it's so complex dates back to an NRC interim staff guidance, DSS-ISG-2010-01 regarding

spent fuel pool criticality safety. If you'll indulge me, I'll read a section from that as well.

"Increasing the storage capacity in the existing SFP was the first step in increasing onsite storage capacity. Licensees transitioned from low density storage relying on flux traps caused by the large center-to-center spacing of the fuel assemblies to high density storage relying on installed neutron absorbers to accommodate the reduced center-to-center spacing of the fuel assemblies.

"However, virtually every permanently installed neutron absorber for which a history can be established has degraded in the SFP environment."

So were the authors of the draft study aware of these and several other spent fuel pool criticality margin issues?

MS. UHLE: Thanks, this is Jennifer Uhle from NRR. Yes, the study did not look particularly at the criticality concern. The way we're dealing with the criticality concern in NRR, in the Office of Nuclear Reactor Regulation, is to increase our attention and focus in communication with the licensees.

There cases where there were licensees, as you're very well pointing out, that we issued violations to. Now, when we issue a violation that does not mean

that the plant is not safe.

Our regulatory requirements that you had pointed to with K-Effective being less than one with unborated water flooding up, that's a very conservative regulatory limit.

So just because there are violations does not mean that the plants are getting anywhere near where adequate protection is not provided from a criticality perspective.

But we do realize BORALL and Boraflex are degrading. We have taken regulatory action and we continue to focus on that to ensure that there is criticality control in the spent fuel pools.

MR. LOCHBAUM: Wouldn't a legitimate hazard concern consider all hazards rather than just one? I mean, if you were looking at relative benefits of pool storage versus dry cask storage, you look at all hazards.

You wouldn't just throw out the ones and select one that gives you the answer you want if you were doing a good job, a responsible job. But that's a rhetorical question.

MR. SHERON: David, I think you have to keep in mind that we looked at this from a risk standpoint. And we also looked at it from a cost/benefit.

And while, yes, a criticality problem can

lead to fines and stuff, does it really lead to a very high risk situation? And when you look at the PRAs and the like, I don't think that rises up at least to the level where the seismic event did.

MR. LOCHBAUM: But if you're looking at it from a cost/benefit standpoint, you could look at the cost of unloading the fuel and restoring geometry versus the cost of all the measures that you do to ensure that the neutron absorbers are there, all the surveillances, all the things.

So if you forget the risk, as you apparently have done, and only look at the cost, it looks like it's more prudent financially to do the transfer to dry cask. And therefore you don't have to spend all the money in putting in the neutron absorbers and in checking them every so often to make sure they're good.

MS. UHLE: Again, I would point to the fact that we feel our regulatory approach is very robust. But we do recognize that if the actual physical separation does promote more conservatism in the criticality concern -- upon hearing your view -- I think in our regulatory documents that we will be providing to the Commission we will write down a more specific reason why we feel that the fact that we did not consider criticality is appropriate.

MR. LOCHBAUM: Okay.

MR. RAKOVAN: Just one last question, David.

MR. LOCHBAUM: I'd like to be back in the queue then, because I didn't get through all of them.

MR. RAKOVAN: Okay, understand.

MR. LOCHBAUM: But just one last question.

MR. RAKOVAN: I'll put you back.

MR. LOCHBAUM: I thought my time was my time, not the filibuster time. But that's why I was shooting for the ten minutes. But we'll try.

ML-13197(a)051 is a March 16th, 2011, letter written by the NRC Ops Center during the Fukushima crisis. Attached is a one page table titled, "Fukushima Daiichi Summary Display."

It showed the priorities for the six reactors at Fukushima Daiichi. Unit 4 was the NRC's Number 1 priority, because, "Core offloaded to spent fuel pool, secondary containment destroyed. Walls of SFP has collapsed. Spent fuel pool liner is intact. No SFP cooling at this time. Working on adding water by hose spray."

It's more than 72 hours after the earthquake and tsunami. Yet it's ahead of three reactors that the NRC thought had suffered severe core damage, had

secondary containment failures. So a spent fuel pool 72 hours later, more than 72 hours later, was the NRC's top priority.

And other emails said that was the recommendation to the Japanese, to put water back in the pool. Air cooling was good enough after 72 hours. The Number 1 priority after 72 hours was a spent fuel pool, not three damaged reactor cores with secondary containment gone. How is that possible?

MS. UHLE: Let me just double-check. This is Jennifer Uhle from NRR. So is the question of why we felt that the spent fuel pool Number 4 was the highest priority 72 hours after the initiating event?

MR. LOCHBAUM: No. I think that was the correct assessment. The assessment is how now can you dismiss -- you have a mission time of 72 hours. Nothing bad can happen after 72 hours. If you were applying these rules, your study for the situation, the Unit 4 spent fuel pool would not be an issue after 72 hours.

MR. SHERON: I don't think we've said that nothing bad happens after 72 hours.

MR. LOCHBAUM: You stopped looking at 72 hours. The mission time is 72 hours. You don't really look beyond 72 hours.

MR. SHERON: That was after two months. In

other words, we said that after two months that the fuel was in the pool that you had at least 72 hours and possibly more time for operators to take any kind of action to put water in the pool. But that was two months later. At Fukushima, I believe, this fuel had just been recently offloaded.

MR. LOCHBAUM: Four months ago.

MR. SHERON: Huh?

MR. LOCHBAUM: Four months earlier. December of 2010.

MR. JONES: Well, I think what you're getting at is we had some uncertainty about the status of the pool at Unit 4, because there was a hydrogen explosion. And not necessarily understanding where that hydrogen came from, one possible place to jump to is steam oxidation of the fuel in the spent fuel pool.

However, the conditions of that fuel as you're getting at it with four month decay did not really readily support that. However, it's hard to explain that.

That's why we were looking at the Tier 1 activities for instrumentation to monitor level in the spent fuel pool, and the associated water that we've issued, to understand the conditions of the spent fuel pool.

Nevertheless, as we explained earlier in the meeting, there was no damage to the fuel, the water. Inventory in those pools was only lost by evaporation. And there was adequate time to recover that inventory later in the event. I guess that's all I really had to address your question.

MS. UHLE: Okay. That was what I was going to say. And what contributed to our concern -- this is Jennifer Uhle from NRR -- what contributed to our concern was exactly that, the uncertainty.

It was 72 hours. We weren't getting a lot of information from Japan. We saw that there was the hydrogen detonation. That leads one to think that there is obviously oxidation occurring.

And as it turned out, as Steve said, there was no uncovery. The hydrogen, as it's currently thought, was actually migrating from Reactor 3 standby gas treatment system. And it flowed into the reactor building for Number 4. So there was no damage to the spent fuel pool.

But because of the hydrogen detonation, even though it was very confusing to us, we felt the conservative action would be to put water in there, until we then determined later that there was no damage.

MR. LOCHBAUM: Very convenient hydrogen

explosions, because they provided the pathways for that water addition. I'm glad my time is up. My voice is gone. Thank you.

MR. RAKOVAN: Well, we'll see if you can get it back and we'll bring you back up, okay. Okay, for our next speakers, I would like to go to Robert Alvarez, then Gordon Thompson and then Ed Lyman. Mr. Alvarez?

MR. ALVAREZ: Good morning. I'll be brief since several issues have already been covered and I don't feel like we should be running over the squirrel over and over.

What I will discuss and ask is, in looking at your study, I came to the conclusion that you did not look at multiple risk factors in terms of a concurrent impacts on a reactor.

And it's been well known, if you just take a little bit of a dive into NRC sponsored research of '85, '90, specifically at this reactor in terms of beyond design basis events, that these studies actually predicted quite accurately what happened at Fukushima, especially the discharge and accumulation of large amounts of explosive hydrogen in the fuel bays that cause really severe destruction of the entire spent fuel infrastructures, including the collapse of the cranes into one of the pools.

And so I'm curious why you didn't look at these multiple risk factors. Because to me it looks like, having worked on the Hill and having to explain this to members of Congress, it looks like you've done this sort of study in a vacuum that excludes all the other variables that would impact the spent fuel pool, especially when you take a look at the aftermath.

Let's assume we haven't had a large release that didn't occur at Fukushima in Pool 4. It is turning into quite a daunting task to come to terms with even physically removing this material right now. And so why didn't you look at that?

MR. ESMAILI: Yes. We did look at, during the outage when the reactor and the spent fuel pool are connected, we did look at the decay heat from the reactor, as long as they were thermohydraulically connected.

But the study was focused on the consequence of the spent fuel pool itself. So we wanted to know what's the difference between a high density and low density. We do have some --

MR. ALVAREZ: Doesn't this violate, say, basic principles of systems engineering?

MS. UHLE: Again, the study was a certain scope. And we recognized the limitation of the scope of the spent fuel pool study done in research. So in a

regulatory analysis, we made conservative assumptions to bound what that effect would be.

And for example, we recognized that there could be a reactor accident occurring at the same time as a spent fuel pool accident. And that would take operator attention away from any mitigating strategies possible in the spent fuel pool.

So what we assumed conservatively, to make the low density loading more safety beneficial than the high density loading, we assumed that the mitigation strategies will be 100 percent effective for the low density loading.

And then we assumed that the high density loading, all the mitigation strategies would not be effective. So we feel that we, again, did a conservative assumption to bound this influence of the state of the reactor and the attention drawn away from the spent fuel pool.

MR. ALVAREZ: As you know, the spent fuel pool is really a system. It involves refueling cavities, membranes, transfer equipment, et cetera. Did you consider the possibility of a full core offload in a refueling cavity?

MR. ESMAILI: We did not look at full core offload because, as we stated in one of the assumptions,

this is not typical. As far as --

MR. ALVAREZ: I understand that. But having worked in this industry for 40 years, one thing about the nuclear enterprise is that it's a surprise when there are no surprises.

MR. ESMAILI: Right. So because the study was supposed to be a best estimate -- and so we were not looking at all the conditions, all the bounding conditions -- we were looking at a best estimate of how the accident progresses.

MR. ALVAREZ: But you do have a relatively high frequency of usage of these systems. And I'm not saying that it's always a full core offload there, it's certainly at least one third of the core going into these refueling cavities at any given time. And you did not look at the impact of that, of an earthquake impacting, let's say, one third of the core during a refueling?

MR. ESMAILI: As the fuel is being removed to the spent fuel pool?

MR. ALVAREZ: Yes. In the refueling cavity?

MR. JONES: All right. This is Steve Jones. Yes, the study implicitly assumed that there was fuel movement into the spent fuel pool. There's no fuel that remains in the cavity, per se.

MR. ALVAREZ: What if it is in the reactor?

MR. JONES: It's either in the reactor, there's one assembly in transit. And then it's placed in the storage location in the spent fuel pool during a typical refueling and --

MR. ALVAREZ: Okay. Well, you've answered my question. The other issue I'm curious about is age and deterioration of the pools.

When I read your study, you have two citations. One is a NEI study about an aircraft impact into a pool. And the other is a 1989 study. And I'm aware at least of a 2001 study that the NRC sponsored by Oak Ridge which I'll just quote.

It says, "As nuclear plants age, degradations of spent fuel pools, reactor refueling cavities, are incurring at an increasing rate primarily due to environmental related factors. During the last decade, a number of nuclear power plants have experienced water leakage from spent fuel pools and reactor fueling cavities."

The authors of the study also indicate that accurate assessment of aging of spent fuel pools is uncertain. Because, "It's often hard to assess what's going on underground," in essence.

Instead, I found it curious that you point

to a study that was 24 years ago when none of these effects were being observed, at least in looking at your references. And how do you come to terms with that? How do you reconcile that?

MR. PIRES: We did not explicitly account for degradation effects of the material. The NRC does keep informed on those studies on degradations of materials in the pools. And just recently, there was a report published.

But we did sensitivity analysis. We considered, we varied properties of the concrete, we also varied the properties of the limiting strains in the liner. We assumed conservative limiting strains in the liner.

We noticed that, for the most part, wave augments in the liner tend to be away from the discontinuities in the pool where you have cross sections between walls. So these areas of low strength.

Also, when we looked into detail at the liner, it turns out that it's very complex component. At the end of the liner there are drainage channels. And these drainage channels try to collect water that might leak through the liner on a regular basis to limit the amount of water that leaks to the concrete.

And that water is collected by these drainage

channels. And it's normally a very small amount of water. It's usually less than water lost by evaporation in a day. So even though it was not explicitly accounted for, we did sensitivity analysis to account for material properties --

MR. ALVAREZ: Do you think that the deterioration that goes undetected can bring about a non-linear event?

MR. JONES: This is --

MR. PIRES: Yes, go ahead.

MR. JONES: This is Steve Jones. I just wanted to clarify. The operating experience we've had so far has been very minor leakage in a variety of locations in a select number of nuclear power plants.

And it's been on the order of tens to hundreds of gallons per day, nothing that would even approach threatening the ability to maintain inventory in the pool. And the normal status is there is no leakage. And these channels monitor that on a regular basis.

MR. ALVAREZ: Now, just to add a little bit to the point that Dave Lochbaum raised, this same study, this 2001 study, also noted that borated water enhances the degradation of concrete.

So there's quite a bit of mitigation going

on because of deterioration of neutron absorbing panels by compensating by adding more boron to the water in some cases, San Onofre being one. I'm not familiar with all the reactors out there. But these are also factors that I just wanted to mention. And finally --

MS. UHLE: Can I just add to that? I think that the answer that Jose provided, that we did vary the properties, the structural properties in both the liner and the concrete account for the reductions, as I think you're trying to lead us to, in any of the material properties due to aging.

MR. ALVAREZ: I have one more question and I'll be gone. Why didn't you compare the hazards of high density pool storage with dry cask storage, the relative hazards?

Because at least, in terms of your emergency preparedness and planning, I'm referring to NUREG-1889 where you're using -- it's the RASCAL model. And you use the RASCAL model, and a lot of it's done for, thank goodness, for test out purposes, not for real world purposes.

But the underlying assumptions in that particular report seem to come from the '87 Brookhaven study in terms of release fractions and things like that. But it does note that your releases, if someone were to

put a shaped charge on a dry cask, it would release about 2500 times less radioactivity than a pool fire.

That is a tremendous difference in consequences. And so why didn't you look at that? I mean, the other issue is just take a look at the Fukushima site. You had 408 assemblies and nine dry casks, which were unscathed.

MS. UHLE: The way we handled this is, of course, the fuel needs to be aged to a certain point and decay heat load dropped, as you know, before it goes into a cask.

And what we did is we assumed that there was no risk posed by the casks. And we compared it to the risks posed by a fully loaded pool. And again, the delta between that, which would then equate to the safety increase, was not enough in our regulatory process to warrant regulatory action.

MR. ALVAREZ: And this includes your increased source terms due to high burnup and the like.

MS. UHLE: Yes, yes.

MR. ALVAREZ: All right. Thank you very much.

MR. JONES: This is Steve Jones. I did just want to point out that the spent fuel pool study does include, in Chapter 10, a comparison of relative

consequences between pools and dry casks that may help answer your question.

MR. ALVAREZ: Thank you.

MR. RAKOVAN: Okay, Roy. I think we'd like to go next to Gordon Thompson, who I believe is on the phone.

(Pause)

MR. RAKOVAN: Roy, are you there?

OPERATOR: This is the conference coordinator. Please press Star 1 to have your line opened.

MR. THOMPSON: Hello.

OPERATOR: Thank you. Your line is open.

MR. RAKOVAN: Go ahead, sir. We're ready.

MR. THOMPSON: Can you hear me? This is Gordon Thompson.

MR. RAKOVAN: Yes, we can. Please go ahead, Mr. Thompson.

MR. THOMPSON: Thank you. I've prepared a comment on the study that we're discussing that was submitted early August. And I don't propose to go over that in detail, because it stands for itself. But I'll touch on a number of points briefly.

In summary, I concluded that the drop study was both misleading and incomplete. And I'm sad to hear

that the NRC staff continues to make misleading statements, which they did in the opening presentations for this meeting today.

I wish the staff would stop pretending that they have examined a low density fuel storage case in the pool. They have not, and they should be forthright and honest about what they have and have not done.

Now, another point I make in my commentary is that the staff has constructed a superstructure of analysis including regulatory analysis based upon a very weak foundation of basic understanding of the phenomena of a pool fire.

The potential for a pool fire has been known since at least 1979. So the NRC has had a period of 34 years during which it could have established a thorough understanding of the phenomena of a pool fire. It has not done so despite many calls for this from public interest groups, state and local governments.

It's essential to establish a solid science based understanding before considering the event sequences that could cause water loss or presence of debris.

Only by acquiring a really thorough understanding of the events that could lead to a pool fire can one establish the intellectual base to be certain

that you can then look at events that might lead to that outcome.

Now, early on people thought about pool fires and said, gee, the decay heat is very low. How can this be a problem? But as soon as you look at this problem you realize that the nature of a high density closed form rack is such that heat transfer is very feeble, especially when there's flow blockage from residual water or debris.

And therefore, you need a very careful analysis backed up by experiment to determine whether your highest decay heat fuel can reach the ignition point. You need further very careful analysis to see how that fire propagates within the first effected assembly and to other assemblies.

This work has simply never been done properly. In this instance, the staff has taken the MELCOR code, which was written for other purposes, and has adapted it without providing a thorough explanation of how they've done this adaptation or what experimental validation they have for it.

The staff has admitted in its own report that the MELCOR code uses a very crude process of modeling radiating heat transfer, which we know is a crucial phenomena in determining the heat-up of fuel,

particularly in the event of flow blockage.

The staff also concedes that MELCOR has no capability to examine clad ballooning or rupture phenomena which can affect fuel heat-up and ignition.

So my recommendation is that this study be scrapped completely and that the NRC go back to basics, start with a clean slate and develop a really solid understanding of the phenomena accompanying a pool fire.

I have laid out in my comments of August 5th briefly how that could be done. And in doing so, the staff would need to address, among other issues, those raised by the ACRS in a letter to the NRC Chair of April 13th, 2000.

And a number of significant phenomena were identified in that letter report pertaining to the phenomena of pool fires. I'll touch on them briefly.

First, there was high burnup fuel, there can be a presence of zirconium hydrides that could lead to spontaneous combustion of ignition in air, spontaneous combustion of zirconium cladding in air, excuse me. Secondly, zirconium air reaction can occur even if oxygen is depleted via exothermic zirconium nitrogen reactions.

And associated particularly with the hydride issue is the point that ignition temperature may be an inappropriate criterion, in fact energy balance may

be more appropriate criterion for the determining whether a fire initiates.

The letter also stated that the staff had neglected exothermic reactions of aluminum and stainless steel. In the event that a fire initiated, they said that the staff had neglected the potential release of small particles arising from decrepitation of fuel.

And they further stated that the MACS code was prone to using an excessively narrow plume and therefore could underestimate land contamination.

So these issues have not been addressed in the current study, that I can see. Perhaps the staff would explain to me how they've been addressed.

But if this problem were looked at in a really systematic science-based manner, the scientific community more broadly could examine all of these issues and, if done correctly, we'd have a really solid understanding of the underlying phenomena and then, and only then, reach regulatory conclusions.

And in the interim, I think it's prudent to take a conservative position that these findings would lead to an identification of the substantial range of circumstances wherein a pool fire could occur.

And just some closing points about the responsibilities of NRC in this matter, the NRC is the

world's biggest regulator. And therefore is looked to by regulators in other nations and, I believe, has the global responsibility to establish a thorough understanding of the pool fire issue.

And an illustration of the significance of this, I have personally viewed a six PWR unit station in Asia where the spent fuel pools are all above grade. I'm also aware of large nuclear facility in a European country that is licensed to hold in excess of 17,000 tons of spent PWR fuel in four high density spent fuel pools configured so that the grade level is approximately mid-height of the fuel.

And undoubtedly other situations like this can be identified around the world. So I emphasize that NRC has a global responsibility to really come to grips with the phenomena of a pool fire.

And finally, on the security issue, the United States Government reserves the right to conduct aerial strikes on countries around the world, and has done so frequently. The NRC has chosen not to require air defense of U.S. nuclear power plants.

If you put those actions together, I believe it's the NRC's duty to accurately inform the United States public of the phenomena associated with a spent fuel pool fire. Thank you. That's my commentary.

MS. UHLE: Okay. I want to thank you for your comments. We do have a few bits of information we'd like to convey in response to, hopefully, fill in some information to you and the members of the public regarding the validation of the MELCOR code that we used and the tests that we have conducted and used to do so. So Hossein Esmaili?

MR. ESMAILI: Okay. This is Hossein Esmaili. Thank you for you comment. And we do share some of your concerns. That's why we are ever improving the code. We do run experiments, et cetera.

And during the past 13 years or so, decade or so, we have run experiments at Argonne to characterize air oxidation. This is compiled in NUREG-6846 for your information. So we do have the characterization of breakaway air oxidation in those experiments. These are input into the MELCOR.

And finally, at the end of the day, we do validation of MELCOR. This is, again, straining against the zirc fire experiments for BWR assemblies that was run from 2004 to 2006, I believe. And currently we are doing the same for the PWR fuel assemblies.

The BWR fuel assemblies, zirc fire experiments have been compiled. It's in NUREG-CR-7143 that shows validation of MELCOR against those

experiments. It also includes code-to-code comparisons, adequacy of radiation models that you mentioned. And I guess that's about it.

As far as validation of MELCOR is concerned, we feel that MELCOR is adequately validated against experiments. That's why it gave us the confidence to do the analysis. Thank you.

MR. RAKOVAN: Okay. If we could go ahead and go to our last speaker before lunch. And I've already apologized to him, to making him go last before lunch. Ed Lyman, from the Union of Concerned Scientists, please.

MR. LYMAN: Thank you. And thank you for entertaining the questions today. I just have a few questions on the draft study.

So the first point does go to the 72 hour truncation. And the guidelines for the study are that all the calculations are cut off after 72 hours. That's one of the basic guidelines.

We think that is arbitrary. And I think my colleague, David Lochbaum, by raising the Unit 4 chaos, the real point of that is that it's quite plausible that in a severe accident situation after 72 hours the recipe for how to mitigate may still be unclear. The circumstances may be unclear.

So in that context, I'd like to ask about Figure 55 versus Figure 57. So it seems a big part of your argument is that when you get to OCP-4 and five that there's no risk of ignition, even in the high density pool. But that's at 72 hours.

So if you look at 55, which is the unmitigated high density small leak in OCP-4, at 72 hours it's a little hard to tell, but it looks like it has a positive slope.

So my question is, have you run the calculation out to a longer period of time? And if so, when does ignition occur eventually from that situation? And I raise that because if you look at Figure 57 again, this is just eyeballing the curve. So that's the low density small leak in OCP-4. It looks like it's a zero slope. And so it looks like it's reached a steady state temperature, in which case, if you go out to longer than three days, your conclusion that it's air coolable may be true only for the low density case and not for the high density case. So that's my question.

MR. SHERON: Yes, Ed, it's Brian Sheron. We recognize that we truncated the 72 hours. It was felt that there was, that provided sufficient time for operators to take mitigative actions.

They do have their procedures for dealing

with situations like that. They've put in place the FLEX program and so forth. And on top of that, the 72 hours is not an absolute.

In other words, it's not like everything all of sudden goes to a pool fire or whatever at 72 hours. There were some sensitivity studies done that show that even beyond that the heat-up takes a long time.

MR. LYMAN: Right. But you didn't do the sensitivity study with regard to duration for this particular scenario, for the OCP-4. And that's specifically the question I'm asking now.

MR. ESMAILI: Actually we did. After we published the report and everything.

MR. LYMAN: Okay.

MR. ESMAILI: So just looking at one of these figures, let's look at 53. I did extend that. As you can see, the temperature is going up by three days. I extended it to another two days.

The temperature goes up by only about 18 degrees heat. And so we are never going, in OCP-4, we are never nearing a zirc fire even in five days. And just extrapolating those temperatures, I don't think we are going to get into a zirc fire anytime soon.

So I did. So the temperature is going on so, so slowly that I don't expect a zirconium fire, even

in the high density, for a moderate case.

MR. LYMAN: So you said it was another 18 degrees elsius after two days.

MR. ESMAILI: After two days.

MR. LYMAN: But if you just drew a straight line, so it's leveling off after that, right?

MR. ESMAILI: Yes. It's slightly going up because the temperature in the building is getting hot. So you're losing some of the heat transfer. But other heat transfer mechanisms aren't there.

MR. LYMAN: Okay. So you didn't calculate the time to the failure though, right.

MR. ESMAILI: No. We still felt that three days was a good truncation time.

MR. LYMAN: All right. So I think Gordon just raised this quickly. But when you have a situation of air oxidation, so you looked at enhanced ruthenium source term. But you didn't look at enhanced low volatile source terms.

So it is true if you have the decrepitation of spent fuel in air that you're going to get more fuel finds so you can have a larger low volatile source term.

But looking at, I think it's Figure 94 versus 95, it looks like you have the same curve for both. So I was wondering why you didn't take that into account.

MR. ESMAILI: Okay. Regarding decrepitation, this came up in the ACRS letter of 2000. And there were some concerns. I think this is based on the early Canadian test that showed that if you expose fuel compact to air that's what happens.

Right now, we think that for the fuel rods that we have with the oxidized cladding, we don't expect any substantial amount of aerosol formation.

Regarding ruthenium release and other enhanced releases, what we did, I think you know that we did change the vapor pressure in ruthenium class in MELCOR to be more representative of a ruthenium oxide. So we do enhanced ruthenium releases.

But this is, we think, it's slightly maybe conservative. But we are checking against the recent French test, the Verdun test. It's not completed yet, but we're still analyzing.

MR. LYMAN: Okay. Let's see. Now, when you compare the two pool configurations, so in the low density configuration you have to go to checkerboarding for some of the fuel in the exterior. And that's because you can't discharge anything that's hasn't been cooled five years. Is that correct?

MR. ESMAILI: That's correct. I still keep the fuel for about five years in.

MR. LYMAN: Right. But you could conceivably move fuel to dry casks after three years?

MR. ESMAILI: I think there is --

MS. UHLE: Yes. I believe some designs allow that. The current practice is that it's five years.

MR. LYMAN: Right. But it is possible you could go to a one by four of empties, even low density if you discharged after three years. And I was wondering if that would make any kind of difference, do you think?

MR. ESMAILI: Even if I remove that checkerboard pattern, that checkerboard pattern is the fuel that's two years old.

MR. LYMAN: Right.

MR. ESMAILI: So that is not contributing a lot. The releases are very low for the low density cases. It's dominated by the 284 assemblies that have been discharged. So I don't think it makes that much of a difference.

MR. LYMAN: Okay.

MR. WITT: This is Kevin Witt. If I could add something on that. For three year discharge fuel, we think that there would be significant amount more casks needed to do that.

Because you're not able to load the same

type of fuel that you would at five years, or even seven or eight years. And so the costs for that type of scenario would significantly increase in the cost/benefit analysis.

MR. LYMAN: Now, you did find that there's no hydrogen combustion in any of the low density scenarios while there is in some of the high density. So isn't there a value in itself of removing that large mass of zirconium from the reactor and spent fuel system?

Right now there's DOEs working on trying to develop fuels that don't have zirconium cladding. So if you had an opportunity to remove a large amount of zirconium and reduce the risk of hydrogen combustion, isn't that a value? You can't quantify it necessarily beyond what you've done. But isn't that a qualitative factor that might also --

MR. ESMAILI: We relied on the reg analysis to show what the benefit of removing this. Yes, we did not calculate releases. But the delta between the high density and low density shows there is a substantial --

MR. LYMAN: Sure, I realize. But do you think that, just in general, to greatly reduce the risk of hydrogen combustion, this of course another Tier 3 issue, is addressing hydrogen mitigation. And so this could also be viewed as a hydrogen mitigation effort.

MR. ESMAILI: I think just talking about the reactor building here, the reactor building here is not really a containment.

MR. LYMAN: No, I know. But --

MS. UHLE: I'm sorry, this is Jennifer Uhle from NRR. Is your question that if we remove more of the fuel, say the three to five year old fuel, I think you're saying that it would reduce the probability of hydrogen detonation.

MR. LYMAN: No. I'm just talking about --

MS. UHLE: Is that what you're saying?

MR. LYMAN: -- what's evaluating the study. I could find the quotation, but there is no scenario with low density loading led to hydrogen combustion, right, while there are a number of the high density loadings that did.

And that's partly because of the much larger amount of zirconium that is oxidized. So I'm saying that, in itself, is a value which should be considered separately as a qualitative factor in the regulatory analysis.

MS. UHLE: And our regulatory analyses are looking specifically at the increase or decrease in safety to the public. So that --

MR. LYMAN: Yes. But I'm saying that

reducing the risk of a hydrogen explosion anywhere in the reactor, because there's collateral damage when you had a hydrogen explosion in one reactor at Fukushima.

Then it interfered with the ability to mitigate the reactor next to it. So I'd think that reducing the risk of hydrogen detonation is another consideration. But I'll leave --

MS. UHLE: Well, I guess my point I'm trying to make is that there is no difference in the probability of release between the low density and the high density. What's different is the amount of source term release. So I don't see that the reduction in the hydrogen --

MR. LYMAN: Right.

MS. UHLE: -- detonation is going to affect safety directly.

MR. LYMAN: So there's no general value in reducing the probability of a hydrogen explosion, whether or not it enhances the release? That seems to be not a reasonable position.

And I want to ask you about some of the calculations with the sprays where it kind of corrupted, right. Footnote 30 says that it failed after ten hours.

MR. ESMAILI: One of the calculations, what page are you on?

MR. LYMAN: This is Footnote 30, sorry.

It's Page 122.

MR. ESMAILI: Yes. Okay, but by that time this was just a numerical issue. It had already stabilized. The temperatures are already stabilized. We could have gone back and re-started calculation, make something.

But I didn't see any benefit to that, because the spray was sufficient to remove the decay heat. The temperatures were stabilized and nothing would have happened after that.

MR. LYMAN: So you don't think this reveals any concerns with MELCOR in general or this --

MR. ESMAILI: Not really, because --

MR. LYMAN: -- the flow regime model?

MR. ESMAILI: Not really, because this is a very, MELCOR is a system level code. We always run into problems when we are running calculations.

So this is, this is not a bug issue. This is, we start a calculation, it's a time stamping issues. So we always have to do calculation. It has nothing to do with any bug in the code.

MR. LYMAN: Okay. Now, the general issue of whether this is adequate for input into a regulatory analysis -- I raised in the last meeting, first of all, what the actual baseline is.

And I understand the regulatory analysis says you have to assume that all reactors are in compliance with current rules and regulations. But as far as the baseline spent fuel pool configuration, the common requirements fall short of actually saying thou shalt maintain a one by four, right. It's not a requirement, but it's an objective.

But you are assuming that the baseline is the one by four high density. And so if we don't know that's actually the case with the fleet, how can the public have assurance that's the correct baseline, and you don't have some pools with configurations that are higher risk?

MR. ESMAILI: We have done calculations with contiguous pattern, with a uniform flow pattern. That information is available. And I think the reg analysis, that was provided. It is taken care of in the reg analysis. So we do have that information available.

MR. LYMAN: And the information is there, but the baseline is still the assumption that the current pool configurations are one by four.

MR. ESMAILI: For this particular plant. Because this particular plant, Peach Bottom, it actually does a little bit better than --

MR. LYMAN: Yes, I realize.

MR. ESMAILI: -- one by eight. But when you apply it to other plants --

MR. LYMAN: But if the question is, is there a significant safety benefit to low density, you have to know what you're comparing that to on a fleet-wide basis.

And if there are some reactors that haven't actually achieved one by four, then there would be a greater safety benefit to going low density than there would be if they were one by four.

So the question is what is the current baseline of the fleet? You also assume full offload capacity, right, in the baseline. We know that's not true for all reactors.

MR. JONES: This is Steve Jones. What I can say is we have evaluations that address certain strategies. They're required to maintain those strategies. And to a large extent, they include those one by four baseline patterns.

I don't know how to address that on a plant-specific basis. From a regulatory analysis perspective, we are generally assuming, given the initiating event, that the event proceeds to a release for bounding cases. And that, therefore, covers any variability among the fleet that might be missed by the specific assumptions.

MR. LYMAN: So basically, it's the low probability of the initiating event is the only real consideration here at all. It's so low that your cost/benefit analysis is never going to show benefit.

And it really doesn't matter whether you have 100 percent release or anything. It's really all based on that very low number. So you didn't even need to do this whole study. You just need to stop at that.

MS. UHLE: Well, it's not just the low probability. That does affect it. But, of course, it is also based on the physics of the source term release, the timing of the release based on the timing so that protective action measures can be taken.

So there's a number of physics that are involved, radiation health modeling that are then incorporated into our analysis to look at the public health and safety benefit of moving to the low density versus the high density. So it's not just a probability argument.

MR. RAKOVAN: Ed, do you maybe have one more question that we can wrap up with?

MR. LYMAN: I guess I will stop there. Thanks.

MR. RAKOVAN: Okay. Let's go ahead and break for lunch then. When we come back from lunch, I'd

like to go to John Sipos, David Weisman and then Tom Cochran. We'll take an hour for lunch. So let's try to be back here at 1 o'clock so we can get started shortly after 1:00.

(Whereupon, the foregoing matter went off the record at 12:00 p.m. and went back on the record at 1:00 p.m.)

MR. RAKOVAN: Welcome back, everyone. I hope everyone had at least a fair lunch, if not a good one. I'm going to continue. This is Lance Rakovan again, facilitating the meeting.

I'm going to continue to go through those who pre-signed up to speak today. And we'll hopefully try to get through everyone in the next four hours.

As I said before lunch, we're going to go to John Sipos, then David Weisman, and then Tom Cochran. I'll try to give a three person, you know, queue if you will so people know when their time is coming up so they can prepare. So Mr. Sipos, if you would, please.

MR. SIPOS: Thank you very much. Good afternoon, everyone. My name is John Sipos, for those of you who I haven't met. On behalf of the State of New York for whom I work, I would like to express the thanks to NRC and to the distinguished group of people here today for holding this public meeting.

It's very important, I think, for the process. And it is an important issue, and it is an important issue to the State. So thank you very much. I appreciate that very much.

Just one question I had at the beginning. Is this hearing or meeting being transcribed? I think there was a question about that.

MR. RAKOVAN: Yes, the meeting is being both transcribed, and since we are webcasting it, we should have the archive of that, as well.

MR. SIPOS: Fantastic. Some preliminary questions, and I guess I'll direct them either to Dr. Sheron or Dr. Uhle or whoever else is on the panel. But as I understand the consequence study, it examined a type of severe accident at a spent fuel pool at the Peach Bottom Atomic Power Reactor Site, correct?

MR. SHERON: Yes.

MR. SIPOS: And so the consequence study was a site specific severe accident analysis of a spent fuel pool accident, is that correct?

MR. SHERON: Yes, it was for one reactor.

MR. SIPOS: Okay. And the consequence study used a computer code known as MACCS, M-A-C-C-S, numeral 2?

MR. SHERON: Yes, I think, yes that was the

correct one.

MR. SIPOS: And from our experience in the Indian Point proceedings, we understand that and I think Dr. Ooly, is it Ooly or --

MS. UHLE: It's Uhle. But I answer to most everything.

MR. SIPOS: Uhle, excuse me. Uhle, I'll try to pronounce that correctly. Thank you. That's for the MELCOR Accident Consequence Code System, I guess that's the acronym, is that correct?

And from our experience in Indian Point, we understand that it's also used for site specific severe reactor accident analyses as well, correct?

MR. SHERON: Yes.

MR. SIPOS: Okay. And amongst the NRC staff, can you tell us who was the principal author of Chapter 7 of the consequence study? Understanding you all work as a team. Yes, sir and I haven't met you so I'm not sure who you are.

MR. NOSEK: Hi, my name is A.J. Nosek. I'm from the Office of Research.

MR. COMPTON: I'll introduce myself. I've worked also with A.J. on Chapter 7, and a few of the other consequence pieces. I'm Keith Compton.

MR. SIPOS: Thank you very much. And as

part of the MACCS2 analysis that was done, who performed that aspect of the consequence study?

MR. NOSEK: I did.

MR. SIPOS: And so you were responsible for the inputs that were made to the MACCS2 code analysis, is that correct?

MR. NOSEK: Yes.

MR. SIPOS: Okay. And did you also make the decisions as to what values should be used for the inputs?

MR. NOSEK: Yes.

MR. SIPOS: Okay. And what version of the MACCS2 code did you use? I read in the report I think it was revision 3.7.0?

MR. NOSEK: Correct.

MR. SIPOS: Okay. And was it MACCS2 or WinMACCS?

MR. NOSEK: So WinMACCS is the user interface that we now have a framework for MACCS2. So MACCS2 is one of the components within the WinMACCS interface. So you could say I use WinMACCS/MACCS2.

MR. SIPOS: Okay, thank you. And how many runs of the MACCS2 code were performed?

MR. NOSEK: That's a good question. It depends on what you consider a code calculation and for

what purpose. For our base case scenarios of these spent fuel pool study they were looking at, we had seven major source terms we were looking at.

And of those, we had a number of different weather trials within there. And yes? We had upwards of 1,000 weather trials per scenario, and we also looked at a number of different sensitivities within those base cases for different dose truncations or NLNC calculations. So seven times three times upwards of 1,000.

MR. SIPOS: And we were using the term run. I've also seen the term case used with respect to MACCS. Are those interchangeable in your understanding or in your parlance?

MR. NOSEK: Yes. It depends on the context.

MR. SIPOS: And you also mentioned sensitivity studies, or sensitivity analyses. Those also factor into the number of runs that were performed, is that correct?

MR. NOSEK: There was additional runs done for sensitivities. Each in both the, I believe, Chapter 9? I don't know if it's still Chapter 9, but the sensitivities chapter as well as in support of the regulatory analysis as well.

MR. SIPOS: Okay. And did both of you also work on Chapter 9? I should have asked that earlier. Yes?

MR. NOSEK: Yes.

MR. SIPOS: Thanks. And do you know roughly when those MACCS runs were performed?

MR. NOSEK: The final calculations were in the span of around November and December of last year.

MR. SIPOS: Okay, 2012. And there were earlier runs done, as well, it sounds like?

MR. NOSEK: Yes. I mean, we will, as we refine our calculations will be doing a number of different runs.

MR. SIPOS: And were each of those runs documented in some manner?

MR. NOSEK: The ones that were documented were the final runs and the sensitivities.

MR. SIPOS: Okay. And were the runs that were done prior to the end of 2012, were they also documented?

MR. NOSEK: I do not believe they were documented in the final report.

MR. SIPOS: Would it be possible for the state to get copies of the input and output files for the runs for which there is documentation?

MS. UHLE: The question of what we have as far as distribution is if there was any proprietary information from the site. So can we get back to you on that question? And the only concern would be the proprietary nature of the data, recognizing your state.

I know there's different arrangements that can be made. So I think it's hard to answer just off the top of our head.

MR. SIPOS: Okay, well --

MS. UHLE: We can meet with you after the meeting and continue the discussion. That would be helpful to us.

MR. SIPOS: I appreciate that.

MR. NOSEK: We leveraged to allow the best practices from the SOARCA report. And we do have a report becoming available that much of those inputs will become available in that document.

MR. SIPOS: And just to close the circle on that, this state is interested in seeing the input and outputs and the results. What went into the runs, what the runs generated, so that we could look at it as well. Thank you.

And were there quality assurance or quality control aspects of the runs? Did either of you perform QA/QC on the runs?

MR. NOSEK: Yes. I mean, one of the number of reasons that we do a number of calculations up into our final runs is as a quality assurance measure.

In addition, we also had our subject matter expert from Sandia review all the inputs. And we also had the ACRS review our report.

MR. SIPOS: And the subject matter expert from Sandia, would that be Nate Bixler?

MR. NOSEK: Correct.

MR. SIPOS: And Joe Jones?

MR. NOSEK: Correct.

MR. SIPOS: And the rest of the Sandia people that are listed, I think, on the second or third page of the report?

MR. NOSEK: Not off the top of my head.

MR. SIPOS: I could read --

MR. NOSEK: I do not know who's on that paper.

MS. UHLE: I believe some of those people are the MELCOR support.

MR. SIPOS: Right, there is --

MS. UHLE: So we can't say off the top of our head whether or not they are all for MACCS.

MR. SIPOS: Okay. But Nate Bixler is, I guess, the custodian of the code for Sandia? So he was

involved in it, correct?

MR. NOSEK: Correct.

MR. SIPOS: And Mr. Jones, as well?

MR. NOSEK: Yes.

MR. SIPOS: Okay. And I think this is set out in the reporter, the information digest. But our understanding is that the Peach Bottom site has two reactors, each with a spent fuel pool.

So there's two pools, two reactors at the Peach Bottom site, correct? And this study looked at an accident to one of those pools, correct?

MR. SHERON: Yes.

MR. SIPOS: Okay. And Peach Bottom is located central Pennsylvania roughly, I don't know, 18 miles from Lancaster, Pennsylvania, correct?

MR. SHERON: I believe so, yes.

MR. SIPOS: Okay. And I checked the 1996 generic environmental impact statement for license renewal. And I think as of 1990, which was the population data that was used in this study, there were roughly 4.7 million people that lived within a 50 mile radius of Peach Bottom. Is that square with your general knowledge? I got it from the GEIS at Table 2.1.

MR. NOSEK: I do not recall the population off the top of my head. But that seems feasible.

MR. SIPOS: And I have a couple of questions that I think Lance, I'm sorry excuse me, that Kevin was discussing this morning concerning the relationship with other activities that NRC is conducting right now.

And I think on the PowerPoint that you handed out this morning, Page 14, it looks like the consequence study is expected to be finalized very soon by NRC staff, correct?

MR. WITT: Yes, they are both expected to be provided at the commission on or before October 11th.

MR. SIPOS: Okay. And that would be before the public comment period ends on the waste confidence proceeding, is that correct?

MR. WITT: That is correct. I believe the waste confidence comment period ends late November.

MR. SIPOS: Right, around Thanksgiving, I think. And I think going back to Page 4 of the hand out from this morning, there was a statement that the schedules have been aligned to facilitate public involvement with the Tier 3 issue, the study, and ongoing waste confidence activities and relating policy issues. And it sounds like that is exactly what is going on, correct?

MR. WITT: That is correct.

MR. SIPOS: And just to be clear, when you

talk about the Tier 3 issue, you're talking about the regulatory analysis or Appendix D that is attached to the consequence study?

MR. WITT: Those are two slightly different documents. The Tier 3 analysis is a generic regulatory analysis applicable to all plants. The Appendix D of the spent fuel pool study was done for that specific plant studied in the report.

MR. SIPOS: Okay, thank you. I appreciate that clarification. I guess I would like to come back to the MACCS2 issues that were part of the consequence study. Could you tell us what role Dr. Bixler played in the MACCS2 analyses that were done?

MR. NOSEK: Nate Bixler is a consultant, and he also is a lead developer for the MACCS2 code. And so we use him as consulting support. But we did the calculations and the model development in-house.

MR. SIPOS: And did he make any suggestions regarding inputs or assumptions to any of the inputs?

MR. NOSEK: Yes, where necessary.

MR. SIPOS: And could you summarize what those suggestions were by Dr. Bixler?

MR. NOSEK: On an overall scheme of things, the models that we started with were leveraged from SOARCA. So our initial starting point was harnessing

the best practices from that report, which also is Peach Bottom, which has site specific meteorology and geography.

So it's also very applicable to our site. And starting from there, we took the source terms generated from the MELCOR code to make it specific to the spent fuel pool study, as well as updates regarding the emergency response aspects. And a few variety of small changes to inputs from different areas.

MR. SIPOS: And did Mr. Jones make any recommendations?

MR. NOSEK: Mr. Jones was assisting NSRG in recommendations for the emergency preparedness and the emergency response and all the protective actions in that part of the code.

MR. SIPOS: And when you refer to protective actions, are you referring to the protection action guidelines that EPA has developed?

MR. NOSEK: Partly. Bottling the emergency response and evacuation as a whole. So including emergency phase relocation, evacuation, shelter in place, and setting up an appropriate response based on the site's emergency action levels, and the specific evacuation time estimates.

MR. SIPOS: There's another individual at

Sandia, I may be mispronouncing his name, Randal is it Gauntt, and my understanding is he's done work with MELCOR as opposed to MACCS. Did he have any involvement with the MACCS analysis that was performed as part of the consequence study?

MR. NOSEK: Not directly.

MR. SIPOS: But he does have experience with MELCOR, correct?

MR. NOSEK: Correct.

MR. SIPOS: Okay. And did he work on any of the MELCOR aspects of the consequence study?

MR. ESMAILI: No, he did not.

MR. SIPOS: Thank you.

MR. RAKOVAN: Sir, just one or two more questions, if you wouldn't mind. Sorry, I'm sitting down right here. I was trying to stay out of the way of everybody. Just a couple more questions, and then we'll move on to the next speaker, please.

MR. SIPOS: It also appears that Oak Ridge National Laboratories had some role in the consequence study. Could one of the NRC staff members here summarize the role of Oak Ridge?

MR. ESMAILI: Oak Ridge did two things for us. First, provided the inventories, you know, radionuclide inventories. So they did a scale origin

calculations for us.

And they also did, you know, doses in the refueling flow, once the spent fuel pool becomes uncovered to see what the radiation levels would be. These are all documented in the report. I believe it's in Chapter 5.

MR. RAKOVAN: Thank you, Hossein.

MR. ESMAILI: Yes.

MR. RAKOVAN: I was just trying to get your name into the statement, that's all.

MR. ESMAILI: Why he keeps telling it. Sorry.

MR. SIPOS: Thank you very much. And also, there was a company, DAKOTA, LLC. Could anyone describe what their role was? I may be mispronouncing it.

MR. ESMAILI: Correct. The individual is Casey Wagner. He was, at the time, he's right now at DAKOTA but he used to be at Sandia. So he was involved in, you know, the MELCOR code development, applications, et cetera. So we used him to some extent, you know, as a consultant.

MR. SIPOS: But it was on the MELCOR side of --

MR. ESMAILI: On the MELCOR side.

MR. SIPOS: Thank you. Just I notice there

were three people involved in the study who's last name was Wagner. Any relationship amongst them?

MR. ESMAILI: No.

MR. SIPOS: Thank you. I do have further questions. Thank you. I do have further questions, but recognizing that there are a number of people, as I said, my flight is very late. I'm happy to have other people --

MR. RAKOVAN: If we have time, we'll loop around to you.

MR. SIPOS: Thank you very much.

MR. RAKOVAN: Okay, thank you. If we could go to David Weisman, who I believe is on the phone, followed by Tom Cochran and then Kyle Landis-Marinello. Operator, can we see if David Weisman is on the phone, please?

OPERATOR: Yes, please press Star 1 if you are connected.

MR. RAKOVAN: Mr. Weisman, are you there?

MR. WEISMAN: Hello. Are you there?

OPERATOR: Mr. Weisman, your line is now open.

MR. RAKOVAN: Please go ahead, David. We can hear you.

MR. WEISMAN: David Weisman, Alliance for

Nuclear Responsibility. Yes, it's funny. As this call began this morning, I was actually just watching the first rays of the sun on the Pacific Ocean out the window, for those of us here on the other coast.

And I must say while I never tire of that, I was quite tired at that hour. But looking at the Pacific brought in mind two questions regarding this study. It seems there's a motivating factor in the decision making that has triggered by the events of Fukushima and it's aftermath.

And so my first of two questions is since you are using a seismic event of great magnitude as your trigger event, why choose Peach Bottom, particularly since the geology of that site, when you're looking to consider probabilistic risk, occurrence, and magnitude, is one of relative geologic stability?

Why not choose instead, since you did need a GE boiling water reactor for comparison, the Colombia Generating Site, and albeit a Mark II but close enough, which is tangential to the Cascadia Subduction Zone of the Pacific Northwest, which the USGS has stated is capable of a 9.0 magnitude quake.

So you have two similarities to Fukushima, subduction zone, magnitude 9. And thus from a perspective of looking at both the type of reactor,

General Electric boiling water reactor, and the triggering mechanism, subduction zone 9.0, more of a closely related analog to the Fukushima situation.

And that was my first of two questions. Either I can give you the second question, or you can take a crack at that one.

MR. RAKOVAN: Let's go one at a time, if you would.

MR. WEISMAN: All right.

MS. UHLE: This is Jennifer Uhle from NRR. The reason why the Peach Bottom site was chosen was a matter of expediency. We had a lot of models already prepared as part of several other studies that we had been conducting.

And so that facilitated, you know, the calculation of what would occur at that particular plant. Now we recognize that the seismicity varies across the fleet of reactors.

And so we didn't just look at the probabilities in terms of the Peach Bottom plant in the spent fuel pool study. We are, as part of our Tier 3 analysis, which is the main regulatory decision making document, we looked at the seismicity variations.

And we increased the probabilities of this particular size, or this particular level of

acceleration and considered that in the sensitivity studies in the regulatory analyses.

And I just want to look to Fred Schofer, if you want to add anything to that Fred to further clarify. Do you think I managed to -- is that okay? Okay. Okay, thanks. So that is how we accounted for the higher seismicity in the other pools.

MR. WEISMAN: But do we know that you're extrapolations pulled out to, for example, subduction zone 9.0 Pacific Northwest size that would be equivalent to a Fukushima event?

MS. UHLE: The accelerations that was actually seen at, I'm going to pronounce it Fukushima, was actually .56g. The actual accelerations we used at Peach Bottom was at the spent fuel pool scoping study, was .7g. So we actually bounded the acceleration.

MR. WEISMAN: Well that would be for the Peach Bottom. Of course, again for those of us here on the other coast, we have your highest here at Diablo Canyon, which would be .75g. But I will go with that, that it was expediency.

MS. UHLE: Well, but again we didn't stop there. When we did our regulatory analysis, we increased the probability of seeing these accelerations so that this additional seismic risk was captured when

we looked at the overall potential safety improvement by going to the lower density loading.

So at this stage, you have not yet seen the document that I'm talking about, which is the Tier 3 document. We have not completed it. We wanted to have this public meeting to get some feedback from everybody.

So that document that will provide our approach, that I think will answer your question specifically will be available at the end of September. And then we are going to have an advisory committee and reactor safeguards meeting, a public meeting.

That is again available for people to participate, or excuse me, to witness. And that is, I can't remember the date exactly. It's October 2nd. So I think that looking at the document when it becomes available, I think that would help answer your question.

MR. WEISMAN: All right. Then we'll move to the second question.

MS. UHLE: Well, actually I think Steve Jones from NRR is an expert in spent fuel pools in the office, is going to add a few more statements.

MR. JONES: Oh, I just wanted to clarify with respect to the west coast plants, the seismic data we have is somewhat older and not directly compatible with the 2008 eastern and central USGS information.

So we are looking forward to 2015 when we expect to have the more updated seismic hazard curves available to fully assess the west coast reactors.

MR. WEISMAN: All right. Well as long as we'll stick on the west coast here. Second question is that your study is, in a broader sense, addressing cross risk analysis in terms of overall reduction, the benefits of overall reduction of the expedited transfer relative to, let's say the potential consequences of human exposure, et cetera.

Add to this, though, that the NRC slogan, if I'm not mistaken, is protecting humans and the environment, and so I'm going to go to another population at risk which hasn't been, I think, addressed yet, affected by spent fuel pools. And that would be the marine environment.

And I'm thinking of this not necessarily in terms of radionuclides, but of the aquatic species, larva, et cetera because if I am not mistaken, spent fuel pools at costal locations, at least the case at Diablo Canyon here, use a portion of the stream of their once through cooling water, and it may be a lower volume, 25 percent of the intake volume, to provide cooling for the spent fuel pools.

And I don't know if that's the case on your

eastern plants like Port St. Lucie or Turkey Point in Florida. These are all costal plants that don't use cooling towers, but rely on once through cooling to maintain a portion of the spent fuel cooling.

And they need to do so even for years, as we've heard, after the reactors on those locations become decommissioned.

But at the same time, we're seeing great deal of activity around the use of once through cooling and the marine environment, whether it's the Point current re-licensing debacle on that or the Riverkeeper two decision, or the State of California Water Board's decision to say that all once through cooling at costal plants, including nuclear plants some point in the next decade.

And so we'll be seeing a growing increase in restrictions and limitations on the use of once through cooling, which again, a portion of which would still be, if I understand that correctly, needed for cooling the spent fuel pools.

And so I'm wondering if, and where in your work the fact that these impacts that could lead to expedited transfer if it's required for your cooling and it's taken away from you, this might force an expediting of transfer at some of these costal locations.

And where is that reflected in your study? I'm not sure, but is the NRC going to attempt to preclude any state, or even your sister agency the Federal EPA with their Clean Water Act requirements from the eventual abandonment or prohibition on once through cooling.

And how might this impact the expediting of cask loading from those pools, because I haven't seen any consideration of this issue in your slides or report.

MR. JONES: Yes, this is Steve Jones in the Office of Nuclear Reactor Regulation. The amount of once through cooling water that's used for spent fuel pool cooling is really trivial compared to the amount used for power generation and heat rejection for the power cycle far less than one percent.

And it's really not within the scope of this study or overall topic.

MR. WEISMAN: All right, so that you could say that any impacts or changes in a once through cooling regulation. Once through cooling was stopped at any of these plants, it would have absolutely no effect on the continued cooling of the pools.

MR. JONES: Right, that's predominantly the power cycle cooling system, which is separate from the safety related cooling system.

MS. UHLE: This is Jennifer Uhle. I would

also like to add, I'm just not sure if this is clear to the public, that there is no water that gets released that's come in contact with either the spent fuel pool, fuel itself, with the spent fuel pool water or the reactor side.

There's always a separation between the contaminated water and the ultimate heat sink or the water that can be taken in from the ocean to cool the fuel in either the reactor or the spent fuel pool. I'm not sure if that was clear to people.

MR. WEISMAN: All right, well thank you for that. If and when this less than one percent of water is lost from this particular source, it will have absolutely no impact on the abilities of the spent fuel pool to maintain its temperature?

MS. UHLE: This is Jennifer again. I guess I'm still a little confused maybe about what your question is. I'm sorry if I'm --

MR. WEISMAN: If any amount of once through cooling water, and again I've just heard, again I thought it was maybe sized 25 percent, but one percent of the stream of water that's taken in for once through cooling is used to help maintain the temperature of the spent fuel pool.

And as Mr. Jones says, it's about, he says

it's less than one percent. So if that one percent is lost, that one percent of water because a prohibition or ban on once through cooling, the pool still remained adequately temperature controlled minus that bit of water that's needed from the once through cooling source.

MR. SHERON: This is Brian Sheron. One thing you have to remember is that even if you, you know, I think what you're postulating is that somehow that some government agency would ban the use of once through cooling at these plants.

I don't really think that's a valid assumption that someone would just automatically ban that. But that said, regardless, even if some utility were to move fuel expeditiously, there would still have to be fuel that was left in the pool, and would require cooling.

MR. WEISMAN: Correct.

MR. SHERON: You can't move all of the fuel into dry casks. So it's strictly you're just removing a very small percentage. And what you're actually removing into dry casks is already very, very low power and requires very, very little heat removal. So I don't really think it has much of an effect.

MR. WEISMAN: Well no, and I'm assuming it's not. That's what I just want to verify with, again,

what Mr. Jones said is that less than one percent of the water coming in through the massive once through cooling is actually diverted or used or flows in a way that it helps keep those pools cool.

So therefore, even if a state were, and by the way Mr. Sheron, the State of California's law actually does say that our once through cooling is prohibited effective 2022 and 2024 in the State of California for nuclear power plants.

And they're building cooling towers and alternatives, so the state law can dictate that. But what I'm hearing, though, is that if we loose that one percent of water, doesn't matter. The pools will remain cool, it was maybe just over the top protection nonetheless. That's all I want to verify.

MS. UHLE: This is Jennifer Uhle again. Yes, we don't see that as being a large impact.

MR. WEISMAN: Okay. That's just what I wanted to make sure. Well thank you. That's my questions for today.

MS. UHLE: Thank you.

MR. RAKOVAN: Thank you, sir. Okay, let's go ahead and go to Tom Cochran followed by Kyle Landis-Marinello and then third, Mary Lampert.

MR. COCHRAN: I'm Tom Cochran. I'm a

consultant to NRDC. I used to head the nuclear program at Natural Resources Defense Council, NRDC. I grew up in the public school systems in Tennessee, so I may butcher some of your names. I apologize for that up front.

I'm trying to get my hands around the overall study, and I would like to start with Dr. Uhle. This process we're going through is what you and I and in the trade refer to risk informed regulation building or assessment.

And so part of your role in this study is to judge the quantitative risks from these calculations against the agency standards, which are the, as I understand it, the principal quantitative safety goals.

So we're here primarily to see if we are meeting the principal quantitative safety goals of the NRC. Now, I'm wondering if it troubles you as it does me that the Fukushima accident, all three reactors that melted plus the fourth one, met the NRC's quantitative safety goals.

Does that trouble you in making judgments about how safe we're going to make these pools that you're doing a assessment against some goals that were actually met by the reactors that melted down in Japan and caused such a disaster.

MS. UHLE: This is Jennifer Uhle from NRR. And let me try to go back for some people that might not be as familiar with the term quantitative health objectives. This was back in the, I believe, '80s or '90s, the Commission wanted to define what was considered to be safe enough.

And at the time, we were improving our use and the accuracy of our probabilistic risk assessment tools that first really started to be used in the '80s time frame. And the Commission indicated that they had safety goals on nuclear reactor -- can we hold off and allow him more time as I give this more lengthy response?

MR. RAKOVAN: Go ahead.

MS. UHLE: Thank you, if that's what's causing the problem, because I think this is important. The quantitative, or excuse me, the safety goals, the Commission said that by the operation of the nuclear power, that what was considered to be safe enough was to ensure that risk due to latent cancer fatality was less than .1 percent of the cancer risk that is seen in today's society.

And that .1 percent of the summation of all the cancer risk, it really corresponds to a latent cancer fatality risk of two in a million years. They also said from prompt fatalities, or in the case of acute radiation

exposure after an accident, that it would also be less than .1 percent of normal accidental risk in today's society.

And that equated to five in every 10 million years. Okay, so those are very low frequencies that would be an acceptable risk to the public from nuclear power. And so what that equates to is that the Commission said this is safe enough.

So when we look at our regulatory process, once we've made a licensing decision and plants are operating, we have certain restriction imposed on us by federal regulation that we have to meet certain standards before we make a licensing change, either the way they're operating or their plant, and it's called backfit.

If people are interested, the actual regulation is 10 CFR 50.109. Now, if we feel that it's necessary for adequate protection, we can immediately make the regulatory requirement come into play.

So when we look at changing our regulations, we keep these figures of merit in mind. And with that, the surrogate that we use to see if a particular plant is acceptably safe is we go for a core damage frequency of less than E2, or excuse me, one in every 10,000 years. And Fukushima did not meet that.

They had an accident. They had three cores

melted. They had --

MR. COCHRAN: Quantitative safety goals. There were no prompt fatalities at Fukushima, right?

MS. UHLE: Okay, I'm --

MR. COCHRAN: Latent fatalities. If you were less than 200 fatalities per million people, you met the quantitative safety goals in Japan.

MS. UHLE: But in looking at the actual plant design, that plant would have been required to have been backfit from their seismic risk and their tsunami risk here in the United States.

And the Japanese have recognized that, and they are taking action to augment their tsunami and their seismic risk at the plants in Japan.

Now, I agree with you the concept that there thankfully were no prompt fatalities and the expected latent cancer fatality results are extremely expected to be low for the Fukushima because they did effective evacuation.

So I think that actually shows the defense in depth of the regulatory process in Japan, and then also in the United States. That again, we make sure that there are emergency preparedness mechanisms in place to provide those measures in case they're called upon.

So the commission is currently looking at

economic consequences, which include I think your point about land contamination. At this stage, we do consider the land contamination in our regulatory analyses. And that is explicitly called out in the Tier 3 activity that will shortly be public.

So land contamination is considered. And at this stage, we are still seeing that with our current estimates that we would not be meeting the threshold that would warrant regulatory action.

Nonetheless, we are taking numerous actions post-Fukushima, and requiring a number of enhancement measures to augment the safety of our power plants here.

And it's been obviously discussed very publically, and there's plenty of public meetings including mitigating strategies is under discussion, spent fuel pool instrumentation, improving severe accident management guidelines, et cetera. So we are taking action to enhance the safety of our plants here.

MR. COCHRAN: Brian, do you agree with me, that Fukushima accidents met the NRC's principal quantitative safety goals? That's a simple yes or no. Or I don't know.

MR. SHERON: Well, I haven't done the exact calculation, but I think the answer is most likely yes, they did meet the safety goals.

MR. COCHRAN: I would like to turn to Mr. Esmaili. The study that you co-authored, just to simplify it for my purposes, you start with an earthquake risk of one in 60,000.

Your analysis says the probability of a fire, well you're not going to get a fire unless it's within the first two months after refueling. So the probability is being knocked down by roughly another order of magnitude.

MR. ESMAILI: Correct.

MR. COCHRAN: And that the probability of getting a major release is yet another order of magnitude below that because of the probability associated with whether the pool drains or not.

Only in ten percent of your earthquake cases did you get drainage of the pool, you don't have a release unless you get drainage. So it's one in 6,000 times ten percent times ten percent.

So it's essentially a probability of a large release from your studied case of one in six million. Now 60,000 times ten times 100, 600,000, 6 million. One in six million. Okay?

MR. ESMAILI: This is --

MR. COCHRAN: Just in round numbers. We're in that neighborhood.

MR. ESMAILI: This is Hossein. I guess this time I remembered my name. Yes, approximately. Yes, we start out with --

MR. COCHRAN: Just approximate.

MR. ESMAILI: Yes. Ten percent probability of liner damage that can lead to a release, a ten percent probability, approximately.

MR. COCHRAN: Yes, approximately. I'm doing a back of the envelope, back of the mine calculation to make sure I understand. And so we have 100 reactors, let's just make life simple, 60 years, maybe half of their lives to go, so 30 years.

So there's 3,000 reactor years to go. One in 6,000 for 3,000 reactor years, you wouldn't expect this even to occur under your study --

MR. RAKOVAN: Tom, can you speak into the microphone please so we can pick you up?

MR. COCHRAN: -- by the order of once in 3,000 years?

MR. RAKOVAN: Can you speak into the microphone so we can make sure we pick you up?

MR. COCHRAN: Yes.

MR. RAKOVAN: Thanks.

MR. COCHRAN: Once in a few thousand years, I mean, that's the bottom line of this study. So I want

to ask you do you believe that your study bounds the risks associated with a spent fuel pool release going forward? You've done a quantitative?

Does your study in your mind, in your technical mind, you know what these guys have done and you know what you've done, is it your view that you've bounded the risk to the public by the study you've conducted.

MR. ESMAILI: This is Hossein again. The study was a consequence study. It was not a probabilistic risk. We put in this probabilistic considerations as you correctly point out, that it was one in 60,000 years, right?

There's a ten percent probability of liner failure and there's a ten percent probability of --

MR. COCHRAN: Something, yes.

MR. ESMAILI: Yes, so we get that. But this shows the probability that something can happen, right? It was never meant to be a bounding analysis. It was a best estimate analysis.

What probability tells you is that, you know, something can happen and that this is certain probability. It doesn't tell you when it's going to happen. So --

MR. COCHRAN: So you do not believe --

MR. ESMAILI: It was not a PRA, it was not a probabilistic risk assessment. Yes.

MR. COCHRAN: So authors of the study, I understand what you just told me, do not believe this is a bounding calculation of risk from an earthquake induced spent fuel fire in the pool?

MS. UHLE: I'm --

MR. COCHRAN: I'm asking him, I'm not asking you. I'm asking the technical guy that wrote the study.

MS. UHLE: Excuse me, we're trying to answer the questions for the benefit of the public. So --

MR. COCHRAN: Then let him answer, and then you answer.

MS. UHLE: No, actually I have the right as a member of the United States Nuclear Regulatory Commission --

MR. COCHRAN: Okay.

MS. UHLE: -- to answer the question because I think --

MR. COCHRAN: Keep track of the tack.

MR. RAKOVAN: We've been --

MS. UHLE: The study that was done in the Office of Research, I was a member of the Office of

Research, I was its deputy director when it was first initiated.

So that was a best estimate study for us to understand what the most likely consequences would be. But we are not just using that study to determine whether if we're going to take any regulatory action. So the study --

MR. COCHRAN: I know that. I heard your earlier testimony.

MR. RAKOVAN: Can you let her finish please, Mr. Cochran?

MS. UHLE: Thanks. So the study doesn't need to be bounded. We wanted to best understand what we think the most likely results would be.

The way we then looked to see other variations, including other reactor designs, et cetera, is by the regulatory analyses and making conservative assumptions that are described in the spent fuel pool study in Appendix D.

And we also have done so to broaden it to the other plant cases in the Tier 3 analysis, which will be publically available here shortly.

MR. RAKOVAN: Do you have one more question, Mr. Cochran?

MR. COCHRAN: No, I don't. And I want to

get credit for the time I've lost.

MR. RAKOVAN: You've got credit for the time you lost, Mr. Cochran.

MR. COCHRAN: All right.

MR. RAKOVAN: Do you have one last question?

MR. COCHRAN: No, I have more than one last question.

MR. RAKOVAN: Can you have one last question, please and be done?

MR. COCHRAN: No, I cannot. I can come back?

MR. RAKOVAN: Then we'll have to take a recess. Do you have one last question, please? I'm trying to get to a couple dozen other people by my clock.

MR. COCHRAN: I'm fine with that.

MR. RAKOVAN: Okay.

MR. COCHRAN: You asked me if I had one last question. The answer is no.

MR. RAKOVAN: I apologize.

MR. COCHRAN: I have several more questions.

MR. RAKOVAN: I should have been more precise.

MR. COCHRAN: I will ask one more question,

and then we will go on to other people.

MR. RAKOVAN: Thank you.

MR. COCHRAN: And hopefully you will allow me to come back.

MR. RAKOVAN: If we have the time.

MR. COCHRAN: Here's my problem. I take your number of ballpark number, one in six million for having a substantial release. And I look at, say we got 3,000 more reactor years of operation of the fleet.

So that's, you know, the probability of this event is one in 2,000, one in a few thousand, one in a couple thousand, something like that per year. So I then ask myself about the security challenge that you didn't address.

And I say what is the probability that you would get a security breach that would cause the same accident, and it's a joint probability of the probability that someone wants to do it times the probability of their success in doing it.

And I would assume that if someone was going to challenge the reactor, they would have sense enough to do it within right after a refueling, and they would pick their reactor and pick the time.

And therefore, I have come to the conclusion that the probability of getting into this scenario that

we don't want to happen is much higher through some sort of successful terrorist event or whatever, which is not part of your study.

So my question is in the security analysis of these reactors, do you look at the benefits of expediting spent fuel removal to reduce the consequences associated with a successful attack on a spent fuel pool.

MS. UHLE: This is Jennifer Uhle from NRR, and the answer to that is no, not explicitly. After the attacks on September 11th, we did a number of analyses looking at aircraft impact.

And we did take some regulatory action, including the requirement of having what we called emergency strategies. They're now incorporated into the regulations there.

I don't know if many people have heard the term B.5.b, that came out of the order. But there were a number of actions such as including emergency power and pumping and ensuring the water supplies.

During those analysis, we did not do the comparison between, you know, the high density loading and the low density loading. We can't get into a great deal about what we did do in those studies, they're not publically available.

We have a robust security measures in place

at the reactors. And we feel that the security threats at a reactor are appropriately considered in other parts of our regulatory program. So the answer to you is no, we did not do that, but we believe the reactors are safe from a security perspective.

MR. COCHRAN: But it's a higher risk. Well, I'll come back later.

MR. RAKOVAN: Okay, thank you. Okay, next on the list I had Kyle Landis-Marinello? Kyle, if you're on the phone lines and you wish to make a comment, can you identify yourself at this point so the operator can unmute your line?

OPERATOR: Thank you. And once again, that's Star 1.

MR. LANDIS-MARINELLO: Hello.

OPERATOR: And your line is now open. Thank you.

MR. LANDIS-MARINELLO: Hi, can you hear me now?

MR. RAKOVAN: Yes, we can. Go ahead sir.

MR. LANDIS-MARINELLO: Great. This is Kyle Landis-Marinello from the Vermont Attorney General's office. Thank you for holding this conference. And it's been very informative.

I've been learning a lot just listening in.

And one thing that struck me is there seems to actually be a fair amount of agreement on some of the issues here.

And I think I heard Dr. Uhle say that the NRC staff assumed that there's no risk posed by dry casks. And so there is some level of incremental risk with leaving it in the pools.

But it sounds like the NRC staff is constrained by the backfitting provision in 10 CFR 50.109, and that that prevents the NRC from doing the safer option of requiring expedited movement to dry casks.

And I wondered if the NRC staff looked at some of the exceptions in that backfitting rule, for instance redefining the level of protection that's required. Or just more generally whether this actually is a backfit.

Some of the rules talk about, the whole rule seems to be what you build your plant under certain regs, and you should be able to count on those regs. And so there's a higher standard you need to show a substantial increase in safety before you need to backfit a plan.

It strikes me as a bit of an odd word to use a backfit for where we are now because we're someplace where we never thought we would be at these plants in that the idea, when this backfit provision came about, was

that plants wouldn't be storing fuel, that it would go somewhere else.

And now a lot of fuel is being stored at these plants. And so is there room for looking at whether this actually is a backfit?

MS. UHLE: Hi, thanks for your comment. This is Jennifer Uhle. And if the agency felt that adequate protection was not provided by the plants, and you can read in 5109, we would again take immediate action to ensure public health and safety.

So if you're looking at the exception to the backfit rule, one is that it's adequate protection. And we've promulgated a number of rules based on adequate protection.

And then another one is if we want to redefine, you know, what the level of adequate protection entails. And in those is, again, looking at the risk posed to the public as some measure, also defense and depth, what have you.

But just to give you an idea of the risks associated with the high density storage with, you know, the current configuration of spent fuel, we computed the latent cancer fatality and it ranged, of course.

But looking at because of the different designs when we did the regulatory analysis with the Tier

3 work, again you haven't seen that publicly yet. It will be coming out the end of September.

And the latent cancer fatality risk is, I'm going to use the term E^{-10}, which means one every, what is it, something to do with one every, no it's more than that, 10 billion years.

So that is, in our mind, so low that it doesn't rise to the level of adequate protection. But we have, and we continue, to assess whether or not we need to redefine adequate protection and whether or not adequate protection, we need to do rulemaking.

And in fact, we have rulemakings underway. And orders were issued after Fukushima that did point to an adequate protection reason for a number of actions post-Fukushima.

MR. LANDIS-MARINELLO: Okay. And I guess it's just kind of from a gut level perspective, even if it seems like a very small number, it's hard to understand why they're not required this measure, particularly when, and I was a little confused by the cost/benefit analysis because I'm assuming that there are two things that weren't taken into account and maybe you can comment on this.

One is a lot of these plants need to move this fuel into dry casks in order to transport the fuel

away at some point. And so the cost of doing it now versus later is actually pretty minimal.

And then the second factor is whether the plants are actually, there's a huge number for what they would cost the plants.

But under the law right now as the courts have defined it that arguably the plants aren't paying anything moving the fuel to dry casks because legally that falls upon the DOE for its breach of contract. So should the cost analysis be redone

MS. UHLE: Again, this is Jennifer Uhle from NRR. We had a long conversation. I was just wondering if you can go back just so we clearly understand your questions, and then we'll, I think Fred Schofer from the Office of Nuclear Reactor Regulation who did the reg analysis can answer your question.

But at this stage, we could benefit by you repeating your question, if you don't mind.

MR. LANDIS-MARINELLO: Sure. When you looked at the cost to this plant of immediately moving fuel that can be moved into dry casks, I wonder if you considered that a lot of the fuel has to be moved in order to be transported to -- or another storage facility at some point, and so the cost is actually pretty minimal when that's the case.

And I also wondered if you looked at whether there actually is any cost, given that the state of the base law that's come down from the federal circuit has said that the Department of Energy is responsible for all those costs. So there's arguably no cost to the reactor operators to move the fuel.

MR. SCHOFER: Hello, this is Fred Schofer, Office of NRR. With regard to the costs for moving the spent fuel into casks, what the regulatory analysis did, and that's attached to the spent fuel pool study in Appendix D, is look at the incremental costs between doing the expeditious movement within, you know, between 2014 and 2019 and then maintaining the low density storage configuration in the pool until end of operation, and then moving the remaining fuel into dry storage five years hence against the current, you know, regulatory baseline which is moving fuel into dry cask storage as to maintain your one core empty inventory in the pool, and until end of your operating license and then moving the remaining fuel into dry cask storage ten years hence.

So those incremental costs were calculated and reported in that appendix.

MR. LANDIS-MARINELLO: Okay. And it was assumed all the costs would fall on the reactor operators?

MR. SCHOFER: It was reported as an industry implementation cost, that is correct.

MR. LANDIS-MARINELLO: Okay, thank you.

MR. RAKOVAN: Is that the extent of your questions, sir?

MR. LANDIS-MARINELLO: Yes, that's it. Thank you very much.

MR. RAKOVAN: Okay, very good. We'll go ahead and move now to Mary Lampert, then we'll go to Linda Seeley and third, Tom Rielly. Mary, are you on the line? Operator, can you check to see if Mary Lampert is on the line, please? Are we on the line? Okay, we're on the line.

Operator, are you there please? Okay. Should we take a five minute stretch break? See if we can make sure that we're on the line and that we have an operator with us. Okay, five minutes? All right, five minute break.

(Whereupon, the foregoing matter went off the record at 2:05 p.m. and went back on the record at 2:11 p.m.)

MR. RAKOVAN: Okay, I'm going to go back to the list as I had it. I'm starting with Mary Lampert. Mary, if you are on the line, if you could identify yourself so that the operator could bring you in. And

Brooke, if Mary doesn't identify herself we'll go ahead and move on to the next person.

OPERATOR: Absolutely. And that is Star 1, please.

MS. LAMPERT: Hello.

OPERATOR: And your line is open, thank you.

MS. LAMPERT: Hello, can you hear me?

MR. RAKOVAN: You could be a bit louder, but yes we can hear you Mary.

MS. LAMPERT: Okay. First I'll start off with that Pilgrim Watch believes this is not a credible study. And while the study pretends to be a broad scientific study into pool fires, instead it narrowly looks at just earthquakes, avoiding important pool fire accident contributors, and avoiding the evaluation of all mitigation strategies.

My first point of discussion is that I believe that it's premature to release the study for two reasons. First, the National Academy of Sciences was called in by the Congress to determine the adequacy of NRC's safety regulations in light of the ongoing Fukushima disaster.

The specific emphasis on the advisability of current spent nuclear fuel pool practices at our

reactors. So it seems to me that both members of Congress and the NRC itself should halt the fast moving train you're on relative to its continuing approval of high density spent nuclear fuel pool storage until the Academy has finished its quality assurance review.

Second, the analysis was done using a MELCOR code that has assumptions and methodology that go back before Fukushima to judge a post-Fukushima situation.

For example, some of the weaknesses in the code would include the economic consequences of not accurately assessing cleanup as discussed by the New York State in the Indian Point adjudication process for relicensing. Also, you could consider emergency planning.

The assumptions there are number one, there are offsite emergency plans. But we have seen, for example, in the Oconee experience that after a year and a half, offsite emergency planning is no longer required, however the spent fuel is still an issue at the site.

So without offsite planning, there's no way you can make an assumption that folks are going to get out of dodge in a timely manner. Nor can you assume that the evacuation time estimates done by KLD are correct because, for example, much of their methodology relies on telephone surveys that do not ask or tell that this

is for a radiological disaster.

And there are multiple problems with those estimates. So bottom line what I'm saying is you're going about this in a backwards manner.

You're coming to a conclusion that fuel storage in a densely packed open train design is safe based on a weak study as opposed to waiting for the National Academy of Sciences report and waiting until you deal with updating the consequence analysis code of the MELCOR.

That also what you could have commented on. But bottom line to me is which is safer, spent fuels that are densely packed with a closed frame design, or dry casks? Although that was not a primary focus in your study, it is clear from reading parts of this study that clearly dry casks are safer.

The study says that a fire in a spent fuel pool in this limited study at Peach Bottom could contaminate thousands of square miles with radioactive material, forcing long term displacement of millions of people and cause tens of thousands of cancer deaths.

The National Academy of Sciences prior found serious consequences expanding over 100 miles of a spent fuel pool fire. The Massachusetts Attorney General found a spent fuel fire at Pilgrim would result

in, could $488 billion of damages and 24,000 latent cancers.

So it seems clear that if NRC is to achieve compliance with its statutory requirement to protect public health and safety, that you have already decided that dry cask storage is far safer, which would allow a backfit.

Do you dispute that the study indicates dry cask storage is safer? Do you dispute that NRC is statutorily required to protect public health and safety?

And do you dispute if you decide the public health and safety are better off with dry cask storage, that you will have the capability to do so?

MS. UHLE: Hi, this is Jennifer Uhle from NRR. So thank you for your comments. Your particular comment about whether the agency should wait on decision making until after the National Academies has completed its work, we'll take that under consideration.

The three points, questions that you summarized at the end of your statement there, yes it is our statutory requirement to ensure public health and safety. That is our mission.

We don't agree with your view that the study done, the spent fuel pool study done by the Office of

Research shows that dry cask is safer. And it did not really analyze the safety of dry casks.

The way we handled that is in our regulatory analysis that enters into our decision making. It guides how we make decisions here at the agency.

We assumed that there was no risk posed by dry casks so that when we did a comparison to the low density, high density with the low density having the additional casks loaded, that enhanced the safety increase that would occur with the low density. Nonetheless, that safety increase did not --

(Simultaneous speaking.)

MS. UHLE: I'm sorry, can I just try to finish because I think there's probably other people on the line that would be interested in just me closing out my comment here, or my response to your question.

So our conclusion is not that dry casks are safer. That wasn't studied. But we did do a conservative estimate to maximize the safety benefit of going to the low density loading for the sole purpose of bounding that case.

And nonetheless, we showed that, from our conclusions on the spent fuel pool study which focused on Peach Bottom, that there was not an adequate increase in safety to warrant regulatory action.

MS. LAMPERT: Well, it seems to me you're talking in circles. First, you assumed that there was no risk to dry casks, so I will take that at face value.

MS. UHLE: We did so in the study to facilitate the regulatory analysis. We were not assessing the safety of dry cask storage.

MS. LAMPERT: Well then before you move forward, this would be another point, it only makes sense for an assessment and comparison of which is safer because safety is your job.

MS. UHLE: Okay, thank you for your comments.

MR. RAKOVAN: Mary, did you have any further questions.

MS. LAMPERT: I think I'll move forward. Or can I cede the remainder of my time?

MR. RAKOVAN: I would rather that you either ask a question or we move on to the next speaker. I have quite a few who have signed up.

MS. LAMPERT: Do you have a preference. The question was may I cede the remainder?

MR. RAKOVAN: We typically don't allow that.

MS. LAMPERT: Okay, I'll let it move on. Thank you.

MR. RAKOVAN: Thank you. Okay, let's go to Linda Seeley, then Tom Rielly, and third either Diane D'Arrigo or Tim Judson. Ms. Seeley, are you on the line? Can you identify yourself, please?

OPERATOR: And once again, that is Star 1. And Ms. Seeley, your line is open.

MS. SEELEY: Thank you. Hello?

MR. RAKOVAN: Yes, go ahead please.

MS. SEELEY: Okay. Good afternoon, or good morning depending on where you are. I have two quick questions. The first question is about high burnup fuel.

And I would like to know what percentage of the spent fuel that's stored right now around the nation is high burnup fuel?

MR. ESMAILI: This is Hossein. I just don't know the answer. Do you? We can look it up.

MS. UHLE: Yes, we would have to get back to you on the specific percentage.

MS. SEELEY: Is it a good, I mean, is it a notable amount of the spent fuel? Or is it a minuscule amount?

MS. UHLE: I would say it's probably roughly half at this stage, but that's my personal estimate. This is Jennifer Uhle. So I do want to get

back to you with a very accurate answer.

MS. SEELEY: Okay. Number two then, from what I've read, high burnup fuel has to stay in the pools longer because it's hotter. Is that correct?

MR. ESMAILI: Yes. High burnup is higher decay, correct. This is Hossein.

MS. SEELEY: That is correct. How long does it have to stay in?

MR. ESMAILI: Well, there is no regulatory requirement on when we move things out of the pool, right? There is some constraint on the thermal, you know, shielding of the casks.

But typically, you know, fuel that is older than five years, that is younger than five years cannot be moved to a cask without substantial penalty on the number of assemblies that can be put into the cask. By the way --

MS. SEELEY: Is that the -- what? I'm sorry.

MR. ESMAILI: Yes, I'm done.

MS. SEELEY: Okay. So five years for either high burnup or, what is the other kind called, normal or regular fuel, or low burnup?

MS. UHLE: Jennifer Uhle at NRR. Yes, we just call it low burnup versus high burnup.

MS. SEELEY: Okay. Okay, so both have to stay in the spent fuel pools the same amount of time even though the high burnup is hotter, but they just can put fewer rods into a dry cask? Is that what I'm hearing?

MS. UHLE: This is Jennifer Uhle from NRR. Yes, the difference between the low burnup and the high burnup in terms of decay heat is really not that dramatic. The regulatory concern about high burnup is whether or not the cladding in material properties are less robust.

But in general, the fact that the low burnup fuel stays in the core for, you know, quite a bit of time and is getting burned, it's really not that much different in its decay heat levels compared to the high burnup fuel. There may be ten percent or something like that.

MS. SEELEY: I see. So then it's about the cladding and the robustness of the cladding. And so when you move the high burnup fuel out of the casks into dry cask storage, would there be greater concern about the cladding, cracks in the cladding or something like that? Do they have to use special equipment for that?

MS. UHLE: This is Jennifer Uhle again. No, the concern about the material properties of high burnup fuel are only during an accident scenario that we require licensees to be able to mitigate.

And that is called a loss of coolant accident. And so the material properties are fine for movement. It's into the spent fuel pool, the regulatory concern is a loss of coolant accident in the core.

We are doing some experimental work to also look at for transportation, the impact of high burnup fuel. And to date, we do not see a safety concern there, either.

MS. SEELEY: Okay. Thank you. Okay, so now this study that you did was based, it was a response to the Fukushima catastrophe, correct? The Tier 3 study, right?

MR. SHERON: This is Brian Sheron. The spent fuel pool study was done just subsequent to the Fukushima accident in anticipation that our commission would be asked questions about the expedited transfer of spent fuel.

MS. SEELEY: Right. So what I think is puzzling to me is that the Fukushima catastrophe isn't over yet. And they don't know how to get the spent fuel out of those spent fuel pools, right? They haven't figured it out there. In fact, nobody in the world knows how to do it, correct?

MR. JONES: This is Steve Jones in NRR. There are plans. My last understanding was that the Unit

4 spent fuel would begin removal in the next year or so. So I mean, there are plans underway to get the fuel out of the spent fuel pools. It is located high in the buildings, and it is accessible.

MS. SEELEY: I know they have plans to do it. They're trying to figure out how to do it. But from what I understand, the rods are not straight up and down, they're kind of askew and they've never tried to do something like this before in the history of the world. So I'm just --

MR. JONES: Well, this is --

MS. SEELEY: -- astounded, frankly, that you could reach the conclusions that you've reached without actually seeing what happens at Fukushima.

And you know, during this whole process that's going on, I would ask you because I'm a member of the public and I'm a very concerned member of the public and I would ask you, as my regulator and as my protector in this world, I would ask you to hold your horses a little bit and give yourselves some time before you come to these conclusions like it doesn't really make any difference whether you move the rods out of the spent fuel pools or not.

To any sensible person who is not an engineer, that is an absolutely ridiculous assumption

that you're making, frankly, because at Fukushima the dry casks were safe.

At Fukushima the spent fuel pools are a total mystery about how they're going to take care of them. We all know that. And you have done this analysis, the mathematical analysis to tell us that it's all okay.

But frankly it's not okay. And you're not doing your job as a regulator and as a protector of me and my family and the rest of the people who live near nuclear reactors in this country.

And I'm quite disappointed in you. I thought we could expect more. That's about all I have to say. Thank you.

MR. RAKOVAN: Okay, let's go ahead and move on to the next caller. Tom Rielly followed by Diane D'Arrigo or Tim Judson. And then Rochelle Becker. Mr. Rielly, if you're on the line please?

OPERATOR: And once again, that's Star 1. And your line has been opened, thank you.

MR. RIELLY: Good afternoon, this is Tom Rielly. Thank you for the opportunity to comment and to make a request or a suggestion during the public meeting covering the scope and range of important nuclear subject matter.

As I stated, my name is Tom Rielly. I'm the executive principal of Vista 360, which is based in the Chicago area. We're an Illinois non-profit public interest leadership group composed of scientists, engineers, business executives and some academics.

We're an imbedded expert volunteer organization. We unilaterally engage matters that impact or potentially impact the public who are in many cases uninformed or misinformed in their busy lives.

Illinois, as you know, is a state with presently 14 reactors and approximately 9,000 tons of nuclear waste, and is also the location of the presently in progress Zion Nuclear Power Station Decommissioning and Site Restoration Project.

The Zion Nuclear Decommissioning and Site Restoration Project will be the largest project of its type in U.S. nuclear history. It started in 2010 and will presumably end in 2020.

The decommissioning model is unprecedented, as this decommissioning site and restoration project is being undertaken with a licensed transfer to a non-public utility employing a limited liability company business structure.

It's a ten year multi-phased billion dollar project drawing down rate peer trust funds in an intense

financial environment without the right checks and balances.

It's a complex undertaking, and due to the project's tasks involving the transfer and on-site storage of high level radioactive waste and spent fuel.

Presently, the Zion Decommissioning is at a critical point of transferring over the next two years spent fuel from a wet pool to some 60 odd licensed dry casks. So this meeting is very germane, and I thank you, we thank you for holding it and bringing this forth to the public sector.

Regarding our comment or suggestion, history dictates that the NRC, in its external communication efforts, employs the terms stakeholder, stakeholders and the public on a commingled basis.

Looking at the term stakeholder, we note along with NRC assistance, that this term is not defined in the NRC's lexicon, glossary, nor in the ADAMS system.

Our respectful request is that this deficiency be corrected and the term stakeholder or stakeholders be clearly defined. Thank you for this opportunity, and best wishes in carrying out your stated mission.

MR. RAKOVAN: Okay. Let's go ahead. If Diane D'Arrigo or Tim Judson are on the line, if you could

hit Star 1 please. Oh, okay. Wow, we have someone live and in person in the room.

MR. JUDSON: Hi, I'm actually Tim Judson and I'm taking the place of Diane D'Arrigo who wasn't able to be here today. My name is Tim Judson, I'm the Associate Director of the Nuclear Information and Resource Service.

Also as background, for the last 15 years prior to my current position, I was the president and I'm a staff member of the Citizens Awareness Network, a grassroots organization based in the Northeast, also working on nuclear power issues.

I've been very engaged in the issue of spent fuel safety and security for a very long time. I, you know, want to acknowledge to some extent the difficult position that the staffer in here to be receiving such heavy criticism.

And without dwelling too much on that, you know, I want to sort of go back and look at the record and the trajectory of where NRC has been on this issue for some time because I think it's relevant to where we are today.

And you know, what's remarkable to me is how far NRC's, you know, analyses and policies on this issue are diverging from reality. And even diverging from

NRC's own work on this in the past.

And I recall NRC's study from 1999, you know, which in some senses was one of the first clearest pictures of the risk that spent fuel pools, and spent fuel pool accidents can have.

And that, in fact, has been the basis of a lot of the independent work that's been done since that time. And you know, that which came into very clear focus, I think, for the public interest community after 9/11.

And so in the years after 9/11 this issue, because of the way it came to light and it came into people's consciousness was framed as a security issue because it became very clear that the issue of what would happen if someone caused an accident in a fuel pool deliberately?

And that was where, you know, the initial studies that were formed by the Alverez team and then the National Academy of Sciences began to look at this in that context and concluded that the NRC's science in 1999 was essentially correct.

But for some reason, since then the NRC has consistently backed away from its own research on that from that time. And what I remember very clearly is after the Alverez report came out, that the very clear

directive from one of the commissioners to the staff was to undermine the science that had been done that showed the risk of spent fuel pool accidents.

In fact, I believe it was the late Commissioner McGaffigan told the staff that he wanted them to do a hard hitting critique that would undermine this peer reviewed scientific study.

And that was in fact, you know, and NRC's consistent position on the issue of spent fuel pool safety has followed that trajectory ever since.

And so now we go from the NRC denying that a deliberate attack on a spent fuel pool will likely cause a major release of radiation to now having to look at what happens if we stumble into an accident scenario like that through a natural disaster.

And again, the NRC is consistently saying that the public should go back to sleep and not have to worry. And what I'm curious about is how, given that we have a real situation, we have a real accident that happened in Japan. And we're calling this, and you acknowledge that this analysis was done in a post-Fukushima regulatory process.

How do you do an analysis of the situation that precludes the realities that we've actually observed happen? I mean, as you say that one of the

bounding assumptions within your analysis is that there isn't a reactor accident happening at the same time.

And yet you're looking at a very large, you're assuming a very large earthquake which could potentially challenge a spent fuel pool, but at the same time would also challenge the reactor.

And we've seen what happens at Fukushima, you know, in that kind of a situation. And you know, as the previous caller reminded us, the crisis at Fukushima is not over.

I mean, aside from the question of the technical ability to withdraw spent fuel rods from the fuel pools and, you know, given the deformation of the racks that are in those fuel pools, the structure itself is compromised and they're trying to figure out a way to prop up the fuel pool at Fukushima Unit 4 so that it doesn't collapse before another earthquake happens.

And so the basic assumptions that have been made here seem completely off base from reality. And that's extremely troubling to the public. And so I think, you know, another aspect of this is the choice of Peach Bottom as the reference reactor for this analysis.

And what I've heard mentioned so far is that partly, Peach Bottom was chosen as a matter of expedience because you already had a lot of data on that reactor.

But the NRC has already acknowledged that there are other reactors that have a greater risk of, you know, accident risk as a result of an earthquake, notably the Pilgrim reactor in Massachusetts was, in the weeks after Fukushima, cited by NRC as having the second greatest risk of accident due to an earthquake, which is also a Mark I boiling water reactor with a high density fuel pool configuration.

So there's a question of why the NRC is making the choices that they are in evaluating these risks. And then another sort of interesting aspect of what's come forth today was Mr. Witt's response to a previous question about the issue of expediting the transfer of fuel into dry casks, you know, even in advance of the usual five year practice of keeping fuel in the fuel pools before putting them into dry storage.

And he said that doing it at a three year time frame would have been an unnecessary additional cost to reactor operators. And it raised the question of, you know, how much cost is too much for the industry in the NRC's eyes.

I mean, I have, in my previous position, tracked the use of dry cask storage at the Fitzpatrick Reactor in New York State. And they load, I believe it's six casks, or no, three casks every two years at that

plant.

And that's older spent fuel that's past the five year usual practice. So if a few extra casks needed to be filled in order to reduce the risk, you know, to get waste out of the pools as soon as possible, that's only a few million dollars.

I mean, to the industry, that's a moderate capital expense. And so in the NRC's views of what's too high of a regulatory burden for the licensees, how much cost is too much, you know, versus the safety that the public deserves on this issue?

So what NIRS would request is that this study be taken back and either, you know, sort of repositioned as a site specific analysis of the Peach Bottom plant, or that the basic assumptions that went into this study be reexamined and a more credible study be done. Thank you.

MR. SHERON: This is Brian Sheron. I mean, first I would want to, you know, thank you for your comments on that. But you know, I again will reiterate that we chose Peach Bottom because it was the plant for which we had the relevant information that we could start this study.

You know, quite honestly, if we were to start it for a different plant, we probably wouldn't be

here today, we would probably still be working on it because it takes a lot of time to gather the information, build the models for the computers and so forth.

It's not something that's done overnight. So the fact that we picked Peach Bottom was not, you know, because we made the wrong choice. It was because we wanted to get something that we could work on right away, okay, and get some answers.

You know, and I can't explain it any better than that. And with regard to how much is enough in terms of spending, you know, I think as Jennifer had discussed before, we have a regulation, 50.109 which talks about cost/benefit and substantial increase in safety.

I joke about it, but a lot of people do, but it's the only regulation on our books that applies to the NRC staff, which was put there by our Commission.

And we have to follow that regulation, which means we have to do cost/benefit analyses and we have to determine whether or not there is a substantial increase in safety for any regulatory action that we make that we don't deem is necessary for adequate protection.

And so I think that cost/benefit analysis, and we have a number of documents which talk about what the criteria are for doing cost/benefit analysis in terms of dollars per person-rem avoided, which you can see.

And those are the costs that we look at. And we can elaborate on that if you want, but you know, I did want to point out that that's how we do our business.

MS. UHLE: This is Jennifer Uhle from NRR. I would also like to add, the cost benefit does not have to be considered if we feel that the action is necessary for adequate protection, as Brian said. The cost doesn't come into it.

And then in addition, the Commission can choose to redefine the level of what is adequate protection, the Commission can choose to not follow the backfit rule.

But at this stage in the staff's work, we do first determine if there's a substantial safety benefit. Well, first we determine if there's necessary for adequate protection.

If the answer is no, then the second thing we do is determine whether or not there's a substantial safety benefit. And from the analyses that we've done at this stage, we don't see that there is a substantial safety benefit.

But we still wanted to continue the work to see if there was anything that would be cost beneficial because that could influence the Commission's direction to actually require the regulatory change.

And again, the cost benefit is just part of our regulatory process, and it's been publically vetted. It's very similar to what other government agencies do, other regulatory agencies.

But we didn't choose Peach Bottom because it was the lowest risk. In fact, we recognize it's just one data point.

And so in our Tier 3 activity that is going to be public the end of September, we looked at the risk posed by the other plants across the fleet, including what we would say is the end associated with Pilgrim, and we adjusted the terms to determine if there is either a substantial safety increase, or if it is cost beneficial.

So we didn't just look at Peach Bottom in our regulatory decision making.

MR. RAKOVAN: Okay. Let's go to Rochelle Becker, then Dr. Henriette Groot and third, Sara Barczak. Ms. Becker, if you could Star 1 to let us know if you're on the line.

Okay, it sounds like you've dropped off the webinar as well. So okay, let's go ahead. Dr. Groot, if you're on the line, please hit Star 1, and then Sara Barczak, third to Liz Apfelberg. Dr. Groot, are you on the line?

OPERATOR: Sir, this is the conference

coordinator. No one is queuing up.

MR. RAKOVAN: Okay, thank you. She had asked to go late in the day, so I'll loop back to see if she's joining us later. Okay, let's go to Sara Barczak, if you're on the line with Southern Alliance for Clean Energy?

OPERATOR: Her line is now open.

PARTICIPANT: Hello?

MR. RAKOVAN: I was looking for Sara Barczak?

PARTICIPANT: Oh, sorry.

MR. RAKOVAN: Brooke, is there anyone else identifying themselves?

OPERATOR: No, no one else has queued up. Here we go, one more. One moment, please. Okay, your line is now open.

MS. BARCZAK: Okay, hopefully this is working. Good afternoon, this is Sara Barczak. I am the High Risk Energy Choices Program Director with the Southern Alliance for Clean Energy. We're a non-profit membership organization that works on energy issues in the southeastern United States.

Thank you for your time and for providing a public works access to participate in today's important meeting. I really appreciated all the comments I've

already heard and the discussions.

It is our understanding that the incident that prompted the need for the particular study we've been discussing today was the Fukushima Daiichi nuclear disaster in Japan.

And from what we know, the dry cask storing site apparently made it through the earthquake and tsunami unscathed, and that spent fuel pools experienced damage and were of high concern for many following the accident, and remain a serious concern even today.

Now we avoid it, and that reality was brought up today. So given that fact, along with all of the technical comments provided previously, and again here today by the other commenters, and given that the nuclear industry itself has been moving in the direction of dry cask storage for quite a while now, we simply don't understand why this study failed to recommend the need to expedite the transfer of spent fuel out of high density storage pools into low density open rack and dry storage.

There are some other human, environmental, and financial costs of an accident at a spent fuel pool, however unlikely, some possible near term concerns about the affordability of implementing lower pool densities.

So there have been a ton of questions asked today, and mine, I don't mean for it to be sarcastic, but

it is a question. And I'll follow it with my closing comment, but has the NRC asked the Japanese regulators and technical experts involved with the ongoing Fukushima disaster whether, given the choice, they preferred dealing with the damaged densely packed spent fuel pools over a damaged low density spent fuel pool?

And in further answer from the NRC staff that we have heard today Southern Alliance for Clean Energy believes the draft study is inadequate, and request that the NRC start anew with an actual scientific study of spent fuel pool fire risk as recommended in Dr. Gordon Thompson's previously submitted comments. Thank you.

MR. RAKOVAN: Could you repeat that last couple sentences? You started to get a little fuzzy there, please.

MS. BARCZAK: Did you hear the question, or do I need to ask the question again?

MR. RAKOVAN: Yes, we got the question. It was just the end there you kind of trailed off.

MS. BARCZAK: Okay. Well, so the end was the recommendation that Southern Alliance for Clean Energy believes the draft study we're talking about today is inadequate and request that the NRC start anew with an actual scientific study of spent fuel pool fire risk

as recommended in Dr. Gordon Thompson's previously submitted comments. Sorry if you heard bad quality there on the line.

MS. UHLE: Okay, thank you for your comments. This is Jennifer Uhle from NRR. We actually have a great deal of contact with the Japanese regulator.

And I think as you may know, we actually had a Japanese site team that was located in Tokyo for almost up to a year after the accident.

I don't believe we've asked that specific question about whether or not they would prefer that it be low density loaded versus high density loaded, although I can tell you that the rest of the spent fuel pools in Japan use the high density loading.

And to my knowledge, at this stage they've taken no action to go to a lower density loading. There is, I think, some amount of confusion as to the status of the spent fuel pools.

They are trying to remove the fuel from the pools. They are looking at coming with a wet storage transfer mechanism. That is not outside their range of possibilities. That's a technology that has, you know, been developed and deployed in various areas.

The concern more is the structural state of the reactor building, and of course the contamination

around the site. I would turn to my colleagues here if anybody wants to add anything else, or if you have any further information on the Japanese viewpoint.

MR. WITT: This is Kevin Witt, I'm the Japan Lessons Learned Project Directorate. We do have indication from the Japanese that there was no damage to the spent fuel stored in their pools.

There may have been minor scratches from debris falling into the pool. But they have done inspections in the spent fuel pools. So we're not aware of any deformation of the fuel in those pools.

And our understanding is that they are proceeding with the removal of the fuel in the Unit 4 spent fuel pool. They were constructing a crane to get that fuel out. And I believe that they were planning to start that in November of this year.

MR. RAKOVAN: Okay, let's go ahead and move on to our next speaker. I would like to go to Liz Apfelberg. Following Liz, Lou Zeller, and third to Kevin Kamps. So Ms. Apfelberg, are you on the line? If you could, could you hit Star 1 please and identify yourself?

OPERATOR: That party is queuing up at this time. One moment. That line is open.

MR. RAKOVAN: Ms. Apfelberg, are you there?

OPERATOR: She may need to unmute her phone.

MS. APFELBERG: Can you hear me now?

MR. RAKOVAN: Yes we can. Please proceed.

MS. APFELBERG: Okay, good. There's been several questions, but I don't think we've gotten a really straight answer, and this is having to do with the safety of dry cask storage over the spent fuel pools in light of the fact that there was not damage to the dry casks in Japan, no readings of radiation from the dry cask storage, why do you not consider in your study the fact that the dry cask storage is safer and say that we need to go to expedited transfer?

That's one question. And the second being that since you agree that your mission is public health and safety and adequate protection of the health of the public, then I don't see that cost/benefit should be something that you consider.

You should be considering whether what you recommend adequately protects the public, and then it's up to the utility to decide if they want to spend that, to have that cost. And if not, then they should just shut down. So those are my two questions at this point.

MS. UHLE: Jennifer Uhle from NRR. Thanks for your question. In the spent fuel pool study done by

research, we did not in that study reassess the safety of the casks.

Nonetheless, and I should have pointed this out from an earlier question and a colleague of mine highlighted this to me, so I appreciate that. We did include a table of some analyses that had been done specific to the safety of a cask.

And those are listed in tabular form in the spent fuel pool study. At this stage, we recognize that the spent fuel stored in the ISFSIs, or the dry cask storage in Fukushima, you know, they were fine throughout and after the accident.

We would also say that, and we've said it a couple times, that the spent fuel pool stored in the spent fuel pools were also adequately cooled, and there was no major loss, or loss of inventory from the pool.

So you know, both the wet storage and the dry storage was safe throughout and after the accident. In terms of decommissioning, TEPCO, the Japanese utility does want to remove the fuel from the spent fuel pool to facilitate the decommissioning of their unit.

So that is the motivation for them to move out the spent fuel pool. Looking at the raw risk numbers, since the spent fuel pool study was not a complete risk analysis, it was a consequence study that

was informed by some probabilities, it's hard to compare apples and apples.

We have not done in this study a comparison of all of the risks associated with spent fuel storage and all of the risks associated with dry casks. I think there's a feeling in the public that dry casks that seems to people is a safer option.

So what we did, we do have a regulatory framework. And part of our regulatory framework that the staff is required to follow does involve determining whether or not a regulatory action increases the safety to the public in a substantial manner.

And we have certain criteria that must be met. And from our analyses, we have determined that movement to a low density loading and using more dry cask storage does not increase the safety to the public to the point that would warrant regulatory action.

Now if we did think, and if we did calculate to show that there was a substantial safety increase, then we would then look to see the cost/benefit. At this stage, we actually did that calculation, and we show that it's not cost beneficial either.

If the staff and the Commission felt that this movement to the low density storage was adequate, or was necessary to provide adequate protection to the

public, then we would not hesitate to impose those requirements.

In fact, we have after Fukushima imposed a number of requirements that are costing the industry hundreds of millions of dollar per utility. So in the cases of adequate protection, we don't worry about the costs associated with that.

MS. APFELBERG: The answers to both of your questions, I hope you do realize, and members of the NRC, that basically the majority of people in the public would disagree completely with what you say and feel that you are more concerned with the costs to the industry than to the protection of the public.

And we hope that there's not a major accident at a plant, another major accident at a plant in the United States that happens. Thank you.

MR. RAKOVAN: Okay. Let's go to Lou Zeller followed by Kevin Kamps and third, Ace Hoffman. Lou, if you're on the line, if you could hit Star 1, please. Brooke, are we getting any reaction?

OPERATOR: Yes, we are. One moment please as --

MR. RAKOVAN: Excellent.

OPERATOR: -- the line queues up. And his line is open.

MR. ZELLER: Hello, can you hear me?

MR. RAKOVAN: We can hear you, Lou. Please go ahead.

MR. ZELLER: All right. Thank you for the opportunity to speak to you today. I want to open with a prologue. The industry term spent fuel is a misnomer. When something is spent, it is consumed or used up.

Nuclear fuel stored in pools is full of energy, but unusable because of its radioactive byproducts. Any radiation in the reactor core limits the utility of the uranium fuel.

Therefore it's heat and radioactivity of that irradiated fuel which presents the problem now under discussion. Now I would like to address the fundamental problem with so called spent fuel study.

The two factors of risk assessment are, in general, the magnitude of potential loss and the probability that loss will occur. The Nuclear Regulatory Commission uses a probabilistic risk assessment to determine what can go wrong, how bad it could be, and how likely it is to occur based on current information.

Problem is that probabilistic risk assessments do not account for unexpected failures. A physicist writing for the Bulletin of the Atomic

Scientists said, "The lesson from Fukushima, Chernobyl and the Three Mile Island accidents is simply that nuclear power comes with an inevitability of catastrophic accidents.

"While these may not be frequent in an absolute sense, there are good reasons to believe that they will be far more frequent than quantitative tools such as probabilistic risk assessments will predict. Any discussion about the future of nuclear power ought to start with that realization."

An earthquake's an unpredictable event. Fukushima disaster occurred in an area with known seismic history in a society well adopted to living on a fault line.

Charles Richter, development of the Richter scale said, "Prediction provides a happy hunting ground for amateurs, pranks and outright publicity seeking fakers."

Charles Richter, California Institute of Technology professor of seismology spent most of his life in this field. He assisted officials in Japan and California with earthquake engineering and safety.

His description of earthquake predictors ought to be taken seriously by the Office of Nuclear Reactor Regulation, Office of Nuclear Regulatory

Research and the Office of Nuclear Material Safety and Safeguards.

For example, to estimate the earthquake risks at North Anna, nuclear engineers used probabilistic techniques to describe potential ground motion. They attempted to account for all potential seismic sources in the region around that plant, which is located in Virginia.

The standard is ground motion that occurs every 10,000 years on average. But the 5.8 scale earthquake in Virginia in 2011 was preceded by a 5.8 quake in 1897. Just 114 years separated the two quakes.

In June, of course, the Nuclear Regulatory Commissions issued the consequence study of beyond design basis earthquake affecting the spent fuel pool for U.S. Mark I boiling water reactor.

Going to that draft, past risk studies have shown that storage of spent fuel is safe and large release due to an accident is low, the structures are likely to withstand severe earthquakes without leaking.

These are the particular problems and the shortcomings are as follows, in brief. The draft NRC study excludes hazards of concurrent reactor accidents known to impact the safety of the radiated fuel pool systems.

As Dr. Thompson has said, the physical proximity of spent fuel pools to operating reactors and their sharing of safety systems means that the use of high density racks creates strong linkages between reactor risk and pool risk.

That's what Dr. Thompson said. As you all know, it was rapid, high energy combustion in the reactor buildings and refueling bay at Fukushima which damaged the irradiated fuel pools.

Second point. NRC staff dismisses aging and deterioration of irradiated fuel pool systems by ignoring the 2011 NRC sponsored study which concludes, "As nuclear plants age, degradations of fuel pools are occurring at an increasing rate, primarily due to environment related factors. During the last decade, a number of pools have had water leakage."

Instead, the NRC staff points to a study done 25 years ago before aging effects were observed. Now, if the Blue Ridge Environmental Defense League were to bring such similarly dated information before administrative judges in the license interventions we are engaged in, it would be summarily dismissed.

Point number three. The draft study does not comply with technical safety analysis standards for reactors.

Pursuant to 10 CFR 52.157, safety analyses must incorporate key reactor station components, including engineered safety features, auxiliary and emergency systems, reactive waste handling systems, fuel handling systems such as that an individual located at any point on the boundary of the exclusion area for any two hour period following an on site postulated fission product release would not receive a radiation dose in excess of 25 rem total effective dose equivalent.

Point number four. NRC study that San Onofre Nuclear Generating Station in California estimated that an earthquake caused fuel pool fire could release approximately 2,500 times more radioactivity to the general public than a dry cask failure.

At Fukushima, all the irradiated fuel dry casks escaped damage during the earthquake and tsunami.

Point number five. In 2011, the Nuclear Regulatory Commission's Fukushima Lessons Learned Taskforce concluded that enhancements to safety and emergency preparedness were warranted, made a dozen recommendations for Commission consideration.

NRC staff prioritized and expanded upon the Task Force recommendations in October 3, 2011 in SECY-11-0137.

Sadly, these recommendations were ignored

by the commission when they approved the plant Vogtle construction and operation construction license in February 2012, the first such license issued in 30 years. Why were such important lessons not learned? Must we wait for an American Fukushima?

Point number six. Senator Edward Markey, in a letter to Nuclear Regulatory Commission Chairman Macfarlane dated yesterday, September 17 said, "I believe the NRC draft is biased, inaccurate and at odds with the conclusions of other scientific experts, including those expressed in a peer reviewed article that was co-authored by you," that is Macfarlane, "in 2003."

Senator Markey continues, "Instead of wasting more NRC's resources on studies that appear to be deliberately designed to yield a no action outcome, I urge you to direct your staff," again he's talking to the chairman, "to read your 2003 paper along with other scholarly materials on this topic and prepare a new study that does not lack credibility." Those are the words of Senator Markey.

Point number seven, finally. We agree with Senator Markey and others here today who said the draft study should be withdrawn and efforts to incorporate it into the NRC's regulatory framework should be halted.

NRC should start a proper investigation of

the risks and consequences of pool fires. If NRC staff lacks the capability to do this work, you should locate agents not dominated by nuclear industry messengers.

Thank you for the opportunity today. I do have a final question, which has to do with the administration. Have you taken steps to comply with Executive Order 12898?

MR. WITT: Can you explain that one, please? This is Kevin Witt.

MR. ZELLER: Yes, Mr. Witt. Executive Order 12898 is the President Clinton's Environmental Justice Order to all federal agencies.

MS. UHLE: Jennifer Uhle from NRR. Yes, we're sorry here. We didn't quite hear your question and we apologize for asking you to say it again, please.

MR. ZELLER: Of course. Have you taken steps to comply with President Clinton's Executive Order 12898 issued in 1994 which is to all federal agencies regarding the requirements of environmental justice.

MS. UHLE: This is Jennifer Uhle. Yes, the answer to that question is yes we have.

MR. ZELLER: How so?

MS. UHLE: I'm not the technical expert in this area. I don't mean to be bypassing your question here. I'm going to look to the NRC members in the

audience if there's somebody that can add some more detail to that answer.

We're going to have to get -- Scott can you? Okay, we have Scott Burnell here to help provide more detail.

MR. BURNELL: Scott Burnell with the Office of Public Affairs. Environmental justice is one of the issues that's considered in environmental reviews for licensing, both new reactors and license renewal applications.

MR. ZELLER: But not with your ongoing study of the fuel pool impacts?

MR. BURNELL: As both Brian and Jennifer have stated numerous times, this is not a regulatory action the agency is taking. It's a consequence study.

MR. ZELLER: I don't believe the order specifically addresses one aspect of the agency's responsibilities.

MS. UHLE: This is Jennifer Uhle from NRR. Again, the study is just one data point amongst numerous data points, including the regulatory analyses that are a part of our regulatory procedure that has been in place for, I would say, over 20 years that is documented in, if you are interested in looking at it, it's an NRC document called NUREG, N-U-R-E-G is the title /BR, which

is new reg brochure. And the number, I believe, is 68.

Oh, excuse me, so it's NUREG/BR-0058. So when we talk about our regulatory decision making, we're using a number of data points, and then we're following the well established regulatory decision making that's outlined in that particular document.

I can provide a little bit more information about the new reactors that are under construction being vocal in summer. And those two plants are, of course, going to be having to take measures that we have begun to promulgate after Fukushima.

A number of those activities include, of course, the looking at mitigating strategies. For instance, looking at severe accident management guidelines and improving the communications in the case of station blackout.

There's a number of activities that you can go to the NRC website under Fukushima and list them there. But those new reactors will have to take those measures, just like the operating ones. Thanks.

MR. ZELLER: Thank you for that reply, Dr. Uhle. But forgive me if I'm underwhelmed. I'm familiar with the environmental justice investigations done for the Vogtle plant. We have many members in the Shell Bluff community in Burke County, Georgia, as well as

other communities in the southeast.

And that's the analysis in those cases does not pass muster. I was hoping that at this level of the NRC staff's deliberations that there would be a closer attention paid to the requirements of disproportionate impacts in communities of color from irradiated fuel, whether it's stored in fuel pools or in dry casks.

MS. UHLE: Okay, thank you for your comments.

MR. RAKOVAN: Okay, do we want to take a quick stretch break? Yes? All right, let's say five minutes because that usually turns into ten. So five minute break, please.

(Whereupon, the foregoing matter went off the record at 3:15 p.m. and went back on the record at 3:29 p.m.)

MR. RAKOVAN: Okay, I'm going to go ahead and keep going through the folks that preregistered to speak today. First, I'd like to see if Kevin Kamps is on the line. After Mr. Kamps we'll go Ace Hoffman -- oh, another live and in-person, okay. I apologize for that.

Then next we'll go to Ace Hoffman, and third to Robert Gould. So Mr. Kamps, please.

MR. KAMPS: Thank you. Good day everyone. My name is Kevin Kamps, radioactive waste specialist at

Beyond Nuclear. And my first question is -- I have a large number of questions, so is there some way that I can submit those to be answered? I don't understand, really, the proper way to do that. Because I don't have time in this five minutes.

MR. WITT: Yes, this is Kevin Witt. You can email me.

MR. KAMPS: Okay, very good. Thank you.

MR. RAKOVAN: And that's kevin.witt, with two Ts, at nrc.gov.

MR. KAMPS: So I'll just get as far as I can on my list. It was said, I believe, in the introductory remarks by the NRC that none of the pools have leaked. Actually, I have it right here in the notes. Twenty Japanese spent fuel pools reported no leakage after both the 2007 and 2011 severe earthquakes.

And I think the key word that's missing is the word "yet." I think it's been communicated by several speakers today that there's ongoing problems at the Fukushima Daiichi site, perhaps most especially at Unit 4. So we're not out of the woods yet.

And I did want to correct the record on a number of points. It was also said by Dr. Uhle that an effective evacuation had taken place at Fukushima Daiichi. And there was an August 2011 New York Times

article which quoted the mayor of Namie, which is a town five miles from Fukushima Daiichi, who for lack of guidance from both the national and prefectural government decided to evacuate his town's population further away from Fukushima Daiichi.

And most ironically and unfortunately for those people directly into the plume because three separate federal ministries have withheld information from the public about the direction of the fallout from Fukushima. And most tragically, they were literally camped out under precipitation and probably got bad doses.

They were drinking and cooking with water from surface streams and the children were playing in this fallout. So the mayor actually referred to the people who withheld the data from him as murderers. That was his word. So I'd have to challenge that notion of an effective evacuation at Fukushima Daiichi.

And to bring it closer to this context, when I attended the annual performance assessment at Kewaunee this past June, it appears that there may be a move on at Kewaunee to do away with the emergency planning zone now that that reactor is permanently shut down within a year or two, I believe.

And questions were asked by local

residents, how can that be? How can you do that when there's still irradiated fuel in the pool? And this very study was trotted out by the NRC staff in the room, even though this hadn't been published yet, made publically available that no, it's actually not a problem.

There's a study that says it's not a problem so it's okay that we do away with the emergency planning zones. So I've heard a number of times today, an assumption by the NRC that evacuation will be smooth and successful and that's how we can determine the cost/benefit analysis finds that we don't need to expedite transfer.

So can someone address those inconsistencies for me?

MS. UHLE: Excuse me, this is Jennifer Uhle. Randy Sullivan from our Office of Nuclear Security and Incident Response.

MR. SULLIVAN: Hi. Randy Sullivan. I'm an emergency preparedness specialist at NRC. Matter of fact I've done emergency preparedness just about all of my career.

Let's start with the last issue first. Kewaunee must apply for an exemption to reduce its emergency plan, and it is not reduced as we sit right now. So --

MR. KAMPS: Yes, but the answer that was given in Carlton, Wisconsin, this June, was that within 12 to 24 months a shut down reactor could do away with its emergency planning zone. And I assume the reason that the question was asked and the answer was given was that that is under consideration at Kewaunee.

MR. SULLIVAN: When they file their paperwork and it is adjudicated that is a possibility. But that doesn't mean the whole emergency plan goes away. There will still be an emergency plan.

The next, going backwards if I'm remembering your questions right, regarding evacuations in the U.S., I take great exception to your comparison of our program to the Japanese program. I think there is significant differences in the way we handle evacuations.

There's no federal ministry that issues evacuation orders in the U.S. That's done by local authorities who have proved that they're really quite competent in managing evacuations. We studied a couple hundred evacuations nationwide in this country, they were all successful.

I can point to one evacuation in 15 years that was not successful. All the others saved lives. The local authorities are pretty good at this, and if I

might say with all due respect, without a whole lot of guidance from Washington.

I think if you talk to the local authorities as to whether they can evacuate their county or not should it be necessary, I think you'll get an illuminating answer. I can't remember what you said before that. If there's something I can help you with I'd be happy to.

MR. KAMPS: Okay. Well, I will take exception to your exception. I think that one exception that you probably cited was Katrina, which I think has a lot of lessons for the NRC to learn. Ironically enough, there was an emergency preparedness conference taking place at NRC as Katrina broke, and I think the thousand people or more who died in New Orleans would probably take exception to --

MR. SULLIVAN: Actually, it was not Katrina. Randy Sullivan again, if I can add. The congressional study of Hurricane Katrina determined that the evacuation itself was successful. Everybody who wanted to evacuate whether they had money or not could evacuate. The problem was not encouraging the people to evacuate and not to have a plan to deal with them when they don't.

Hurricane Rita, some six weeks later, actually was a very, it was the one evacuation we've

studied that actually killed people.

MR. KAMPS: Yes, I think as I said, a lot of people died in New Orleans. But, you know, it wasn't me who brought up this issue. It was the NRC, Dr. Uhle, who said that the evacuation at Fukushima Daiichi was effective, and that's what I was referring to. It was not effective for, one example, the town of Namie.

So another point that was raised by a previous public member, Lou Zeller, was that U.S. Senator Ed Markey just yesterday pointed out the irony to Chairwoman Macfarlane that she joined several people who are in the room today including Robert Alvarez and Ed Lyman, Gordon Thompson who is on the phone, in a January 2003 study, peer reviewed study that actually saw a great cost/benefit advantage to expediting the transfer of irradiated nuclear fuel out of pools into dry cask storage. So I would just underline that point.

I just wanted to touch on another accident scenario that was not looked at apparently in this study, and that's heavy load drops. There have been some near misses around the country, at Palisades in 2005, at Prairie Island in the mid-1990s.

So with these optimistic assumptions that the pool will completely drain of its water, it seems like there are some worst case scenarios that for one, Dr.

Thompson has pointed out where there's a partial drain. And we of course, as one of the two dozen groups represented by Dr. Thompson and by Diane Curran in that coalition, endorse that concern that there could be worst case scenarios than what you've looked at. And so could you address that?

MR. JONES: Sorry. This is Steve Jones in the Office of Nuclear Reactor Regulation. I guess from a heavy loads perspective, first of all, there's a large fraction of the fleet has separate cask loading areas that are separated from the spent fuel pool and the cranes are restricted from operation over those pools. So for those facilities we don't expect any impact from heavy load drops.

For the remaining pools there's some that are founded on bedrock and others that have very thick floors on the order of four or more feet thick that may be susceptible to cracking in the event of a load drop from some heights, but that we don't have detailed evaluations of those.

But regardless of that we do expect that if there was a problem with a cask drop it would largely be a leak at the bottom of the pool not a leak somewhere that would cause a partial drain condition.

MS. UHLE: This is Jennifer Uhle from NRR.

I can add to that too. In our regulatory analysis, although the cask drop was not explicitly modeled in the spent fuel pool study, in Appendix D to the spent fuel study we do consider looking at NUREG-1738 which was a previous study that was done.

We took the initiating of that frequency from cask drop and that was factored into our regulatory analysis. So if you are interested you can take a look there. There's a little bit more information.

MR. KAMPS: Yes, the McFarland, et al., study from 2003 also referred to that as a citation that the significance of a heavy load drop.

I wanted to touch on Fukushima Daiichi again. It's interesting to hear what the NRC has had to say today. Because there was a point in time when the chairman, Greg Jaczko, the NRC's representative on the ground in Japan, Chuck Casto, at the time with the best information they had available were making precautionary assumptions that Unit Number 4's pool had lost water, that there could be a pool fire underway. And that contributed perhaps in large part to a decision to evacuate Americans 50 miles away from Fukushima Daiichi.

And also U.S. advice to Japan, I guess you could say, probably contributed to Japanese decisions to use helicopter water drops as many as five days after the

initiation of the catastrophe at Fukushima Daiichi, the use of concrete pumping trucks to get water into the pools.

So today it's been expressed as there were no problems with the pools. There was a period of time when the NRC was quite concerned that there were catastrophic problems with the pools. So it seems like catastrophic problems with pools, that is, fires releasing catastrophic amounts of hazardous radioactivity is within the realm of possibility and should be defended against.

But you wouldn't know that listening to what NRC has to say today as compared to, let's say, the first week of the Fukushima Daiichi catastrophe when it was believed that there was a fire underway.

MS. UHLE: Yes, this is Jennifer Uhle from NRR. Yes, a number of us were in the incident response center here during and after the Fukushima event. Again, we talked earlier about the rationale for what we didn't think -- well, there was the hydrogen explosion and that we thought, well, we didn't at that time understand that the building that the hydrogen was migrating from, the Unit 3 reactor building.

So with the hydrogen explosion we didn't quite understand what was happening there. So to take

a conservative measure when the Japanese said, do you think it's a zirconium fire, we said, well, we don't know. We weren't getting a lot of information.

And so there was a suggestion, if you have water available put it in. Now it turned out that that wasn't the case, but we felt that was conservative at the time. And it really was highlighted to us the importance of situational awareness in a reactor accident scenario.

And as a result, post-Fukushima we've required licensees to put in spent fuel pool level instrumentation so that again under such a scenario the operators would be able to better understand the levels in the pool to then hopefully not distract them. Although we don't believe that such a drain-down is probable, but because of the lessons learned that it was distracting that we took that action.

MR. KAMPS: And I commend the NRC for taking conservative actions like that. I would point out that one of the nearest misses we've had with a pool drain-down was a frozen pipe at Dresden Unit 1. So I just find it astounding that some half-century after these reactors were designed that there's still no instrumentation on the pools to know where the water's at.

The final point I'll make is regarding terrorism and security issues. With mass shootings on

U.S. Navy bases, U.S. Army bases, on the other side of the coin, a nonviolent action at the Oak Ridge weapons-grade uranium depot, it's pretty clear that the highest security zones in this country are vulnerable to infiltration.

And the example I'll give for a nuclear power plant is Palisades in Michigan, where the head of security, long story short, was a complete fraud who had fabricated his security clearances, had fabricated his credentials to hold that position, and fortunately was not a threat although his behavior would have indicated that he was a threat because he bragged about his violent career, I guess you could say, which seemed to have gotten him the job.

So that wasn't the only plant he worked at. He worked at Seabrook as well. And it was Esquire magazine that broke this story in May of 2007. So it seems to me that an intentional insider attack on a high-level radioactive waste storage pool may be the worst case scenario, and I wonder why that hasn't been considered in this study.

MR. WAY: My name's Ralph Way. I'm a senior technical advisor for security in the Office of Nuclear Security and Incident Response. We have looked at the insider, and that look has intensified as a result

of recent incidents as well.

We have a behavioral observation program and a number of other programs put in place to ensure that individuals are both screened and they're monitored while they're onsite.

MR. KAMPS: So referring back to my example again, William Clark at Palisades, chief of security, apparently passed all of NRC's and Consumers Energy's and Entergy Nuclear's screening procedures. So how did he get his job if NRC has these screening procedures in place?

MR. WAY: Well, we put the screening procedures in place. He goes through a background check, and there are a number of other agencies that are involved. But even once an individual is onsite in a job, there's a behavioral observation program and other programs in place to monitor an individual's activities as he goes forward. That's how he was detected.

MR. KAMPS: What I find ironic, and I encourage you to read the Esquire magazine article, May of 2007. If an Esquire reporter can detect aberrant behavior with the chief of security at a U.S. nuclear power station, then I don't understand how the NRC missed that.

And, you know, just citing the Navy yard

shootings two days ago, that individual had a security clearance. He also had a pass. That's how he got in. So if we can't secure the weapons-grade uranium storage depot in the United States, I take NRC's assurances with a grain of salt about security at these --

MR. WAY: Well, I'll just make one additional point in addition to the behavioral observation program. There are a number of other physical barriers that are put in place to protect plants and plant material from sabotage.

MR. KAMPS: Yes. The examples I've given have shown that other agencies of the federal government have failed in those regards. Thank you.

MR. RAKOVAN: Okay, let's go to Ace Hoffman then Robert Gould, and third to Franklin Frank. Ace, if you are on the line can you please hit Star 1?

OPERATOR: And his line is open.

MR. HOFFMAN: Okay, can you hear me?

MR. RAKOVAN: Yes, we can. Please go ahead sir.

MR. HOFFMAN: Okay, thank you very much. In listening to Kevin Kamps' presentation and the NRC response I'd like to make a comment, first, on the evacuation issues in Japan. Because of going around trying to get San Onofre closed over the last couple of

years, one of the places that we went to besides all the city councils was the emergency responders. And they were adamant that as soon as you start to talk about anything having to do with nuclear -- now they did believe that they could evacuate if necessary -- but if you started talking about nuclear they said, we don't understand anything about that.

We get that from the experts, and they're talking about you guys in Washington. So asked exactly which community is going to be evacuated, they have no idea and they're going to be relying on you to do it. And that's the part that failed in Japan, not the little guy who wanted to know what he was supposed to do, but the authorities who were going to tell him what to do. And that's your responsibility and you're the ones that failed in Japan.

So let's hope that you do better here, but your answer did not do better. You said, no, the local guy's going to be handling it, they did an evacuation. Yes, they are, if they know that they're supposed to do it.

Okay, now what we've been talking about here, I've heard that the baseline is the dry cask storage. Is the spent fuel pool safer than the dry cask storage? And that we're relying on that as a baseline

because of NUREG BR-0058. And apparently what that NUREG regulation does is it moves the baseline to what's considered zero for another study, so the one in 10,000 years of per accident for, you know, accidents per year, 1 in 10,000, and things like that are all part of that baseline.

And we're not really considering the time factor of when are we going to move this stuff to Yucca Mountain? If it stays in the pool for two years and then gets moved to someplace that's either interim or is safer or far away from where it is versus if we move it to the dry casks and then say, well, there's other places we need to worry about more, it's going to stay in the dry casks for 80, 100, 300 years, whatever.

Another baseline factor that's not being considered is the shutdown factor. I mean we didn't hear, we heard somebody say, and it was not agreed with, that a dry cask, a single dry cask with a satchel charge would be about 2,500 times less risky than a spent fuel pool fire. And so I'm wondering how many times less than shutting a reactor down, you know, what's the difference there? What is our baseline for this sort of thing?

And then moving on to the security issues that we're not allowed to talk about -- airplane strikes. We're talking about small airplanes, small amounts of

fuel and low speed. We're not talking about what actually happened on 9/11 and similar types of things.

Whether or not the casks can be transported or dropped, we're talking about maybe a six-inch post or an eight-foot drop when, really, these are unrealistic values. What about the entire cask being crushed as it goes under an overpass or something like that?

Again, are we going to leave it in dry casks? Are we going to move it? Are we going to leave it in spent fuel pools? There's more than the two choices. And why would any terrorist get onsite just to use one satchel charge? I think it would be far more than one.

A couple more items. During your presentation, these are very complicated issues with a time factor involved, I didn't see any graphics, fancy charts, showing how these drop over time. Not just the temperature or the radiological chance, dangers, but what about earthquakes, anything over a long period of time? So if we move it to dry casks it's going to stick around a long time. If we leave it in spent fuel pools because we're going to move it away soon it's a different calculation.

And Fukushima was mentioned. We're two and a half years away from it almost, and yet you guys don't know what to do about Fukushima. And this is rather

important. You said that you have people onsite in Tokyo, and Tokyo's so far away from Fukushima that the Olympics are going to be held there. That's not really onsite. I think you're afraid to go onsite and I don't blame you.

So I don't want to see one dry cask compared to a reactor spent fuel pool fire. I want to see fabrication errors included, unsafe transfer included, and other events all extrapolated to not one pilgrim reactor but a hundred very different reactors.

The chances of this study being accurate to all of the different reactor situations is, you know, one percent because they're all very, very different. They all have enormously thick, and rooms full of manuals. Not one compares to another.

So I think that's about all the things that I would like to cover, and I look forward to getting the answers to this, not just here at the panel today but in another kind of, these are things that we need to change.

We need to stop talking about incremental safety issues, but relook at the whole situation and what is safe for America's nuke waste. We haven't solved it in 65 years. Thank you very much.

MS. FINCH: Thank you Mr. Hoffman. My name is Lynne Finch. I'm the assistant facilitator. Did you

have a specific question that you'd like an answer to today?

MR. HOFFMAN: Well, other than what is the baseline that we're talking about what the dangers are, I don't think there was really a very specific one.

MS. UHLE: Hi, this is Jennifer Uhle from the Office of Nuclear Reactor Regulation. The question that we're trying to focus ourselves on here is whether or not there's a substantial increase in safety by moving the older fuel, which is typically the five year old fuel, from the high density pools into dry cask storage that would then create a low density loading situation in the spent fuel pools.

And --

MR. HOFFMAN: Sure, but it creates a permanent situation in the dry cask storage arena, and there's a time factor involved.

MS. UHLE: I'm sorry. I didn't hear you. If you could repeat your statement again?

MR. HOFFMAN: Yes, thank you. Sorry. Once you move the older fuel out of the spent fuel pool you create a safer situation in the spent fuel pool which you're arguing is not substantially safer. But you now create a permanent situation of having an additional dry cask or ten dry casks or 50 dry casks which are now going

to sit for dozens, maybe even hundreds of years.

So is that time factor being considered as to how long you would have moved it from the spent fuel pool offsite completely versus from the spent fuel pool to the dry casks where it remains for 200 years?

MS. UHLE: Yes. We didn't address what specifically the risks were for the fuel in the dry casks because the public interest that we had heard and the request from Congress was to determine whether we need to take regulatory action to move it into the dry casks because of the viewpoints that many share of that.

Their feeling is that the dry casks are safer. And they're not, in that determination I don't believe that they are as concerned about the aging of the dry casks as in their perception the risk in the spent fuel pool. So when we did our analysis we assumed pretty much that there was no risk associated with dry cask storage.

And so that would maximize the safety increase of going to the lower density loading configuration. But when we did so we still did not reach enough of a safety benefit to warrant our regulatory action. So I hope that answers your question.

MR. HOFFMAN: I suppose so. Thank you.

MR. RAKOVAN: Okay, if next we could go to

Robert Gould, followed by Franklin Frank, and third, Becky Rafter or Diane Valentine.

Mr. Gould, if you're on the line can you please hit Star 1?

OPERATOR: That party is not queuing at this time.

MR. RAKOVAN: Okay, thank you, Brooke. Let's see if Franklin Frank is on the line please. Mr. Frank?

OPERATOR: And I do believe that party is queuing at this time. One moment.

Mr. Frank, your line is open.

MR. FRANK: Thank you. I'm very pleased to be able to comment today, and I'm honored to be in the company with so many very articulate and highly qualified speakers. I generally agree with most of the speakers who have been concerned about the conclusions of your report.

As a former fire chief who responded to emergency incidents at Diablo Canyon Nuclear Power Plant, I've taken a key interest in the plant. And before retirement I was appointed to the county nuclear waste management committee and did further study on high level nuclear waste storage and transportation.

And I was quite surprised when I read the

conclusions of your report that indicated that it would not be cost effective to reduce the density in the spent fuel pools. We looked at these issues very carefully and concluded that it was almost a no-brainer to reduce the densities in the spent fuel pools, and that was before there was additional information concerning the possibility of spent fuel pool fires.

The thought that the spent fuel pool is an active system, requires constant cooling is something to be considered, considering if there was an event that contaminated the entire site there would be no one to keep spent fuel pools cool.

I was also concerned that the scope of your study was quite limited. It focused on strictly direct impact of seismic damage to the pools. And this was a very narrow perspective. There's many other things that could impact the pools and their integrity.

Even though the pools might stay as an integral entity and the racks would stay okay, I am very concerned, and I've asked this question on numerous occasions to the NRC and event safety committee about the integrity of the fuel rods themselves.

These rods, particularly since high burnup fuel is being used now, the cladding, basically the zirconium tubes which contain the pellets, the fuel

pellets, tend to degrade from exposure to high levels of radiation and also a high temperature borated water.

And I think that it's important to understand that any serious shock to the pool, even though the pool and the racks stay intact, might cause significant damage to the fuel rods and might even allow the fuel pellets to fall to the bottom of the spent fuel pools.

If this were the case it could impact the cooling. If the cooling was compromised this pile of rubble and pellets could heat up and generate radioactive steam, perhaps hydrogen could be released, and it would be very difficult to control.

I've asked this question and have not gotten a specific answer from anyone. They say, well, that's an interesting question. Well, it's more than interesting. It's critical. If the integrity of those rods are impacted and they start falling to the bottom and accumulating at the bottom of the pool it could lead to a serious problem and perhaps even a pool fire.

This could be the result of an earthquake, an airplane crash or a bomb. I would like to know if this has been studied, and if it's been studied I would like to know what methods were used.

MR. PIRES: This is Jose Pires from the NRC

Office of Research. First, considering the damage to the rods themselves, the racks where the fuel is stored are sliding racks. They can slide in the pool so they are not going to be subjected to very large acceleration forces.

Besides that, the concern normally that exists with the fuel rods is cask drops in which the accelerations are 20Gs or higher, which are much higher than the accelerations for seismic loads. I think that's my response.

MR. FRANK: Well, I am concerned that you're only looking at seismic only. I would like to know if you've studied the accelerations due to an aircraft crash, particularly in boiling water reactors that are elevated, and also bomb damage.

Not necessarily that the damage would impact the pool to the point where it could cause it to lose water, but simply accelerating the size of the pool and the racks that could degrade the rods. I understand the rods are subject to significant degradation and have been broken just by moving around.

So can you tell me what kind of studies have been done?

MS. UHLE: This is Jennifer Uhle from NRR. After 9/11, or post-9/11 we had done numerous studies,

very detailed analyses looking at spent fuel pool integrity and the impact of the reactors due to aircraft impact. Unfortunately can't get into a lot of details on that because it is classified information. We can't talk about that.

But as a result, we did take some regulatory actions and we're confident that there's adequate protection assured from the aircraft impact for both the pools and the reactor. Part of what we're doing post-Fukushima is actually to increase the ability of the licensees to be able to respond, not from a security standpoint but ultimately from a beyond design basis event that will provide even more portable equipment that can be brought to bear in the case of such an event.

MR. FRANK: Thank you for the information. I'm still very uneasy about your response considering it doesn't sound like you've actually conducted physical tests. And I have some real serious concerns about your models that have been used in the past, and I think Mitsubishi would probably agree with me.

Their models didn't quite work out for the steam generation down at San Onofre, and almost all your computer models have been based on certain assumptions that proved to be wrong. So I would think that you could actually create a test system that would actually test

this in reality.

Now I find it difficult to think that these racks would be sloshing around in there without damaging the rods in an actual test, and I don't see why you couldn't come up with a simulation, not using a computer but actual models of a spent fuel pool and some examples of assemblies that approximate what is actually in the pools.

MR. WAY: This is Ralph Way. I'm a senior technical advisor for security in the Nuclear Security Incident and Response. As Dr. Uhle indicated, we have done a number of experiments. But we've also done actual mock testing where we've taken different explosive charges, weights and geometries, and physically fired them against targets and exemplars of spent fuel, taken that data, analyzed it and then taken appropriate measures to mitigate the effects of those types of charges.

MR. FRANK: Well, thank you for the information. This is the first time I've ever gotten any answers whatsoever. I'm still pretty uncomfortable with the tests that I've investigated. I've investigated these tests that you've done in the past, and in many cases they don't convince me that there's not some risks involved, some significant risk.

And basically why I called today was because I'm a landowner and a five-generation farmer who could be contaminated if there was a serious problem at Diablo Canyon, and I think that you have the obligation to make sure the risks are absolutely at the minimum. Cost/benefit analysis has no place in protecting the public, and I certainly agree with many of the people that spoke before me. Thank you very much for the time and I hope you take these comments seriously.

MR. RAKOVAN: Thank you sir. Let's go to Becky Rafter or Diane Valentine, then to Linda Lewison, and third to Rod McCullum. So Ms. Rafter or Ms. Valentine, are you on the line? Could you please hit Star 1?

OPERATOR: And someone is queuing up at this time.

MS. RAFTER: Good afternoon everyone. This is Becky Rafter with Georgia Women's Action for New Directions, and both professionally and personally we work with community members who are living around the Plant Vogtle and Plant Hatch reactors here in Georgia.

And I am calling in to encourage the NRC to further revamp and further revise this particular study in order to make it more comprehensive, and to look in greater detail at the risks of spent pool fires, and also

to take particularly into consideration a cost/benefit analysis of the risk of fire versus the risk of a cask rupture, in particular around the extremely high percentage of less radioactive release in the case of a cask rupture. And I would like to echo what the gentleman said before the break around including an expanded study and analysis around an environmental justice analysis, in particular with regards to the extreme difficulties of communicating with and among rural communities living near these reactors particularly in Georgia, and also of the difficulties of evacuation and of preparedness in the community.

And I just mainly, as yet we don't feel that this study has robust enough data to make a strong conclusion, and we highly encourage NRC to expand the survey to include the concerns that were brought up today.

And I just want to thank all of you for taking the time to listen to these comments, and we recognize that like most of us on the phone you all as researchers and administrators also have as the highest regard to safety of people working and living around these facilities. So thank you for your time.

MR. RAKOVAN: Okay, let's go to Linda Lewison followed by Rod McCullum, and then third to Gail Comer. Ms. Lewison? If you are on the phone lines can

you hit Star 1 please.

OPERATOR: And someone is queuing at this time. And your line is open.

MS. LEWISON: Hello, this is Linda Lewison.

MR. RAKOVAN: Go ahead, we can hear you.

MS. LEWISON: Hello?

MR. RAKOVAN: Yes, we can hear you. Please go ahead.

MS. LEWISON: Okay, I'm speaking as a member of Sierra Club Nuclear Free Campaign and the Nuclear Energy Information Service, 32 year old watchdog in Chicago.

Last December we held a conference held by NEIS to call attention to the problem that the fuel pools were not built to accept indeterminate and ever-expanding amounts of radioactive waste. We can't really properly describe the scope of the problem even with your study until we take into consideration that we need to stop making more nuclear energy in order to even get a handle on the numbers that we are talking about to solve the particular radioactive waste transfer problem that study is addressing.

As you heard previously from Tom Rielly, we around the Great Lakes are the rate payers who are funding the largest decommissioning in history at Zion, Illinois

is closer to Chicago, as are all of Illinois' reactors, than Tokyo is to Fukushima.

We also have the Kewaunee reactor in Wisconsin facing a fuel transfer, and we have the dry casks from the fuel transfer at Big Rock Point in Michigan. And we have Palisades looming over as it's expected to be closed soon because of its legitimate problems, and facing a new set of problems associated with decommissioning and spent fuel transfer decisions.

So we around the Great Lakes are surrounded by the risks associated with irradiated fuel transfer decisions. My questions relate to the Zion site, the largest decommissioning in history that's supposed to begin on the ides of November as we call it, 60 casks each to be a five-day transfer operation lasting over the next 300-plus days.

We are facing in actual time, in immediate time, the problem of the risks from sudden drops and partial draining of fuel pools 60 times from the 60-plus transfers to 60 dry casks within the year.

My first question is, what is the NRC's plan to provide public oversight and transparency for this process on both the fiscal and safety fronts, and what back up plans are being provided in case something untoward and dangerous happens?

When we asked at the public meeting of the Zion Community Action Council about even a single fire engine being around we were told not to worry, things looked perfectly safe. And my second question relating to Zion is the following.

MR. RAKOVAN: Ma'am, excuse me. This is Lance Rakovan and I'm the facilitator here. Our Region III office in Chicago has the lead for the Zion project. And so, I mean we could take a stab at some of these answers, but there's no guarantee that we're going to be able to answer them with any accuracy because we just don't have the people here who have the background to answer those questions fully.

So we can get you a contact in the Region III office if you'd like to, or you can email one of us and we can send you that contact. But I don't think we're going to be able to do your questions justice given that we don't have the expert here.

MS. LEWISON: That's fine. I'll take the contact, and let me just move on to the second question which is a little more specific.

MR. RAKOVAN: Okay.

MS. LEWISON: If you are recommending keeping irradiated fuel in the irradiated fuel pools as long as possible, why have you endorsed Exelon emptying

the irradiated fuel pools at Zion ten years ahead of schedule? Although this reactor has been closed for many years, is that reason enough to empty these fuel pools this far ahead of schedule? What is Exelon's rationale for doing this?

And if there is time, my last question. What is your recommendation including the specific time frame for what you recommend doing about the irradiated fuel pools at Fukushima? Are you part of the global group advising them currently and what are you advising?

MS. UHLE: This is Jennifer Uhle from the Office of Nuclear Reactor Regulation. Let me respond to your last question first, and that is, we have a great deal of contact with the regulatory agency in Japan and so does the rest of the world in learning from the Fukushima results, but we are not an official advisory capacity although we do stay abreast of what their plans are and what they're doing.

So I can't add anymore than that as far as any recommendations that we haven't given any to TEPCO or to the regulator with regard to their spent fuel pool campaign.

With regard to Zion, again Zion decommissioning is handled out of Region III. And as part of their decommissioning project that was approved

by the agency and is under constant oversight by the agency, if they're choosing to move their fuel into storage that is up to them as far as the timing.

They do have to meet the regulatory requirements specifying what is necessary under decommissioning and also consistent with their decommissioning plan. But we don't, and this study is not recommending that the fuel be stored in the spent fuel pool, but it's also not recommending that the fuel be moved to the dry casks.

I mean there is a physical limit. After the fuel is irradiated it does need to be in wet storage for a certain amount of time based on the cask designs that are currently available, and at this stage, typically, as the spent fuel pools have a number of assemblies in them and licensees do move the older fuel into dry casks.

And the question that was posed to us was, does it make it safer if they move all of their older fuel into the dry casks, because is there enough of a safety benefit to warrant regulatory action? And based on what we have done so far, although our work is not yet complete, we do believe that there is not enough of a safety increase to warrant regulatory action as far as requiring that the older fuel be moved out of the pool.

MS. LEWISON: Thank you.

MR. SHERON: This is Brian Sheron. I just

want to add that, you know, I think Zion's been shut down for quite a number of years now, and I would imagine that the fuel in their pool is cool to the point where the concerns that, you know, we've been talking about here about the potential for any kind of a fire if cooling was lost and stuff, is not probably applicable to that pool. I mean I would imagine that fuel can be air cooled if the cooling was lost.

MS. LEWISON: What you are saying is that the situation at Zion as you know, as you said, this has been closed down for many years, was outside the scope of your study, if I understand you correctly?

MR. SHERON: Yes, just because of the age of the fuel since it's been removed from the reactor.

MS. LEWISON: Thank you.

MR. RAKOVAN: Okay, let's go to Rod McCullum, then followed by Gail Comer and Sherry Lewis. And just to remind you all we do have a hard stop at 5 o'clock, unfortunately, so we'll try to get to as many people as we can in the time that we have remaining.

Mr. McCullum?

MR. MCCULLUM: Thank you. I'm Rod McCullum of the Nuclear Energy Institute representing the nuclear industry here today. I want to thank the staff for providing this forum and for doing this study.

It's a very informative and useful study.

We believe the forum you're providing here, and I understand this is the second such forum, is a good example of openness. Your report has been subjected to a lot of scrutiny here today, and I feel that is just one of the strengths of our regulatory process that we get this kind of discussion. It has been very interesting, a lot to think about.

I do want to, as I say, lend the industry perspective, which of course begins with our very strong felt belief and something we've been demonstrating by meeting the regulations with plenty of margin that both the pools and the casks are safe. This really comes down to a decision as to what is the most prudent thing to do, and in that context I want to emphasize something that Kevin Witt said this morning that I think is extremely important, and it's in Appendix D of the report, but it is a very important aspect of this, is that accelerating the movement of used fuel out of pools and into casks does not simply mean you are loading the casks faster.

It means you are loading more casks, because the younger you go down to the more into that inventory of fuel that's hotter you go, the less able we are to load the higher capacity casks. We manage that very

carefully to keep radiation exposures to our workers as low as possible.

So you are, as is indicated in Appendix D and as Kevin referred to, it's not a question of loading the casks faster, it's a question of loading a lot more of them. And I think as you went further down that road it would be even more.

So this is not just a question of, well, we'll just throw a couple more million dollars at the problem. This would be a significant strain on a lot of very scarce resources. It would be taking resources away from things that have been shown to be of value to protecting public health and safety to something that we're seeing from this report is not a value of protecting health and safety.

It would be a strain on our radiation protection resources, the skilled individuals we have that make sure that we keep radiation exposures as low as reasonably achievable on every cask loading campaign. It would be a strain on our industrial safety resources, the same resources that assure we manage all those heavy loads.

The nuclear industry has one of the most impressive industrial safety records of any industry out there. It's even safer than working in most office

environments. So these are resources we are very proud of. They are resources we are very proud of. They are resources that are very scarce.

These are skilled individuals. The people who would operate these loading campaigns, the skilled people who work our refueling floors, who work our outages, who do all that in a safe and timely manner, those would be resources that would be strained. There really is a high bar for having to show a safety benefit here.

All of those resources are bounded by the price of electricity. And indeed probably the most significant issue is here is our ability to provide electricity in a clean, safe and reliable manner. Public health and safety all over the country depends on that.

Nuclear energy does not release harmful pollutants into the air. The health effects of those pollutants are absolutely known and they are absolutely certain. They are avoided if we are able to operate within the price of electricity and produce clean air energy. And of course we are very concerned as the Nuclear Energy Institute has expressed on behalf of the industry on many occasions about the cumulative impact of additional regulatory burden.

So we appreciate the staff giving such strong consideration to this choice and weighing it with the sincerity that you are. And I think when you do that and you look at the impacts that would result from accelerating the movement of fuel out of the pools and compare that to what, I believe, is the most fundamental conclusion of your study, which is that after a couple months for the plants studied under the assumptions studied the fuel is air coolable after a couple months, which means that moving all of that older fuel out there doesn't help with respect to decreasing the probability of an accident.

That's not surprising to the people out in the industry who understand the decay heat curves associated with spent nuclear fuel, who understand the nature of this material and understand why the pools are configured the way they're configured. And of course also heat decays because the radioactive elements producing the heat decay.

So while you're not making any accident less likely by moving that fuel out, you're also not really making a sizeable difference in the consequences of any unlikely accident. And again here we are balancing theoretical impacts against the very certain strain on resources that would occur.

And this is why that backfit rule that the staff is held to is so important. You're essentially looking at things that are very real versus things that are imaginary. And I say imaginary because there's a lot of distance in between two months and five years.

Okay, pull back to three years. Let's say we're going to start changing the practice and move the fuel out after three years. Well, there's still a lot of distance between two months and three years. You've heard a lot of criticisms of the report. You've heard about assumptions you could make differently. You've heard, you know, about you could be more bounding, you could be less best estimate. And this is all a very interesting discussion, but I don't believe when I look at the fundamentals of used fuel and decay heat curves and the radioactive decay and knowing what all those radioisotopes are, I don't believe you'll ever get to the point where that two months and that five years or that three years come together. That's a huge gap and that gap -- do more studies, fine. But I don't think there's a way to close that gap. So to me the obvious conclusion from this is that there is no safety reason to expedite the movement of used fuel to dry cask storage.

I did want to say a couple things about criticality. That was brought up. Certainly in these

type of accident scenarios it's not criticality you're concerned about because, you know, you need water for a moderator and you're talking about losing water in pools here.

But a statement was made I would like to correct, earlier, about Boraflex and BORALL degradation as if these two things are the same. They are not. We understand in the industry we can no longer rely on Boraflex. We're not relying on it anymore. BORALL we think is different.

In general, we think we have plenty of margin, you know, to protect against criticality. We have engaged the staff. We believe that. We know that. We understand we need to demonstrate that so we've engaged the staff on producing some guidance where we can make it more transparent and open just where that margin is, and we certainly encourage the staff to work with us on that.

Finally, one other thing that's come up a couple times today I'd like to respond to, and then I'll be shorter than my time I hope. This idea of the statements that came out of NRC in the first 72 hours of the Fukushima accident as being contradictory to what's now being said in the study.

What's now being said in the study is what's

consistent with what the experts have believed all along, again it's not surprising. What was surprising to us was that we couldn't explain that building that had blown up.

I think NRC should -- I know I was in the NEI emergency response center at that time, and I was really beside myself because I could not believe that a spent fuel accident happened. All of my colleagues and all the experts kept telling me it couldn't have happened.

But I couldn't explain the building until I had that, I just remember the a-ha moment when I was looking at an aerial photograph of the site and I saw that the standby gas treatment systems of Unit 3 and Unit 4 were routed to the, you know, the same stack. That's a moment of my life I'll never forget.

But it goes to, you know, setting the record straight when we say something that's wrong. A lot of statements were put out by NRC that were flat out wrong during that time period. We shouldn't be using those statements as the yardstick for how we react to very well conducted scientific studies.

I mean, I think the Japanese people are very thankful that their own government didn't decide to evacuate a 50-mile radius around that site. So this is part of getting it right, this study. It's a good study.

We hope that it will be completed. We hope to see the additional work. We look forward to that.

I thank the staff for undertaking this, this is important, and we look forward to continue to engage. Thank you. I don't have a question, I'm sorry.

MR. RAKOVAN: That's okay. Do we have Gail Comer on the line? Ms. Comer, if you're on the line could you please hit Star 1 to be identified?

OPERATOR: That person is not responding at this time.

MR. RAKOVAN: Okay, if I could check to see if Sherry Lewis is on the line. Ms. Lewis? Again, if you could hit Star 1, please, and identify yourself.

OPERATOR: And we do have a response at this time. One moment. One moment please. And Ms. Lewis, your line is open.

MS. LEWIS: Okay, thank you. I wasn't planning on speaking today, I was just listening. But I am blown away by that last speaker who sounds so authoritative and so confident. I'm sure some of what he's talking about is okay, but boy, there's a lot that I don't agree with.

One of the main things I want to ask about is what exactly is your mission statement? Could you please repeat it to me again?

MS. UHLE: This is Jennifer Uhle again from Office of Nuclear Reactor Regulation, and our mission is to ensure adequate public safety with regard to the civilian uses of nuclear material.

MS. LEWIS: Well, that's your job but not NRC? Are you different?

MS. UHLE: No, that's NRC's job.

MS. LEWIS: So then the operative word is adequate, apparently, because it's not then as I hear that it's for public safety and for the environment. What was that statement? Can you repeat that one? Do you understand what I'm asking?

MR. SHERON: No, could you repeat the question?

MS. LEWIS: The sentence that I have been hearing previously, earlier today, has been something to the effect of the NRC's job is to make sure that the public and the environment are safe. And the word "adequate" wasn't in there. It was that the public is safe.

And what I understand is that may be what your mission statement says, but it's quite obvious to me that you are saying that the environment and the people be safe within the context of having a nuclear industry. At no point are you ever considering getting rid of the entire nuclear industry.

Now there are awful things that can happen that people don't expect, and I mean, ask what the people in Fukushima would want now. Would they want no nuclear power, you know, to have happened, now that their lives have been ruined for so many people? I live near Diablo Canyon in a beautiful area, and it would be more than criminal to have this area be no longer allowed for people to live in.

And as far as the evacuation goes in Fukushima, the people were not told for two days that there was a problem. They were not told to evacuate. They were not told there was any radiation release. So you ask us to, you know, that you are using conservative estimates and that the work is robust. Those are just cloud words.

I'm quite angry, as you can tell, and that's all, really, that I have to say. What you are doing is balancing public safety with nuclear power, and that's not what we want. We want to be safe, away from nuclear power, and you're saying nuclear power is a given. We have to have that for various reasons. We'll make it as safe as we can given that we have nuclear power. Well, take that given away. Okay, thank you, and I'm glad that you had this long discussion all day. Okay, goodbye.

MR. RAKOVAN: Okay, let's see if we can get

a couple more speakers in before we hit 5:00. I have a few others that have preregistered to make comments, so I'll continue to go through our list.

Carole Hisasue, I'm sure I'm slaughtering your name. I apologize for that. If there's a Carole Hisasue, if you could hit Star 1, please, and identify yourself.

OPERATOR: Someone is queuing up, one moment. Carole? Go ahead.

MS. HISASUE: Hi. Am I on it now?

MR. RAKOVAN: Yes, you are. Please go ahead.

MS. HISASUE: Okay. I'm Carole Hisasue. I'm not an expert. I'm not a specialist. I'm just a resident living within ten miles of Diablo Canyon nuclear power plant. And when we talk about the issue of the expedited transfer of spent fuel to dry casks and you start talking about cost effectiveness or cost/benefit, it just horrifies me.

Isn't safety supposed to be our priority rather than cost? You know, words like cost effective and cost/benefit, it sounds like the study was written by the industry. I'm from Japan and, you know, I've been to Fukushima and I've lived in Tokyo for most of my adult life.

And I can tell you that the people in those evacuation zones that weren't evacuated are angrier than they can be. I mean, I can use stronger language which I won't. And so, you know, when someone mentions that, oh, they're thankful that they didn't have to evacuate, I think that's completely wrong.

And then when you start talking about, you know, there wasn't enough of a safety benefit to warrant expedited transfer of spent fuel that's it's not cost effective, is there a safety benefit or not? And I think we can all agree that there is, and if there is then cost should not be an issue here.

I feel like I'm stuck inside a clunker car which should be junked but it's still being driven. And because of it's so old of course there are more chances of accidents, and not only that now it's carrying dangerous nuclear waste in the trunk. And when I ask the driver, why don't you move it away, he tells me, oh, it just costs too much.

I just feel like I'm talking to people from another planet sometimes. If it costs too much to be safe, and we're talking about this analogy of the clunker car, I think it's time we get rid of the car.

You know, English is not my first language so if, you know, I mis-say things, please, you have to

excuse me. But I'm just getting very upset about this whole study and the fact that it doesn't take terrorism into account. Given U.S. foreign policy, I think that's a very big risk.

So the whole study, I think, is incomplete. It's not handled well. It sounds like it was written by the industry. Those are, you know, my comments, others have stated similar, and I hope that, you know, you will study these other issues in depth and to a point that, you know, the public, especially those living near nuclear power plants can be satisfied. Thank you.

MR. RAKOVAN: Thank you for your comments. Can we go to Jane Swanson or Elizabeth Bruce, if you're on the line? Jane Swanson or Elizabeth Bruce, if you could hit Star 1.

OPERATOR: All right, go ahead.

(Recorded message)

OPERATOR: Okay, go ahead. You are all queued up.

MR. RAKOVAN: Who do we have on the phone line please?

OPERATOR: Your line is open.

MS. RESON: Whose line is open?

OPERATOR: Your line is open.

MS. RESON: Oh good, this is Myla Reson. I

have a couple of questions. One is that early on in the call someone from the state of New York asked if transcripts would be available, and we were told that there would be transcripts. And I'm just wondering when they might be available and how do we find them.

And then beyond that let me just go ahead and make the comment that when Jennifer Uhle was talking about some of the problems associated with high burnup fuel she seemed to not be aware of the work of Robert Einziger from the Office of Nuclear Materials Safety and Safeguards with the NRC.

I think that it would probably be a good idea to communicate with Mr. Einziger and educate yourself about serious problems with respect to dry cask storage of high burnup fuel, the lack of adequate safeguards for high burnup fuel storage at this time and also the lack of certified transport containers for high burnup fuel.

It's my understanding from having listened to a workshop in which Mr. Einziger participated earlier this year that the problems presented by the cladding, the zirconium cladding, et cetera, are at this point presenting tremendous challenges with respect to adequate dry cask storage at this time. That's it.

MR. RAKOVAN: Excuse me, ma'am. Could we have your name again please?

MS. RESON: Sure. My name is Myla, M-Y-L-A, Reson, R-E-S-O-N, and I'm calling from Southern California, from the San Onofre nuclear waste dump danger zone.

MR. RAKOVAN: Okay, thank you.

MS. UHLE: Hi, this is Jennifer Uhle, I'm from NRR. And yes, we're aware of the work that has been sponsored by NMSS, Nuclear Materials Safety and Safeguards, being carried out in the Office of Research.

And I think what we'll do, because I think there's a bit of an interpretation, that you have an interpretation that differs from that of the agency, so I think that what we can try to do is we will write up and make sure that Mr. Einziger is on concurrence for that write-up and then respond to your concern on the website.

I think we plan on posting a few of the questions in written form that we do have a little bit to follow up on. So I think that might help and clarify some of the concerns you raise. Thanks.

MS. RESON: Thank you.

MR. WITT: This is Kevin Witt. In response to your question about the transcripts, we do normally have a summary of the meeting, and I think we will plan to include the transcript on to the summary. So that will be available.

MS. RESON: When will that be available?

MR. WITT: The meeting summaries are typically completed within 30 days following the meeting and we do post them in our online document management system known as ADAMS. So you can look into ADAMS for this meeting and you should see the summary.

MS. RESON: Thank you.

MR. RAKOVAN: I'll ask one more time if Jane Swanson or Elizabeth Bruce are on the line with Mothers For Peace.

OPERATOR: Jane Swanson is available. Go ahead, Jane.

MS. SWANSON: Thank you. Jane Swanson, a member of San Luis Obispo Mothers For Peace. I think I'm the seventh or eighth member of our group whose spoken on this call, so of course we thank you for the opportunity.

I'll be extremely brief because what I really want you to do is to stop being rude to the people who know the most. So the way you did not allow Diane Curran to question the authors of this consequence study was disgraceful, and the way you cut off David Lochbaum when he had a very interesting line of questioning I thought was also very rude.

And as a member of the public I really want

to hear what these experts have to say. So I will stop right there and hope that you get back to Diane Curran and Dave Lochbaum.

MR. RAKOVAN: Okay, do we have Mary Olson on the line from Nuclear Information and Resource Service? Ms. Olson, if you're online can hit Star 1 please?

OPERATOR: No, not at this time.

MR. RAKOVAN: Okay, do we have Paula Gotsch? Paula Gotsch? And I apologize if I'm mispronouncing your last name. Again, if you're on the line please hit Star 1.

OPERATOR: Okay, one moment. Ms. Gotsch, go ahead.

MS. BRUCE: Hello, my name is Elizabeth Bruce. I live within the 50-mile radius of radiation for Diablo. My first question is this. Are you familiar with the Damascus accident? Perhaps you aren't. I know I wasn't. It happened 33 years ago to today. It happened in a small town in Arkansas when Bill Clinton was governor and being visited by William (sic) Mondale who was then senator.

What happened occurred in a nuclear silo when a technician accidentally dropped a screwdriver down the silo and inadvertently tore the shield.

Miraculously, an explosion which could have caused a major nuclear explosion and taken out the state of Arkansas was taken care of by the technicians onsite.

Now I bring this to your attention because this is what, when we talk about probability we're dealing with, who would have thought that a dropping a tool down a nuclear silo could result in a major nuclear accident? We're dealing with nuclear power, nuclear waste. It doesn't fit into graphs and charts. I think you need to be reviewing it with greater respect and keep the distance.

So that was my observation. I've listened today, all day, sitting at my kitchen table, and I come away realizing that this issue is so very, very important. That the fuel rods need to be transferred to the dry cask storage. This will at least give us some security for the present, and we don't know what the future holds. Thank you very much.

MR. RAKOVAN: Okay. That actually gets through all the preregistered people that at least I had, and although we checked with a few that unfortunately weren't on the line, I'm going to go to Lauren Gibson who's been taking questions through the webinar all day. Just to give folks who didn't have a chance to ask questions or didn't have time at the mic, if we can get

a few questions before we go ahead and conclude today.

So Lauren, if you could give us just a couple questions that haven't been addressed through other discussions today, if you would.

MS. GIBSON: The first question is from Tom Clements. Question to NRC staff -- please explain how this study took into account the impacts to spent fuel pool management in accidents of high burnup fuel and spent plutonium fuel, MOX, both of which have higher heat output and lower burnup spent uranium fuel.

As the trend is to higher burnup fuel and as DOE is on a search to find reactors willing to use experimental MOX fuel made from weapons-grade plutonium, the impact of the spent fuel forms could be considerable to a spent fuel pool. Thank you.

MR. ESMAILI: Well, this is Hossein Esmaili. What we did, if I understand the question correctly, is that we actually did inventory calculations, origin calculations. We calculated the inventory or radionuclides, you know, that Oak Ridge did the calculations. We calculated the decay heat. And these were all taken into account when we did the accident progression. So as far as the decay heat and inventory was concerned, these were taken into account.

(Off microphone comments)

MR. RAKOVAN: Mr. Cochran, can you give us a chance? I was ready to step in and ask him to address the MOX fuel issue.

(Off microphone comments)

MR. RAKOVAN: Well, we appreciate that. Thank you. Can somebody address the MOX fuel or is that outside of the realm of what we can address with the expertise that we have here today?

MR. SHERON: I think, you know, the answer is no, we did not take into account MOX fuel for this study. And that, you know, I think that if plants start using MOX fuel and load it into their spent fuel pools, that's something we will have to take a look at and address at the time when that occurs.

MS. GIBSON: The next question refers to the NRC staff analysis. It sounds like a small number of people concluded that a partial drain-down is not credible. Federal information has been provided to the public to demonstrate the warrants for that conclusion.

I don't mean to sound naive or simplistic, but a mag. 9 earthquake and 19-meter tsunami at Fukushima had not been deemed credible by the responsible parties. My point is that technical risk analysis entails a great deal of epistemic uncertainty, involves assumptions that need to be vetted carefully and so on. In light of the

degree of concern expressed by 26 environmental groups and other parties, might it be premature to close out this tier 3 issue?

MS. UHLE: This is Jennifer Uhle from the Office of Nuclear Reactor Regulation. The spent fuel pool study done by the Office of Research did not look at partial drain-down. However, in the Appendix D to that study where the regulatory analysis was done, we made a conservative assumption where we assumed -- excuse me, in the tier 3 analysis that we are working on right now that will be publicly available at the end of September, we made a conservative assumption in any case where there was a pool that could have a drain-down, a partial drain-down, we assumed that the release frequency was 100 percent.

So if you look at the probability of the seismic event, we assumed there was partial drain-down and we assumed that no mitigation measures were capable of mitigating it, and we assumed 100 percent of the time that it would be a release. So we conservatively down did the issue associated with partial drain-down when we looked at whether or not the movement to a low density loading in the spent fuel pools would increase safety substantially. Hope that answers the question.

MS. GIBSON: The next question. I heard

someone reference an NEI study. Is there a percentage of your research and analysis done for you by the nuclear industry and its supporters such as NEI that you relied on for this study? If so, was there any additional rigor, scientific or otherwise engaged in by the NRC to determine the accuracy or scientific validity of the reports?

MS. UHLE: This is Jennifer Uhle from NRR. No, we don't rely on the industry analyses to make our conclusions. Sometimes we need information about how many assemblies are in the pool or things like that, that is, you know, a fact that we need to get from the licensees, and in that case we would use that type of information, but never information that would be subject to any kind of interpretation.

MS. GIBSON: Okay, and our last question. As an average, what percentage of spent fuel at nuclear power plants are already in dry cask storage?

MR. JONES: I'm sorry, I didn't hear that question.

MR. SHERON: What percent is in dry cask storage?

MR. JONES: This is Steve Jones at NRR. I think the percentage varies quite a bit from plant to plant. There are a few facilities that have not yet

begun dry cask storage, other facilities have been operating dry cask facilities for well over 20 years. So difficult to give an overall perspective, but I'd say somewhere around 50 percent is now in dry storage.

MR. RAKOVAN: Okay. Jennifer or Brian, do one of you want to close?

MS. UHLE: Yes, this is Jennifer Uhle again from NRR. And I do want to thank everybody. We've been here since 10 o'clock and we appreciate everybody's endurance and their willingness to raise concerns, make some comments, ask some questions.

We hope we did answer those questions that were posed. Public outreach and getting the public output is a vital part of our regulatory process. So we are not completed with the tier 3 study.

We will be considering what we heard today, and in fact we do have some questions we need to answer and we will put them, as well as the transcripts from the meeting, and we'll make that available with the meeting summary that should be posted within the next few weeks to three weeks or so. But we'll try to do that in an expedited basis here, because the next important meeting that I do want everybody to be aware of is another public meeting and that will be October 3rd with the ACRS, our Advisory Committee and Reactor Safeguards.

Oh sorry, 2nd, I can't get that date right today. Sorry, October 2nd, to facilitate that and the public understanding, the ACRS's understanding, that tier 3 work, although we are not complete with it, we'll make what we have available, publicly, in late September. I've said that.

But of course we will be considering what we heard today. So again, I thank you. It was a long day but you got us thinking. You saw us looking back and forth to identify the appropriate speaker here because you raised some good issues and we hope we communicated effectively with you.

So thanks to everyone. Thanks to everybody on the phone and our facilitators here today, and safe travels to everyone.

(Off microphone comments)

OPERATOR: Are you taking questions on the phone?

MS. UHLE: We have a speaker here today in the room that's asked for these last four minutes, so I think we can have one more question and he's here. So that's what we'd like to do.

MR. COCHRAN: In the designs, in the reference study where you're saying the probability of an earthquake was 1 in 60,000 per year, how much would

that frequency have to increase for you to flip your decision on whether or not it would, cost effective to expedite the removal of spent fuel? I want to understand where we are in probabilities to reverse the decision, because I think it has application to the security issues that which are not addressed in your study.

And then one last question or comment. If you believe what you say and you ought to advise the Congress against consolidated offsite storage, because your conclusions would argue that it is not cost effective.

MR. SHERON: Just to respond, I'm not sure when you say, you know, how would the frequency have to increase before it would turn around our conclusion. Because obviously when you go to a higher frequency earthquake the magnitude goes down.

MR. COCHRAN: No, no. No, for the earthquake you assume --

MR. SHERON: Just mean the probability.

MR. COCHRAN: Probability. Increase the probability, when do you flip?

MR. SHERON: Yes, I'm going to have to ask Fred if he has any insights on that, since you did a cost/benefit.

MR. SCHOFER: I didn't do a break even

calculation to do that, but in the reg analysis, if you recall, the spent fuel pool study looked at a particular seismic event and that is that 1:60,000 year earthquake.

In the reg analysis, not only did I consider that earthquake, but I considered the more energetic 1.2G earthquake as well, plus numerous other initiators that could challenge spent fuel pool cooling or integrity.

And so that total set of initiators were considered which are well, you know, although the seismic were the dominant, I combined two earthquakes plus other initiators and we came to that conclusion in Appendix D. So it would have to be, you know, even more than what I already considered, but I didn't do a break even.

(Off microphone comments)

MS. FINCH: At this time it is 5 o'clock. I'd like to thank you very much for your time and attention today.

OPERATOR: All right. This completes today's conference. You may disconnect at this time.

(Whereupon, the foregoing matter went off the record at 5:00 p.m.)