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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON NUCLEAR WASTE

(ACNW)

138th MEETING

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WEDNESDAY,

NOVEMBER 20, 2002

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ROCKVILLE, MARYLAND

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The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 10:00 a.m., George M. Hornberger, Chairman, presiding.

COMMITTEE MEMBERS:

GEORGE M. HORNBERGER, Chairman

RAYMOND G. WYMER, Vice Chairman

B. JOHN GARRICK, Member

MILTON N. LEVENSON, Member

MICHAEL T. RYAN, Member

ACNW STAFF PRESENT:

JOHN T. LARKINS, Executive Director, ACRS/ACNW

SHER BAHADUR, Associate Director, ACRS/ACNW

HOWARD J. LARSON, Special Assistant, ACRS/ACNW

MICHAEL LEE

RICHARD K. MAJOR

RICHARD P. SAVIO

ALSO PRESENT:

BRITTAIN HILL, Center for Nuclear Waste Regulatory Analyses

JOHN TRAPP, NMSS, NRC

C-O-N-T-E-N-T-S

Agenda Item Page

Scientific Update on the Igneous
Activity Issue at Yucca Mountain
John Trapp 302
Britt Hill 327

Transportation Working Group Workshop

Introduction, Milton N. Levenson 369

Transportation Safety in the U.S. and Worldwide
Presentation of Rick Boyle 371
Presentation of Kevin R. Blackwell . . . 383

Summary of DOE Shipping Experience
WIPP Shipping Experience 418
Alton Harris
Foreign Fuel Shipment Experience 429
Maureen Clapper
Navy Fuel Shipment Experience 444
Don Doherty, DOE

Summary of Utility Experience
Progress Energy, Robert Kunita 486

Public Comments 540

Workshop Summary and Discussion 546

P-R-O-C-E-E-D-I-N-G-S

(10:00 a.m.)

CHAIRMAN HORNBERGER: The meeting will come to order. This is the second day of the 138th meeting of the Advisory Committee on Nuclear Waste. My name is George Hornberger, Chairman of the ACNW. The other members of the committee present are Raymond Wymer, who is vice chairman, John Garrick, Milton Levenson and Michael Ryan.

Today the committee will, one, hear a scientific update from the NRC staff on the igneous activity issue at Yucca Mountain and two, after completion of that presentation and discuss, the committee will adjourn for lunch, an important item, and then at 12:30 this afternoon, we will continue our workshop on the transportation of spent fuel in the Two White Flint Auditorium, which is downstairs.

Mike Lee is the designated federal official for today's initial session and I hear from Mike that he took three days of training to learn how to be a DFO. I think he'll be good at it. This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. We have received no written comments or requests for time to make oral statements from members of the public regarding today's sessions. Should anyone wish to address the committee, please make your wishes known to one of the committee staff.

It is requested that the speakers use one of the microphones, identify themselves and speak with sufficient clarity and volume so that they can be readily heard. Before proceeding, I would like to cover some brief items of interest. Andy Campbell left the ACNW staff in October to become a Section Leader in the Division of Waste Management. Andy will be leading the Environmental and Performance Assessment efforts we wish him well.

We welcome Neil Coleman, Neil's around somewhere, there he is, okay. We welcome Neil Coleman who joined the ACNW staff for a two-year temporary term as an ACNW Senior Staff Scientist. Neil has been with the NRC since 1983. He comes from NMSS where he served as staff hydro-geologist and program element manager for USFIC. Neil is a well-known hydro-geologist and geo-morphologist. He received his MS in geology from the University of South Florida.

Congratulations are due Jenny Gallow, who was selected in September as Chief Operations Support Branch, ACRS/ACNW. We also welcome Dr. Hussein Norbash (phonetic) who has been appointed Senior

Fellow for ACRS/ACNW. His Ph.D. is in chemical engineering from the University of Minnesota. He formerly worked at the Brookhaven National Laboratory in Upton, New York. For those of you who need a geography lesson, that's on Long Island.

Recently the ACRS welcomed Michael Snodderly (phonetic) and Ramin Assa as Senior Staff Engineers. Mike has been with the NRC since 1989. Before coming to the NRC, he worked at the Calvert Cliff Nuclear Power Plant for three years. Mike has a BS in nuclear engineering from the University of Maryland.

Ramin has been with the NRC since 1991. Before joining NRC he worked with Consolidated Edison for seven years. He has a BS in nuclear engineering and an MS in mechanical engineering from the New Jersey Institute of Technology and a Masters degree in international management from the University of Maryland.

DOE announced that in early December W. John Arthur will replace J. Russell Dyer (phonetic) as Deputy Director for Repository Development. His offices will be in Las Vegas and he will have prime responsibility for building and licensing the Yucca Mountain Nuclear Waste Repository Project. I presume that should be licensing and then building. Mr. Dyer will stay on the project as Senior Project Advisor. A $230 million contract extension for clean-up of the West Valley Demonstration Project has been awarded to West Valley Nuclear Services Company. During the 27-month extension period activities will focus on decontaminating the former reprocessing facility in New York State and completing the construction of a facility that will be used to remotely process and package waste for offsite shipment.

Okay, so we now go to our regular meeting and our one item on the agenda for this morning is an igneous activity update. The committee has been interested in the issue of igneous activity and potential consequences for the proposed Yucca Mountain Repository. And this is an update. We've heard I think extensive presentations. We had a pretty long meeting, was that in June, Mike? I think it was in June. And so this is going to be an update and we have with us John Trapp and Britt Hill, who will do the presentations, and because we have only until 11:30, without further ado, here's John Trapp.

MR. TRAPP: Good morning. Can you hear? Is this mike okay? I can be heard okay. Okay, good. Can you hear me? Yeah, there will be two presentations this morning. In preparing for this and in discussions with Mike Lee, you wanted to hear those things which are significant and because of the time frame, we picked these two items; one which is a discussion of the interim report of the DOE sponsored peer review and the other which is a discussion of a combination of the aeromag data and its effect on probabilities. We feel these are the most risk significant items that we can be talking about this morning.

I want to point out that what I'll be presenting is my take on the most significant points of the presentation. There may be some people that would go through and pick out one or two other things but we can discuss any of these as we go. If we go into the background, the panel was formed initially in the spring of 2002, basically under Bechtel SAIC working at the request of DOE.

The basic task was to review the technical basis used to analyze the consequences of igneous events and to recommend any additional tasks that would significantly strengthen the program. They had a kickoff meeting in May. We attended that meeting. The interim report was issued in August and in September they had a panel meeting on it. I believe the committee has been given copies of this report. Okay, well, if need be the report can be found at the DOE website. I've got the web address at the bottom.

DR. BAHADUR: We got copies.

MR. LEE: It was in Dr. Hinze's trip report. We had that whole package.

CHAIRMAN HORNBERGER: I'm sorry, I have seen it.

MR. LEE: Yes, we have it.

CHAIRMAN HORNBERGER: That was the appendix to Bill's.

MR. LEE: Yes.

CHAIRMAN HORNBERGER: The appendix actually didn't come through but I knew it was there.

MR. LEE: We have it.

MR. TRAPP: If I can kind of cut to the chase, what really is the bottom line of the report. The main emphasis of the report was on magma-repository interactions. I'd like to point out that this is one of the agreement items that we've got with DOE, Agreement 2.18. And it really goes into the Woods, et al paper and the various ramifications of this. If you take a look at Woods et al, one of the things that everybody gets totally hung up with is the initial transient, the shock wave, whatever we want to call it. But if you go through the paper, one of the things that comes out is the initial transient does not cause significant damage to the canisters. Therefore, the initial transient, and you can argue about the values, parameters that were put in. If you say that ours were too conservative, even with those values, they do not cause damage but the other points that come out of this is the follow-through, the flow through the repository can cause significant effects and the possibility of openings being raised at other spots.

If you take a look, the panel recognized this and I think page 49 kind of summarizes it, this is a so-called dog-leg scenario which needs further careful study. So they recognized that this is a real concern and I'll be going through and I'll be discussing some of the things they are suggesting. They do suggest additional modeling, for instance, a more comprehensive calculation of magma flow after intersecting a drip is required. And if you do take a look at this report, you'll find that there's about 30 pages of very extensive mathematical formulas in the appendix which goes through these various problems, how you can formulate the problem, how you can take care of some of these things, which I'll discuss a little bit later.

So there is quite a bit of extensive material in there, even if it is an interim report.

One of the things the panel recognized was the importance of the dose. Now some of the discussion you've heard before was suggesting volatiles below half a percent. If you take a look, for instance, at our RRSR, our number has always been it has to be greater than two percent, something like two to five. Well, the panel basically said two and a half to four percent was their best estimate as to the volatiles that they'd got. However the effect of CO2 hasn't been considered and it's something they feel should be added in here.

They're worried about the timing and the amount of the vapor phase as it effects the transport processes. Timing really here is mainly looking at the relationship of any possible event to the thermal cycle that the repository goes through. The effect of the thermal cycle will effect how the dike would interact with the repository. I note that this is really a complex mixture. You're not looking at a standard fluid, you're looking at a multi-phase fluid. And one of the real problems in trying to analyze this is the thing evolves passively.

As it moves, as it gets closer to the surface, you've got bubbles absolving, et cetera. As they absolve, it moves faster, changes its properties. As it changes its properties more bubbles will absolve. So you are not looking at something that is a easy item model. Other suggestions they talked about, well, in addition to the CO2 you should take a look as some of the sulfur bearing species, hydrogen sulfide, sulfur dioxide and metsopick (phonetic).

And some effort they recommended taking a look at the amphibole-bearing species because this will give you a better handle as to how the actual amount of how the water is in the system. There was a tremendous amount of discussion on dike propagation and a tremendous amount of concern with the properties of the dike tip. One of the problems here is that the theory in this really doesn't fit observations. If you go through the theory, you should be talking about dikes in the Yucca Region of about 20 kilometers or so. You don't have dikes like that. You've got dikes a couple kilometers, maybe up to five.

One of the things I will point out again in the appendices they recognize this and they talk about different modeling that can be done to compensate for this non-juxtaposition between theory and practice. They point out that the property of the magma tip is important. What is it you really got in that area? Do you have a vapor phase, do you have a degassed fluid, the magma itself or most likely do you have a bubbly mushy mixture, et cetera?

It should be noted that the state of the models, and this is my way of stating it, are really 1.5-D. What they do is they take a 1-D flow model and couple it with a 2-D rock mechanics model to do these type of calculations. So you are trying to get a better understanding of these things but the full 2-D and 3-D really are not state of the art. We don't have the parameters, properties, et cetera, to get into it. The 3-D models that they sometimes talk about are really two of these 1.5-D, one in a vertical and one in a horizontal and this is what they call a pseudo-3-D model.

Again, look at the appendix. There's a tremendous amount of math in there and they do recommend that you don't go to these 3-D models. Take a look at what they call 2-D models, use these in volume conditions to get a better idea of exactly how material will move and interact.

One of the differences, and it's been brought out before, the conditions of the dike tip.

The panel believes it's less active than we do. One of our concerns here really is if you take a look at the dike tip, the actual size and volume considerations of the dike tip is extremely small compared to the mass of material which is moving through the repository. They recommend more modeling and I will note here that they had seen during the initial presentation a -- some work by Gaffney from DOE. The think that this may be a good first pass at understanding and computing mass flow through the system. I would assume in the final model or final report they will have looked at this in much more detail and give much more detailed recommendations on this.

They also recognize the complex state of rock stream, effect of faults and topography, and the possible effects that these could have on the magma flow processes. If you go back to the presentation similar to the ones Britt Hill has made previously to the committee, you'll remember these different diagrams where he's showing the location of the repository in relationship to the topography of Yucca Mountain and discussing this. This is basically the same concept that's being brought through. So their recommendation really is that you have to consider the effect of surface topography, the strain or response and all this during the thermal period.

One of the interesting things that they brought up is the possibility of sill formation or actually having the dike spreading out in a horizontal manner in this area.

If you get into some of the other activities or recommendations, they have concerns listed with redistribution, magma waste package interactions and magma waste form interactions. I'll point out that these three items are also part of our agreements with DOE for things that have to be studied. They did recommend also more modeling, but the panel recognized their shortcomings in their mixture of the panel. They didn't have people that really were specialists in this area.

So you end up with very general recommendations. Further review by qualified expert worth considering.

CHAIRMAN HORNBERGER: John, are there experts in this?

MR. TRAPP: Yes.

CHAIRMAN HORNBERGER: Experts in how packages behave in contact with magma?

MR. TRAPP: Well, not really magma, but

experts in mechanics of package response.

CHAIRMAN HORNBERGER: Mechanics of packages, so that's what you mean, okay.

MR. TRAPP: I guess I got ahead of myself. And they also agree of fragmentation of the waste, this was a concern.

Scheduled activities; well, one actually which is in the past and I believe you also were getting copies of this, but there is an interim review of this by consultants for NWTRB, the same ones that you had when you were giving your presentations and if you don't have it, again, here's the web address that you can pull these up. While there may be a slight difference in emphasis in there, I think what you'll find in those reports agrees with what I've presented today.

The peer review report was scheduled initially in December and then January, but it looks like it's going to be February right now. One of the problems that DOE had is Bob Budnitz, who was chairman of the panel, received an offer from DOE that he had to accept. It was just too good to turn down, and so this reformatting of the panel and putting a different chairman in charge has caused a little bit of a delay.

PARTICIPANT: Did they select a new

chairman?

MR. TRAPP: Pearson, I believe is the -- is that right, Britt? I think Pearson, yes.

The one report that we're interested in is actually, while we want to see the final panel report, we're more interested in a follow-up DOE report because that report, which is scheduled for about two months after the panel report comes in will list what DOE is going to be doing in response to the panel recommendations and this will figure out how the program evolves and we plan on briefing you following this review.

I was asked to give also my thoughts on how it effects our program. Well, I pointed out and I'll point out in this bullet -- I'm not used to giving it this way. I'm usually standing up wandering around to see what's going on. But basically the report supports the concerns that we've raised and the basis for these various agreement items. They're areas that have to be worked at, looked at, et cetera.

Then if you'll take a look at the NRC sponsored investigations, they really form the basis for a lot of these concerns. One of the things I was pleased to see throughout this report was many references to the igneous activity IRSO (phonetic).

And I think very honestly that if you take a look at this review, you couple it with what's coming out of the risk insights, what we'll show is that we have been and are continuing to work on those things which are appropriate. That's my presentation for today and I'm open to any or all questions.

CHAIRMAN HORNBERGER: Okay, good. Thank you, John. That was a good summary of the interim report and you do think that -- I mean, your anticipation is that the delay will be slight and it will be February?

MR. TRAPP: My discussions which was last week, was that February should be a real number.

CHAIRMAN HORNBERGER: Okay. Questions from members, Mike, John?

MEMBER GARRICK: I just wanted to make sure I understood what you were saying, John. You said the issue is not so much the shock wave analysis and the impact on the waste packages in terms of violating their integrity as it was on flow-through.

MR. TRAPP: Long-term flow-through.

MEMBER GARRICK: Long-term flow-through, but that you mean pathways, creation of pathways?

MR. TRAPP: Pathway creation, the amount of time that the packages will be sitting in this type of environment. The -- if you do a thermal response or a shock response under the initial conditions, the package is sufficiently robust that there's really no effect. You put it under these conditions, the temperature that you've got, the magma -- the package really cannot stand this type of thing. This shows up in NRC calculations, it shows up in DOE. The only question really is the amount of damage that's going to be happening to the package. The over-pressure in the package alone is considered sufficient from the heating to rupture the end caps, this type of thing.

Again, if you go back to the presentation that Britt had a couple months ago, he discussed some of these things the fact that actually after you get a waste package of C-22 heated up to these temperatures, you really don't have C-22 any more, you've got something else and the package is extremely brittle and has lost most of its strength.

MEMBER GARRICK: So it would just accelerate the whole waste mobilization process but it wouldn't necessarily be a short-term or it is.

MR. TRAPP: It depends on what you mean short-term. It's short in the lifetime of the repository.

MEMBER GARRICK: Well, it's short in terms of with respect to the current time constants being used for establishing doses, but not short in terms of it happening immediately at the time of the event.

MR. TRAPP: No, the thing is, it won't -- we're not concerned with the first few seconds. Now the flow of the volcano is going to be days to weeks. In that time frame, the thermal effects on the package are sufficient to cause package failure. The package failure at that time can cause, if you're talking groundwater, opening up for groundwater, but if you're talking these multiple pathways or the dog-leg scenario, et cetera, there you're talking about bringing more canisters that are now damaged into the path of the magma and possibly incorporating more material.

If you go through that, then this flow really becomes important because you're talking about possibly segregating the flow so you've got magma in certain spots, you've got gas in the others. You're trying to figure out the total amount of damage of the package and the velocities and carrying capacities of this material to determine if you can incorporate waste and how much waste you can incorporate.

MEMBER GARRICK: And with these new analyses, you're still talking about the same order of likelihood in terms of the frequency with which such events might occur?

MR. TRAPP: Frequency of which the initial event occurs. Britt will actually go into more detail on that later but we haven't gotten to the point, and DOE has not gotten to the point where you could sit there and put a number on is it more likely to go up or is it more likely to follow one of these dog-legs. That's what some of the ongoing research has to determine.

MEMBER GARRICK: Okay, thank you.

CHAIRMAN HORNBERGER: Raymond?

VICE-CHAIRMAN WYMER: I certainly do not have a comfortable feeling that there's a very good understanding of the modeling activities at this point. Practically everything that you presented that was looked at during this panel and in the report was more modeling needed, more modeling needed. And it's a very complex situation, almost unbelievably complex. Is there any reason for optimism that any realistic useful modeling will be done in the time frame of the licensing process?

MR. TRAPP: I really would have to defer to DOE on that. They've got a tight schedule. I know they have started some of the modeling already. For instance, I did mention the work of Gaffney. So there are some things ongoing but the total program, the DOE and others responding to this, I really cannot tell you until I get their report following the final report.

VICE-CHAIRMAN WYMER: I bet you have a feeling.

MR. TRAPP: They've got a lot of work to do is the way I'll phrase it.

VICE-CHAIRMAN WYMER: Okay. Thanks, that's all.

CHAIRMAN HORNBERGER: Milt?

MR. HILL: I'd like to add just a point, if I may. This is Britt Hill from the CNWRA. While I don't think we're going to get to a good process level model where we are going to have a realistic representation of magma flow, I think we're going to have some good constraints on the real important processes that will allow us to evaluate the canister response and also the potential for waste incorporation.

If we'd just take a step back from the initial modeling and look and say we're not getting an over-pressure that caused instantaneous failure of a waste package. So a lot of the argument about the initial couple of seconds really doesn't have a high risk significance to it right now. Some of the discussion is whether the magma flow following that initial decompression will be on the order of 100 meters a second of ir there's low volatiles maybe 10 meters a second, about 20 miles an hours, but we're still talking about a pressure gradient that has magma flowing relatively rapidly, a lot faster than somebody could walk, into a drip and so there's going to be minimal thermal effects because the mass of the waste packages versus the tunnel diameter versus that mass of magma relative to a 20-mile an hour emplacement rate is going to be pretty small. So we're talking about heating and thermal effects.

We've constrained some of this to say that yes, we're going to have flow, there's going to be within some range of uncertainty that flow, and we're going to have to consider waste package response. And we can narrow it down to two alternatives; is that magma going to go straight up from where it intersected or is it going to have some sort of a dog-leg and effect the source term? We can develop alternative conceptual models for both of those scenarios and evaluate the risk significance.

VICE-CHAIRMAN WYMER: So you're saying or at least suggesting that you think there will be enough information available at the time of the license application review to make a judgment about the DOE's presentation?

MR. HILL: I think we'll have enough from alternative conceptual models to evaluate the risk significance of these distinct possibilities. I don't know if we'll be able to get a robust estimate of the likelihood of each scenario occurring. That may not be a tractable sort of problem, but I think we can evaluate to a first order, the fundamental physics and chemistry and mechanics of what's going to be going on in this very complex process. The challenge is trying to come up with a process level model that says we don't have to worry about it. It's a little bit easier to say, well, assuming first order relationships, could this be a concern, yes or no.

VICE-CHAIRMAN WYMER: So you think at the proper time you will be able to evaluate the risk.

MR. HILL: Yes, I think we'll have enough information to consider a do range (phonetic) of alternatives.

VICE-CHAIRMAN WYMER: Thanks.

MR. TRAPP: The uncertainty, as Britt's pointed out, will be quite large.

VICE-CHAIRMAN WYMER: Yeah.

CHAIRMAN HORNBERGER: Milt?

MEMBER LEVENSON: Yeah, I have a little more specific question. The modeling that was done that led you to the conclusion that the containers waste packages were likely to disintegrate rather rapidly following the initial, did that analysis -- was that a good thermal analysis in the sense that the -- I think it's a safe assumption that the magma is not super-heated and the waste packages have a large amount of heat capacity. They almost certainly are going to almost instantly be covered with a shell of frozen material. Is that level of detail in your model or are you assuming constant temperature exposure of the waste package independent of things like heat capacity? I mean, I think that's a type of analysis that's much simpler to do than things like magma flow.

MR. HILL: This is Britt Hill again. In the IRSR Revision 2, 1999, we did a simplified conductive cooling model using the heat capacity of the waste package considering the heat capacity of the magma. We did not go into secondary quench effects but even if you have a quench of magma, that quench is probably at about 900 degrees C, so the magma is solid at about 950 degrees centigrade. So even though it is quenched, it is still awfully hot relative to the sort of temperatures that we see grain boundary effects in C-22.

MEMBER LEVENSON: Well, it's hot but it doesn't have a great deal of heat capacity to transmit when it's solid. Was this an actual heat transfer-based calculation?

MR. HILL: It assumed -- I'm trying to remember from the analysis. I don't think it looked at the change in conductivity between the magma itself and the waste package.

MEMBER LEVENSON: Okay.

MR. HILL: We have been asking the Department of Energy for a more detailed analysis of what would happen to a waste package that's in the flow path because we're not dealing with a static magma. This magma is flowing in the order of tens of meters per second past the waste package, so it's not a simple stagnation and cooling relationship. We have melt-back phenomena on dikes, for example, where you may have an initial quench but as the material underneath the quench deforms, the quench would be on the order of centimeters and would likely degrade and fall back.

So it's a very complex phenomena on the scale of hours that we're going to be trying to model.

MR. McCARTIN: This is Tim McCartin. If I could add one thing and I guess I want to make sure this is clear, that there are at least two levels that I think are being discussed here. From a performance assessment standpoint, there is an assumption in the Code that both ourselves and DOE make that the waste packages that are contacted by magma offer no protection whatsoever and so -- and all the waste is incorporated and taken up. Some of this detailed modeling is direct -- how conservative is that and part of what's being looked at is the -- are there -- is there a technical basis for assuming less than that but right now, the performance assessment analysis you see both ourselves and the Department undertake assume no protection and so that -- you know, be aware that this is being investigated sort of what might call an off-line analysis more detail to see how appropriate the assumptions in the PA, how bounding are they, how conservative. Maybe they're right on the money but there is two levels of analysis going on here.

MEMBER LEVENSON: I appreciate that, Tim, and I understand. I have no question and no problem about making certain conservative assumptions in connection with licensing. But I start to get a little bit hung up when the analysis which is supposed to be risk informed, starts including such assumptions that are rather extreme, might be appropriate for licensing but I don't think they're appropriate when we're trying to do best estimate analysis.

MR. TRAPP: We have discussed this with the waste package people and I can't get any waste package person in the eruptive phase to tell me that the package is going to last. If I could get somebody to say that, maybe I'd feel that this was not a correct assumption, but --

MEMBER LEVENSON: Well, I'm just trying to sort out whether this is an assumed situation or is really a result of calculation.

MEMBER GARRICK: I think what Milt's really saying, is there an engineering mechanistic model associated with the degradation of the waste package?

MR. TRAPP: Aside from the impact end cap failure, not really.

MEMBER GARRICK: Yeah, okay.

MR. McCARTIN: Yeah, and from a performance standpoint, we took what might be a conservative assumption and what you're seeing is that was our first step, let's assume this and now analyses are being done looking at this very complex problem, as John and Britt have talked about many times and is there a technical basis for backing off that and it's not an easy path. That's the hard part of it.

MR. TRAPP: Again, I'll point out that the panel recognized it. They also said that they didn't have the right people but it needs to be looked at. So it is a problem that is being looked at and it's one of our agreement items.

MEMBER LEVENSON: Part of the background, John, is yesterday in our workshop on transportation information was presented that indicated that for a waste package in transit, not this waste package but a CAS (phonetic), that something like 30 hours in a 1400-degree fire, the internals fuel inside hadn't come anywhere near failure rate even. So --

MR. TRAPP: Well, first off, it is a different material.

MEMBER LEVENSON: It's a different material but they also did not have any incipient insulating phenomena like solidification of magma. This was a live flame and this is just because of the very large heat capacity, which as to be taken into account. If you omit taking that into account, you're not doing best estimate. I don't want to get into a detailed discussion. It's just that we would like to see best estimate analysis.

MR. TRAPP: The analysis in the IRSR basically took a look at two different cases; one which we thought was a high transfer function, one which we thought was a very low transfer function. What it amounts to in both cases you end up with these temperatures above the 800, 900-degree C well within the time frame of volcanic activity.

MR. HILL: This is Britt Hill. Again, those were scoping calculations. They were not a detailed engineering analysis but they were sufficient and coupled with what we see for volcanic eruptions that we could come up with no technical basis, nor has the Department of Energy come up with a technical basis that would indicate a waste package in the throat of an eruptive assaultive volcano would remain intact given the duration of activity would be on the order of hundreds of hours of exposure to these temperatures and neglecting all components of mechanical force.

CHAIRMAN HORNBERGER: And I think what both of you are saying is that they analysis would have to take into account that the dog-leg scenario would, in fact, be different than being caught in the throat of an erupting volcano. And these heat transfer mechanisms really would be different in the two cases, right?

MR. HILL: I'm not sure that would really be the case though, because the pathway to the surface would be along that dog-leg and so we're looking at there would be some potentially different effects from the volatiles, just we'd have to consider bubble ascent in that conduit, but what we're really saying is the throat of the volcano, that conduit, would go horizontal for a bit and that's really the only mechanical difference in the dog-leg versus a standard vertical conduit in a typical volcano.

MR. TRAPP: There is a difference in the type of fluid. The segregation of bubbles could cause a difference in the analysis.

CHAIRMAN HORNBERGER: John, did you have something else?

MEMBER GARRICK: No, I was just going to make the off-hand remark that maybe there needs to be more of an engineering analysis presence in the effort. I don't know who you have on that peer review committee and whether there's any real engineering modelers on it.

MR. TRAPP: No, not for this type of thing and they recognize it and they say that they should have a qualified expert take a look at this problem. It's up to DOE to decide if they want to augment the panel and bring in other people but they recognize the problem and say, "Look, it's got to be responded to".

CHAIRMAN HORNBERGER: Okay, well, I just want to congratulate Ray Wymer for using the word optimism in a question to John Trapp.

(Laughter)

MR. TRAPP: That's something that normally does not happen.

CHAIRMAN HORNBERGER: And I think now we'll move on to Britt Hill, who will update us on probability.

MR. HILL: Okay, well, do I need to shout or is everybody hearing okay?

CHAIRMAN HORNBERGER: Need to just check with the reporter. You can hear him, okay.

MR. HILL: Well, I think I'll stand up because sitting down just feels a little too much like testimony to be comfortable. I'm going to talk today on some of the recent developments in the area of probability that are arising from uncertainties about the number and age of volcanos current buried within about 30 kilometers of the proposed repository site.

I'll just jump right into it and set the stage. Back in 1995, the Department of Energy conducted an elicitation for the probability of volcanic hazards in the Yucca Mountain Region. There had been some aeromagnetic surveys, these geo-physical surveys that were conducted as part of regional surveys or investigations for the Nevada Test Site, as far back as the early 1960's. At the time of the 1995 elicitation, there were seven anomalies located south of the repository in the Amargosa Desert area that experts reasonably interpreted as buried basalt. A couple of them had some ground magnetic surveying done and there was different degrees of confidence.

So using the available information in 1995, the PVHA panel assigned likelihoods of anywhere of maybe 20 percent to 90 percent certainty that each of these seven anomalies were caused by buried basalt at volcanos. One of these anomalies found around the junction of -- or right around the Town of Lathrop Wells, has been intersected by drilling 50 meters worth of basalt and it's dated at about 4 million years. So know one of those seven is actually buried basalt.

Since the PVHA elicitation in `95, there's been some high resolution magnetic surveys, both ground magnetic and aero-magnetic, conducted in this region and various interpretations of those surveys show that there could be at least 17 more anomalies that could represent varied basaltic volcanos within about 30 kilometers of the proposed site. Now, in addition to the possibility of 17, we've got more uncertainty than did before, because we're seeing that geo-physical anomalies, these magnetic anomalies, are present in areas where know there's no basalt and also the real troubling part is there's basalt present in the sub-surface in areas where there are no geo-physical anomalies.

So how can our probability models be effected by this kind of uncertainty and the location and age of basaltic volcanos, including this problem of present but under-protected events. So I don't want to belabor the aero-magnetic data. You've got Bill Hinze to tell you more about that. But this is one simple way of looking at it. It's what's called a residual anomaly map. We're using the U.S. Geological Survey data from Rick Blakely, et al's report in 2000.

Simply, take the magnetic data and subtract out the long wave length background function. This helps identify the anomalies a little bit clearer. Back in 1995, this area south of what would be Highway 95 was pretty easy to find some volcanos. And so Anomalies A through G, down around here, Anomaly A is right up here, had been identified and those are the ones that were given 20 percent, 90 percent weight by the panel.

Now, based on these new data that integrate across the Yucca Mountain Region, we've got seven additional high to medium confidence magnetic anomalies that a wide range of experts, U.S. Geological Survey Center, Bill Hinze and others have taken a look at and agree, yeah, it's a reasonable interpretation, can have buried basalt at Anomaly I, Anomaly H, essentially all of our black to white triangles, Anomaly Q and L, M, N and O as well, right up in there.

There's six other anomalies that are also identified as well, maybe there's basalt there but it's a fairly low confidence interpretation. These are generally subdued and broad anomalies but there are some challenges in the data. For example, Anomaly K the survey was up at a very high altitude when it got down to here because the pilot didn't want to run into black mountains, sort of an understandable consideration. So if you had buried basalt and you were up really high, it might look like a very subdued anomaly but low confidence.

For the rest of the discussion, I'm just going to be focusing on the high to medium confidence anomalies and ignore the low confidence ones for now. In addition to the aero-magnetic data, we've got for other anomalies that are labeled 1 through 4 for clarity, that are identified from ground magnetic surveys. These are surveys that we've conducted at the Center to try to get a better understanding of what these aero-magnetic anomalies mean. Are they buried basalt, are they faulted bedrock or whatnot. This is just an example of the ground magnetic survey from the Steve's Pass area that's just south of Bear Mountain.

What see are blocks of faulted welded tufts and buried basalt, buried basalt in Anomaly 1 and Anomaly 2 beneath anywhere from a couple tens of meters, to perhaps 300 meters of alluvium south of Highway 95. You walk over this area and it's nothing but dirt, a little outcrop of tuft right there but by and large, just looks like dirt. We've continued the survey this year down south to this area to take a look at the aero-magnetic anomalies, L, M, N and O.

Now, the interesting thing with these

anomalies is it's not just a couple of guys sitting there looking it and going, "Yeah, looks like basalt to me". Actually Dennis O'Leary and others at the U.S. Geological Survey constructed 2-D models across these data and you can model buried basalt as a reasonable fit to these data with the welded basement tuft sitting down there as well. So you're not just guessing. You're doing a mathematical robust analysis that gives you a non-unique solution that shows, yeah, you could have a couple hundred meters of dirt, alluvium, basalt and then welded tuft.

MEMBER RYAN: A quick question, are any of these -- I'm sorry, are any of these identifications confirmed by cores?

MR. HILL: No, it would be a fairly straightforward thing to do but none of these anomalies with the exception of B on the initial map have been drilled.

MEMBER RYAN: That would be kind of a good way to test your mapping skills.

MR. HILL: Right, I'll get to reducible uncertainties towards the end of the presentation.

So here are the ones that we've identified, but we've got some serious concerns about other ones that may remain there that haven't identified yet. Here's the proposed depository site. Highway 95 will be coming through right about here. And have these alluvial basins to the southwest and southeast of Yucca Mountain. They're nice and flat. Occasionally, you've got basalted volcanos on the top of them, but they're underlaying by very noisy bedrock. And when you have this magnetically noisy bedrock, it can mask the signals of the overlying basalt.

Here have in Crater Flat about a 4 million-year old basalt center. This is the young Lathrop Wells cone and you can see the anomalies from these are very indistinct relative to the white outlines of the basalt itself compared to some other areas that are very similar looking by the welded tuft. So even in areas that was know have basalt sitting at the surface, that signal doesn't come through on a number of the recognized centers. So there's uncertainty in the data right now to identify all the features that know are there. So it's kind of hard to have confidence that others might remain undetected.

In addition, the reason for Nye County drilling, out here at Well 23-P intersected basalt about 400 meters below the surface in an area that has no distinct magnetic anomaly. Now, you can see kind of a pink high coming through there but if this represents a basalt anomaly, you can see very similar other magnetic anomalies throughout this basin that would contain a 40-mile wash, a lot of other anomalies out there that could potential represent buried basalt that haven't identified and the survey hasn't identified as buried balsaltic centers.

And for example, that same character is well repeated throughout the Crater Flat Basin as well. So what this is coming down to is have limited ability to see all the features that can -- that know are at the surface, have clear evidence that other basalts remain buried in areas where have no distinctive magnetic anomaly and so this question of could there be present but undetected volcanos clearly is yes. don't have reasonable confidence that all the potential features out there are characterized beneath the sub-surface in the Yucca Mountain Region. And we're going to need, and the Department, more importantly is going to need to develop some sort of a technical basis to quantify that uncertainty.

So to sum up the mag data, have got high confidence, because you can walk up and touch them, that we've got 12 volcanos for sure sitting there in the Yucca Mountain Region that are ranging anywhere from about 80,000 years old to about 11 million years old. These are the ones that have either been sampled at the surface or drilled and intersected in, for example, the VH-2 core or the Felnerhoff Federal Wells (phonetic) down south around Highway 95. These are the known ones, 12 known events. In 1995 seven additional anomalies were considered, so in addition to 12, we've got the seven more with 20 to 90 percent confidence that those anomalies represent basalt.

Now, increase that from the aero-magnetic data, the seven additional, additional anomalies with high to medium confidence interpretation as representing basalt and add in four more from the ground magnetic surveys. So in other words, we've got at least 11 magnetic anomalies that can be reasonably interpreted as basalt identified after the DOE PVHA. also have to consider that about half of our known volcanos don't produce distinct anomalies and that varied basalt exists in areas that don't give us distinct anomalies as well.

So that's what we're dealing with, with the first task on uncertainty, 11 additional volcanos and some consideration that may not know where all of them are. To identify location -- if you find that it's hard to identify location, wait till you try to put an age on what you think these anomalies could be. The USGS, O'Leary and others have modeled about half of these high to medium confidence anomalies and they come up with burial depths anywhere from a 500 to 300 meters below the surface. Now, perhaps could take the burial rate and constrain that burial rate well enough to say, well, if had uniform burial, maybe could estimate the age. Burial rates are controlled by two processes, the rate that the sediment comes to that area and also how fast that area may be subsiding. Well, unfortunately in this Yucca Mountain Region, those two terms, the amount of sediment, the sediment production rate and the sediment transport rate as well as the subsidence rate can vary quite a bit, so you can't just take an average sedimentation rate of about .03 millimeters per year and apply it with any real confidence to these anomalies and say, "Ah, well, they range with that depth maybe a couple of million to maybe 10 million at 300 meters".

You can make that estimate but the uncertainty on that estimate is very, very large. And when you consider the uncertainty because of differences in sediment rate and differences in base and subsidence rate, the best you can do is say, "Well, these anomalies are somewhere between two and 11 million years", but you can't get better resolution from this sort of a burial rate between .01 and .1 millimeters per year.

So given that sort of uncertainty, have to constrain it somehow because that doesn't give us any information on recurrence rate.

MEMBER GARRICK: Now what kind of distributions to you put on those uncertainties? In other words, do you have enough data to construct a probability density function for these events?

MR. HILL: Well, the --

MEMBER GARRICK: Do you have enough information?

MR. HILL: No, I think you'd be looking at something --

MEMBER GARRICK: So when you talk about uncertainty, what are you then talking about if you're not talking about something like a probability distribution?

MR. HILL: Maybe I'm using the term incorrectly but the uncertainty would be what you would say if you used an average rate, get an age of about -- an estimated age of five million years, the uncertainty on that would be plus or minus 5 million years. Perhaps it would be plus or minus 6 million years once you considered the range of sedimentation or the range of burial rates that you would use out there.

MEMBER GARRICK: Yeah, well --

MR. HILL: The thing that would constrain it is, know it's not older than the rock it lies on which is about 11 million years.

MEMBER GARRICK: Yeah, the much preferred approach would be to have the mean be the direct result of the probability distribution and the mean be your probability.

MR. HILL: That's not a mean.

MEMBER GARRICK: Yeah.

MR. HILL: That's the average of two numbers and the population that know of burial rates out there is at least on this order of magnitude. So have no idea really what the average burial rate means for the central tendency of the burial rates. If did then, yes, could use a more -- the estimated age with the plus or minus would mean something to it but don't.

CHAIRMAN HORNBERGER: Well, to a certain extent your next bullet is going to address some hypothetical probability densities for the observations.

MR. HILL: We're going to apply different hypotheses to -- well, don't have enough information to estimate the age of each one of these anomalies directly, but have to go forward. have to evaluate the significance. So what do is look at the characteristics of other Western Great Basin volcanic fields. make that assumption that Yucca Mountain is not unique in the west. Well, clearly that's a possibility but have no information that says Yucca Mountain is unlike the rest of the volcanic fields out west.

So say what are the hypothesis, what can reasonably expect to see for unknown events of this age range where could be having uniform recurrence anywhere between 2 and 11 million years. So those 11 anomalies could be uniformly distributed throughout this interval of time. Conversely, we're just going to arbitrarily pick 2 to 5, 5 million years because, well, that's the age cut-off that the Department of Energy used in the PVHA, so this gives is another measure of evaluating the significance of this uncertainty by assuming these 11 anomalies are distributed uniformly between 2 million and 5 million years ago.

But the troubling thing is that what see in other basaltic volcanic fields is its non-uniform recurrence rates. These things will bloom in activity for a period of a million years and then settle back down to a low level of occurrence rate. The for about another million years or so nothing much happens, you maybe get one or two volcanos popping off and then another bloom in activity. We've already seen from the available data that four million year ago there was a real bloom in activity in the Yucca Mountain system. The data are limited but it's very clear. Four million years ago something happened in this system that caused a large number of volcanos to cork off.

Could it be that these very volcanos also represent events that occurred during that period of activity 4 million years ago? In other words, could the recurrence rate be appropriate for one million years of activity where had intense volcanism in the Yucca Mountain Region because that's what see in the available data. don't know whether the last event, the Lathrop Wells Volcano, that comes one million years after the preceding event in Crater Flat, does that event at Lathrop Wells 80,000 years ago, represent the end of one period of activity, the start of a new period of activity or a continuum of long range recurrence? With available information have to evaluate all of those alternative hypotheses and their effects on probability.

I'd like to emphasize right off the bat that have not analyzed all the probability models that have developed. This is just the first pass. They're a good analyses. They're not scoping. They're rigorous analysis but it's with a single class of probability model, where identify volcanic events as point events. The reason we're doing this is there's no secondary interpretation that I have to make about how many events line up to make up an alignment, what's the age of an alignment, what's the sub-surface term for the dikes. Those are important issues but it adds a letter of complexity. So we're scoping the first effect of this new aero-magnetic data with these alternative hypotheses for probability models where define a volcanic event as a point source event.

This is not a full range of uncertainty or potential alternatives to the probability. started off this with a base set of what are our known events out here. have four that are about 10 million years ago, nine that are 4 million years old and five that are less than about a million years. You can again see, four million years ago is where have the peak of past activity and that activity has tended to cluster rather that be uniform.

So we'd start off saying, well, let's just assume it's uniform. Ignore that clustering, we'll leave that to other people. We've got 18 events over 11 million years. Let's not quibble the decimal place. We'll call it two volcanos per million years. This is the recurrence rate. put that recurrence rate into this probability model where take a Guassian curve and fold in the gravity data. This is the Connor et al. 2000 approach where weigh the probability distribution with the gravity.

Areas that have low gravity are probably more extended and favor volcanism. Areas that would have a high gravity value are less extended and have less tendency for volcanism. give that a 90 percent weight and this is the resulting map of recurrence rate throughout the region. High recurrence rate remains in Crater Flat. have the probability gradient and essentially the boundaries of the probability -- excuse me, the boundaries of the recurrence rate are defined by the Crater Flat Basin itself.

There's our starting point. We'd say about 1.1 times 10^{-8} for the probability. Add in the anomalies, the high confidence, the medium confidence, aero-magnetic anomalies and ground magnetic anomalies, so take our 19 pre-existing volcanos, add in the 11 anomalies and say those anomalies represent basalt anywhere from 2 to 11 million years old, of uniform recurrence. So that would round up to a recurrence rate of three volcanos per million years a opposed to two volcanos per million years. There are some small changes that are important in some but not really as obvious when you take a first look at it.

There's some small changes in the spatial recurrence rate when you throw in these additional anomalies into the mix, and end up with a probability that's 1.4 times 10^{-8}. So the addition of these anomalies into the data set has a very small effect on the spatial recurrence rates and that's what you can see by comparing the contours between these two.

The thing that's driving that effect or in probability is what is the change in recurrence rate? If say the anomalies are in the same locations as before, our basalt two to five million years ago, we'd consider only the volcanos of course, that are younger than 5 million years, so we'd end up with 14. Get out the old volcanos, leave them out of the data set, add in our 11 anomalies and say over the past five million years we've ended up with 25 volcanos giving us a recurrence of five volcanos per million years. The probability has essentially doubled. We're up to two times 10^{-8} and again, some variation in spatial occurrence rate.

The problem is, what about that pesky one million year episode of activity? All those related to a period of activity four million years ago, and that duration of activity was a million years. don't know what Lathrop Wells represents but use an average long-term recurrence or something that represents a potential increase in activity based on a past increase in activity. So if say we're just going to use that four-million year recurrence rate. already know we've got nine volcanos at four million years. add in our 11 anomalies and say they're also four million years old. So had 20 volcanos that occurred within what we're presuming to be a million years of activity. It may even be less than that but for convenience, we're just going to call it a million years.

Get a recurrence rate that could be 20

volcanos per million year and the resulting probability would 8.6 times 10^{-8}. I want to emphasize that that does not represent the upper bound or the potential upper bound on probability. We've got a number of other models that have to consider how these may cause changes in the number of alignments, changes in dike length, dike orientation but that has to go through some more steps before can talk about it. But will have to evaluate whether that range of models, the uncertainty that have on that range of models would change the current range that we're using for probability between 10^{-8} and 10^{-7} or a consideration that 10^{-7} represents a reasonably conservative upper boundary.

MEMBER RYAN: Maybe I could ask you a question before you go on. You know, in looking at these four different cases that you have here, I guess, it's four, it seems to me based on what you said about what you know, certainly or uncertainly, that the coefficient really doesn't mean much, if it's 1.2 or 8.6. I mean, it's 10^{-8} and it's fairly insensitive to the number of volcanos you assume in some period of time.

MR. HILL: Uh-huh.

MEMBER RYAN: Is that a fair statement?

CHAIRMAN HORNBERGER: The 8.6 is really 10^{-7} is your point; is that correct?

MR. HILL: That's correct.

MEMBER RYAN: Okay, so it ranges from 10^{-7} to -- that's fine, I accept that.

MR. HILL: I'm getting ahead of myself just on where I'm going.

MEMBER RYAN: Okay, well, maybe I'll wait till the end and ask a question then.

MR. HILL: I think some of this will come forward.

MEMBER RYAN: Okay, go ahead.

MR. HILL: But the range 10^{-8} /10^{-7} range was based on recurrence rates that went up to about 11 volcanos per million years but there wasn't much weight given to them and generally were using recurrence rates on the order of five events per million years. So we're seeing a factor of -- up to about a factor of 8 change with the simple point source models given some of the uncertainties in the recurrence rate.

MEMBER RYAN: That helps. A factor of about five in recurrence rate gives you about a factor of eight in probability; is that what the end of the story is, if I heard the numbers right. You said them pretty quick, I might not have them right.

MR. HILL: No, that was comparing the previous models -- I'm trying to think with the information here were showing a change in recurrence rate for the point models of two volcanos per million years up to 20 volcanos, so an order --

MEMBER RYAN: So an order of magnitude change in recurrence rate gives you an order of magnitude change in probability?

MR. HILL: Yeah, about an order of magnitude change, a little bit less --

MEMBER RYAN: A little bit less.

MR. HILL: -- because the spatial term decreases it.

MEMBER RYAN: That makes sense.

MR. HILL: So how are going to go forward? It's important to know how we're going to go forward from here. have an agreement with the Department that the DOE will examine the new aero-magnetic data for potential buried igneous features and evaluate the effect on their -- I should say their probability models or probability estimates. received a letter report the end of September from the DOE that does that evaluation. That report is currently under review. It's been submitted to the

NRC and we'll be able to talk more about that after the report has been commented on by NRC staff.

We're considering a number of effects in our review of the report. Of course, the easiest and most straightforward one to think about is uncertainty in the number and age of potential volcanos, some of the things that we've been talking about here for recurrence rate and location but also there's a lot of parameters that can change when you bring in this ne information such as lengths of alignment, numbers of alignments, how you would define a volcanic event. Is it a point source, does it include a subsurface term, because in the DOE's elicitation, those were different interpretations depending on who you talked to. There wasn't a uniform definition of a volcanic event.

Also would conceptual models change? You know, here we're essentially doubling the number of potential events out there. Would an expert coming in now, looking at these information say, "Well, there's more of a tendency for clustering"? Should I have to consider temporal nonhomogeneities in recurrence rate as well as spatial nonhomogeneities? I don't but I think it's a legitimate question to be asking when see a doubling in the amount of available information.

Of course, the effects of present but

undetected volcanos is something we're going to need to talk about because just can't demonstrate that know where all the volcanos are in the sub-surface out there. And finally, does this information present a need to update the 1995 elicitation or are there other approaches that might be equally viable for supporting a license application such as numerical models that can be validated in the peer review literature.

And these are just some of the questions that we're considering when review the DOE's response to Igneous Activity Agreement 1.02. And in addition to our review, we're going to continue to model and interpret the aero-magnetic and ground magnetic data. I think can get a better estimate of confidence on some of these anomalies when do a more robust modeling to say whether can create a reasonable model to represent buried basalt and give us that kind of a geophysical signal? haven't had the opportunity to do that yet.

We've been relying on some of the USGS personnel who are let's face it, world renowned experts in doing this sort of thing and they're coming up with models that will fit buried basalt for a lot of these anomalies, but we're going to continue to do our own independent work to try to get an independent estimate of confidence on this and, of course, like I said, evaluate the effects of new information on the full range of probability models that have at our disposal, not just point source events.

There are a couple of considerations though that don't fall under our path forward, but need to keep in mind. First, Dr. Gene Smith and Dr. Ho at the University of Nevada, Las Vegas, are continuing to develop and publish process level models for spatio-temporal recurrence rates and probabilities of volcanic disruption. Their work, some of the process level work, has been reported in GSA Today, ties into papers in the Journal of Geophysical Research and I understand from conversations last month with Dr. Smith at the Geological Society of America meeting in Denver, that that work is continuing to go on and he and Dr. Ho are looking at potential ways of incorporating this uncertainty in recurrence rate into a temporal recurrence rate model, but I don't know how this is going to effect their view of recurrence but in the GSA Today, paper, Dr. Smith says recurrence rates of 11 to 15 volcanos per million years seems to be more appropriate based on his interpretation of the origins of basalt in the Yucca Mountain Region. That was not considering the effect of this new information from the interpretations of the magnetic data.

CHAIRMAN HORNBERGER: Did you say, Britt, that there's a GGR paper that post-dates the GSA Today?

MR. HILL: This is the Wang and others paper that's looking at the origins of basalt throughout the Death Valley, Reveille Range, Crater Flat. It's sort of the technical basis behind the GSA Today paper. I know it was submitted and accepted prior to GSA Today but I'm not sure of its exact publication date. I believe it was earlier than the GSA Today paper. And when talked about the uncertainty to pardon me in the loose use of the term "uncertainty", these are reducible uncertainties. These are not philosophical or conceptual models that can't be addressed.

These are anomalies that exist for features that exist in the geologic record. can have a very good interpretation of what's down there with a very simple drilling program, for example. You model the data, you come up with where is the peak intensity of this anomaly, you drill that anomaly, because these anomalies are only a couple of hundred meters below ground. They're existing through an unconsolidated, a poorly consolidated alluvial section, essentially it's dirt, and generally above the water table. So rotary drilling down to this sort of depth and seeing, well, did hit bedrock tough or did hit basalt, is one fairly ambiguous way to resolve the uncertainty. If it's basalt, bring up the chips and date it. That reduces all of this silliness on recurrence rate and alternatives on recurrence rate to a much more robust analysis where have constrainable dates. can treat it like data rather than alternative hypotheses.

Of course, the aero-magnetic survey itself was not designed to find buried basalt. It was designed to look at regional groundwater, regional basins, so it wasn't optimized to find buried basaltic volcanos out here. There are ways, though, that you can conduct a low altitude survey and find with better confidence, signals that would represent buried basalt or eliminate the possibility of buried basalt based on the patterns that you see in those data.

Of course, additional ground magnetic surveys can help resolve the uncertainty on some of these anomalies but they're fairly labor intensive to do. That's just another way you can think of to gain confidence in interpretations or come up with alternative interpretations. And of course, detailed modeling can help resolve things as well, but in terms of ability to reduce uncertainty, these are ranked in priority. This is a real great way of reducing uncertainty, drill the anomaly. This is going to be very ambiguous and probably is going to leave you with a lot of residual uncertainty in your interpretation, the modeling.

So to wrap it up and leave a little time for discussion, we've got 11 basaltic volcanos that can reasonably be interpreted from the existing magnetic survey data and these post-date the 1995 elicitation. So for the Yucca Mountain Region in general, for the area that we're concerned about for probability models, we've got 13 known basaltic volcanos with dates on them, 17 likely buried volcanos that do not have good age constraints. They're not dated. We're doing indirect sort of estimates on how old they are. Now, using alternative interpretations of the potential ages for these 11 new events, get anywhere from a factor of 1 to a factor of 8 increase in the spatial temporal probability models that we're using. That doesn't represent the full range of models. That's just the models where used point-source events.

I'd like to close with keeping in mind that that analysis has no consideration of how many additional basaltic volcanos could remain present and undetected in alluvial basins west and east of Yucca Mountain.

CHAIRMAN HORNBERGER: Thanks, Britt. A quick question before I go to the committee; can you -- well, just are there points that you've made in this presentation that are not in the Center Report, I think Stamatakos, et al?

MR. HILL: Yes, the effect on probability is quantified here where did an estimate in the Center Report. The interpretations have not changed with one exception, Anomaly 4, did ground magnetic surveys after the report. It went from medium confidence to higher -- or excuse me, low confidence to medium confidence based on the ground magnetic survey. And I'm not sure if Anomaly 3 increased in confidence as well. That's the one under Big Bear. So there's some subtle changes, but the main effect is probability.\

CHAIRMAN HORNBERGER: The main, okay. Mike.

MEMBER RYAN: I'm coming at this as a geologically challenged member, so be patient.

PARTICIPANT: You've got to get in line to get that right.

MEMBER RYAN: Well, I'm thinking about this just from kind of thinking about error and uncertainty analysis. You know and a couple of things catch my eye. You say there are 17 likely buried volcanos not dated. You also said that defining something as an event is a professional judgment, it's not something you've verified by some criteria. You've also said in the bottom that there's undetected volcanos. My question is, it's probably true that some of those 17 won't be buried volcanos because you just don't know until you drill them.

MR. HILL: That's certainly a possibility.

MEMBER RYAN: So, you know, it's probably not a sum of 30 or -- yeah, 30 volcanos that are there. It could be less than that, it could be more or whatever. I guess what I'm trying to get at is a lot of what you're characterizing as uncertainty and variability really is qualitative and judgmental rather than quantitative in the sense of take out your statistics book and do hypothesis testing.

MR. HILL: Well, certainly for the variability, the data are very poor to get any rigorous measure of variability.

MEMBER RYAN: Right.

MR. HILL: The uncertainty a little bit

looser and how much of this is really epistemic uncertainty and versus for that 17 how much of that would really represent buried volcanos. I think the point make is that guessing on whether a volcano is there or not there based on somebody looking at the data is a really poor way of going forward.

MEMBER RYAN: Sure.

MR. HILL: I would cite the 1995 elicitation where when you weigh the probability that these were buried volcanos, or that there were additional buried volcanos out there, that each expert was asked how many additional volcanos are out there. They give such low likelihoods to it and the effect is there might be one additional buried volcano at the 1995 elicitation.

And so while others might have been considered, changes in recurrence rate that might have been larger, there was such low weight given to that, that the uncertainty that really is propagated through the DOE calculations is plus or minus one additional volcano for present but undetected. And you can see here we're talking about an order of magnitude more uncertainty to that.

MEMBER RYAN: But what is not clear, though, coming forward is what analytical information you used to have improved that estimate. You're doing the same kind of interpretation of -- and by the way, I agree with your comment, drill it. You know, I've never met geologists that don't want to drill one more hole or at least one more hole. And then that's fine because that is proof positive and the analytical information you can hang your hat on. But I'm struggling a little bit and it's probably my own ignorance to see how we've come off of judgment and gone into -- well, we've refined the judgment and have other qualitative information and the mapping to refine the judgment but it's still very much a judgment rather than a measurement.

MR. HILL: Oh, absolutely.

MEMBER RYAN: Okay.

MR. HILL: You know, it's a matter of a discussion relevant to licensing is, does the new information effect an existing elicitation or increase the uncertainty that would have, and if so, how much. Is it risk significant and that is what have had to try to do. have to use judgment because have no data. have to try to constrain these in a responsible and transparent way. That's why we're evaluating alternative interpretations because don't know what the data are. don't know what the ages are. have to try to say these are three alternatives. There may be others. These are the models have. There may be others but have to give that quantitative information about what's the effect, are quibbling about a decimal place? And I think this analysis clearly shows that we're not quibbling a decimal place, we're talking about alternatives that are effecting roughly an order of magnitude variations in probability. Ultimately what that means in terms of risk, we've got to consider the full range of models and more rigorously the data. The analyses demonstrate we've got to do it.

MEMBER RYAN: It seems at some point, though, you have to prioritize that range of models and focus on more likely than not models.

MR. HILL: Uh-huh, I agree.

CHAIRMAN HORNBERGER: John.

MEMBER GARRICK: Speaking of drilling, in one of our tours visited a room at Yucca Mountain that had what appeared to be miles and miles of cores of material. Is there any possibility that existing cores, if they're appropriately cataloged can be used to reduce some of the uncertainties you're talking about rather than a new drilling program?

MR. HILL: did a real quick analysis

using the well site location information that have from the Department of Energy just to see if there were any drill core or drill holes over areas that thought were anomalies and the answer is no.

MEMBER GARRICK: I see.

MR. HILL: So don't have existing drill hole data nor did see any evidence of drill holes at or near the places that did ground magnetic surveys. That's why the intersection for Nye County 23P is so important, because it's just a random hit.

MEMBER GARRICK: Yes, yeah.

MR. HILL: I think can use that information for the shallow wells to get a better idea in these basins what's the depth for alluvium, where do have drilling information, constraining that spatial uncertainty term a little bit more for present but undetected but I don't think we're sitting on any information that shows well, found basalt in this well. A lot of those wells were at or near the mountain, generally on bedrock or areas that we're not considering as alluvial basins of buried basalt.

MEMBER GARRICK: Okay, thank you.

CHAIRMAN HORNBERGER: When talk about the interpretation of disruption under the mountain, though, why are constrained to just be in the alluvial basins? Why can't you use the information on the wells drilled in rock?

MR. HILL: This is for basaltic volcanos that erupt at the surface but were buried.

CHAIRMAN HORNBERGER: I understand what the aeromag survey is. I'm just trying to get a handle on why you would rule out the wells drilled near the mountain if what you were trying to do is figure out what might be there that is undetected. I mean, I know you're not going to detect it with aeromag. That's clear.

MR. HILL: Well, the mountain is made up of rock.

CHAIRMAN HORNBERGER: I know.

MR. HILL: I'm not sure why would look at drill holes in places that know there's no buried -- there's no alluvium or buried volcanos. We're not considering those --

CHAIRMAN HORNBERGER: But how do you know there aren't any buried volcanos? How do you know there aren't dikes?

MR. HILL: Well, if they're buried, they're older than 11 million years and they're not related to this episode of activity. They're not younger than 11 MA if they're covered by 11.45 and older at the top.

CHAIRMAN HORNBERGER: Okay.

MR. HILL: So --

CHAIRMAN HORNBERGER: Yeah, that makes sense.

MR. HILL: And there's -- by the way, you can't see the dike in Solatario (phonetic) Canyon in the aeromagnetic survey nor do you expect to be able to see it. It's too small a feature.

CHAIRMAN HORNBERGER: Small a feature, right.

MR. HILL: And have to consider, could there be additional volcanos in the sub-surface that had been eroded and buried recently.

CHAIRMAN HORNBERGER: Yeah, okay. Raymond?

VICE-CHAIRMAN WYMER: Nothing.

INTERVIEWER: Milt?

MEMBER LEVENSON: Yeah, I have -- as usual, I have a question based on ignorance. How do you get from the -- assuming you could accurately know the number of volcanos and you know the accurate ages, how does that -- what's the uncertainty in going from there to recurrence rates?

MR. HILL: You make an assumption of

whether you want a uniform temporally homogeneous recurrence rate or some sort of a process level model that would use non-hemophoric recurrence rate. It's a judgment because are going to deal with sparse data, even if had 30 events.

MEMBER LEVENSON: Okay, I understand that. But then I don't understand why all of the emphasis on how important the age is since the total range is only plus or minus a factor of two. You say it's five plus or minus five is the total range of age, that's a factor of two. There's got to be a much bigger uncertainty in your going to recurrence rates than factors of two. It's got to be like orders of magnitude and you convinced me of that when you discussed how irregular and how variable are the various recurrent rates.

MR. HILL: Well, first, I wouldn't -- I was trying to explain for uncertainty if that average rate was really a mean sedimentation rate, that had a central tendency, could say five, but the uncertainty here that would assign to the age, given the uncertainty, the range of sedimentation rates would be much larger than the age that you guess itself. So plus or minus five really is not quite correct, because --

MEMBER LEVENSON: Well, I'm looking at your list which says there's somewhere between two and 11 and that's --

MR. HILL: The age is constrained between two and 11 million years, but you can't say the mid-point of that age plus or minus the uncertainty represents the range because that mid-point doesn't have any statistical meaning. It's just a mid-point. It's not a central tendency of a population distributed --

MEMBER LEVENSON: But your calculation of a recurrence rate is just an assumption. It's not a statistically based thing.

MR. HILL: Well, of course, that's why I say we're evaluating alternative hypotheses.

MEMBER LEVENSON: I don't understand why you reject one because it isn't statistical but then you go on to base the whole thing on something that is statistically no sounder. I'm just trying to -- what I'm getting at, I understand all the uncertainties et cetera, but what I'm trying to say is, if you spend a lot of money and done a lot of drilling and knew all of the ages very accurately, would that really enable you to calculate the recurrence rates any more accurately? And I think maybe not.

MR. HILL: I think you would have a better basis to look for patterns or assume --

MEMBER LEVENSON: Yeah, but from an -- you know, I'm not -- I don't understand geology and I don't understand statistics. I'm an engineer and I'm trying to get to a bottom line, how do I figure out what the number means, and getting more background and more data doesn't necessarily held me. How do I use it?

MEMBER GARRICK: It sounds like a rock song, I don't understand nothing, but --

MEMBER LEVENSON: How do I use it? What does it mean?

MR. HILL: Well, it means that you can't get a rigorous engineering sort of approach that says here's what we're going to do because --

MEMBER LEVENSON: Oh, I know that. I know that.

MR. HILL: -- because there's ambiguities in interpretations. This is one interpretation. I'm sure you're going to read in the next year another interpretation that's going to have much higher numbers than that and it's going to be in the peer review literature and it's not going to be from us.

MEMBER RYAN: One of the things that I

think is important is that you know, things like these probabilities you've calculated are typically viewed as Poisson statistics and you're never going to have, as you pointed out, enough events to really apply any numerical statistics. You're in non-parametric arenas. So the point Milt, that I think you're making is a good one, is that you never -- you know, you can't really come up with an analytical distributed statistical analysis like think about, you know, sampling or engineering or any other kind of testing of variables, but we're very much in an interpretive qualitative non-parametric arena of assessment. So always think about these rates per year as a mean value or some kind of a statistic of a distribution when, in fact, they're not.

MEMBER GARRICK: Britt, have you considered doing a Bayesian analysis of this because this strikes me as a perfect application for a Bayesian analysis. You start out with a prior that could just be a flat distribution and you go from there and you -- and I think you'd be surprised at what would happen as you infer from your additional pieces of information to the distributions. I really would encourage you to consider that.

MR. HILL: I appreciate that suggestion on other things that can try exploring. I don't know if it's going to give us a better or more robust answer but it's certainly something I haven't thought very much about doing.

MEMBER RYAN: It will certainly give you one that three analysts do the Bayesian analysis and they'll come up with the same answer.

MR. HILL: That's true.

CHAIRMAN HORNBERGER: How many Bayesians does it take to change a light bulb?

MEMBER GARRICK: Especially if they're a Bayesian.

MR. HILL: With this sort of uncertainty in the data, there is a lot of different interpretations that can be placed on it. That's what it really is going to come down to.

MEMBER GARRICK: The great thing about a Bayesian analysis, it would tell you exactly what the data is telling you and I suspect that you would be getting PDFs that would have between the fifth and 95th percentile uncertainties of the order of two or three orders of magnitude. And I think that would be an important piece of information to have.

MR. HILL: I'm comfortable thinking that we'd get that kind of order of magnitude uncertainty given the gross uncertainty in the fundamental data.

CHAIRMAN HORNBERGER: Mike, did you have a question? I'm sorry, the other Mike.

MR. LEE: The lesser Mike.

CHAIRMAN HORNBERGER: No, not lesser, just the other Mike. You can't even say the bigger Mike.

MR. LEE: I think it's pretty clear from your presentation today, as well as what the state has done and others in terms of probability development. It's possible to develop estimates of probability for volcanism at Yucca Mountain.

MR. HILL: That's correct.

MR. LEE: But nevertheless, the technical basis for the DOE program continues to be the PVHA.

MR. HILL: Yes.

MR. LEE: And as a formal expert elicitation that's been conducted generally in accordance with NRC guidance, they have a -- it's incumbent on them to consider new information when it becomes available. I'm not saying that they have to reconvene the elicitation but DOE has to examine new information.

MR. HILL: Yes.

MR. LEE: Can get a sense of how DOE is going to -- is handling this new information or is that in that letter report that you've made reference to?

MR. HILL: That's in the letter report and that's under review by NRC staff right now.

MR. LEE: Okay. So in many respects the strength of that elicitation or how well it stands the test of time will depend in large measure on how DOE reacts to new information when it does become available based on our judgment.

MR. HILL: I think in terms of our judgment, did outline concerns in the aeromagnetic report last year that talked not just about the magnetic data but the range of new information and our view on how that would likely effect an understanding of how basalt keeps coming to this specific area and the letter report that's under review will expand on that.

MR. LEE: Okay, I have one question for John when we're done.

CHAIRMAN HORNBERGER: are very close to being done so make it quick.

MR. LEE: Real quick, John, to what extent have the staff vectored its -- or considering revectoring its consequence modeling work based on the preliminary results coming out of the peer review report?

MR. TRAPP: Basically, we'd see very little revectoring. The work that are doing I think addresses exactly that they're talking about.

MR. LEE: Thank you.

CHAIRMAN HORNBERGER: I want to thank both John and Britt for this good update. need to keep tabs on these things and we're always interested in hearing new information. So thanks very much.

MR. HILL: Thank you.

CHAIRMAN HORNBERGER: We're going to adjourn and remember we're going to reconvene the transportation working group. That will be in the auditorium at the P1 level in this building. Adjourned at 11:30.

(Whereupon at 11:32 a.m. a luncheon recess was taken.)

CHAIRMAN HORNBERGER: All right. The meeting will come to order, and I will turn this over to Milt Levenson, who is in charge of this workshop on transportation.

MEMBER LEVENSON: Good afternoon. This is a continuation of the workshop for the Transportation Working Group.

I'm Milt Levenson, Chairman of the working group. The working group actually consists of all five ACNW committee members.

The objective of the workshop is to examine the technical aspects of spent fuel transportation package design, analysis, and testing methods to determine whether sufficient evidence exists or if additional information needs to be obtained to substantiate that spent fuel can be transported safely. Included with that, of course, is the experience.

The ACNW will use this information to make recommendations to the Commission as necessary on the transportation of spent fuel.

In addition, it is our intent to publish the proceedings of this workshop in an NRC NUREG.

Yesterday the working group heard presentations regarding research, development, analysis, and testing of spent fuel transportation packages.

Today presentations will be made to the working group regarding spent fuel and high level waste transportation safety experience in the U.S. and abroad. For these discussions the presenters include various federal agencies and industry representatives that have been directly involved in the regulation and shipment of spent fuel and high level waste.

It is requested that all speakers, whether they're presenters or questioners, use a microphone, identify yourself, speak clearly so that not only can the audience hear you, but so our reporter can hear you.

I would like to point out that for today's meeting there is one all inclusive package of viewgraphs in the back of the room. We have received on request for time to make oral statements, although we will allow time for questions from the audience later.

I would like to thank all of today's participants for taking the time and making the effort to participate in the workshop.

For those of you who are participants, you know that while I'm chairing it, someone other than I did the bulk of the work putting this meeting together. That's Tim Kobetz, and I'd like to acknowledge all of the work that he did in putting this together.

We will now proceed with the workshop. I call upon Mr. Rick Boyle from the Department of Transportation to begin the first presentation.

MR. BOYLE: Thank you.

Thank you for the opportunity to speak and come forward as part of the Department of Transportation's Spent Fuel Projects Team.

As he said, my name is Rick Boyle. I work in the Research and Special Programs Administration, which houses the Office of Hazardous Materials Safety, and I head up the Radioactive Materials Team there.

If I can give you an overview of my presentation today, I'll do a very, very quick regulatory overview so you can see a little bit more where I sit within the department; tell you some of the regulatory issues we have or the department is working on concerning the transport of spent fuel.

Tim gave me a list to say we must talk about history and incidence. So I have a slide each on that.

And then a couple of programs of interest to show you some of the ongoing programs we're working on at the department both with the NRC and with our modal authorities.

I'll jump a little bit ahead in the agenda. Kevin Blackwell is also here from Federal Rail. So he'll be giving a follow-on presentation. It might be best if you let me go through my presentation, Kevin go through his, and then we'll both kind of stand up and share the microphone for questions, but if you want to ask questions as we go along, that's fine with me as well.

Briefly, as an overview, it's my office in the Research and Special Programs Administration that works with the NRC Spent Fuel Project Office in developing the radioactive materials packaging and development and transport standards, and you see those two logos at the top.

That doesn't include IAEA, but that's also the international realm where both of us sit on that committee.

The next level down or equal to us really is the modal authorities within the Department of Transportation that develop the operational standards for the conveyances and conduct the compliance assurance programs.

And what you would see there is the Federal Railroad Administration, the United States Coast Guard, the Federal Aviation Administration, and the Federal Motor Carrier Safety Administration.

This slide was real good until yesterday afternoon when Homeland Security comes into it and Coast Guard slides out from the Department of Transportation and into Homeland Security, and I think

Kevin could continue on as the modal perspective, but the Federal Aviation Administration has also sent their HAZMAT program to TSA, which is Transport Security Administration.

So HAZMAT in the modal authorities is a bit in flux right now, and sitting there in my desk, we're not sure if the HAZMAT program is going someplace either. So this slide is certainly as it appears I'd say noon yesterday before they created the Office of Homeland Security.

If I could then go into just a few issues that we're working on now, it is security and safeguards requirements. I think homeland security and its formation would highlight some of the issues that we're working on, but we also see the effort starting.

There's a conference in July at the IAEA where we certainly believe the IAEA is going to start a transport security program, be it within their Transport Division or separate, and that would be our responsibility as the competent authority for the U.S. to participate in that.

Again, your homeland security, as well as our internal TSA, the Transport Security Administration. The NRC and their safety program and

SFPO, as well as their Security Division working on their interim compulsory measures.

We're working on counterpart regulations at the Department of Transportation for that, and then certainly within DOT it's not unusual to see my Federal Rail and Highway and Motor Carrier counterparts coming into our office to discuss that.

Certainly there's always the turf battle going on as to who's really leading the show here, as well as what standards should be put in place.

The second issue surrounding much more of the Yucca Mountain hearings is the mode and route selection criteria. Hopefully many of you are familiar with the guidelines that the department published in '92 for selecting preferred highway routes for highway route controlled shipments, which would be spent fuel.

You can certainly see that those were published in '92. So they're very old. We're working -- Federal Motor Carrier is working. So I would have to say "we," and that would be the department -- is working on updating those and defining better what preferred routes, alternate routes, state approvals, and things like that would be.

And also, if we look at some of the bills and some of the comments that are coming out, a good question for Kevin later on is will there be some sort of rail complement to this as we start looking at approving routing, routes for rail.

Next, and I think this meeting does a good job in helping this, is the public participation in the process. We're often told that our regulation process, it's almost a fait accompli once the international organizations, which would be the IAEA or the ICAO, the Civil Aviation Administration or Organization -- excuse me -- or the IMO, once they pass this that, you know, there's very little we can do.

So we're looking at increased public participation; of course, training from the operator and the shippers, emergency responders and the governments right now, governments being the first responders as well as the people that will be conducting the inspections and providing escorts as necessary.

Some of the technical issues we're working on is radiation protection, again, particularly in light of the inspectors and the escorts, which the regulations really weren't developed around those.

Proper contamination limits, and air and sea transport requirements.

Moving into what I think the meat of the presentation is and what the information you really wanted to see was a bit of the transportation history, and I will focus on highway only and let Kevin Blackwell deal with the rail aspect and answer those questions.

Our data from the mode and route study that we published a few years ago listed from '79 to '80 that 89 percent of the shipments made in the U.S., that is, outside of the Department of Energy, of spent nuclear fuel or high level waste were made by highway, although the high percentage of shipments, certainly more is carried by rail. So only 27 percent of the tonnage is carried by highway.

So if you want to do the math, it also found that would be 1,600 total shipments were identified. Just doing the math of 89 percent, that would be just over 1,400 highway shipments for 427,000 kilograms of spent nuclear fuel or high level waste transported by highway.

It has been conducted in legal weight trucks. Approximately 300 kilograms of spent fuel is the average load. The security and safeguard requirements were as defined in the NRC regulations, and the route selection is as defined by Federal Motor Carrier Safety Administration, although I'd have to go back to that. It would be Federal Highway Administration because motor carriers didn't exist ten years ago when this book was put out. So it will be a combination Research and Special Programs Administration, Federal Highway Administration that put out the original route selection guidelines. Those are now overseen by Federal Motor Carrier Safety Administration.

A bit of the incident history. We've logged 1.6 million miles traveled, and we've had eight accidents and no releases. I'll be stepping on Kevin's toes a little bit here because in the eight accidents that also includes rail.

Summarizing those, December 8th of 1971, in Tennessee the driver of a truck carrying nuclear waste swerved off the road in a rain storm. The truck rolled over into a ditch, and the driver was killed. The cask carrying the waste was thrown off the truck, but the cask was not damaged and no material leaked.

March 29th of '74, in a North Carolina rail yard, a trail derailed and struck another train that was carrying an empty cask designed to carry spent fuel. The damage to the task was superficial.

February 9th, in Illinois, the trailer of a truck hauling nuclear waste collapsed while the truck was crossing a railroad track. The cask was not damaged, and no material leaked.

August 13th, '78, in New Jersey, an empty nuclear fuel cask was being placed on a trailer when the trailer deck failed because of a broken weld. The cask was not damaged.

December 9th, '83, on the Indiana-Illinois-Tennessee border a waste hauling truck separated from its trailer which was carrying a nuclear spent fuel cask. The cask was not damaged and there were no leaks.

March 24th of '87 in St. Louis, a train carrying nuclear waste collided with a car at a road crossing the cask was not damaged, and there were no leaks.

January 9th of '88 in Nebraska, a train carrying an empty cask derailed. The ask was not damaged.

December 14th, '95, in North Carolina, a train carrying empty casks derailed, and the casks were not damaged.

This is public information that we got when we were putting together hearing notes. So I'll just pass a copy of that to Tim. I have enough words on this slide already without going into those short descriptions.

But that's a history of the accidents we've seen, and again, that would be for non-DOE shipments.

A couple of programs of interest that we've been working on. Maureen Clapper from the Department of Energy will cover the research reactor fuel shipments in much more detail, but we have coordinated with the Department of Energy on the return of that fuel, and that's a little misleading.

That's a picture of the BNFL ships, but they didn't really use those, but it's the only ship picture I had at the moment. I don't want to mislead anybody with that, that they used the purpose built ships.

The next program started off probably five or six years ago as the Spent Fuel Project Office and DOT were working on the new surface contaminated object standards and putting those into the regulations, and we realized we had a problem with very large outage equipment, as well as large components, and we struck an agreement for the transport of large components.

And what you see there is a steam generator, and the steam generators are taken to either Barnwell or Envirocare. This one is the heavy haul. Usually it's a short heavy haul to a multimodal point where they would be loaded onto a train or a barge as shown in the picture, and the steam generators that we've taken were from Connecticut Yankee, Maine Yankee, Kewaunee, Big Rock Point, San Onofre, St. Lucie, Haddam Neck, D.C. Cook, and we also issued an exemption to DuraTech because they moved many to their Memphis facility and then found out they couldn't keep them there and took them to Envirocare. So we offered another exemption for them to move those large components.

So we feel we're prepared for dealing with both heavy haul on the highway, as well as a barge or rail shipment of something this size.

Other components that we've moved. I wanted to show you the multimodal aspect of this. This is the Waltz Mill reactor tank, and as you see, it was taken to the railhead in the top left by highway that's heavy haul. It was then loaded onto a rail car and taken by rail the rest of the way. So we are looking at multimodal transfers both to water and to rail.

And if I go to the last slide for heavy haul, this is the San Onofre reactor pressure vessel head that would move from San Onofre to the Envirocare facility, heavy haul the entire way. That's basically a 150 foot hauler with a -- my black and white doesn't show up as well. Reactor pressure vessel head is in blue there, and you can see it as it was loaded, and I believe that's leaving the facility in the top left. In the bottom right is on the highway.

It just moved at night with police escort, and that would be a San Onofre to Utah. So we would be prepared for heavy haul over longer distances as well.

And then finally a last program of interest probably more to myself than to you, the transport of front end material. Again, you can see that by vessel, and that's a vessel that's chartered out of Seattle to go to Japan and continue with that.

And then the front end material, bottom left, would be front end material coming in from Canada to be enriched, and then the bottom right would be the enriched material going out of the United States Enrichment onto its customers, but domestically and internationally.

And then finally the last page is just

contact information for myself. I apologize that federal motor carriers couldn't be here to give you a more in depth analysis of what their escort provisions and inspection criteria would be, but I'd certainly be willing to pass on any questions you had for motor carrier or for the Coast Guard. I guess they'll be at DOT for a little while longer. They won't break right off to Homeland Security too soon.

So with that, that's the end of my presentation, and I will give the incident summary to Tim before I leave.

MEMBER LEVENSON: Okay. Before you do that, I'd ask whether any of the committee members have a question of fact or something they'd like to do at this point.

(No response.)

MEMBER LEVENSON: If not, go ahead, Kevin.

MR. BLACKWELL: Good morning or good afternoon, I should say. I'm Kevin Blackwell with the Federal Railroad Administration of the Department of Transportation in the Hazardous Materials Division here in Washington, D.C.

I want to thank you for the invitation to be here today and to discuss a little bit about FRA's experience and history with transport of spent fuel by rail.

Hopefully, bear with me a little bit if you can. My daughter saw fit last week to pass on to her father her cold she had. I've been fighting it since last Friday, and I may have to take frequent stops to hydrate myself. So hopefully everyone will be able to hear me and understand me well enough.

There have been approximately -- and this is based upon information I've been able to put together -- 1,300 spent nuclear fuel shipments transported by rail over the past 40-plus years, and it's important to note here that you'll see throughout the presentation here I make a distinction in the numbers between shipments and movements because, while it's easy to count a shipment by highway, it's usually a single package. Rail movements can sometimes encompass multiple packages and singular movement.

And in looking at numbers from various sources, the numbers do change between shipments and rail moves, and I'll make that distinction as I go along in some of the numbers.

And the 40-plus years, that goes back, I guess, to the early '60s.

There have been approximately, and I think Rick covered just about all of them, five incidents or accidents that have occurred involving spent nuclear fuel packages by rail. Rick, I think you had four of them that were by rail up there, one of which was a grade crossing accident. I'm not going to re-cover what you did.

However, I also counted. There are some incidents that occurred, and it depends on how you define an incident. Take, for example, the Three Mile Island train with the spent fuel from Three Mile Island. We had an incident where a hitchhiker actually climbed on board the train that was carrying the spent fuel cask to catch a ride, and that was classified as an incident. So it all depends on how you want to classify the words "accident" versus "incident" in regards to how you count the numbers.

Needless to say, there has not been a lot of incidents or accidents. As Rick stated, they have all been minor in severity in nature, and none of which have resulted in any loss of package integrity.

The history to date of the rail transportation strongly indicates that the packages can be transported safely and have been to date. I understand that there are concerns about the ramp-up of a number of shipments in regards to the rail transportation environment, and that's one of the reasons you'll probably hear today and in many other meetings recently.

But the history has shown that it is a safe method, and the railroads have and can transport this material safely.

Some of the past spent nuclear fuel shipments that have occurred -- and I'll try to outline them here a little bit. Can everyone see the black okay? Is that visually all right? I don't know why I went to back here from white, but I did.

Pacific Gas & Electric was a cross-country move from California to New York from '69 to '71, and this is where I'm making the distinction between shipments and moves. There were 15 rail movements, 15 trains. I do not have unfortunately -- I can find that if anyone wants to know -- how many packages may have been in each movement, but for purposes of the presentation time limit, I just went to how many moves there were. So there were 15 cross-country moves from '69 to '71.

Monticello was from Minnesota to Illinois from '84 to '87, a total of 29 rail moves.

Cooper Station, Nebraska to Illinois, '84 to '89, 30 movements.

TMI, Pennsylvania to Idaho, '86 to '90, 23 movements.

And the Shoreham facility, which I guess is classified as slightly spent fuel, it wasn't really completely spent. It was just about fresh fuel. That had only been using it as a test mode, a start-up mode at the Shoreham reactor. That was from New York to Pennsylvania, and that was an intermodal shipment of rail-barge down to Philadelphia where it was transferred from barge to train, to the Limerick plant in Pennsylvania, and that was 20 -- I'm sorry -- 33 moves.

Carolina Power & Light, the current ones we have going on right now -- and I guess I should defer and say it's Progress Energy. I'm used to referring to it as Carolina Power & Light since back in '89 -- we've had shipments of spent fuel going on between their operating facilities in North and South Carolina by rail, solely by rail, from '89 to the present, and they're still going on, and there have been 130 moves.

And, again, in the numbers we keep we don't make a distinction as to how many actual packages may be in any one move. A train movement of spent fuel is a train movement of spent fuel from a safety standpoint in how we count some of our numbers, and these numbers are not counted by adding regulation. We do this in house. So it's what we have as far as our records go.

The Foreign Research Reactor Fuel, which is the DOE moves from South Carolina, we've had one in California, from California to INEEL. There have been 19 moves to date. Most of those, all but one, East Coast by rail from Charleston, South Carolina, to Savannah River site.

And of course, we have the Department of Defense, the naval nuclear shipments, shipments of naval spent fuel, which are ongoing, and while you'll hear them say there have been over I believe it's close to 800 shipments they make reference to now, it breaks down in my understanding to about --

MR. DOHERTY: Don Doherty.

Seven hundred and forty-two.

MR. BLACKWELL: Thank you, thank you.

MR. DOHERTY: But those are individual cask shipments.

MR. BLACKWELL: Thank you.

And I put approximately 400 up there train route-wise because they can vary from anywhere from one to four casks per shipment. So I try to keep synonymous with the train movements.

Of course, in the future, we may have the West Valley at some point. That's still waiting to go. That will basically be the first cross-country rail shipment of commercial spent fuel since Three Mile Island by rail, and we still don't know or are not sure when that may go, but it's going to be one move of a spent fuel cask from West Valley New York to Idaho.

The potential movements of commercial spent fuel to the Private Fuel Storage Facility in Utah, which they intend to use by rail just about 100 percent to the ability they can. That is a potential which their time frame has them still on their time line in my talks with representatives of that initiative for late 2004 or early 2005.

A lot can happen in that time frame. We understand that, but we still consider that as being on the books as a potential railroad case.

And of course, we have Yucca Mountain.

The private fuel storage initiative estimates about 50 train moves per year once their geared up, and of course, I think Yucca Mountain according to EIS was about 130 rail movements per year.

Obviously there are universal concerns

that everyone seems to have both from the regulatory safety standpoint and the public being safe and secure transport. Safe transport goes directly to package integrity as a first line of defense.

The Federal Railroad Administration being a modal administration of the DOT, we do not have directly regulatory authority in issuance or development of any of the hazardous material regulations. That's by statute.

RSPA is the one who issues the hazardous material regulations. We work very closely with RSPA on matters of regulation that will affect the rail industry from the HAZMAT standpoint.

The rail operational side of the house is Federal Railroad Administration's under the Federal Rail Safety Act, and that's in a different set of the regulations, the 49 CFR 200 series, where it deals with mechanical requirements and operational requirements, signals and train controls, track requirements, that kind of thing, the rail environment infrastructure.

Obviously from the standpoint of safe transportation, it's package integrity and radiation levels and rail carrier operational control.

Secure transportation obviously has always been on the radar screen for those concerns and FRAs. Obviously in post 9/11 times, it is higher on the radar screen than in the past.

And measures to address secure transport of actually any kind of material in the rail environment had become an issue. The FRA has been working very closely with many different entities, including the rail industry, AAR, different modal administrations, and addressing and trying to work through security concerns and security issues to deal with a potential security threat to the rail operating environment.

FRA as an agency does have a very high confidence level in the integrity of spent fuel packaging, especially when you look at it in relation to other types of packaging that is used to transport hazardous material.

However, we do recognize that risk management principles in general dictate that you have to look at the transportation environment as a whole in regards to the safe and secure transport of spent nuclear fuel by rail.

And to that end, aside from conducting our mandated mission of safety oversight of the nation's rail system, we instituted a policy back in the late

'80s actually as a result of Three Mile Island, which was basically a one page policy back then, and as a result of the Foreign Research Reactor Fuel shipments, it grew into what is now known as the SCOP, Safety Compliance Oversight Plan.

And, again, I want to stress this is a policy. This is not a regulatory requirement. It is something the FRA developed in an effort to focus safety inspections for spent nuclear fuel and high level reactive waste because of the recognized high profile and high concern politically and from the public and from the rail transportation industry perspective.

That's what it basically does, is it does focus what resources we have. Keep in mind that the Safety Compliance Oversight Plan is not meant to supplant the regulatory safety compliance requirements. It is meant as an additional level.

The railroad industry does conduct inspections of their equipment and their infrastructure. As a matter of course, the Federal Railroad Administration does conduct inspections of the operation of the nation's railroads.

I knew this was going to happen. Excuse me. I was hoping to get through without a coughing fit. I had one this morning.

This is intended to focus inspections on spent fuel and high level waste shipments and add a third tier to where we can focus our resources on equipment that is used to transport this material, the infrastructure along the routes that may be traveled as far as track inspections, to insure that the regulations that are in place that dictate the levels of compliance and safety that need to be maintained on the infrastructure are, in fact, there and will address any problems.

It is not necessarily meant as extra regulatory requirements. There are requirements in there that are not necessarily based in regulation, but if you look at the SCOP, the plan, 90 percent of it puts an onus, a responsibility on the Federal Railroad Administration to do certain things.

It's a living document. It's going to undergo periodic review. It's meant to be able to be updated, evaluated, taken into account new regulations, new technologies that may come about and be utilized in the rail industry. It's not meant to be a hard and fast document. It's meant to have flexibility.

And for anyone wishing to see what it is in its current state, it is available on Federal Railroad Administration's Web site at the Web site that's stated up there, and it can be downloaded in a pdf format.

It is currently undergoing a review and possible update because it is four years old right now, originally drawn up back in '98.

From the security standpoint, I guess the DOT -- and Rick touched on this -- is addressing security concerns as they relate to transportation of all hazardous materials. All spent nuclear fuel, granted, is a particular concern, a particular high profile. The security of matters affect the transportation of all hazardous materials and need to be addressed on that level, not just for spent nuclear fuel and high level waste. That's just one particular subcategory.

The FRA itself as a modal agency is working very closely with the AAR and with the rail industry on addressing matters of security, and I can't speak too much as to what's going on with it. I know there is a plan. I think, Bob, did you address this at all yesterday when you were talking? Okay. I'm not going to cover what you covered then.

And, of course, there's the DOT

rulemaking, HM-232, which currently as a proposed rulemaking came out May 2nd. I know the comment period is closed, and my understanding is that it's anticipated to be out in a final rule probably in the next two to three months, some time in that time frame, as a final rule. And it is intended to address security requirements for all transports.

Lastly, this is probably of interest to a lot of people. The dedicated train study that was mandated be done by HMTUSA '90, by Congress in HMTUSA '90. I see some people smiling in the back.

A lot of people like to say it's late. I'll put a Washington spin on it and say it's not late. It's timely. If it had come out back in '94 when it was supposed to, would it have the same effect or be as timely now? I don't think so personally.

And we anticipate that the final study will be ready to be provided to Congress and, therefore, available some time in early 2003, and that Congress will have the study provided to them.

Based on the results of that study which I cannot specifically comment to right now because it is not out in the public realm, the second step that was mandated is that the DOT actually take the results of the study and determine whether or not any rulemaking is required for dedicated trains.

The study also mandated that the study itself not take in to account cost-benefit analysis; only safety versus dedicated versus regular freight transport of spent fuel and high level waste.

The last thing I have is a couple of information Web sites that could help provide additional information. In the interest of time, I didn't want to put in here information that may be of interest to people on rail safety statistics, accident rates. That can entail quite a lengthy presentation.

But there is a Web site that will give you those tables and information like that, which is the safetydata.fra Web site. A lot of the information that the FRA collects on accident and incident rates and that kind of thing is now on line and available to the general public.

That's all I have, folks, unless there's any questions.

MEMBER LEVENSON: Okay. Mike, a question for either of our DOT speakers?

MEMBER RYAN: No, thanks.

MEMBER LEVENSON: John?

MEMBER GARRICK: Yes. On the dedicated train study, who specifically is performing that study and is it a technical study?

MR. BLACKWELL: The study actually was being performed by Volpe, the Volpe Center up in Massachusetts, in Cambridge, and it's a study. The study mandated that -- Congress mandated that the study look at only the safety parameters between shipping spent nuclear fuel and high level waste in a dedicated freight consist versus a regular freight train consist, and that's what this study will be looking at, comparing one against the other from the aspect of safety parameters.

MEMBER GARRICK: You and the previous speaker gave us some information on history of accidents and incidents. One of the other things that's of great interest to this committee and the safety of transport is the emergency response.

Can you comment at all about the response experience, since these for the most part were rather incident events and nothing serious in the way of having releases or what have you? But nevertheless, there must have been implemented some sort of emergency activity.

And who was in charge and how was it manifested, et cetera, et cetera?

MR. BLACKWELL: From the aspect of

emergency response, first let me preface the answer with the fact that the DOT, with the exception of the Coast Guard, who may not be DOT -- none of the agencies have any responsibility to perform emergency response measures from that regulation. We don't do emergency response. We're not mandated to do that. Therefore, we don't have the ability or the training to do that as an agency.

With that said, the rail industry does have an emergency response mechanism set up. Every railroad has emergency response plans, emergency responders that are trained to respond to hazardous material incidents.

And while they don't specifically tailor their training to radioactive materials, they tailor it to response to hazardous material incidents covering the nine kinds of hazardous material classes that are transported, of which radioactive materials is one.

The incidence that Rick was referencing, I'll be honest, I did not dig into each particular incident to see what the response was. I know that two of the responses I can tell you that I saw he stated from the date, were derailments. When you say derailments, were derailments of the nature that were misleading in the term "derailment." They were in a railroad yard.

The derailment consisted of the cars/trucks hopping off the track at yard speeds, which is anywhere from five to eight miles an hour. So it was not a derailment in the sense that people may get the idea of a trail derailment of a catastrophic nature that you're used to seeing on the news.

In fact, 90 percent of the derailments that are reported that meet the derailment criteria are in railroad yards at very slow speeds. I think I'm right on that number.

Ninety-five percent, Bob, 90 percent?

That's the number I was last told by our statistical people.

But from the response standpoint, the railroads have a response mechanism. In their response plans, they are familiar with their local response chain, the contacts and chain in the local areas. They know who to contact. They're bound by federal law to contact certain federal entities.

The EPA and, I guess, the Coast Guard have mandated responsibilities at the federal level for response, as does FEMA. I guess I can't really get too in depth from a standpoint of working for Federal Railroad as to what requirements there are for a response.

MEMBER GARRICK: Could either of you address the question of whether any of them require invoking any radiological teams and response?

MR. BLACKWELL: Not that I'm aware. I mean, all I can tell you is from some plans I have seen, they do address that based upon the nature of the incident and the course of action that's decided between the rail responders and the local response community who responds and they coordinate with whether they decide to implement the course of action on a radioactive materials incident and call appropriate personnel based upon the nature of the hazard and nature of the incident.

MEMBER GARRICK: Okay.

MR. BLACKWELL: I'm not sure if that answers your question or not.

MEMBER GARRICK: Well --

MR. KUNITA: Perhaps I can address that issue.

We have coordinated with communities along our shipping route, provided a coordinated tabletop exercise and field exercises. So since the inception of the Incident Command Center, all of these organizations can respond to a radiological event.

Improvements in the emergency response guide that address radioactive materials, they do have teams that can be dispatched usually at the state level to help the local community, and they're well versed in radiological aspects.

MEMBER GARRICK: Yeah, one of the things I was trying to get at is what is our experience base.

MEMBER LEVENSON: Have they ever been called out in the 2,900 shipments we've had to date that have been necessary to call out radiological response team?

MR. BLACKWELL: Not that I'm aware of. I don't know.

MR. KUNITA: Some of the folks that did end up working for Progress Energy in prior history worked for the state, and they have advised me of incidents where they did respond usually to a minor event where they thought there was a problem, and it turned out --

MR. BLACKWELL: A precautionary measure.

MR. KUNITA: Yes.

MR. BLACKWELL: I can say this. There have been some rail incidents involving shipments of low level radioactive waste where responders have had to respond to transported radioactive material incidents, usually contaminated soil or contaminated material, but of a low level nature, and they have gathered experience in those incidents from responding to a radiological type incident by rail, but nothing on the aspect from a high level spent fuel or high level waste situation that I'm aware of.

MEMBER GARRICK: Thank you.

MEMBER RYAN: Let me offer a comment that might help, Dr. Garrick, but you know, these are all route controlled shipments, and that process alerts all of the state and local response units all along the line. So I think that's part of the coordination, is you usually get response state by state, and part of the route control process -- and correct me if I'm wrong -- is to make sure that that's well established and well understood so when shipments are coming through, whatever states and local folks want to do to be alert or aware, they certainly have that opportunity.

MEMBER GARRICK: Thanks. Thanks, Mike.

I have a couple more questions on transportation, but I think I'm going to wait until we hear from the DOE folks because it affects them as well.

Thank you.

MEMBER LEVENSON: Ray?

VICE-CHAIRMAN WYMER: Yes. Were all of these transportation tests that you've been expressing here today by dedicated rail?

MR. BLACKWELL: Most, but not all.

Can you still hear me okay?

There is currently no regulatory requirement to transport spent fuel high level waste by dedicated train at this point in time. That does not mean that has not been done.

The Progress Energy shipments are dedicated consists. The Foreign Research Reactor Fuel shipments, dedicated consists.

Many, I'm not going to say all, but many of the naval nuclear shipments have been dedicated consists. The fire shipments, most of those, a large portion of those were in dedicated consists by choice, not necessarily by any requirement.

VICE-CHAIRMAN WYMER: The small experience base in non-dedicated train transport of these high level radioactive material.

MR. BLACKWELL: The transport of dedicated consists, material in dedicated freight is not something that would be new to the rail industry, no. Then, again, transporting in a regular freight service is not something new to them either.

VICE-CHAIRMAN WYMER: Thank you.

CHAIRMAN HORNBERGER: I noticed when you were talking about the rulemaking, HM-232, that's for all hazardous material. So is this typical in your regulations that high level radioactive waste shipments fall under all of your regulations for hazardous materials?

MR. BLACKWELL: When a regulation is usually developed -- and, Rick, you can back me up on this or chime in -- we address the transport of hazardous materials of which Class VII radioactive materials is one of nine hazard classes. There may be some culling out of certain hazard classes in regards to the type of rulemaking it may be, in regards to packaging or something, but you don't necessarily address a particular hazard commodity in a rulemaking, no.

Is that correct, Rick?

MR. BOYLE: That's correct.

MEMBER LEVENSON: Just speak into the mic.

MR. BOYLE: Yes, that's one of nine hazard classes, and as a broad based initiative, it is a function specific or a case specific basis. So as you're required to put in security provisions, I don't think anybody should be confused at treating Class IX miscellaneous HAZMAT as getting the same security as any radioactive, in particular, spent fuel that is developed to address the hazard that the material presents.

So it's done generically but is implemented specifically to the hazardous material.

MR. BLACKWELL: I can speak to the NPRM since that was put out. The NPRM which, if anyone here is familiar with rulemaking knows that it may not necessarily be exactly the same in the final rule after comments are received, but the NPRM tied the requirements in this rule to anyone who was required to register under 107.

Now, anyone who ships spent nuclear fuel or high level reactive waste is required to register under that part. So the rule would apply to anyone who offers or transports these types of materials.

It's in the proposed rulemaking. That's how it was proposed to come out.

I really am not privy to know what kind of comments they received or what kind of changes may have been made or not made on the comment period to know how it will come out with the final rule at this time. I guess we'll know when we see the advanced copy of the final rule. The FRA hasn't seen it yet either.

MEMBER LEVENSON: I have a couple of questions. One, on this rulemaking on security, is that something relatively new? What's the responsibility for security division between the Nuclear Regulatory Commission and DOT on these shipments?

MR. BOYLE: I would say that's to be determined. You see the NRC putting forward interim compensatory measures. They've already put out their spent fuel measures, and then they're looking at other ones.

The Department of Transportation has reviewed those. I think there was no comment or support for the spent fuel case based on the need or the uniqueness of the material. I don't believe the department is supporting the NRC expanding those measures any farther than they are right now.

I don't want to say it's a turf battle, but as you can see, with our security rulemakings going on and new departments being formed, it's a little up in the air exactly who has that.

But in the point of this meeting, if you were talking about spent fuel, I think NRC would be the lead. I don't think anybody is here to step in and replace them as far as spent fuel goes. If you broaden it to all hazardous material or all radioactive material, I think that's where there becomes more of a battle as to what's going on.

MR. BOYLE: In the context of this meeting, there is an existing MOU between DOT and the NRC on who has what participation matters.

MR. BLACKWELL: But it doesn't cover security.

MR. BOYLE: But it doesn't cover security, at least not yet.

MEMBER LEVENSON: The next question I have: do you have any guesstimate as to the accident rate between spent nuclear fuel and generic hazardous material shipments?

MR. BLACKWELL: From the rail transport side, I'd have to ask how would you define an accident rate. From other hazardous materials, there are accidents that can occur because a package fails and leaks material.

But there's also derailments; there's also -- there's just different accident criteria that is collected in the rail standpoint, and it has to be quantified a little bit differently.

That's kind of a very broad question to try to answer, I guess.

MR. BOYLE: I think that the general rate is -- and I'll be very conservative with this -- if there are three million shipments of radioactive materials a year, there's probably going to be less than 50 accidents a year, incidents/accidents, anything that goes wrong with that. There would be your annual rate, and put these over 40 years to see data.

You know, there's no study that says, "Here's the accident rate when it's spent fuel. Here's the accident rate when it's a Type B package. Here's what it is for all radioactive materials."

MR. BLACKWELL: There is data that can be looked at from how many regulated radioactive material shipments have been --

MEMBER LEVENSON: Yeah, I was going beyond the radioactive material. We ship a lot of other very hazardous materials, and I just wondered whether the accident rate for radioactive materials no matter how you define it is any different than the accident for other hazardous material.

I guess this is somewhat in the context that unless the accident rate for radioactive materials is significantly higher than the average, why would you go to dedicated trains for spent fuel and not to other hazardous materials unless there's a significant difference in the consequence and risk.

MR. BOYLE: Well, I don't know of any study that puts that out, but you have to be very careful that with almost a million shipments daily of hazardous material, the criteria to define what's an accident and how it gets reported is very different than spent fuel.

I think even in the low level waste scenario for radioactive material, when a truck incident, a separation or even a flat tire or an equipment problem, it doesn't even register. It's not even in the picture as far as an incident with non-spent fuel or low level waste. It certainly isn't in the picture with hazardous material.

But if that vehicle is carrying spent fuel, we'll have a summary of it 30 years later. So I think the first thing we have to do is say what incidents or accidents do you want to count, and you would probably get into a range that if you held all of HAZMAT to this reporting scenario, it would be difficult to know what the rate would be, but we don't collect that amount of paper.

MEMBER LEVENSON: You sort of indirectly answered my question in that you do have a double standard in your reporting and data collection.

MR. BOYLE: Yes.

MR. BLACKWELL: That's one of the things we're trying to look at. If you were to take that to the rail side, and we've had people try to look at our Web site and actually take rail accident data and correlate it to the number of HAZMAT accidents and make a correlation, and it's two different reporting criteria because rail accidents could be anything from a highway grade crossing accident to, like I say, trucks jumping off a track in a rail yard or a locomotive.

So the accident criteria is different, and you really have to look at what -- you have to quantify the data you're looking at in relation to comparing it with other data.

MEMBER LEVENSON: Do you have one significant figure, an estimate for the ratio of radioactive shipments to hazardous material shipments in total up to the railroad?

MR. BOYLE: Radioactive would be about

three percent of the total.

MR. BLACKWELL: That's total. Of the railroad, it's, I believe, less than one tenth of one percent of HAZMAT the railroad -- we're talking all regulated radioactive materials. Less than one tenth of one percent is radioactive.

MR. BOYLE: And three percent is all radioactive materials, any quantity, as small as a limited quantity all the way up to spent fuel. Three percent of the total.

MR. BOYLE: Now, there is another factor there by rail, is that you have to look at this number of shipments compared to tonnage or train miles even for that matter.

MEMBER LEVENSON: So if Yucca Mountain leads to tripling the number of shipments per year compared to what it has been in the last couple of years for spent fuel, generically that really makes no impact on the total hazard material problem at all.

MR. BLACKWELL: Yucca Mountain is spending 130 rail moves a year.

MR. BOYLE: That would be correct.

MR. BLACKWELL: That's nothing in relation to the number of train movements done a year nationwide. That would be nothing.

MR. BOYLE: I just wanted to say how many more shipments it wouldn't really appear in the statistics, but again, I'll go back to a comment that was made earlier. Spent fuel is held to a different standard. It's not just going to run into the generic million shipments a day number.

MEMBER LEVENSON: Yeah, we understand that, but we're trying to focus on the risk and the technical aspect of the risk and the double standard doesn't make it less safe.

Any questions from the ACNW staff? Any of the other presenters care to? This is a workshop. So you're all free to question and challenge the speakers.

MR. BLACKWELL: Be nice, Bob.

MR. FRONCZAK: Bob Fronczak with AAR.

I just wanted to point out that in 2001 there were 51 percent or 51 percent of the rail accidents were at greater than ten miles an hour. That doesn't answer your question, but it gives you some relative idea that it's probably not 90 percent that happened in yards, but it doesn't really answer that question.

MR. BLACKWELL: I was going by a number that may be a couple of years ago.

MEMBER LEVENSON: But I think you defined two different accidents. You had said "derailment," and you said "accidents," and those could be quite different.

MR. BLACKWELL: Yes. I was actually referring to the number of derailments that were reported. The number I was referring to from a couple of years ago was the number of derailments, that 89 percent actually occur in a yard situation.

MR. FRONCZAK: And a lot of the accidents that I'm referring to are grade crossing accidents where there's not a derailment. So that's possible.

I guess, you know, one other clarification. You know, I suppose the data is there to do a study on derailment rates of dedicated or radioactive material shipments. It would probably be very difficult to do.

The implication that I heard was that the derailment rate or the accident rate would be less than other hazardous material shipments. That's kind of the -- no? That wasn't what you guys said?

MR. BLACKWELL: Well, I guess I was asking -- that's why I was trying to say quantify the data. Like we know we have about what, 1,100 non-accident releases a year? That doesn't mean we have 1,100 derailments a year. It depends on what you mean by an accident involving HAZMAT.

Are we talking about an accident involving the release of the material from the package that's intended to hold it, or are we talking a transportation type movement accident?

MR. BOYLE: I would say until you define your criteria I'm making no comment on it, the accident rate, better or worse until we sat down and defined what accidents we want to talk about, what we consider a shipment to be, and once we set those parameters, we'll let somebody then give us a lot of money to run the number up with --

MR. BLACKWELL: You've got to have bounding criteria.

MR. BOYLE: But I apologize if somebody thought I said it was better, worse, or the same, but I think until all of the criteria are developed and we all agree that's what we're counting, then we'll go off and start counting.

MR. FRONCZAK: And then you would have to factor in the fact that most of the shipments have been by dedicated train into that.

MR. BLACKWELL: It would be an interesting process to see somebody go through.

MEMBER LEVENSON: And I think that your latest comment, Rick, is an important one for general information because let me ask you a question of what I interpret it to mean, and that is that if I go to the various Web sites and get some numbers, I'd better be very careful in how I use them and what I attribute it to because there is not good, clean, crisp definitions that are all widely accepted; is that right?

MR. BOYLE: That's correct. That's correct.

MEMBER LEVENSON: That's a fairly important point. A lot of people go to a Web site, get a number, and think they know what it means.

MR. BLACKWELL: In fact, I brought that point up when the data from the FRA's safety Web site was first put on there, and their data was used in certain ports involving spent fuel, and one of the points I brought up to our people was that it would certainly help if we put the defining criteria on the Web site so people would know what the numbers may actually mean.

MEMBER RYAN: You know, as a follow-up, when I think about accidents, I started thinking about car accidents, and that can be anything up from a 200 car pile-up like we saw in the fog a couple of weeks ago to I backed into a bumper in a parking lot and scratched my fender. You know, they're both accidents. There is both some impact, you know, small versus huge.

Is there any document or reference that we can go to and look for, you know, how accidents get categorized? Sometimes it's on a financial criterion. Sometimes it's on an impact criterion.

MR. BOYLE: Yes. DOT has reporting requirements that would list what needs to be reported to the department, and that would be what we would consider our accident or incident database. So those criteria would be in the regulation.

But certainly, as you point out, what is reported to the Department of Transportation different to what's reported to the NRC, different to what's reported, say, to your home office, so DOT does have criteria. They're printed in the regulations, and keep a database of those incidences.

MR. BLACKWELL: And the FRA also has separate accident reporting criteria that the nation's railroads have to report in the 49 CFR 200 series different from the HAZMAT criteria.

MEMBER LEVENSON: Yeah, I was going to say let me guess: they don't match.

(Laughter.)

MR. BLACKWELL: No.

MEMBER LEVENSON: And, again, I think that's coupled with the fact that, you know, as I think everybody sort of agreed, there's a double standard for spent nuclear fuel shipments. So that makes it real tough to --

MR. BOYLE: Correct. With radioactive materials as a whole, we have more stricter reporting requirements. Basically whenever the package fails, you'd report it, and that would be on whatever package is involved. That would be our standard because that's what we developed.

The FRA standards would be different because they're, if I can say, they're running the railroad. So they are concerned about derailment and grade crossings, where my office, we don't care what happened to the package. We just want to know did it survive or not. You know, is it still intact?

So that would be why there's two different reporting criteria in the same department.

MEMBER LEVENSON: That leads to a question. When you say for radioactive material, are you using the technical scientific definition, is something radioactive, versus the legal definition? And what I mean by that is, you know, Congress has declared radioactive materials whose origin is coal or oil or, in many cases, accelerators as not radioactive for some regulations.

MR. BOYLE: Our definition is 70 bacquerels per gram or greater as --

MEMBER LEVENSON: Regardless of source.

MR. BOYLE: Regardless of source.

MEMBER LEVENSON: Any questions? We have a couple of minutes for questions.

(No response.)

MEMBER LEVENSON: Okay. I want to thank both of you, and we'll move on to the summary of DOE shipping experience, and our first speaker will be Alton Harris.

MR. HARRIS: I'm ready to go when the committee is ready.

MEMBER LEVENSON: Go ahead.

MR. HARRIS: Good afternoon. My name is Alton Harris. I'm with the U.S. Department of Energy out of Washington, D.C. I work for the Office of Environmental Management, specifically the Office of Waste Isolation Pilot Plant.

In the introduction, it was mentioned that this workshop is specifically looking at spent nuclear fuel and the packaging associated with the waste form. I'm going to be speaking to you about the Department of Energy's experience with transuranic waste shipments. There's a slight difference.

Transuranic waste is radioactive waste contaminated with alpha emitting radionuclides with half-lives greater than 20 years and concentrations greater than 100 nanocuries per gram.

What I'm going to basically go over first is just a snippet of what our mission is in case you're not familiar with that; the packagings that we are currently using and plan to use in the future; and our shipping experience since 1999 when we began shipping.

Congress authorized the waste isolation pilot plant to permanently isolate up to 6.2 million cubic feet of defense generated transuranic waste in a deep geologic repository. This is actually nearly Carlsbad, New Mexico.

This isometric is just a representation of the facility out in Carlsbad. The repository is actually 2,150 feet below the surface.

Here's what transuranic waste looks like in 55 gallon drums that have been cut away. To the lower left there is a picture of what would be metal pipe, metal pieces of laboratory equipment. The one above it is de-watered sludges. The one to the right of it, the upper right, is just a mixture of different kinds of things you would find in laboratory work when we were processing and developing nuclear weapons. And in the lower right is another waste form that comes in it's basically contaminated gloves, booties, laboratory wear, glassware. That would also be characterized as waste.

Again, I stated if you didn't hear before transuranic waste is alpha emitting radionuclide with half-lives greater than 20 years and concentrations greater than 100 nanocuries per gram.

In terms of our mission for shipping the waste to WIPP, we project that we'll be shipping between 17,000 and 20,000 shipments over the project's estimated life to be 2034 right at this particular time.

We're considering alternatives in how we might accelerate those shipments and actually making 34 shipments a week and actually closing the facility by 2013, and actually when I say "close the facility," I mean to carry the bulk of the waste that's presently stored around the nation, what we call the legacy transuranic waste, and bring that to WIPP and place it in the repository.

To date, we have made over 1,300 shipments. As of this morning, we had around 1,374 shipments.

We make shipments, as you see, from sites across the United States: the Hanford site, Idaho National Engineering Laboratory, Rocky Flats facility in Colorado, Las Alamos National Laboratories in New Mexico, and the Savannah River site.

And so we've moved approximately over 36,000 drums to WIPP.

MEMBER LEVENSON: Are these shipments all by truck?

MR. HARRIS: Yes, to date they are. We are considering a rail option, and if we were to pursue this, we expect to maybe start that in the year 2005.

This next slide here shows the proposed routes. The previous slide showed what routes we've actually used to date, but as you can see, the sites where we have transuranic waste is stored across the country, and we expect over the life of the project to be making shipments from these various sites down to Carlsbad, New Mexico.

From a routing standpoint, just to answer a question that I might anticipate you asking, we consider our shipments as though they were highway route controlled shipments. Of the 1,300 shipments that we've actually had, only some 400 actually have been highway route controlled shipments.

We've entered into agreements with the Western Governors Association, the Southern States Energy Board, and on transportation protocols that we use for our shipments, and as part of those discussions and with the State of New Mexico, we have told them we would route our shipments as though they were highway route controlled shipments to the extent practicable.

The packagings that we have are broken down into two different classes for different wastes that we have. I gave you the definition for transuranic waste. There's actually a subdefinition. If you were to stand at the outside of the packaging and if you were able to get a reading less than 200 millirem per hour, that's what we call contact handled transuranic waste.

And the packagings we use for this are the TRUPACT-II, the HalfPACT, and our proposed packaging that we hope to have designed and built, the TRUPACT-

III.

The TRUPACT-II is a -- and I'll show you some pictures in just a second, and I'll give you the definition of those characteristics -- but right now we have 67 TRUPACT-IIs, which form the bulk of our transportation fleet, and we hope to increase that to 81.

We're in the process of fabricating HalfPACTs right at this time. When we're done, we expect to have 15.

The size for the TRUPACT-III packaging actually hasn't been defined as of yet.

Now, for our remote handled transuranic waste, this would be waste that's too hot for a waste handler to get next to. The exposure at the surface of a waste container would be in excess of 200 millirem per hour.

We have the RH-72B cask, which is a scaled down version of the shipping cask used for the Three Mile Island shipments, and this particular packaging, we have four that we actually have in our inventory right now, and we expect a fleet size of 12 when we're done.

And we're also using another packaging for remote handled transuranic waste, the CNS 10-160B cask. The one interesting thing about this particular packaging is that it's single containment, and so we'll be only able to carry less than 20 curies of plutonium per that shipping container.

All of our packagings that we use, they are certified by the Nuclear Regulatory Commission. So there isn't an issue with DOE self-certifying these packagings.

This picture right here is a representation of the TRUPACT-II. There are three on this trailer, and the picture in the background is actually the waste isolation pilot plant.

The TRUPACT-II is approximately eight feet in diameter and ten feet high, and it has a payload capacity of some 12,000 pounds, almost 13,000 pounds. But what we have done with our shipments, they're basically all under the 80,000 pounds gross vehicle weight.

The HalfPACT, the next slide -- oh, excuse me. This particular picture here just shows the payload going into a TRUPACT-II. Fourteen 55 gallon drums are able to go into this packaging as a standard configuration. There's some others, but this gives you a general sense of payload that we use. So 14 55 gallons are being lowered into this unit.

It's much like a Thermos within a Thermos, if you can envision that.

At the back of this trailer, there is the HalfPACT and the front two packagings are the TRUPACT-II, and the HalfPACT spans -- its outer dimensions are eight foot in diameter by approximately eight feet high. It is capable of holding seven 55 gallon drums as its normal configuration.

And the reason we have this packaging is to help us carry heavier payloads. Like we have sludges at the Idaho National Engineering Laboratory, and this just allows us to carry more at one time.

I don't have a picture of what our representation of the TRUPACT-III would be. We're actually meeting with NRC right at this very time in a different portion of the building and talking about the potential plans that we have in developing this packaging.

This picture here is a picture of our 72B cask. It's approximately -- it looks like a bell bar. The outer pieces you see are the impact limiters. The actual cask itself is approximately six feet in diameter, and the overall length with the impact limiters on it makes it 16 feet.

Its normal payload configuration is three

55 gallon drums. It's shielded packaging.

We actually haven't started using this package just yet. We hope to make some intersite shipments from Columbus, Ohio, and possibly within California to the Hanford site before the end of the year. We're still making final arrangements for that to occur, but this would be the first use of this packaging when we do get approval to make these shipments.

Excuse me. I stand corrected. We won't be using the RH-72B. We'll be actually using the CNS 10-160B cask for this purpose, these intersite shipments I was just mentioning, and this will be one of our first times, the Department of Energy's first uses of this packaging.

When we do begin making remote handled shipments from other sites to WIPP in approximately the year 2005, that is when we expect to begin using the RH 72B task. I apologize for that slip there.

Next slide, please.

This is just the packaging for that.

Specifically our performance has been great, using these packagings and working with the NRC and getting them certified and available for our use.

We've had two minor accidents. Actually

unfortunately they both have occurred in the recent past, August and September. One was a fender bender up in New Mexico, some less than ten miles away from the WIPP site. We had an individual who was driving under the influence of alcohol that rear-ended our vehicle, and there was no damage to our packaging, no loss of life, and the instant didn't meet the department's threshold for occurrence reporting.

In September we had an accident up in Wyoming where a driver had a medical condition, actually veered across the median and went off into a wooded area, and the vehicle stopped. The package on the -- well, three packages remained on the vehicle, on the trailer, and there was no loss of life, no loss of containment, and that's basically how that incident went.

So we're proud of our safety record to date, but you know, there's always room for improvement.

Of probably more interest to you, we've spent a lot of time and effort working with the Nuclear Regulatory Commission improving the contents and payload capacity for our packaging. For the TRUPACT-II, we've had over 19 revisions to our TRUPACT, which allows us to streamline and increase the capabilities of this packaging.

To date with the packagings we have on the table, excluding my talking about the TRUPACT-III, we could ship 74 percent of our waste. The remaining 25 percent, 26 percent of the waste that we still had outstanding is not shippable because of its size. We have large boxes around our complex, and either we would have to go in and slice that waste up and repackage it or we'd have to develop a larger box packaging, and that's what we're hoping to accomplish with our TRUPACT-III design when that is certified by the Nuclear Regulatory Commission.

So that would take care of 24 percent of the waste, and the last one, 2 percent of the waste, we have a hydrogen gas generation problem. Here, again, either we could dilute our waste and repackage it or we could find engineering alternatives and solutions to work it so that we could still use our existing packages to make these shipments, and we're attempting to do that right now.

This is the end of my presentation, and I'd be glad to answer any questions that you have.

MEMBER LEVENSON: Does any committee member have a question of the DOE?

(No response.)

MR. HARRIS: Sounds great. Thank you.

MEMBER LEVENSON: We'll get back to you with our question.

MR. HARRIS: Okay.

MEMBER LEVENSON: The next speaker is Maureen Clapper, who will speak on the foreign fuel experience of DOE.

MS. CLAPPER: Thanks.

Good afternoon. My name is Maureen Clapper, and I'm with the Department of Energy. I'm the Program Manager for the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program, and this program resides within the Office of Environmental Management, specifically within the Office of Integration and Disposition.

I'd like to thank the ACNW for giving us the opportunity to make this presentation today.

The overview of today's talk, I'll go into the background of the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program; the status of the acceptance program; shipment planning and execution; and then finally lessons learned, issues and challenges.

Background of the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program, which unfortunately doesn't have a very good acronym so I have to say this lengthy name all the time. In the 1950s and '60s under President Eisenhower, there was a decision made to provide partner countries with enriched uranium for research purposes. These countries had to agree not to develop nuclear weapons in exchange for this material, and again, it's used in research reactors for research and development purposes, peaceful uses of nuclear materials.

The uranium was provided to 41 countries, which are shown on the map. The countries are highlighted in yellow, but that's not showing up very well on this, but they are also written; detailed names are written on the map as well. So again, this was 41 countries that received this enriched uranium.

The goal of the Foreign Research Reactor Program is to recover nuclear materials which could otherwise be used in nuclear weapons. The strategy of the program is to play a key role in the civilian nuclear fuel cycle. Since high enriched uranium is potentially weapons usable, the mission of the program is to get this material out of the cycle.

And the program works jointly with another Department of Energy program called the Reduced Enrichment for Research and Test Reactors Program, another unfortunately long name, called the RERTR program.

RERTR is involved in the technical development of low enriched fuels to provide these research reactors, many of which were provided with high enriched uranium at the outset. So these reactor cores are converting from high enriched uranium to low enriched uranium, and then our program provides the means for this fuel to be shipped back to the United States since it is U.S. origin enriched uranium.

So, again, by implementation of the program, the U.S. accepts eligible spent fuel, and many of these reactors can directly convert to low enriched uranium.

Research reactors are important. They are used for medical, agricultural, and industrial applications. Right now they're currently used for the medical isotope productions.

The reason for this policy is to reduce the threat of nuclear weapons proliferation, while letting countries enjoy the benefits of nuclear technology; to reduce and eventually eliminate high enriched uranium from worldwide commerce; and allow time for countries with spent fuel, both high and low enriched uranium, to resolve their own disposition pathways.

And the time span of the program allows reactor operators to eliminate long-term liability associated with spent fuel management and disposition.

Some of the details on the policy. Research reactor spent nuclear fuel containing uranium enriched in the United States will be accepted from 41 countries and managed in the United States. Originally in their record of decision and environmental impact statement, 20 metric tons was estimated to be returned. Five tons of this is high enriched uranium; 15 tons, low enriched.

And this includes two research reactor material types, and that is the aluminum based MTR type fuel, material test reactor, and then TRIGA, research reactor spent fuel, and the TRIGA fuel is a Zircaloy, zirconium alloy fuel, and then some target material as well. Targets are used in the production of medical isotopes.

Based on correspondence with eligible countries and reactor facilities, we now anticipate about half of this material will be made available for return, and that's because several countries have decided either not to participate. They may have a lifetime core.

If they participate in this program before 2006, this would require that they shut their reactor down, and this is a voluntary program. So they've got the decision to make with respect to that.

Some of the reactors have slower burn-up than was originally expected of this fuel in the reactor, and then finally, other countries have done what we've really wanted to, and that is find alternatives for their own management and disposition of this material.

One example is in the Netherlands. They've built COVRA, which is a high level waste and spent nuclear fuel storage facility. And so they will eventually be storing some of their fuel there.

The program has a ten year acceptance policy that was initiated in May of 1996. It will go until May of 2006, and this provides time for reactor operators to develop their own solution for material, but the fuel irradiated during this ten year window can be accepted over a 13 year period.

So, therefore, the fuel cannot be irradiated after May of 2006, but we'll accept it until 2009 so long as the country comes forward and claims that they have eligible material they want considered for transport.

The status of the spent fuel acceptance program. Twenty-five shipments have been completed to date. Most recently was September 27th of 2002, which we received eight casks from Japan. The photo on this slide is at the Charleston Naval Weapons Station in South Carolina.

We've received 5,537 spent fuel assemblies from 27 countries. Three cross-country shipments have occurred to date and one West Coast shipment was completed.

Ninety-five percent of the material under this program is material test reactor fuel, which will be interim stored at the Savannah River site. Therefore, most of the fuel shipments have come into the East Coast.

Five percent of the fuel is TRIGA fuel. TRIGA fuel is stored at the Idaho National Engineering and Environmental Laboratory in Idaho. So we have had one shipment of TRIGA type fuel come into California, and then that was transported by train to Idaho.

After September 11th, planning was under continuous tight scrutiny of upper level DOE management. DOE did halt shipments on September 11th, and once again on October 7th of 2001, the day that we started the air campaign over Afghanistan. And DOE remains in close contact with federal and state law enforcement agencies, the naval installation, Coast Guard, and the NRC while shipments are underway.

This next slide shows the foreign research reactor spent nuclear fuel shipments to date. It's actually not updated. It shows 24 shipments. The 25th shipment should be under the right side where it says 20. It should say 21 shipments to the Savannah River site. I lost my contractor who provided me graphic art support. So I haven't found anybody to update this, and they own the graphics. So I can't just go in and change it.

The next viewgraph shows a map with shipments planned over the next year. We're expecting fuel from Japan. Most of Japan's shipments go through the Panama Canal, and Japan ships empty casks to England for other programs, and so while they're shipping those empty casks, they utilize the opportunity of those shipments, of those ships transporting the empty casks, and they'll put the spent fuel on those casks and then store the fuel in England until there is a larger European shipment later in the year.

We were trying to get fuel from Indonesia. I'm not exactly sure when we're going to be able to visit Indonesia. My travel was with the Assistant Secretary for approval when the Friday before the Sunday blast occurred in Bali, so our travel plans are on hold until we hear from the embassy in Jakarta. We are also working with South Korea who's very interesting in returning fuel under the program. And then we'll have a shipment from Europe in 2003 also that will include fuel from Germany, Austria and France.

Shipment planning and execution. We work very closely with DOT and NRC. We enjoy a strong and positive working relationship with our DOT and NRC colleagues. We look to them for support of licensing of the transportation casks. Many of which come in are foreign casks, so they're coming in with a foreign certificate of compliance, so we've got to them reviewed and get the license application in the United States, the certificate of compliance.

And then identification of suitable transportation routes for this material, route approval for transportation, oversight of transportation activities, support during shipment execution, transportation planning and stakeholder outreach. DOT and NRC play critical a role in the successful implementation of several mission critical

DOE shipping campaigns.

And on this next slide, for those of you who have not seen a spent fuel cask, ours are smaller than the ones Alton was showing you, and there will be a slide later that will give you some perspective of the size of these casks. This is a cask with the basket removed, and this is a cask from Japan, and, actually, this is one of the casks that will be seen hopefully next year when we get the shipment in from Japan of TRIGA fuel. On the outside of the cask, there are what they call cooling fins to cool the casks.

And in the next slide, this is the basket that's inserted into the cask. Each one of those cells holds one of the TRIGA fuel assemblies. And the baskets are made specifically for the fuel. When the fuel gets to Idaho, in this instance, Idaho will remove the fuel and the basket and then place it in dry storage underground. In relation to that, the Savannah River Site stores fuel, the MTR fuel in basins. And so Savannah River is what's stored in the basins. Idaho's TRIGA fuel is dry stored.

The spent fuel shipment planning, the fuel casks arrive at naval installations and are transported to either the Savannah River Site or Idaho based on the fuel type. Again, for Savannah River Site it's the MTR fuel, the aluminum-based fuel, and for Idaho it's the TRIGA fuel.

Receipt of TRIGA fuel on the east coat occurs about once a year, and this results in a cross-country shipment transport. And this will occur because we, as I said, 95 percent of the fuel is MTR fuel, so a lot more of our shipments include MTR-type fuel. One of the countries will come forward and say, "We've got some TRIGA that we'd like sent on your next shipment," and so to increase efficiency we typically look for multiple casks from multiple countries and bring this fuel in. We try to get as many casks on a ship as possible.

Route selection is governed by NRC and DOT regulations. It requires shipper to minimize radiological risk, and minimizing time in transit minimizes the radiological risk. This is the picture that I promised, showing a little bit of a perspective of the size of the cask. This is the Japanese 18.5T cask in the Savannah River Site's decon facility after receipt and unloading of the cask.

Some of the key facts for cross-country shipments, they're highly interactive campaigns involving extensive communications among all levels of government, local and state as well. We receive a high level of public and media awareness, we stay very close in contact with our PR people who get a lot of questions from local newspapers asking about shipments. So we've got a lot of good guidance that's already been established that we release for the shipments so that people are made aware of these shipments that are coming through.

Campaign planning and execution is similar from shipment to shipment, although some approaches and participants are different. And this comes to play when the routes change. We can use several routes for those cross-country shipments. Cross-country shipment planning is a year-long advanced planning process. We work with the foreign countries on timing, licensing issues, casks, we collect data on the fuel, select and schedule the casks, select transportation services contractor.

There's a Cross-country Transportation Working Group, which was formed and tasked with developing and maintaining a transportation plan for completing the cross-country shipments in a safe efficient manner. And on those Cross-country Transportation Working Group is our members from local law enforcement as well as state protection.

Route evaluation and the selection process occurs for reach cross-country shipment, and transportation and security plans are also developed for each shipment. This shows the interstate highways that are used, the three potential routes which were identified in 1999, and they're reevaluated each year for a shipment campaign to route the material between South Carolina to Idaho.

We've completed three cross-country shipments successfully. The first was in August of 1999 when we had five vehicles, one cask per vehicle enclosed in an ISO container by truck, 446 TRIGA rods from Romania, Slovenia, Italy and Germany. The second cross-country shipment was completed in July of 2000. This was one vehicle, one cask, 90 TRIGA rods from the United Kingdom. And the third cross country was complete in July of 2001. There was no TRIGA fuel that was scheduled to come into the United States in 2002, and in 2003, we're currently considering fuel from Rikkyo University in Japan. That would be one cask from Japan and the cask that was shown in the pictures preceding.

Some of our planning considerations, DOE requests data on road conditions, planned construction and takes this into account in evaluating routes through every potential corridor state before routes are selected. DOE works with states and tribes to identify and resolve, where possible, construction, congestion, timing, escort and training issues to ensure safety. And DOE will continue to work with state and tribal officials to address planning, safety, response and stakeholder concerns.

Some of our lessons learned, issues and challenges, inspections and escort link-ups and avoiding rush hours are all time-sensitive events. Up until the NRC's central compensatory measures, spent nuclear fuel had to be escorted only when going through populations of 100,000 and greater. We haven't had a shipment since the new order's been placed, but some of our past experience in having escort link-ups with state highway patrol did give us concern on one occasion when the state highway patrol wasn't at the safe haven to meet the shipment on time, and so the state highway patrol at the other side of the border had to wait for the state highway patrol to meet them.

But this causes a cascading effect then, because these shipments are planned. We give notification to the governors seven days in advance that we're transmitting this material through the state, and when we fall behind in one state it just falls into the next state. We do want to avoid rush hours, so sometimes a two-hour delay in one state can end up as a 12-hour delay, because you've now got rush hours that you also have to avoid.

Several planning areas need to be more clear, consistent and timely. Route approvals, change in plans, information dissemination and then, for example, the change in designated rush hours in one state was not disseminated to DOE. When DOE was two hours outside of arriving in a state, we found out that the state had changed their rush hours, and we had to wait until rush hours was over before we could proceed going through that state.

Dates, times and ship names are considered Safeguards Information by the NRC regulations. We've also found that these equivalent measures do not necessarily apply in foreign countries, some of who have openness policies, and much of this information can be found on their web sites in their regulatory equivalent bodies of NRC in foreign countries.

Current issues and challenges, identifying certification needs and getting technical information from the research reactor operators in the foreign countries to support reviews of casks early in the shipment planning process, cooperative planning with states and tribes has been good, but it's changing in this new security climate. We've heard from more than one director of state homeland security that they want to be involved, and we're more than happy to involve the state homeland security directors. We would like to work through their state contacts that we already have established.

Security issues abroad may affect shipment schedules and configurations, for example, when and where vessels can pick up. And the Yucca Mountain debate and decision in Congress raised awareness on all spent nuclear fuel transportation. Numerous requests have been received form reactor operators for our program to extend the expiration date of the policy. The United States at this time has no plans to extend the policy. And we're starting to see some geographic challenges where scheduling is becoming more complex as fuel is de-inventoried from regions in the world, so we've got fuel where we've got maybe ten assemblies in Peru because we've cleared everything out of that area. So that leaves us with some geographic challenges in the future, and we want to go back and get as much fuel as we can under the program that's eligible.

Two thousand two and beyond, spent nuclear fuel has been shipped safely in the United States by DOE and by private entities for over 40 years. DOE elements at headquarters and in the field recognize our Cross-Country Transportation Working Group has been, and will continue to be, successful. And we want to continue to use what works. Every shipment is unique and reveals new opportunities for improvement. The federal agencies continue to undergo bottom-up safeguards and security reviews. We expect new ways to work and new interactions, in particulars with yesterday's Department of Homeland Security formation. And then cooperative planning will enable DOE states and tribes to adapt to changing circumstances. And that's it.

MEMBER LEVENSON: Okay. Thank you, Maureen. Now we'll go on to Don Doherty who will cover experience in shipping Navy.

MR. DOHERTY: My name is Don Doherty, and I work with Naval Reactors and have really for almost 42 years. So, Kevin, we're hanging in there together.

The first couple of slides I've got are some product advertisements.

(Laughter.)

So it's fairly clear what we do. And that is the total focus of what we do. There are corollary and things that support it, but that's the purpose is supporting the fleet. And our program involves a lot of national security issues, a lot of classified material. When you get into spent fuel shipments, those are national security shipments, and therefore there are different sets of rules that go through. So some of the things I want to show you that are different reflect that.

The spent fuel cycle, upon refueling and defueling, all spent fuel is transported by rail to the Naval Reactors Facility on the INEEL site. That is our central location for receiving the fuel, for handling it, for inspecting it. One hundred percent of our fuel is inspected when it gets there. Some of it looking for somewhat superficial damage, but some of it is very detailed, including destructive examinations and detailed dimensional probing. We do that, one, to ensure that the fuel continues to do what it -- to perform as it's supposed to in operation, we don't get any nasty surprises, and another main purpose, especially with destructive work, is to make the fuel better, figure out how to get more lifetime out of it, get more performance per square inch of fuel area. And that's resulted in the original cores were operating for about two years way back in the '50s that now they're operating for 30 years. And that obviously produces an awful lot less waste, spent fuel to be handled.

This map looks similar to other ones you've seen, and there's been some talk about special trains, dedicated trains, and I guess I wanted to clarify something. The Naval Reactors Program does not require special or dedicated trains, we have not in our whole history. As has been correctly pointed out, we'd have -- when there's been a major schedule need, for instance, if we have the first core of a new core type and we want to get it back to Idaho to quickly get in and do some examination and get confirmation right away that it's performing as it should, we will pay the extra cost to have a dedicated train.

The shipments come from four locations -- well, really five. On the east coast, Portsmouth Naval Shipyard is up between New Hampshire and Maine, technically in Maine, and then down in the Norfolk area in Virginia, Norfolk/Newport News, there's a private shipyard and there's a Navy yard. On the west coast, in Washington State, there's Puget Sound Naval Shipyard fairly near Seattle. There's also a shipyard out in the Pacific at Pearl Harbor in the Hawaiian Island. The spent fuel removed from ships in that shipyard is moved back by ocean-going ship, specially-rigged ship, and goes to Puget Sound Shipyard, and it's shipped from there. All the fuel from both coasts goes to Idaho, so these are rough routes.

And I say they're rough routes because we allow the railroads to designate the route. And why do we do that? The railroad is a closed system. If we allow them to do this, they're the experts, they do the job right, they understand their system best. They know where the track is good, where there are certain problems, like the heat problem with the rails we had here in Washington. In the wintertime, they know where the snow and the ice may be. There may be periods when rail lines are blocked, and as was mentioned by Maureen, it is desirable to move this fuel as quickly as possible, and we feel the railroads are in the best position to do that, and that's what we've been doing for the last 45 years.

Also, in talking about dedicated trains, we ship by regular rate service. We do not, as I say, pay for special trains, so our spent fuel could be on a special train, and there are many times when it is, there are other times when it's sitting in a train with general freight. Again, being a national security shipment, we're not trying to drawn attention to our shipments, and when they're in a train of 60 or 40 other cars, they don't get much notice.

And my numbers differ, as was pointed out before by Kevin or whoever, that we say 742 shipments were made in the last 42 years. Those are casks, those are not -- I was sitting here when you did that, and I was thinking, gee, what's the right number for movements, and I think it's -- I came up with between 300 and 400, so I'm not going to argue with your 400 number.

Next slide shows a picture, now I just told you about we don't always use dedicated train. That's obviously a dedicated train. As you get closer to the INEEL in Idaho, there really isn't much other freight going up in that direction, so typically they're all that way.

There's another thing I need to mention or I'm going to be misleading here. Can we go back to the rail route slide? In the east coast, we generally move in regular service because the railroads agree with that. As I say, we have occasionally paid for special service and dedicated trains -- we call them special trains -- but at the transfer in the border of

Kansas and Missouri, or whenever the transfer is to Union Pacific for travel in the West, Union Pacific chooses to usually use special trains, dedicated trains -- not always, but usually. That is their preferred method. And that's their choice, we have no problem with that, we just don't want to pay extra for it.

MEMBER LEVENSON: As a taxpayer, I applaud you.

MR. DOHERTY: All right. This slide is just, as I said, it shows the train and there are four casks on this one. We don't usually have that many. There are many trains that have just one, quite a few have two, this shows four, I think our record is once we had six. It was an injunction in Idaho and we had to clear out fuel that had been stacking up in shipyards, and we had six on one train.

The nature of the fuel is very rugged. I'll get into that a little bit more later, but it's a very different kind of an animal than what you're used to in terms of commercial fuel. The containers, of course, are robust, but that's probably no different than any other Type B container, they've got to meet the same requirements.

Shipping practice, we have two escorts

with every shipment. They're armed, and they are active duty Navy people, they're extremely highly trained, they have done a lot of security exercises involved with what if somebody tries to take the train, hurt the train, what are the kinds of things you could do to foil the attempt. The caboose, which is at the very end there on the picture, and I have a bigger picture of it later, is where the escorts ride. They have a number of communication systems available to them. They are in the -- people who monitor national security shipments know where this train is at all times, at least they know where the caboose is at all times, and there are periodic reports that the escorts have to make. If they fail to make them, then that tells somebody something, and there are appropriate response mechanisms.

Next slide, a little bit more about the naval spent fuel characteristics. It is a solid metallic fuel, it's not flammable, not explosive. I can't go into a lot of real detail because it's classified. It's built for combat. It operates in Navy ships which are supposed to continue to operate to fulfill their function even when under fire, even when depth chargers are going off. You don't want to -- that's not the time you want to lose your propulsion power when you're engaged with the enemy. So they are very, very rugged so that they can accept high shock values. And since the crew, especially in the submarine, lives in this metal tube, under water, for months at a time, with an operating reactor, it is a very strong requirement of ours that there be no fuel leakage of any kind and that the primary coolant does not have fission products, they can't get up through some sort of primary coolant leak or vent leak so that they contaminate the atmosphere of the submarine.

The punch line of all this, just because of the way it's designed for its military function, it is very durable and rugged and suitable for transport, can handle transportation accidents very well, although we've never had to test that.

Let me talk a little bit more about the containers. The Naval Reactors Program has always had a very, very conservative design philosophy that we design for extreme worst-case conditions. Our shipping container, that's the M-140 shipping container, is 14 inches thick solid stainless steel walls, and it, of course, is a Type B certified container, NRC-certified container. Normally, radiation levels allowed by the transportation limits are 200 mr per hour on contact or 10 mr at six feet. We typically, when we measure these, are about 3 mr per hour on contact and about a tenth of an mr at six feet. And these I won't talk about but they are some of the criteria that are required to be certified for a Type B container. I think everybody in this room has at least some familiarity with these, so I'm not going to really talk about them.

Shipping practices more specifically. Because the fuel is very rugged and the containers are also very rugged, we judge the shipments are very low risk, so we operate in such a way that gives us an efficient operation at reasonable cost. And I mentioned they're national security shipments, and over the years with all those shipments, we've had no releases of any radioactive material. I think one of the trains we were on had an accident at a crossing many cars removed from where the spent fuel cask is, and there was -- I don't know if there was any personal injury. There was certainly no damage to the containers or the rail cars or our casks. And that's over 45 years.

This is a picture of the escort car I mentioned, and the escorts -- at the top of the caboose, there is that sort of cupolo at the top, which has windows all the way around, and the escorts are on duty -- there are two of them and they alternate being on watch 24 hours a day, and there's someone up there who is watching the containers at all times, day and night. And the escort car has to be positioned close enough to the containers in the train that we have that visibility. If the train stops for some reason, and escort will get out and do an inspection. I mean he doesn't go and check for levels but he'll just look, is there anything about the car, does it have a hot box, is there any potential problem that they ought to be advising the train crew of? These are government-owned cars, both the escort car and the cask car. We coordinate very well with the railroads. Our escorts communicate with the train crews.

And we also, and I'll talk a little bit more about this later, there was a discussion about emergency response. We do a lot of outreach work on emergency response, partially because it's a national security shipment and we don't have the notification kinds of interactions with states and tribes that is common on other shipments. We go out of our way to be involved and to talk to the emergency response organizations, the state organizations on the probable routes of our shipments, and we conduct exercises, accident exercises. Since 1996, we've run them on both coasts, and we're currently planning one in Kansas which would involve emergency responders. I'll show some more slides on that later.

Our escorts -- let me go back to the escorts for a second. Because of the nature of the fuel and the container, if there is an accident, we're not particularly worried about radioactive release. Obviously, we all would want to prevent that, but we understand our situation very well. Our escorts are trained to be helpful. You talk about first responders, if our fuel is on a train, our escorts, along with the train conductor, are the first responders to quickly size up the situation. If there's an accident, our escorts have already called it in from the escort car before one of them leaves to evaluate it. The other escort stays in the car to make sure that the communication is set up, and then when it is set up, they have handheld communication devices which they can carry around with them. And they assist the people that are there. If there is a crossing accident and a truck driver was hurt, then they are trained in first aid, they have the necessary gear in the escort car and are prepared and would proceed to give first aid. As I say, summoning assistance that's already happened in the escort car, and I'm sure the railroad also would have done that.

And only after you look at the immediate consequences and make sure people are safe that we then go do a routine survey of the rail cars to confirm that there's no change in any of the radiation levels. And once the state police, fire department, whoever the responders in the area are arrive, they would take over incident command, and our escorts would assist them -- put up "keep out" tape, whatever they're asked to do. Next slide.

Security emergency response, if you had something other than an accident, if you had someone attempting to do some sort of mischief, sabotage, stealing something, our escorts are trained to contact whoever is needed to provide assistance -- local authorities, local police and, again, the national security connections if that appears to be a concern. They're supposed to ensure the safety of the material being shipped, as I mentioned, and they have these security exercises, which, by the way, they invite railroad people, railroad police people to them. The railroad fully knows what's being transported in our shipments. It is the only prudent way to do it.

And the others are fairly obvious, you try and keep somebody from continuing to do the malicious activity, although the Navy couriers are not trained to go throw themselves in front of the cask and be shot with AK-47s. They are supposed to maintain their own safety while still being able, with their handheld communicators, to tell people what's going on. It's very hard to imagine that you would be anywhere in the country where you could not, with the kind of communications they have, have assistance fairly quickly to the site of the occurrence.

People have talked about terrorist attack, it's come up fairly often. People have talked about shaped-charge weapons. I don't know how familiar people are with such weapons, but the explosive charge really occurs on the outside of the tank or bunker or in this case a cask, and you project a stream of very high velocity, very high temperature particles which cuts through the side of whatever you're trying to cut through. If you get into the inside turret of a tank, you'll set off ammunition and the tank -- that's the beautiful picture you see where the whole turret of the tank blows off. But there's nothing to blow up inside a spent fuel cask. It's inert material, it doesn't catch fire, so you would and could drill a relatively small diameter hole through the side of a cask, even our 14-inch thick casks, and in the heat and agitation of the event fuel would be damaged inside, there would be a puff of radioactive material out. But there is no fire going on to disperse that material. It would tend to be localized. Obviously, meteorological conditions can affect that, but it would tend to be localized. We think the significance would be fairly low, and it would be a local clean-up job.

It's also -- get philosophical here for a minute -- it is not a very inviting terrorist target. It has high psychological value maybe, but it is not a -- there is not a large explosion, there are not very large numbers of casualties. It seems to us if you were trying to plan that sort of a thing, this isn't a very obvious target, but then I'm not a terrorist.

Let me get back to the exercises I talked about briefly. We've had two on the east coast, two on the west coast -- actually, yes, two on the west coast, and we're planning one in Kansas. We invite to those exercises just about all of the states on our transportation routes. We invite them to send the state representatives if they chose to. We go through

-- our shipments go through a couple of Indian reservations. We invite them to send their fire departments or police departments. And we get a fair response, although usually, not surprisingly, it's from the states more or less fairly close by where the exercise is.

And in an exercise, you have to simulate a lot, obviously, but for instance let me give you an example. The next slide is a picture of an exercise that was held in Idaho, and you will see a sort of jury-rigged bleachers we built here with a sun cover over it on the right. And those are people who came at our invitation from various state agencies who are involved in emergency response and they observe the operation. The local fire department, local police department, state police were involved as players. It was treated as a -- where the picture is being taken there's a road and there's a road crossing there, and we had a simulated -- it was a potato truck in Idaho and it had actually had a very bad accident a week or two before, and they towed it here to the edge of the railroad crossing and even had the bumper hanging off, and the bumper theoretically derailed one of the cars, and therefore they played through the whole exercise. The driver was injured, it was clear how the escorts interact with the emergency responders and incident control, and those have been very, very useful to us.

I think that really concludes what I had prepared to say.

MEMBER LEVENSON: Okay. Thank you. All three of our DOE speakers are now fair game.

CHAIRMAN HORNBERGER: I must say that it's an impressive bit of experience on the part of participants from DOE, and knowing DOE is such an intimate agency with no stovepipes, I can infer that the Yucca Mountain project has certainly conferred with all of you to gain from your experience, and I just was wondering if all of you could confirm that for me?

MR. HARRIS: I can from the viewpoint of the Waste Isolation Pilot Plant Program. Even the Undersecretary of Energy has made public comments that Yucca Mountain project would initially model their transportation program like the WIPP Program. So they are looking at what we do. For example, we're beginning to negotiate -- we'll start the negotiation of rail protocols with the western states. Before we can begin that process and actually select a rail carrier, we're going to be involving the Yucca Mountain project, the Office of Civilian Radioactive

Waste Management or their new name is -- I don't know their new name that they're being called, I guess the Office of Repository Programs or something like that. But, yes, we are coordinating with them.

MS. CLAPPER: Actually, I thought the Undersecretary said he was going to model the program after our program.

(Laughter.)

We have worked very closely with RW. In fact, the entire time that RW was up on the Hill, all of the Qs&As that came through were sent through with our Office since our staff's been working very closely in response to those Qs&As. Since our programs are viewed as the active and successful transportation programs in DOE, we can help answer those questions.

MR. HARRIS: And, actually, my colleague, Maureen, is probably correct. I'm not going to -- I had heard this statement. But, anyway, so I'm not speaking on behalf of the Undersecretary of Energy or the Deputy Secretary of Energy, so I stand corrected by my colleague. We can say one thing, though, that the Department of Energy is interested in conducting its shipments safely and working with local, state and federal officials and tribal officials to make these shipments occur safely. And so whatever experience base that the Department has we'll use that base in whatever future transportation programs that come online.

MEMBER LEVENSON: Hopefully you're both right because the programs are different. The foreign reactor fuel involves shipping heavily shielded materials, et cetera, whereas the WIPP Program is essentially unshielded materials to date but a lot of experience on road transportation, so there's really different experience, and hopefully it will all feed into the system.

MR. DOHERTY: The Naval Reactors Program is an active participating program, and we ship under our DOE head because all spent fuel is owned by DOE. And we have been working quite closely with the Yucca Mountain people. We have shared all of our experience in a lot more detail than I was able to get into here. We have had people from Yucca Mountain who are clear and fully understand the nature of our fuel and the nature of our shipping practice, which will not be directly applicable, I understand. And we have had a lot of interaction with them. In fact, when this meeting is over I'm going to the airport to get on a plane to go to Las Vegas and because we go down there three or four times a year and spend time communicating back and forth as to what we're doing and what they're doing. A lot of that is aimed at the naval fuel actually going in Yucca Mountain, but there is also the interaction on transportation, and they have been interested in some things, and we have shared some design features, and I think some of the features on their disposal package are actually going to be a little bit different because of some of those interactions. So, yes, we recognize the importance, and we much want people to listen to us. We just can't tell them as much as we'd like to.

MEMBER LEVENSON: Well, I think, incidentally, I want to express appreciation on the part of the Committee for your being here. It wasn't very long ago if we had invited somebody to come talk about Navy fuel, we would have been stiff-armed and said everything is classified and we can't talk about it. And we really do appreciate -- we understand a lot of it has to remain classified, but we do appreciate your making an effort to extract what you can talk about.

MR. DOHERTY: This is the kinder, gentler naval reactor.

(Laughter.)

MEMBER LEVENSON: I know the origin,

Rickover was a student of mine.

MR. DOHERTY: Well, I was, unfortunately, a pupil of his.

(Laughter.)

MEMBER LEVENSON: Ray?

VICE-CHAIRMAN WYMER: I was just curious to the extent to which types of people on this side of the table talk to the people on this side of the table.

MR. HARRIS: Frequently. Actually, I see Kevin at many of the meetings I go to when we meet with the western states and the southern states on transportation protocols related to the WIPP shipments. So we're not strangers to each other or strangers to the Nuclear Regulatory Commission and their staff.

VICE-CHAIRMAN WYMER: Do you have regularly scheduled meetings?

MR. HARRIS: Yes. Actually, with the Nuclear Regulatory Commission, we're actually meeting with them today in this very building on some of our packaging.

VICE-CHAIRMAN WYMER: I was thinking about coordination.

MR. HARRIS: Yes.

MR. BLACKWELL: We coordinate -- I can speak for FRA -- we coordinate regularly with the Department of Energy on Marines with foreign research, with the WIPP. I go to all these coordinated tech working group meetings, the state meetings, we're constantly in constant e-mail contact. In fact, my boss is often kidding me that I work more for Department of Energy than I do for Department of Transportation, but that's -- we coordinate and we've been doing this since '92.

VICE-CHAIRMAN WYMER: Thank you.

MR. DOHERTY: Naval Reactors, since I can't be left out, also participates in the transportation forum of the gatherings of the various people around the country periodically. We participated very actively in the transportation protocol work that DOE was developing to try and make all parts of DOE shipments, to the extent practical, kind of look the same and do things, practices, notifications, we're talking about radioactive accident assistance and that sort of thing. And those have all been codified now, and I think a manual was issued. It's not called protocols anymore, it's called -- I don't remember the name, but there is a manual which is now issued, which is supposed to be a much more consistent set of requirements, notifications in case of accidents and that sort of thing.

MEMBER GARRICK: One of the popular phrases of the day is public outreach, and all of you mentioned it, and all of you indicated that you have the programs and activities and drills and what have you in the name of public outreach. I'm very curious as to what the response has been, what the reaction has been, whether it was needed, where you do it a lot does it make any difference, has there been a public problem? Would you each care to comment on that a little bit?

MR. DOHERTY: I mentioned some of the things we do. Going to the periodic meetings with the other people that are involved in transportation is another thing. We have made presentations quite similar to what I just did there. A lot of people know Ray English in our program who has been running the transportation side of it for a long, long time. And he knows a lot more of the details than I do, but since I was here in Washington it was easier for me.

And in terms of problems with the public, by and large, no. We do a lot of outreach things. We have a site like a shipyard or our prototype reactor site. People actively go out and meet the people in the state government at their own volition -- "Hey, I'm so and so. This is what we do. Would you like to come down and take a look around and we can show you how we do these things," up to and including the state level. And the response has been very, very good.

I think, probably naive, but I think we're fairly well regarded in that connection as doing things right and communicating clearly and honestly. When we say something it's the truth and you can count on it. And we're consistent, if we promise we're going to do something, we do it. Are we perfect? No. But we try very hard to have that outreach go on. The same is true of the local emergency responders and stuff in the area. That wasn't always true, as was pointed out, ten years ago or 15 years ago but it is now.

MEMBER GARRICK: Well, the reason we're very interested in it is the Yucca Mountain project if you go into the field, so to speak, you go to Nevada and you talk to citizens, you get the sense that transportation is one of the number one -- perhaps the number one issue. And so whatever outreach DOE has had so far in that arena has not been very effective in moving that off the table as something that the public has great concern over.

And I was just curious from the -- I'm very anxious to extract from the experience base the maximum we can about issues that we're anticipating with Yucca Mountain. So I was very anxious to know if there was similar kind of problems in your programs and whether or not your outreach programs were successful and whether or not if they were successful you were offering counsel and advice and assistance and communication with the Yucca Mountain project?

MS. CLAPPER: I think our outreach programs have been very successful, and I kind of look at it from a top-down approach with our Public Affairs officers working with us. And I'm with groups like -- I had mentioned the Cross-Country Transportation Working Group, which has the state contacts that are -- the ones that are going to be actually out there doing inspections of the trucks and escorting the trucks and acting as the first responder.

But as kind of a middle layer between the Cross-Country Transportation Working Group and then the Department of Energy, we've got the regional groups, the Midwest Council of State Governments and Southern States Energy Board. These groups, there are four of them, the Northwest State Governments as well.

There are four of these groups and they have meetings annually, they constantly ask for Department of Energy, Department of Transportation, NRC to participate and give updates on the shipping programs. And they've told us over and over, "We like what we see, we like how you guys are doing it, and we want it to continue." So they seem to like how we've interacted with them, what has been provided, and I look at it as a positive.

MEMBER GARRICK: Have any of you participated in any of the public forums on Yucca Mountain on this topic?

MR. HARRIS: Not on Yucca Mountain, at least I haven't.

MS. CLAPPER: No.

MR. DOHERTY: We were active in the -- well, not active, it was a DOE lead but the environmental impact statement hearings went on for a number of years. There were public meetings all the way around the country and many in the local area in Nevada, and we were available for those meetings. We were seldom called on very much, but we were available, we had material. They have a much more difficult problem.

MEMBER GARRICK: Yes. Okay.

MR. HARRIS: I could also give some perspective on our outreach program and our success in that also. Much like Maureen, we use a regional planning process and working with these regional groups like the Western Governors' Association, the Southern States Energy Board, we've been able to leverage not only having DOE and our contractors speak about the safety of our transportation program but also working with these various groups and the tribal groups, we've had them be able to go out and speak to their constituents directly. So there is not only hearing the federal government say one thing but hearing it echoed by the state and local officials has helped us in our public outreach program.

We've been shipping since 1999. We started with one shipment per week. We've had our highest rate in recent past this summer when we got up to 29 shipments per week. So as the level of shipments have increased and people are more aware, it's almost like, oh, there goes another WIPP shipment, the media has stopped tracking and following every time we do a shipment. The only time when we see a flux of new activity or new refocused energy is when we open a new corridor. And if you saw, we're primarily just working on this Idaho to New Mexico corridor, down from Hanford, Washington State. So really the folks in this corridor have seen us and they're comfortable with it. When we open new corridors we expect there might be a flurry of renewed public interest, and it will be an opportunity for us to do some outreach and working with these folks until they get a comfort level.

MEMBER GARRICK: Thank you. I have a couple more if I can. You spoke about dedicated trains, that always gets my attention. You also mentioned that you didn't pay for them, and while my colleague said this was happy news from a taxpayer standpoint, I suspect to stockholders of the railroads it's not so happy news. Can you share with us do you know anything about the difference in the costs if you were to pay for them?

MR. DOHERTY: I have some old mental numbers, and I am very reluctant to put them out because they're pretty old and the value of the dollar has changed quite a bit.

MEMBER GARRICK: No, I'm thinking maybe just on a percentage basis. Yes, just a percentage increase of a dedicated shipment versus a regular train shipment. I don't want to put you on the spot.

MR. DOHERTY: No, no. You're looking for

order of -- I mean that kind of a thing, and it's not -- it would not cause an order of magnitude increase in shipping costs. I mean we pay -- we have very heavy casks, so we pay a fair amount --

MEMBER GARRICK: Yes.

MR. DOHERTY: -- for the shipment.

MEMBER GARRICK: But an order of magnitude is a big number.

MR. DOHERTY: Yes, and we're not anywhere near that. I mean I would hesitate to even say it would double the cost, but I don't know that.

MEMBER GARRICK: All right. Thank you. Let's see, I have something else that I wanted to -- oh, you spoke of fuel examination. What was the principal purpose for doing the fuel examination at the end of the shipments?

MR. DOHERTY: It's primarily -- I mean every fuel cell is examined -- I mean this is not lab coat technician kind of detailed examination but in a water pit at the NRF, Naval Reactors Facility, in Idaho, using TV cameras, using binoculars, using mirrors, there is an examination of all accessible surfaces just to look for anything unexpected. I mean it's a done examination in that sense that it's confirmatory, I mean it's good. A good result is if you see nothing at all out of the ordinary. What you're looking for is something different, and we occasionally do see something which upon investigation we conclude, well, what is that red stain and upon getting some samples and doing some examinations conclude it's --

MEMBER GARRICK: Well, the reason I bring it up is one of the issues in Yucca Mountain is the ability to take credit for cladding and also another issue is the assumptions that are made about a certain number of either casks or fuel that is flawed or damaged or what have you. And I was quite curious as to whether or not what you do do in the Naval Reactors Program would give any insight or guidance on what might be done in the commercial fuel that would enhance confidence in the quality of the fuel and therefore impact the performance assessment. But it doesn't sound like it's that kind of an examination.

MR. DOHERTY: Not checking every one but the way we operate the reactors on ship we are continuously -- not continuously, but very, very frequently sampling the primary coolant and looking for any indication that there has been any sort of fission product leak. There's always a little bit of trapped uranium in cladding and you're going to get some fission products from that, but you go to base level and what you're looking for is some increase and rate of increase which is just unexpected and we don't see it. So you end up starting with the assumption that you don't think there's a problem but you still do the examination because you can.

And you might -- if there is a fuel defect of any significant size, there would typically be some sort of indication where the water flow leaves the module. The Zircaloy material, uranium, will tend to accelerate corrosion, and there could be other deposition products. There might be a stain you would see or something. But it isn't really done for that and we certainly can't argue it's 100 percent effective for that, but we do the -- you know, we then select some and do extremely detailed examinations constructively and doing sectioning and polishing surfaces and working our way down, just verifying that there's no process -- that the cliff isn't very close, the cliff is far away.

MEMBER GARRICK: Final question is --

MR. DOHERTY: And let me just explain. And commercial fuel, the whole phenomenon is different. The nature and the construction of the fuel assembly is different. There are corrosion phenomena that can occur in the commercial fuel. It's not in our fuel type because of the classified nature.

MEMBER GARRICK: Right. You had mentioned that when you have some sort of an event on a train shipment and you talked about the activities of the security people, the escort people for the shipment, and had indicated that kind of the last thing they do is check the radiation levels around the casks. But my point is don't you have permanent radiation monitors on these trains?

MR. DOHERTY: Not to my knowledge. You have a cask which has been sealed and checked that it's sealed and checked that it's airtight. You have had no events occur. You've had a tremendous amount of experience with these casks. We haven't had them come out to Idaho and upon inspection find that, oh, gee, that must have started leaking somewhere back in Iowa. We just have never had anything like that.

MEMBER GARRICK: I was thinking of something with the special caboose, that you might have some sort of a --

MR. DOHERTY: One could conceivably do something there, but to the best of my knowledge we don't do it. But there are -- I'm almost certain we don't do that.

MEMBER GARRICK: Okay. Thank you.

MEMBER RYAN: All the good questions have been asked.

MEMBER GARRICK: You always have one more good question.

MEMBER RYAN: Well, I was going to add from my own experience on trucks, for example, very often drivers will be trained to verify on their routine stops that the DOT requirements are still being met. So that's common in truck traffic. I don't know about rails, but it is quite common on the low-level waste side. So maybe something like that's happening with the train folks, I don't know.

MR. DOHERTY: I think the train crew has responsibilities in that connection too --

MEMBER RYAN: Yes.

MR. DOHERTY: -- to do inspections of the whole train.

MR. BLACKWELL: The train crew does not have any training or responsibility to conduct radiological examinations.

MR. DOHERTY: No, I know that.

MR. BLACKWELL: Oh, I thought you were talking about just for radiation.

MEMBER RYAN: Yes, I know. Typically, in

truck transport in the U.S. a lot of times if it's a dedicated unit, that the drivers will have the training and they will verify DOT measurements and so forth.

MR. BLACKWELL: The requirement for a train crew there's nothing that would require them to have the knowledge, the expertise to conduct a radiological-type inspection. They will conduct inspections for securement, making sure the cars and the breaks are routine type inspections but not in-depth radiological inspections of radiation levels or anything like that, no.

MEMBER RYAN: And all that's just really visual.

MR. BLACKWELL: Correct.

MR. DOHERTY: No. I didn't mean to imply that they did -- they are looking for something about the car which might produce an accident somewhere down the road. They are not worried about -- we do periodic inspections on the route at various times when there's an opportunity to do so, but that is not -- there is not you've got to stop the train to do it every so often, no such requirement, nor do I think there should be.

MEMBER LEVENSON: I have a couple of

questions. Have there ever been any -- in these plus or minus 400 shipments, have there ever been any cases where the escorts were needed? Now, I don't mean they were helping out when the train hit a bus or something, but was there ever a case where they needed because of the shipment?

MR. DOHERTY: I've never asked that question. In the time I have been associated with it, I have never known an occurrence where they were needed. I have a colleague of mine here who has some experience also. Would it be all right if I asked him if he's had any experience?

MEMBER LEVENSON: Sure.

MR. GRIFFITH: Tom Griffith, Naval Reactors. To my knowledge, we've never had the couriers do anything. I've only been working in the area since '94, so that's all I can speak to.

MR. BLACKWELL: I can add one thing, and that's from personal experience. I don't know if it falls under the heading of "needed" but there was an incident we know of involving one of our inspectors who recognized what the shipment was in a regular con sys and was approaching the cask to do a visual inspection, and he was challenged and stopped by the security personnel.

MR. DOHERTY: I'm aware of that, yes. And they do that 24 hours a day, even if you're in a shipyard. And if there is anything that is perceived as being out of the ordinary, they make sure they understand.

MEMBER LEVENSON: On the Research Reactor Fuel Program, a couple of questions. From what you said, I gathered this program is limited to the highly-enriched uranium and research reactor; is that correct?

MS. CLAPPER: No, that's not correct. The program did not want to provide a disincentive by only accepting HEU, so the program accepts HEU and LEU. However, a country has to agree to convert their reactor from high-enriched uranium to low-enriched before we would take their fuel.

MEMBER LEVENSON: But you will take back the LEUs.

MS. CLAPPER: Correct. The 20 metric tons that were in the EIS, in the environment impact statement, five tons of that was HEU and the remainder being LEU.

MEMBER LEVENSON: I gather it's not in your program, but is there a similar program for power reactor fuel of U.S. origin exist in some countries?

MS. CLAPPER: No.

MEMBER LEVENSON: No, meaning there's no program or you don't know?

MS. CLAPPER: There's no program that I know of.

MEMBER LEVENSON: Oh. I have one question related to the WIPP shipments. You said that some of the stuff that's out there potentially high hydrogen generation so it might have to be repacked or something before it can be shipped to WIPP. I assume that high hydrogen generation means either high plutonium or plutonium-238.

MR. HARRIS: You're correct.

MEMBER LEVENSON: In either case, if it's high enough to be a hydrogen problem, is it also high enough to be a neutron source problem?

MR. HARRIS: I can't actually respond to that part of the question. I believe the answer is -- actually, I know the answer is no to that. But, for example, we've gotten -- I can give you an example of how we've worked with the NRC and gotten some guidance on what we could do for 2,000 drums of this what we call high-wattage waste at Los Alamos National Laboratories. Just recently the NRC has allowed us to lower the shipping period, because right now under our

60-day compliance for the TRUPACT-II, we have 60 days in which we'd have to open a close TRUPACT-II because of the hydrogen and the acid buildup. Well, we were able to demonstrate through calculations and modeling that we could safely ship these 2,000 drums from Los Alamos, New Mexico down to the Carlsbad facility within seven days. And so therefore they lowered this value and we had an agreement so that we could make these shipments, and we plan to start these shipments later this year.

MEMBER LEVENSON: But has somebody looked specifically at the neutron generation issued from these?

MR. HARRIS: I am not aware of that, sir, but I could ask that question if that's of interest.

MEMBER LEVENSON: I have one generic sort of question that's of interest to me, but I'm sure that none of the three of you are probably in a position to answer it, but I'll ask it anyway. We're interested in trying to get a feel if somebody has never done anything, then you have limited confidence it could happen. Something's been done 1,000 times with no problems, you start getting a little more confidence. I think that the actual number of shipments involving nuclear weapons is at least an order of magnitude more than the total of all of the other DOE shipments that you've talked about. Do you think it might be possible to get such a number? No details, no routes, no where they go, no anything, just a number for how many shipments there has been, because the total number of shipments with no incidents is something that is helpful in getting the sense of confidence.

MR. DOHERTY: I can try and get that for you. I don't know that I can get that for you.

MEMBER LEVENSON: I understand.

MR. DOHERTY: But I can at least ensure that the right people are going to be asked. I'm not going to be able to get that going next week.

MEMBER LEVENSON: Well, you know, since very few submarines or carriers or airplanes land at Pantex, we know there's somewhere between 20,000 and 30,000 bombs that existed. Clearly, there are tens of thousands of shipments, and the question is is it 20,000, is it 50,000, is it 100,000?

MR. DOHERTY: I think your perception is correct. I have no idea what the numbers are or how available they are to get, but I will attempt to do that.

MEMBER LEVENSON: Okay. Staff have any

questions?

MR. KOBETZ: This one's for Don. It goes back to one of your slides about the shipping containers and their design requirements. And one of the statements is that it can withstand the equivalent of a 60-foot drop onto a reinforced concrete surface?

MR. DOHERTY: Yes. I always have to explain that. That was an analysis -- I mean the requirement is, of course, a 30-foot drop onto an unyielding surface, and you go do the energy transfer and the amount of energy that goes into deformation of the -- that has to be absorbed in the deformation of the container. And, obviously, if you use a real surface, even one that is perceived to be fairly hard, that number goes down. And our analysis showed that it went down by about a factor of two. Well, wait a minute, no, that's wrong. I mean I can't talk about energy in that connection, but the height would approximately double. I don't have that, and I couldn't lay my hands on it very easily right now; in fact, I've often wondered why I leave that in the slide. I think I've got to get rid of it. But we did that in good faith and that's what we show, because we ask the question ourselves, what does that mean in terms of real surfaces, and that was the number we came up with.

MR. KOBETZ: That's the big difference.

MR. DOHERTY: It gives you a bit of a warm fuzzy.

MR. KOBETZ: It's not necessarily unyielding.

MR. DOHERTY: Yes. I mean there are no unyielding surfaces.

MEMBER LEVENSON: Any other people have questions?

MR. HOLT: Mark Holt, Congressional Research Service. I have a question on the shipments of the naval reactor spent fuel on the regular trains regarding security. That came up yesterday whether you have any kind of arrangement for making sure that your cars go straight through or do they end up sitting around quite a bit of the time. How does that affect those issues?

MR. DOHERTY: Well, we have -- as I say, the escorts are there all the time, and they also are charged with trying to make sure that our -- to the extent that you can do on a railroad -- a railroad's a closed system and there are certain -- you know, it's very, very, very hard to keep moving all the time for a lot of complicated reasons. But to the extent that they're able to expedite movement, they do that. I mean if they are in a -- for instance, there's a switching where one train -- a train coming from somewhere here is being reassembled in a yard so that some other cars are being added because they're going the same place where the train is going.

While that's going on, if that isn't proceeding fairly expeditiously, they will use their connections and their ability to communicate with the railroad people, the train people and the people that run the yard to try and attempt to expedite the process. So can we assure that they move at all times? Absolutely not. I don't think you can find very much on the railroad system that you can get that assurance, if anything, but by having them on board, they have been very effective in moving our shipments faster than they would have otherwise.

MR. HOLT: So you are reasonably able to ensure that these regular trains go through, and you don't see the need for a dedicated train for that reason, for security reasons.

MR. DOHERTY: No, and as I said, there are some security reasons why you are a lot less visible if you're not in the dedicated train that barrels down the highline. There are two sides to that story, and when we get into Yucca Mountain there will be a set of conditions established for how shipments of spent fuel will go to Yucca Mountain, and we will have to take that into consideration on our shipments.

MR. BLACKWELL: I'd like to say something here if I could. It's just from an impression standpoint. I hope no one here has the impression that if something is moving in a dedicated con sys that it is constantly in motion. The con sys makeup does not necessarily mean it never stops. There are other factors that come into play.

MR. HOLT: Thanks.

MEMBER LEVENSON: If there are no other questions, I think we'll take our break now, and we're starting a few minutes early but let's get back a few minutes early and try to reconvene at 3:40.

(Whereupon, the foregoing matter went off the record at 3:22 p.m. and went back on the record at 3:41 p.m.)

MEMBER LEVENSON: Let's get back to our meeting, please.

Our first speaker after the break is a summary of utility experience by Robert Kunita and Steven Edwards. Just introduce yourself, and then go ahead.

MR. KUNITA: All right. My name is Bob Kunita. I'm with Progress Energy, and I'll be making the presentation today. Steven Edwards had to attend another meeting.

Progress Energy has service areas in North and South Carolina and part of Florida. Under Progress Energy is Carolina Power & Light and Florida Progress. As of the first of the year, we'll be changing our name to Progress Energy. So everything will be under that one name.

Progress Energy has five nuclear reactors. The Robinson plant is in South Carolina. It's a PWR reactor started in '71. Brunswick Units 1 and 2 are boiling water reactors located in North Carolina and started in 1974 and 1977. Crystal River is our PWR plant located in Florida. It began operation in 1977. Harris is our latest plant. It's a PWR reactor located in central North Carolina.

Today I want to focus on our reactors in the Carolinas. We are shipping from our Brunswick units in the southeast corner of North Carolina and the Robinson plant in the upper portion of South Carolina to our Harris facility located in central North Carolina.

This slide shows a history of our reracks, and for our Brunswick and Robinson plants we have reracked to the maximum extent we feel practical. Our Harris facility started a bit later. It was initially designed for four reactors. It shared one large fuel building, and that fuel building was essentially completed. Only one of the four Harris plants was, however, finished to completion.

Our Robinson plant is our earliest unit, and we have processing contracts, which are to take care of the spent fuel. But in 1977 when the United States Government changed its policy regarding reprocessing, we suddenly ran into a storage problem.

So in 1977, we embarked upon the program wherein we would transfer some of the fuel to the Brunswick site, so there was sufficient storage -- vacant storage area in the pool, so we could do a rerack. So in '77 we began shipments to our Brunswick units. Between 1977 and 1981, we shipped a total of 304 assemblies, 44 shipments. Each of those were single cask shipments.

We then proceeded with reracking, and that held us for a bit of time. But in 1989, again for -- need for additional storage, we began shipments to our Harris facility from Brunswick in 1989 and from Robinson in 1990. And at the present time, we are still shipping from Robinson and the Brunswick Units to Harris.

As of today, we have made 159 train shipments, 3,473 assemblies, and 29,369 train miles. I have not included the empty return trains, so if you're interested in the number of trains, those would double.

Because we're a nuclear utility, we do everything by very detailed procedures. We have program level procedures, which define how the shipment program works, and specifically how each site will handle their part of the job.

There are interface agreements between our sites and with the support organizations, procedures for annual inspections of the cask, handling, loading, and unloading of those casks, and detailed procedures to select the field to assure that it meets the certificate of compliance requirements.

We also have procedures to make sure that we provide the advanced notice required by NRC regulations to both the NRC and to the states to which we transport fuel. And, of course, we have en route emergency and -- routine and emergency procedures.

We own four of these casks. This is the IF-300 spent fuel shipping cask. It uses an interchangeable basket, so we can reconfigure the cask for -- to ship either PWR fuel or BWR fuel.

The cask is constructed of a stainless inner shell, depleted uranium for shielding, a stainless outer shell, a water annulus for neutron shielding, and then the corrugated outer shell.

These are the valve box covers, and I'll talk about those a little bit later. There's two of them. That provides for fluid and gas entry into the inner cavity. There are expansion tanks for the neutron shielding in the annulus, and there are, of course, valve box covers to -- so we can sample the fluid or change it, as need be.

The annulus is split into two compartments -- the upper portion and the lower portion. Here at the lower left of the slide you can see the closure head. It has -- this cask has integral impact limiters and does not use the balsa wood impact limiter.

This shows one of the IF-300 casks on the rail car, and the enclosure has been slid back so you can now see the cask. This cask is being prepared for entry into the Brunswick fuel handling building. Once we get it into the building, of course, we'd put it into a redundant lifting yoke, and that consists of a cradle you can see down here, and an upper part that has hooks that connect to the lifting trundles. Either system is capable of carrying the entire load.

We use this redundant yoke at our Brunswick and Robinson sites, since the cask goes right into the spent fuel pool. Once the cask is loaded and removed from the pool, it is taken over to this decon facility. This is at our Brunswick site. There's scaffolding in there, and this is where we finish torquing the closure bolts. We decon the outer surface and prepare it to be placed back on the rail car.

That's not the correct slide.

Each of our shipments is inspected by the U.S. Department of Transportation, Federal Railroad Administration.

Next slide.

Once the shipment departs, it is carried in exclusive use shipment in a dedicated or special train. Here you see the locomotive, one flat car, two cask cars, another flat car, and the caboose at the end.

Next slide.

Once it arrives at our Harris facility, we reverse the process. The only difference is that at

Harris we have a separate cask pool, so we don't need the redundant yoke.

Next slide.

We have a well-defined organization that's in place for each and every one of our shipments. It consists of a shipment manager, a shipment communicator who is located on our emergency operations facility for the duration of the shipment. This communicator is in contact with the shipment and has communications capability to the warning points in each of the states in which we transport fuel.

Also, has contact with emergency management personnel in those states. And also communicates with our control rooms for notification to the NRC.

Now, we have escorts on there. We have a senior escort who has radiological expertise, a mechanical escort who has a working knowledge of the shipping cask. These are separate and distinct from the security personnel.

We have plant response coordinator and teams standing by at both our shipping plant and the receiving plant. Should an event occur, the shipping plant would respond for the first half of the route; the receiving plant for the remainder of the route.

We have a response manager who has administrative responsibilities for the entire shipment. He becomes the recovery manager in the event of an accident of any type, and he has a predefined recovery organization in place.

There is emergency response information on board each train, in accordance with DOT regulations. There are shipping papers which defined this as an exclusive use shipment. It's labeled Yellow 3 in the shipments placard there -- radioactive, and contains orange panels which bear the numbers 2918 for a loaded shipment or 2982 for an empty.

This is the information that the first responders would use, should they have to respond. The pre-departure radiological surveys are also on board. The escort gets a copy.

Let me talk about cask experience, and then I'll talk separately about transportation experience.

We've been using these casks over a number of years, and we did run into a weeping or leaching problem where cesium would tend to sweat out of the pores of the cask. And it seemed to be a function of temperature, dew point, surface furnish on the cask, and so forth.

We typically use a caustic decon solution, TSP or trisodium phosphate, Blaze-Off, and we've tried a number of those to try and solve this problem.

We think we have finally cracked this problem, and we have used a mild citric acid solution to take out all of the leaching that was coming out of the cask. We couldn't understand why. You know, we went through extensive deconning, why it seems to sweat so easily, depending upon whether you went through a freeze-thaw cycle, what happened to the dew point, whether it was a hot day, and so forth.

So we decided that more aggressive treatments weren't appropriate. We had looked around, and this is kind of out of the box thinking, working with Chem Nuclear who had prior experience with this. We found that this worked very well.

We now only do it on an as-needed basis. When we decon either the loaded or empty cask, we go back to this traditional treatment, and then only on an as-needed basis do we use citric acid.

We did run into a problem, and we ended up identifying an unreviewed safety question, and we requested approval of a license amendment for our facilities. What we found out is that NRC had issued a Bulletin -- I believe it was 92-6 -- that had to do with lifting heavy loads at a nuclear powerplant.

And we specifically got a request for additional information at our Harris site, because we did not have a redundant yoke. So we found that we were moving the cask not fully buttoned up, because our vendor's procedures and the vendor's SAR indicated we were to remove the box, valve box covers, and to remove all but four of the bolts in preparation for either loading or unloading.

On an inquiry, we found that the vendor did not have the supporting analysis. This cask has gone through many hands, first from General Electric to Nutech to Pacific Nuclear. Somewhere through that evolution we could not come up with the necessary analysis to support that. So we stopped all cask handling until we resolved the situation.

We knew in our gut that this was all right, because we were moving older fuel and we were covered by other accident analyses which are more severe. But nonetheless, we went in and did the detailed analysis to show that the head would not fully come out, the fuel would remain in the cask, but we could not assure it would be leak-tight.

So we did the dose analysis and confirmed that, indeed, we are far, far below the Part 100 limits. This is all captured in NRC Information Notice 99-15.

Also, in handling the cask, we find that sometimes there is some wear or debris gets in the seal-surface, so we undertook seal-surface machining, and we actually repaired a gouge and buffed out some scratches. None of these were safety-related issues. We just wanted to make sure that when we loaded fuel and we got into the leak tightness inspection that we wouldn't have a problem that would cause us to have to unload.

We have also had the cocked head recovery efforts. What happens is that unless you bring the cask up -- the cask head up very, very carefully, very level, then you could -- you can skew the head on the 32 guide pins or the sleeve studs.

The head cables are designed to break, because you don't want to ever try to lift the entire cask only with the head cables, because you might drop it. We did end up with a few guide pins that were bent and a few studs that had to be replaced.

Also, there was a pool cleanliness issue described in Information Notice 97-51. In a boiling water reactor, the fuel tends to act kind of like a filter, so we were ending up with some iron oxide deposits that then got transported to our Harris plant, which uses a borated pool. And so we had some iron oxide crud that we had to deal with, and all of that is treated in the safety analysis. It was just to question the cleanliness of our pool.

Let me talk about transportation experience now. There was a crossing accident. We think it was about 1990. This was an empty shipment being transported back to what -- to our shipping plant. This was a crossing accident where an automobile struck the locomotive. There was cosmetic damage to the locomotive and to a rail ladder that was on the side of one of our cars.

We did have some folks on board that shipment. They responded immediately to provide whatever assistance they could to the driver of the passenger vehicle. We did also, in 1995, have what is technically called a derailment, in that the track -- this was an old, unused plant spur. We just happened to back the empty train onto it, awaiting the railroad to bring their locomotive.

What had happened was back when they built that plant there was this old road that is no longer used, yet there were some rail ties that went across it and were, therefore, buried. What happened was that the ties had degraded, and the track just moved apart.

The car remained upright. If you look at it, it was just only about a degree or two off of vertical, from the vertical line. But technically it constituted a derailment.

Earlier this year there was an attempted boiling on one of our loaded shipments. And we did have all of the necessary folks on board, and those folks were aware that two young individuals who were what was called probationary release -- so we knew these weren't hardened criminals or anything like that.

They had -- I don't know all of the full details because of privacy laws. My understanding, what I'm told, is that these individuals had the option of being on probation and reporting periodically to a parole officer, or attending a boot camp. These two individuals selected to attend the boot camp, but then decided they didn't like it, so they departed.

Law enforcement was looking for them. Our folks on board were aware of that as we approached this area. One of them jumped on the flat car because the train was slowing at that point. One attempted but failed. He was immediately challenged. The one who got on the flat car was immediately challenged by the escorts and by the other security personnel on there.

Four law enforcement vehicles were at the train in like two minutes. So we know the system works. I'm kind of afraid what would have happened had we not known the nature of these two individuals who were out there.

Next slide.

We also have a caboose that we use for our escorts, and, as indicated yesterday, these older rail cars, one of them seem to look alike. So we ran into a problem with our friction-driven generator and the rectifier set, and we could not find a replacement for that. All of the cabooses seemed to have different sets of equipment, particularly with the rectifier system.

So we ended up replacing it with a diesel-fueled electric generator. We also put in backup batteries. We have talked to the railroad car inspectors many times, and we asked them, "What can we do if we wanted to significantly improve the safety of our train?"

They went through and spotted some

straight plate wheels, which they decided, well, the better thing to do was have curved plate wheels. These straight plate wheels apparently had a tendency to crack over time.

As I indicated, we do inspect our cars on each and every shipment. We also call in CSX, who is our local railroad, to provide inspection on the cars every 30 days. And then even beyond that, we have them shopped at the Hamlet Rail Yard for a thorough shop inspection of the cars.

We do also inspect our side track annually, and we use UT inspections.

As I indicated earlier, FRA inspectors have been on each of our loaded shipments. There's a HAZMAT inspector and a motive power inspector, and HAZMAT is looking for labeling, and so forth.

Motive Power is looking at the mechanical systems of the locomotive and each of our rail cars. Typically, it looks at the locomotive the day before the inspections.

Test our train air brake system, and what we are finding is that we would test them the day before. But because we were varying when we would make these shipments, the temperature could drop. We made some very early morning shipments, and we found that we were having air leaks. So we got tired of that, and we hard-piped all of the air lines in the cars and that effectively solved that problem.

We have had both NRC and FRA inspectors at our site, and there was not agreement on when a shipment begins. That's important for us, because it defines the interface between our site responsibilities and our shipment responsibilities. For example, the site emergency plan, when is that added? The health physics personnel, their postings, and so forth, when is that added? What about security?

And with regard to our shipment plan, when do the escort responsibilities under Part 73 begin? When do we put the state warning points on notice that there is a shipment? Etcetera.

So this became an NRC/DOT interface, and this eventually went up to the government lawyers in Washington for an answer. The answer that came back to us is that the shipment begins when both the locomotive is connected and the shipping papers have been provided to the carrier. So we said, "Good. We've got the one single answer that seems to work for everybody."

The current problems we're wrestling with, they're not really safety-related. We're running out of some of the older fuel that we were shipping, and we're now needing to ship fuel above 45,000. We recognize that there's been excellent work by the NRC and industry in issuing Revision 2 of Interim Staff Guidance 11. It addresses the ability to dry store fuel above 45,000. And on a case-by-case basis, we're addressing the transportation side.

We do have some Robinson rods now at Argonne National Labs under an NRC program looking at the material properties of high burnup fuel.

The IF-300s were an earlier generation cask. They come under 7113 with regard to what we can do, and we -- I think we need more guidance there from that respect. For example, there has been a recent issuance of Revision 2, Interim Staff Guidance -- I believe it's Number 8, having to do with credit for burnup. And it's not clear at all to us or to the NRC staff as to whether that can be applied to a previously-approved package.

The new Part 71 is going to come into play, and that impacts the generation cask. We believe that this has been a workhorse for us, and it works very well. We'd like to continue to be able to use them, but we are, nonetheless, also undertaking an effort examining whether we should spend a lot of money to reanalyze this cask to the new Part 71.

Our problem there is that these casks are only issued a license for five years, so it's very difficult to justify large capital expenditures for something that we can only be assured we'd be able to use for a five-year period of time. So we wondered as to why that is the current practice. We'd like to see a license that goes much longer, obviously.

That concludes my presentation.

MEMBER LEVENSON: John?

MEMBER GARRICK: No. Go ahead.

MEMBER RYAN: I was going to ask a question. You showed the picture of the cask earlier, and it's got a water jacket for neutron absorption. What would the unshielded neutron exposure rate be at the surface of the cask if you didn't have the water? Do you have any idea of that or --

MR. KUNITA: That would vary upon the contents of the fuel.

MEMBER RYAN: Do you have a range, though?

MR. KUNITA: We have looked at that situation for some of our table-top accidents, because even in the safety analysis we assume we'd lose the entire water jacket. Well, it turns out that for our table-tops, when we looked at that situation, they still met the regulatory requirements. So --

MEMBER RYAN: Of 200 mr contact or --

MR. KUNITA: The accident dose rate limits.

MEMBER RYAN: Oh, the accident dose rate. Okay. So that would be, what, 25 --

MR. KUNITA: I don't remember the number off the top of my head, but --

MEMBER RYAN: -- r, or --

MR. KUNITA: -- I think it's lower than that.

MEMBER RYAN: Okay. Thanks.

MEMBER GARRICK: You answered one question I had about what constitutes the starting of a shipment. I wanted to ask you, do the utilities track individual fuel assemblies?

MR. KUNITA: Oh, yes, by serial number.

MEMBER GARRICK: And would they track these right through to when that day comes to emplacement in the repository?

MR. KUNITA: Our obligation, as I understand it, ends when the Department of Energy takes the fuel assembly. We have to meet the reporting requirements, and Issue 741 said we do that on a fuel assembly basis. It's a special material inventory control system.

MEMBER GARRICK: So there is no particularly -- particular interest on the part of the utility to track them beyond that point. And I'm thinking just on the chance that something dramatic could happen, you wanted to retreat them before they were actually -- before the closure of the repository.

MR. KUNITA: We maintained the records for well beyond our license life for the plant. So we have that capability. It's just that we hadn't thought that through to that --

MEMBER GARRICK: Right, right. It's -- and, of course, one of the issues in the repository is heat load, and the tracking of the fuel assemblies is important to that. Of course, you can always measure it. But I would guess that the DOE would pick up on that track and sustain it somehow.

MR. KUNITA: Yes. We have to determine the heat load to ensure that we comply with our NRC certificate of compliance, which specifies a total carrier heat load and an individual heat load.

MEMBER GARRICK: I found your experience information on problems with the casks to be very interesting. It's the first time anybody has taken the discussion to that level. Have you exchanged with other shippers and other types of casks with respect to those kinds of issues, and do they have similar kinds of problems?

MR. KUNITA: We're aware of some, like, for example, the weeping problem.

MEMBER GARRICK: Yes.

MR. KUNITA: It seemed to be an industry problem.

MEMBER GARRICK: So there is some lessons learned that --

MR. KUNITA: Yes, we have a mechanism for changing information through INPO.

MEMBER GARRICK: You're not the only one having those problems.

MR. KUNITA: Not to my knowledge. As far as I know, this is a common problem throughout the industry.

MEMBER GARRICK: Yes, okay.

MR. KUNITA: And, of course, wear and tear and maintenance is an everyday activity at all of our nuclear plants. And we have staff and procedures to be able to handle those.

MEMBER GARRICK: Thank you.

CHAIRMAN HORNBERGER: Again, it appears to me that you have just an excellent record of experience and safety. And I'm curious, is that industry-wide again? Are there -- are you the biggest shipper amongst the utilities, or are there others that do this kind of shipment as well?

MR. KUNITA: We're aware of other shipments, but we -- I believe we're the only ones shipping spent fuel assemblies. There are other rod shipments going for research. In fact, we shipped some from our Robinson site. Those tend to be truck shipments. All of ours have been rail.

CHAIRMAN HORNBERGER: Okay.

MEMBER LEVENSON: Two questions. Your shipments today, I understand, are all wet-to-wet. That is, come from a pool and they go into a pool. Do you envision that the problems might -- but as we look down the road and for the future in Yucca Mountain, a large fraction of the shipments are going to be from dry storage, etcetera. Do you think that will make any difference?

MR. KUNITA: No, I wouldn't think so.

MEMBER LEVENSON: You might not have the weeping problem if you don't have pool water, etcetera.

MR. KUNITA: That's true.

MEMBER LEVENSON: But you don't anticipate that would make much difference.

MR. KUNITA: No, I don't. Our preference, of course, would be to ship from our pools.

MEMBER LEVENSON: The other question is the arithmetic and the geography looks like most of your shipments are like the order of 200 miles or less. But your idea or your option of using dedicated trains, is that influenced by the short distance?

MR. KUNITA: No.

MEMBER LEVENSON: Would there be any difference if it was 2,000 miles and two different railroads?

MR. KUNITA: We basically ship using dedicated trains as a convenience and as a scheduling matter for us. We have defined the reactor refueling outages, and so we tend to work between them. If we were not to ship sufficient fuel and then cause us to have a plant down, then the replacement power costs are just astronomical. So that drives us to want to, from a need standpoint, not a safety standpoint.

MEMBER LEVENSON: So this isn't a safety or a security, just a scheduling thing.

MR. KUNITA: That's correct.

MEMBER LEVENSON: Okay. Any questions

from the staff? Any questions from any of the other presenters who are left? Any questions from the audience, or any comments?

Okay. Thank you very much.

We'll then move on to a summary of international experience with Ian Hunter. Ian?

MR. HUNTER: Okay. Good afternoon, everybody. Can you hear me okay? Thank you.

My name is Ian Hunter, Vice President from Transnuclear, Inc.

A brief introduction of my career -- I've been in the nuclear industry for over 25 years. I started my career in the enrichment part of the nuclear industry, the front end of the fuel cycle, and I spent five very enjoyable years building centrifuge enrichment machines.

I then jumped to the back end of the fuel cycle and started a long involvement with spent fuel and high-level waste. I have worked within the COGEMA Group of companies, Transnuclear in Paris, which is going to change its name to COGEMA Logistics. And more recently, I moved to the U.S., working for Transnuclear, Inc.

Throughout that long career, I've been privileged to work in many different countries within

Europe, each of which has its own regulatory authority similar to the NRC. I totaled it up, and it came to around nine different countries where I've worked on projects -- a very enjoyable and a very worthwhile experience.

I would not claim to be an expert. I would not be so presumptuous. I've learned a lot today and yesterday, and hope I'll continue to learn things throughout my career. I would consider myself a practical engineer, a mechanical engineer by profession.

And I think it's very interesting, the speakers we've had over the last two days have not only shown things like technical basis, but on a practical basis for members of the public. I think that's very important.

I'm a very touchy-feely type of engineer. I like to go out and feel the product and see its service. So maybe if we can try and keep you awake for the next 20 minutes.

If you'll permit, Mr. Chairman, a quick poll. How many people in the room have actually seen a spent fuel cask or a high-level waste cask? Would you raise your hands? A good number of you.

Those of you who raised your hands, how

many of you have actually witnessed a loading operation? Still a good number of you.

Okay. How many of you who raised your hands the last time have Scottish parents?

(Laughter.)

Nobody? Okay. So we've got the experts, and we can say I'm a representative from an ethnic minority. Okay?

Right. Next slide, please.

In the next 20 minutes, I hope to give you an overview of the COGEMA organization. I feel for the scale of the operations, both for COGEMA's own transports and for those worldwide.

Touch upon the safety record, and then, perhaps the most important thing, some of the challenges and lessons learned with conclusions.

So next slide, please.

Very brief overview of the organization. I guess a lot of you are familiar with Transnuclear, Inc. It had a long pedigree in this country in the cask and spent fuel business.

Transnuclear, Inc. is part of COGEMA Logistics, a French-based organization, which has over 800 staff worldwide dedicated to the design, construction, licensing, and operation of all types of radioactive packages. COGEMA Logistics is part of the COGEMA organization. COGEMA is a nuclear fuel cycle company, which is involved in both mining, enrichment, and the recycling and reprocessing of spent fuel, and they employ around 15,000 people.

And we trace our parentage back to the AREVA Holding Company, which was formed last year, which embraces both COGEMA and Framatome, the reactor company, which gives us a total corporate size of around 50,000 people.

The next slide, please.

These statistics I drew myself from some old data. They may not be exactly up to date, so please treat them as approximate. and just to give you a feel for the scale of spent fuel and high-level waste worldwide.

I've listed the six main players in terms of numbers of nuclear units, commercial nuclear operating facilities. Obviously, the USA is top with other 100 units; France, 59.

But if you look on the right-hand side, the percentage figures, the percentage of nuclear electricity generation, and it's interesting that the quantities of individual reactors don't tie in exactly with the percentage of nuclear generation. So you can see in France, in particular, nuclear electricity generation is strategically very important for that country.

Also, with the exception of the USA, the rest of those countries today are in some way involved in either reprocessing or high-level waste shipments. Reprocessing will require some form of transportation.

And my own personal estimate is that from the quarter of a million tons of spent fuel which have been generated to date in commercial rectors, around one-third of that has already been reprocessed. So you could say around a third of that has already been shipped somewhere.

A large proportion of the interim storage will be onsite storage at the reactors, but some of it will be offsite. So that's been shipped also. So that gives you a feel for the kind of scale of the operation.

This is a photograph of the COGEMA La Hague reprocessing plant, northern France. Five thousand people work on this facility. There's actually two reprocessing plants within the site, and they have a capacity -- a combined capacity of 1,700 metric tons of reprocessed fuel per year.

Also on the site are facilities for

converting the high-level waste generated from reprocessing from a liquid form to a vitrified form, and in addition there's other treatment facilities for low-level waste.

Next slide, please.

This shows one of the spent fuel pools at the COGEMA site. I have no idea what quantity of fuel is there, but you can see there's a fair amount of fuel bundles dotted around those racks. And I would class that as interim storage awaiting reprocessing.

And the latest statistics that I found from the COGEMA information was that last year they did actually reprocess more than 1,000 tons of fuel. All of that fuel, incidentally, has been delivered in spent fuel casks.

Okay. If we just look at the back end of the fuel cycle, I've listed the annual shipments of back-end material. When I say shipments, I mean individual cask movements or package movements. And you can see over the last four years it averages out around 1,000 packages being moved per year of back-end material.

If you just focus on the spent fuel and high-level waste, then this year we're well over 260 individual cask shipments, and you can see that the breakdown is fairly constant on the French side. The European varied in 1990 and 2000. I'll explain why a bit later.

And more recently, we had an increasing volume of vitrified waste being shipped. This is the waste arising from reprocessing contracts being returned to the country of origin.

That 250 is around about the same number of cask shipments we're talking about for Yucca Mountain and private fuel storage. So I think the COGEMA current experience is roughly equivalent to what you expect for future U.S. movements.

Next slide, please.

Okay. How do we move this material? We own a fleet of heavy casks, Type B spent fuel casks. You see one on the top right-hand side.

We own special heavy-hold trailers for moving by truck. And we also own dedicated rail cars, which incidentally move in most instances as normal freight, up to speeds of 60 miles per hour. Those are purpose-designed rail cars, and I'd just like to draw your attention to the canopy arrangement here.

This is a closure with ventilation, and this was something that COGEMA introduced very early on in the fleet, primarily to keep the cask clean. If you're in the business of shipping spent fuel, you would like the empty cask to arrive at the reactor site as clean as possible.

And so to prevent it from accumulating dirt from long voyages, it's a good principle to have a canopy. And there are other advantages, which I'll touch on later.

Next slide, please.

We are involved in all types of modes of transport, not just by truck or by rail. We are involved in sea transports. Fuel has been shipped from as far away as Japan, and I don't think you can get geographically further from France than Japan.

The Japanese shipments were undertaken by Pacific Nuclear Transport, PNTL, in which COGEMA has an interest. The other modes of transport are by truck, predominantly in the last 20 miles between the nearest rail link and the COGEMA reprocessing facility.

So everything which goes to COGEMA at least goes by rail and truck. Some of it by sea also.

Next slide.

This shows one of the most commonly used spent fuel casks in Europe, called the TN 12. I think I would probably describe it as the Cadillac of spent fuel casks. It's got so many advanced features in it.

I've worked on all different designs of spent fuel casks, and this one is probably the most performance in terms of what it can actually achieve.

Next slide, please.

The reasons behind that is that the French and nuclear generating at EDF, Electricite de France, was conceived with reprocessing as a direct part of the generating system. So they don't have large spent fuel pools at the reactor sites. This means that the challenge for the cask designer is to ship fuel with relatively low cooling periods; typically, less than one year.

So this cask, which was designed to meet the maximum diameter allowed for transportation on the European Rail Network, has a capacity of 12 PWR assemblies or 32 BWR assemblies. It's a forged steel construction. It has a removable internal basket, which will allow the use to be changed over from either PWR or BWR types. But also, the basket can be changed as fuel enrichments increase to keep up with the need for operations.

An extensive heat transfer system -- these casks are typically loaded with heat thermal loads around 50, 60, 70 kilowatts. All of the external parts are stainless steel, and there are special features to interface with dry unloading facilities.

Next slide, please.

This is a photograph of a dry unloading facility, perhaps a confusing term. What you see there is a cask, a vertical spent fuel cask, and ducked to the underside of a facility where it can seal on the upper end of the cask.

So the impact limiters have been removed. And through a special system at the upper end of the cask, the lid system can be accessed remotely, and the fuel can be removed and taken into a dry cell. That's a dry unloading facility.

This actually exists at COGEMA La Hague. It's called T0. And it allows very fast, very efficient, and remote unloading of spent fuel.

Also, in some of the French PWR 1300 megawatt reactors, they use this to load the fuel. Those of you who have seen spent fuel loading pools may be surprised to know that there are systems where, like in this photograph, the spent fuel cask goes underneath the pool. It's positioned vertically, a plug is removed from the pool, and the spent fuel is loaded wet into the cavity, and then the plug is reinserted. And that avoids having to put the cask into the pool. Very interesting.

Next slide, please.

A very quick overview of high-level waste casks. From the external viewpoint, very similar to spent fuel casks, large 100-ton glass-type big casks. On the inside, a much simpler configuration for a basket. Because we're not dealing with fissile material, the baskets are very much similar construction. And, of course, there's no spent fuel inside. The contents are stainless steel canisters with vitrified waste.

Next slide, please.

Just a few words on the infrastructure. On the upper photograph you see the terminal at Valognes in northern France. This is the terminal which allows modal transfer from rail to truck. This is the nearest rail link to the COGEMA reprocessing plant. We believe this is the biggest dedicated terminal in the world for transfer of spent fuel and high-level waste.

COGEMA also operates a marine port facility for spent fuel shipments, and you see in that photograph one of the PNTL ships being unloaded ready to transfer to a rail car.

Next slide, please.

This is a closeup of operations at Valognes. Essentially here it's a lift-on/lift-off arrangement going from either truck to rail or vice versa. And the actual cask is an interesting one. It's a dual purpose cask designed by Transnuclear for a Swiss customer.

Normally, dual purpose casks are loaded once, and then they sit in interim storage awaiting shipment for final repository. This particular customer had reprocessing contracts to honor with COGEMA, so he took the opportunity to use the dual purpose cask for routine spent fuel shipments before he would finally use it for interim storage. So it does prove that dual purpose casks actually work.

The gentlemen on the right-hand side is taking a smear test. That is a typical test which is used to check for non-fixed contamination. So just bear that in mind, and I'll refer back to it.

Next slide, please.

It's been said many times in the last two days, more than 30 years of spent fuel and high-level waste transport, and millions of cask miles covered, and during that time by sea, by truck, by rail, never been an accident involving the release of the radioactive contents. A very impressive record.

Like has been said by other speakers, we have experienced minor traffic incidents. Usually, the damage has been confined to the conveyance, and nothing of a significant nature to the packing unit.

One interesting reference which I can pass on to you from the UK National Radiological Protection Board -- while I worked in the UK, they carried out regular surveys of spent fuel being shipped through UK, and these surveys were aimed at evaluating the potential dose uptake to the public as published information. And their conclusions were that from the operation of spent fuel, on a day-to-day base, dose uptake to the public is insignificant.

Okay. We've all been saying how safe it is, and we're all very confident that nothing will ever happen. But it might one day.

Next slide, please.

This shows equipment designed by the COGEMA group for accident recovery. This is part of our emergency response equipment, and it's never been used. What you see here is an exercise.

On the left-hand side is equipment designed to operate in remote areas, heavy lift equipment to recover a cask that may have fallen off of a truck or a train and rolled down an embankment.

On the right-hand side you see what I suppose you'd call a kind of moon buggy arrangement to recover a cask and pull it into a safe area. That's actually a dummy cask.

I've personally participated in many emergency response exercises in Europe, and I can say these are treated very, very seriously. They involve professionals from the emergency response organizations, fire, police, etcetera, who are very used to dealing with emergency exercises.

And the responses that are tested out are not just the technical response in terms of the teams who come out and do simulated recovery exercises, but also the testing of the management of the exercise itself. We can do table-top exercises on paper and test how we can respond with telephone calls.

But there's no real substitute for going out there in the field and sending people out to remote areas and practicing it in real time. And these are very realistic.

One of the speakers earlier mentioned about the possibility of terrorist attacks and the likely consequences. This has also been studied by COGEMA. One of my colleagues in Transnuclear was responsible for organizing tests with the French military where they attempted to puncture a spent fuel cask, and they've got data to show what the actual possibilities are.

Obviously, the information is classified. But in general, we can say that these are extremely hard and difficult targets to penetrate.

However, in the extreme unlikely event that one was penetrated, techniques do exist to seal the cask and put it in a safe condition. And I have witnessed technicians practicing those techniques on dummy situations.

Next slide, please.

Okay. Let's move on to the lessons learned. The previous speaker mentioned maintenance as a very important area. If you operate a fleet of spent fuel casks, which you are shuffling between reactor sites and reprocessing facilities covering many thousands of miles during their lifetime, it's inevitable that they're going to suffer some kind of minor damage -- paint chips, knocks, scrapes, etcetera.

Very robust objects, but a 100-ton object takes some stuffing when you move it with a crane. So I've seen instances where casks have been bruised and scraped. And in order to keep the fleet in a pristine condition, it's very important to have not just only good maintenance policies but proper facilities to undertake the maintenance.

COGEMA has at the La Hague site its own dedicated cask maintenance workshop. We can take casks and strip them down completely to their individual component parts, repair and upright any superficial damage, and put them in a new condition, something not to be forgotten if you're embarking on a big fleet campaign.

On the logistics side, in the early days of my involvement in spent fuel transports, we used to track the position of the cask by regular contact with the rail companies. I should point out that in Europe the way in which shipments are organized is perhaps different to what you envisage in this country.

From a physical protection point of view, these are not Category 1 shipments. If there is any plutonium involved, such as mixed-oxide fuel or plutonium itself, those are performed with high security vehicles, escorts, etcetera. Spent fuel and high-level waste travels as normal freight. There are no escorts in Europe.

So in order to track closely the positions of the individual casks, trucks, trailers, with the advent of technology we now have satellite tracking. And, in fact, routinely from our headquarters in Paris every single shipment is tracked worldwide, and it's very easy to identify the position at any moment in time of any particular package.

The operations center also serves as a command and control center in the event of any emergency incident.

Okay. One other challenge -- public acceptance. I'm glad we've got members of the public here today. I'd encourage them to ask questions.

Transport is in the public domain. Many of us have worked in nuclear facilities, and we kind of hide behind the fence and the regulations or white coats, whatever. Transport is out there in the public. We owe a duty to them to explain what the safety is about, and that is an ongoing process.

And I'm going to give you an example of what we described as a minor technical problem and how that kind of may be a disruption in our transport operations. This occurred in 1998. The previous speaker referred to weeping, I think, is that -- I would call it sweat out.

It refers to the instance whereby -- I'm not going to go through the numbers. They're straight out of the regulations. But basically, when a cask comes out of a spent fuel pool, it's decontaminated and cleaned down to very clean levels.

The phenomenon of sweat out or leaching is well known, well documented. However, in 1998, the frequency of these incidents led to a temporary cessation of the transports. This was called upon by, actually, the railway company, SNCF, who were not happy about the frequency, which is in the range of about 30 percent.

We can try and put it into layman's terms, what we're talking about. I think it's very interesting to draw an analogy.

Think of non-fixed contamination as wet paint. If a cask has been painted and that paint hasn't dried, if you touch it with your hands or if any equipment touches it, you can remove some of that wet paint and transfer it to the vehicle or to other places. Once it's dry and it's fixed, it is fixed. It will not come off.

We're not talking about leakage of the contents. Unfortunately, this incident was blown out of all proportion, and it was implied at the time that the casks were actually leaking.

The shipments were restarted within France within a small number of weeks. However, in Germany, where the political climate was such that the government were actually considering abandoning nuclear power completely, it took us two years to restart the transportation. So a small incident led to some quite big consequences.

How do we deal with the problem technically? Well, there was a meeting between the French and German governments, high level. They set up a commission comprising of members of the regulatory authorities in those two countries.

They were soon joined by representatives from Switzerland and from the UK, and they undertook a comprehensive review of the problem itself, what was the root cause of these contamination incidents, why we were seeing instances of contamination on rail cars, hot spots on casks, and they looked at it from all angles.

One area they looked at was the actual methods of measuring the contamination. You saw earlier the smear test. What they found was that there are differences in the techniques and the procedures between the individual countries, in some cases differences in the equipment, in the calibration, which led to false indications.

We're talking very, very low levels of contamination. So it's not inconceivable that a consignor will clean the cask, certify it clean, and ship it off. Somebody with a different instrument will measure it and declare that there are hot spots. So that was one area.

The other area they looked at was how to prevent from -- the contamination from taking place completely. Very interesting areas they looked at. Of course, the root cause of the contamination itself is the contaminated pool water.

And they did an examination with ALARA principles. That is to say, looking at what the dose implication would be to the workforce for choosing technical solutions. One solution would be to actually clean up all of the spent fuel pools, eliminate all of the dissolved fission products or the activation products -- cobalt, etcetera.

Technically feasible. Of course, we're not talking cost here. We're just talking technically. Technically feasible.

But from a dose point of view, the collected contaminant particles would be in filters. These filters would have to be handled, removed, disposed of, and it would actually create more of a dose uptake than other solutions to prevent contamination.

They came up with some very innovative methods to reduce contamination actually, such as in the surface of the cask. I'm going to show you a photograph now. But the message I would like to say is that in order to solve a problem like this, which involved different countries, different operators, different languages, different authorities, you really need to have very close collaboration between all the parties concerned. And that's what we achieved.

Next slide, please.

Okay. This is just a photograph showing the conventional cask loading facilities in a pool. On the left-hand side you see a spent fuel cask under water, the lid being manipulated, and on the right-hand side is some of the preparation operations.

Next slide.

This shows a new technique which is used today in many reactors in Germany and in France. What you see under the vinyl cover is a spent fuel cask ready to go into a pool. Underneath that vinyl cover is a stainless steel jacket which covers the finned area of the cask.

So with this dual barrier system and the introduction of clean water between the cask and both the stainless steel skirt and the vinyl cover, you can effectively prevent any contact between contaminated pool water and the cask surface.

Next slide, please.

This just shows after a fuel loading with the lid positioned, washing taking place. So it is possible technically to overcome this sweat out problem by handling procedures.

Okay. Next slide, please.

All right. Just to sum up the experience in terms of quantity, a few more figures for you to look at -- 30,000 metric tons of spent fuel shipped by the COGEMA group worldwide, many, many thousands of cask miles, millions of cask miles in effect.

More recently, we're building up a history of high-level waste shipments almost -- as in terms of high-level waste being shipped to date.

Next slide, please.

And in conclusion, we can tell you that safe transports are possible by careful management. The safety record can be maintained. But I can also say, quite honestly, that the safety culture in the COGEMA companies is very, very strong, right from the top down. The corporate culture of safety and quality and excellence adds to that success record.

But, again, public acceptance is a major issue. We're out there every day shipping fuel. Sometimes we have to talk to people who are concerned about rail shipments, sometimes about truck shipments, sometimes about sea shipments. It could be the other side of the world. We have to listen to them, and we have to respond.

And, finally, I would just like to say that COGEMA is very willing to share this experience with others. Those members of the committee who would like to visit any of the facilities, you're very welcome to do so, if you'd like to contact me through Tim.

I would also like to extend that invitation to all members of the public, but I'm not sure if the facilities are open to the public. They were closed down after September 11th. I see one of my colleagues here. Are they open again? No, not for the moment. So I'm sorry about that.

Thank you for your attention, and I'm now ready for any questions.

MEMBER LEVENSON: Thank you.

Mike, do you have a question?

MEMBER RYAN: I'll ask my neutron question again. If you lose your neutron shield, can you give me some estimate of external neutron dose rates on the surface of a cask?

MR. HUNTER: Again, I'll give a very hesitant answer. It depends on the fuel and the particular cask. The TN 12s -- they have a solid external neutron shield of polyester resin, so it would be very difficult to lose that.

MEMBER RYAN: So you probably even haven't touched on that accident analysis?

MR. HUNTER: In the accident analysis, we do assume that the neutron shielding capability is lost. We do assume that.

MEMBER RYAN: But no, you have no numerical estimate?

MR. HUNTER: No. But in -- if you look in the regulations under Fire Accident Conditions, you are allowed much higher dose rates anyway.

MEMBER RYAN: Sure.

MR. HUNTER: As opposed to --

MEMBER RYAN: The other question --

MR. HUNTER: I couldn't give you a general figure, it varies so much.

MEMBER RYAN: Okay. The other question I have is on the dry transfer situation. If I understood you right, this is actually a dry transfer in the sense of the cask isn't dry.

MR. HUNTER: Yes. It is --

MEMBER RYAN: It's actually hooked up to a pool.

MR. HUNTER: Yes. The photograph that was shown early on was of a system which is operated at La Hague T0 facility.

MEMBER RYAN: Right.

MR. HUNTER: Where the dry cask is hooked up to a dry cell.

MEMBER RYAN: So you're doing air lifts of fuel.

MR. HUNTER: We're doing air lifts, yes. That operates 24 hours a day remotely, very low dose operation. The operation is a very safe system.

It's a similar system in the French 1300 megawatts reactors. In that case, it's actually wet loaded. Dry from the sense that the outside part of the cask is in a dry area, but it's ducked to the underside of a spent fuel pool. So the inside of the cavity is wet.

MEMBER RYAN: Could you talk a little bit more about the experience you have with air lifts of spent fuel? Because I guess that's going to be more in play at Yucca Mountain.

MR. HUNTER: Air lifts, in what sense?

MEMBER RYAN: Contamination control, operational issues, anything of that sort.

MR. HUNTER: Do you mean of airborne contamination?

MEMBER RYAN: Yes. Just, you know, I mean, when you -- I mean, you have to decouple the cask after you load it. You know, I mean, do you have any other special issues with air lifts?

MR. HUNTER: In terms of the draining and the drying of the cavity.

MEMBER RYAN: Yes.

MR. HUNTER: Yes. Well, procedures have been developed over the years -- vacuum drying equipment with filters, etcetera. We don't generally have any particular radiological problems from airborne contaminants from the drying and draining processes.

MEMBER RYAN: Thanks.

MEMBER LEVENSON: John?

MEMBER GARRICK: My colleagues will be glad to know I only have a couple of questions. My second question has four parts to it.

(Laughter.)

CHAIRMAN HORNBERGER: And 16 subparts.

MEMBER GARRICK: That's right.

(Laughter.)

How do you get the heavy cask recovery equipment on site? And what kind of times are required for that for some typical scenarios?

MR. HUNTER: The heavy recovery equipment would be delivered by special trailers. Obviously, it isn't something that you would deliver to a remote area in a number of hours. It might take a number of days.

In terms of emergency response, the first crews who would arrive would do radiological surveys to verify what the condition was. If there's any direct remedial action required, they would be taken by technicians. Engineers would work with simple tools.

The recovery operation can actually take place in a leisurely timeframe, perhaps some days after the event.

MEMBER GARRICK: So there would be an advanced team of some sort in the emergency response sense.

MR. HUNTER: Typically, yes.

MEMBER GARRICK: Yes. Maybe this is a

question that would be addressed to everybody, even maybe the NRC. But one of the things that's been kind of impressive about the last two days' proceedings has been the amount of experience that actually exists in the transport of spent nuclear fuel.

My history of doing risk assessments of nuclear powerplants, we have not been blessed with such a rich database for our analysis.

Now, here is a case where the nuclear industry seems to me is in kind of a unique shape in terms of experience. The problem with it is that it hasn't been very well organized, and there seems to be a tremendous opportunity here to integrate and correlate a handsome database that would greatly facilitate questions from the public on matters of transportation safety.

And I'm thinking here of a capable data-oriented team looking at all of the data and doing some data partitioning of the type that really is useful in analyses. And such partitioning that comes to my mind would be fuel type, cask type, fuel handling, distinguishing fuel handling from transportation, distinguishing storage or interim storage from transportation, empty cask shipments.

I think the opportunity is really a great one to put forth in hands of the industry a database that would go a long ways towards substituting, if you wish, for a great deal of analysis. Is there any institution, organization, in any of your countries or affiliations, and maybe the NRC, that have considered doing just that?

MR. HUNTER: Well, I know there are database type of information that is available at the IAEA in Vienna in certain categories. Certainly, COGEMA itself has archived all of its shipment data, and we'd certainly be very pleased to put that together in the form of a database, form a suitable commercial arrangement.

MEMBER GARRICK: Yes.

(Laughter.)

And maybe the DOE people -- have you had any activities that would be of the type to try to integrate the transportation database into some more meaningful package?

MS. CLAPPER: It's an interesting thought. There is nothing out there that I can refer to that has that type of database.

MEMBER GARRICK: See, the reactor operating experience has gone through some of this same kind of evolution of being integrated and brought together. And the impact of that database has been enormous in terms of making the issues much clearer to the public on the basis of experience.

There is this tendency to say that we're dealing with something that is extremely mysterious, extremely dangerous, and about which we know very little. And here is a case where we know just a great deal. And I would much rather have data answer my risk questions than have to rely on analysis, as much as I love analysis.

And I think the opportunity to do that -- to do just that is here, and that would be one of the bottom lines that I get out of this whole workshop.

MR. HUNTER: If I could just answer that. I think the UK and French competent authorities do keep statistics in terms of incidents for all radioactive packages. They would have to be analyzed to isolate out spent fuel and high-level waste.

MEMBER GARRICK: Yes. Yes. And I think the partitioning here of the data into the right kind of categories would be very important, and also extremely valuable.

MEMBER LEVENSON: Ray?

MEMBER WYMER: Because of the nature of COGEMA's work, you must deal with quite a broad spectrum of fuel types that you have to ship. Can you talk just a little bit about the -- any special shipping problems that arise because of this spectrum of fuel types?

MR. HUNTER: Problems that arise? I think most problems are resolved by long-range planning. I can tell you I've been involved in projects where we've contacted utilities five years before they plan to ship fuel.

And during that five years, we've identified what equipment and procedures they need to have in place in order to make smooth shipment possible. And also, if necessary, develop new baskets to suit the fuel type, obtain licenses, etcetera. So most of the problems have been anticipated.

At a practical level, what tends to happen if you look right across the board of PWR and BWR fuel types, although they are notionally very similar, the details are extremely wide ranging in terms of geometry, the physical nature of the fuel bins, the materials, etcetera. There is a wide range of material out there, and you really have to get down to the very fine detail in order to ensure that you --

MEMBER WYMER: Well, do you not deal with things other than PWR and BWR fuel shipments?

MR. HUNTER: Yes. There are AGR --

MEMBER WYMER: That's right.

MR. HUNTER: -- fuel. I've dealt with Magnox fuel.

MEMBER WYMER: Yes.

MR. HUNTER: In the UK. I've dealt with wet fuel shipments. That is to say, casks partly filled with water. They pose particular problems.

MEMBER WYMER: Yes. Well, some of these fuel types are a good deal more fragile than others, and I wondered if in an accident situation that causes any special considerations.

MR. HUNTER: Well, from my experience of shipping irradiated PWR and BWR fuel, I've never known an instance where fuel has failed during shipment. Routinely when casks arrive at La Hague, the fuel would be sifted, checked, and --

MEMBER WYMER: Well, Magnox are not as rugged as --

MR. HUNTER: Magnox is a different thing because that's corroding all the time.

MEMBER WYMER: Yes.

MR. HUNTER: That's why it has to be reprocessed.

But an interesting instance -- I mentioned minor instances on traffic. I was involved in a shipment in Europe of spent fuel to La Hague, and there was a 50-ton truck -- cask which slid off the road and actually went onto its side and landed in a field. Very little damage, just some paint scraping.

But we took the cask back to the reactor station, which was only a few miles away, and we examined the fuel by taking water samples, because these were water-filled casks, and we found there was no -- it was very robust.

MEMBER WYMER: Okay. Thanks.

MEMBER LEVENSON: George?

CHAIRMAN HORNBERGER: I don't actually have a question. I'd just make a comment, then compliment you. You stated that you wanted to keep us all awake until 5:00, and you did so admirably.

MR. HUNTER: Thank you very much.

(Laughter.)

PARTICIPANT: Now you can go back to sleep.

(Laughter.)

MEMBER LEVENSON: Any questions from the ACNW staff? Question?

MS. GUE: Lisa Gue with Public Citizen, and I do appreciate your indulgence in hearing the public comments that I've made at this meeting.

And the two hopefully brief, since it's the end of the day, comments that I wanted to make are just general, not specific to your presentation, but general to this meeting overall and to ACNW's continued consideration of nuclear waste transportation issues.

First of all, just locating this within the current context, while NRC holds specific responsibility for licensing high-level waste transportation casks for general use, these conversations obviously are happening right now at a time when NRC also holds responsibility in the licensing phase of the two projects -- private fuel storage and the Yucca Mountain Project -- that would initiate unprecedented nuclear waste transportation in this country.

And I think it would be very helpful for ACNW, or the NRC as a whole, to be able to consider these transportation questions in -- within the specific context posed by those projects. And yet the Department of Energy has not put forward the specifics of the transportation plan for the Yucca Mountain Project.

There has been an assumption during this meeting of preferred rail transportation routes. But the Department of Energy has not specified -- has not gone on record with a decision about a mode of transport for Yucca Mountain.

There has been some assumptive statements made about how many tunnels Yucca Mountain shipments would pass through, what other materials might be on trains going to Yucca Mountain. And, again, there has been no specific decisions made about shipping parameters for Yucca Mountain or much less -- much less the modes of transportation.

And in the case of private fuel storage, the information on transportation has been similarly minimized in the environmental impact statement. And this not only does not inspire public confidence -- this tendency of the Department of Energy to apparently conceal this information is how it appears.

It does not only not inspire public confidence, but it also makes specific analysis as to the environmental impacts and public health impacts of transportation impossible. So, again, as I mentioned yesterday, we would be very happy if the committee would recommend that the Department of Energy come forward with some of these specifics and present them for public scrutiny and expert technical scrutiny as well.

And, secondly, I mentioned yesterday that the focus seems to have been, in terms of accident risks, on fire and impact consequences. Of course, there are other regulatory accident parameters that have not been discussed.

In addition to that, I would hope that the committee might consider also the non-accident impacts of nuclear waste transportation, particularly in the context, again, of these large-scale shipments that are planned. And this, again, would require some information about the routes that are to be used.

But given that the casks licensed by NRC do not completely contain radiation, there is a public health impact from repeated close contact with these shipments as they pass by. And there are demographic considerations as to who lives close to the shipment routes.

And as one of the presenters mentioned yesterday, when -- where these shipments might stop if they have to stop, and how often they might be stuck in rush hour or gridlock traffic. So that seems to me -- of course, consideration of the accident consequences is very important. But, additionally, it seems to me the non-accident considerations equally merit your attention.

So thank you again for having me here.

MEMBER LEVENSON: Questions or comments?

MR. SHAFFNER: My name is Jim Shaffner with Parallax. I actually have a question for the speaker.

Given the large reliance on nuclear power in Europe, is the public at large better able to understand the issue than perhaps the public in this country? And thus be less susceptible to some of the arguments of people who are opponents of the endeavor?

MR. HUNTER: It's very difficult to generalize with Europe, because it's a mixture of countries, a mixture of cultures. But certainly, in France --

MR. SHAFFNER: France was what I was specifically thinking about.

MR. HUNTER: -- nuclear power is well accepted. In fact, most French towns, the local mayor would be very happy to have a nuclear power station built in his area, because it brings jobs, it brings economy, etcetera.

I think also the fact that both in France and the UK there has been a concerted effort of public outreach, public acceptance information, that must have helped to allay some of the public fears. We saw yesterday the smash hit CGB train crash, which was done some years ago.

I personally think that was a wonderful demonstration for public acceptance -- a scientific study. I'm not talking about gaps, etcetera. But for the guys in the street to see a train crash into a spent fuel cask, and the cask doesn't leak, is a real demonstration of safety.

MR. SHAFFNER: Are radiation issues -- are radiation education part of the general education curriculum over there, like they are kind of not in this country?

MR. HUNTER: I don't believe so.

MR. SHAFFNER: Hmm?

MR. HUNTER: I don't believe so.

MR. SHAFFNER: Okay.

MR. HUNTER: You know, radiation is something which people are very afraid of until they go to the hospital. Very quick to take an X-ray.

MR. SHAFFNER: Thank you.

MEMBER LEVENSON: Any other questions? If not, I will declare the workshop at an end and turn the meeting over to our Chairman.

I want to thank all of the speakers and

the audience for their patience and indulgence also.

CHAIRMAN HORNBERGER: Yes. And I will echo that thank you to all the speakers. Excellent day and a half meeting.

I am now going to declare a 10-minute break, and then we will reassemble. The committee will have some discussion about the workshop, because Milt wants us to while everything is fresh in our mind. Ten-minute break.

(Whereupon, the proceedings in the foregoing matter went off the record at 5:07 p.m. and went back on the record at 5:18 p.m.)

CHAIRMAN HORNBERGER: Okay. We're going to reconvene. I anticipate that this will be a relatively brief part of the meeting.

What we want to do is Milt is going to be tasked with preparing a letter report to the Commission on this workshop, and he wanted to make sure that we got down our initial thoughts on what might be in such a letter. And so let's go down the list here, the line here, and just give our preliminary thoughts.

Mike, do you want to start from that end?

MEMBER RYAN: Sure. Really endorsing what

John said about gathering this data in a database I think is probably the principal or one of the principal things we could offer as being helpful.

I was, as John mentioned, very impressed with the international numbers, all are different experience from DOE, DOT, and other points of view. And I think it will be instructive to systematically gather that, so it is available for good analysis to really get a broader integration of the experience to see what maybe true rates are and those kinds of things. So that's one.

I'll defer for the moment.

MEMBER GARRICK: Yes. I think that would be my number one recommendation. The other thing that I think is very important for the letter would be a few highlights of some of the things that came out of the workshop that were of great general interest.

You know, we talked about the emergency response problems associated with the cask, that while it may be leak-tight, it may have lost some of its shielding. And I think that kind of question needs to at least be addressed.

I think the different approaches that are used in the different entities are extremely valuable and need to be highlighted and summarized. I'm thinking of things like the positions of the different groups with respect to things like special trains or dedicated trains.

I thought it was very interesting that the Europeans tend to not only not think in terms of special trains. They don't think in terms of escorts. And there's reasons for these kinds of things, and I think we need to -- it would be important for us to acknowledge that.

So I think that in addition to some sort of a recommendation about taking advantage of this database, because this is one case where probably risk assessments in the sense that I usually would recommend would probably be unnecessary because of the supporting evidence.

And even where it is necessary, the supporting evidence is such that the uncertainties could be pretty minimum. But beyond that, I think highlights of the important lessons learned -- I thought the information that the utilities presented on the problems with the casks was extremely valuable and hasn't been discussed a great deal.

And the practical issues associated with cask handling and cask movement and the distinctions between transporting and handling and the other phases of the whole operation that came out of the two days I thought were -- was valuable.

So I think there's a real opportunity here for us to highlight some information that the Commission would be interested in, in addition to making some recommendations.

CHAIRMAN HORNBERGER: So we have on record that John Garrick recommends an actuarial approach to risk analysis.

MEMBER GARRICK: That will be the first time in my life.

(Laughter.)

The first time I would ever recommend that.

MEMBER LEVENSON: But not often do you encounter something that really has --

MEMBER GARRICK: That's right. Why do a risk assessment when you know the answer?

MEMBER WYMER: Well, I want to -- since it's already been seconded, I'll third the support of John's statement about coordinating, correlating, gathering, and analyzing the transportation data. And you can make a very good case on the basis of just providing a risk-informed background or regulation in this area.

I also thought that there was quite a bit of discussion about public participation, and that people seemed to be -- have made a best effort to communicate with the public. As we all know, that's an extraordinarily difficult thing to do sometimes, but I was sort of impressed by the fact that people seem to be trying, people in the industry.

I thought that also I was encouraged, and think we should make a note of the coordination among the various organizations involved in transportation as ratified by that. The DOT, the American Association of Railroads, and DOE, that this is a good thing and people ought to know that it's being done.

I think we need to pay attention -- I think we ought to make a note and make mention of the fact that there was public concern expressed about areas other than the technical areas at which this specific meeting was directed. We do not apologize for what we did and didn't do.

We stated clearly what our goals were, but that doesn't mean we covered all of the important bases that are out there to be covered. And so we ought to make note of the fact that these people are concerned about routing, which we don't have any input from DOE yet, at least not specific, and some of the other public concerns.

And that's my first crack at observations.

CHAIRMAN HORNBERGER: Let's see. I think these are all good. And I guess I think that it is probably important for us to point out that what we heard on the first day in terms of the shipping casks and the analyses, which, of course, is the real NRC responsibility, indicated to me that our methods of analysis have really improved.

It appears to me that people can do an excellent job on these analyses, and that all of the experience, everything points to the fact that the existing NRC regulations are entirely adequate to do -- to specify a cask that is very robust with respect to realistic accidents, both rail and truck accidents.

And I think that's -- that would be important for us to point out, if, in fact, we go back over the information that we got at the meeting, that's what we include. That's certainly what I took away from yesterday morning's meeting.

MEMBER LEVENSON: Are there any -- any of the other -- any of the rest of you have comments on yesterday's meeting?

MEMBER WYMER: I certainly agree with the statement that George made about the -- there seems to have been a quantum leap in the sophistication of analyses of cask responses to accidents -- accident conditions.

MEMBER LEVENSON: I think there's a small problem. I think improved methods of analysis are available. It wasn't clear to me they're being used.

(Laughter.)

MEMBER GARRICK: I think, Milt, regarding your yesterday -- your comment about yesterday, I think one of the things yesterday that impressed me a great deal was the discussion between Sandia and Livermore, particularly in regard to modeling, and the tradeoffs that you can make between tests and analytical models.

I think there was a very important message there that could be put in sort of the context of how the labs could reinforce each other in terms of one going down one direction and another one going down another direction. And the opportunity that that provides for some sort of effective compromises.

CHAIRMAN HORNBERGER: You're recommending collaboration amongst DOE labs?

MEMBER GARRICK: I'm recommending -- yes, right. Absolutely.

(Laughter.)

CHAIRMAN HORNBERGER: Mike Lee?

MR. LEE: We should only recommend things that are possible.

(Laughter.)

MEMBER GARRICK: Well, I have a habit of bringing up the -- those kind of things.

MR. LEE: No. The only point I was going to make is just acknowledging there's a lot of horsepower in the Livermore analytical capability. And this marriage would seem -- I mean --

MEMBER LEVENSON: Incidentally, Mike, for one of the questions we had raised earlier during the break because of the very efficient staff person on this project located and got delivered here someone from the regulatory side who was involved in licensing the casks. And I'll give you the number -- what happened when the neutron shield is gone.

If both boral and plastic is completely gone, the requirements for licensing is that they have to demonstrate a maximum field of one r per hour at one meter. No neutron shield at all. They're used whether boral or plastic. Any neutron material has gone.

There's no way that it might --

MEMBER GARRICK: And it's limited to an

emergency response issue.

MEMBER LEVENSON: Emergency response and one hour -- one r per hour at one meter.

MEMBER RYAN: Well, I think that's an important element. It was a question that was raised that I just did not have any number in my head, and I appreciate that -- one r per hour in an emergency circumstance is certainly not life threatening, and, you know, that combined with the information that we did have about the lack of breach of casks, I think that's an interesting bounding situation.

Thank you.

I also learned one of the other audience members mentioned to me that that analysis is, of course, as you pointed out with the regulatory requirement, typically in all of the safety analysis reports. And I'm sure for every cask design that's calculated it's just a matter of pulling that together, but that's helpful.

MEMBER LEVENSON: Okay. Tim, think we've got enough to do a letter?

MR. KOBETZ: I just want to make sure that you've got enough on yesterday's from what -- I know that you've got a lot of views on it, too, Milt, so maybe I'll let you --

MEMBER LEVENSON: I've got some notes.

CHAIRMAN HORNBERGER: Let me raise a question. We heard in the fire analysis summary for the Baltimore Tunnel -- and one of the things that at least had gone through my mind was sometimes a presentation of an analysis that is, shall we say, less than realistic, i.e. an infinite supply of fuel burning at the hottest temperature, and then also presenting this threshold temperature of -- is it 1058? 1058? As some magical number when it really doesn't have anything much to do with anything?

And I think that there is -- all I'm questioning is whether we want to make a comment on a presentation issue. We've done this with respect to TSPA and doing unrealistic analyses and perhaps raising the concern --

MR. KOBETZ: The technical basis for the 1058?

CHAIRMAN HORNBERGER: Yes.

MEMBER LEVENSON: Go ahead, Mike.

MEMBER RYAN: George, I was thinking about something similar, and maybe we could broaden it to this question that -- we heard a lot of information. Some of it was very familiar to me and some wasn't, and I took note of the fact that I think it's very important for us to either comment on or consider -- and maybe not comment on -- the notion that it's very important to match the testing with the goal.

You know, if it's a specific technical test to meet a criteria that's very analytic, that's one kind of situation. If it's a system engineering performance demonstration, like a drop, again, against some kind of criteria, that's maybe a second.

And then third is more of a global demonstration of performance like a crash test where perhaps it's more visual than anything else, that something does survive a catastrophic accident -- controlled, but nonetheless a little different slant on it that we might want to talk about those three different kinds of tests, because it seemed to me that sometimes people would very quickly talk about data for one kind of a test in another context and switch back and forth.

And that sometimes is helpful, but sometimes, frankly, is confusing. Maybe we want to touch on that point. I think that's along the lines that Milt has talked around about, you know, what is the appropriate highway crash speed and those kinds of issues.

MEMBER LEVENSON: You know, the 1058

raised an interesting point in the sense that it's an old, old number from previous times for previous purposes prior to attempting to be -- to risk-inform anything. And I think maybe we might consider commenting that as things come into current use that are that old, they really need to be reviewed to make sure that old numbers are neither too high nor too low.

We don't know sometimes which way old numbers are, but we should -- just because it's embedded in a regulation that's N plus one years old, it shouldn't be considered cast in concrete when it's coming into use for new applications that really need to be updated, best estimate today's world.

MEMBER GARRICK: I think you've characterized it well. I think it -- what this committee has tried to be constructive in is advising the Commission on how to interpret the risk-informed regulatory practice business. And I think connecting these kinds of numbers that grew up out of a more prescriptive time --

MEMBER LEVENSON: But it didn't make any difference.

MEMBER GARRICK: -- when it didn't make much difference, and at a time when the approach to licensing was pretty much design basis and the prescribing of critical parameters to making sure that these kind of parameters aren't really causing some obscurity with respect to the implementation of risk thinking.

So I think you've got it -- this to the context that it should be discussed.

MEMBER WYMER: I'd like to make a point again that we made it -- the point strongly in a previous letter, but I think what came out of this workshop discussion yesterday makes it important to say it again, because the question arose again of sorting out the practical safety-related aspects of cask safety and risk on the one hand, and those data that we gather with respect to research areas, the things that we're interested in just to validate the models that we have that go well beyond anything we expect the cask to experience.

That's a very important point. It keeps coming up, and it's a gadfly, and we need to make the point again and try to lay the issue to rest if we can somehow.

MR. KOBETZ: I've got a question with regard to the 1058. Would it be helpful if I got the committee the staff's position on why they use that for the peak cladding temperature?

I mean, they've got the database on that, but I know they are also looking at, is that a number, or should they use something else? So I'll try to find out what information I can on that tomorrow.

CHAIRMAN HORNBERGER: Yes. Okay. That would be good.

MEMBER LEVENSON: You might also ask them why they use 1058 in a shipping cask of old dead fuel, and the use a similar number of over 2,000 degrees in reactor core accidents, where you've got an energy dispersive mechanism. This is just incredible inconsistency.

CHAIRMAN HORNBERGER: I'm actually interested in the number of significant figure. Okay? Why isn't it 1059?

(Laughter.)

MR. KOBETZ: All I can tell you is it's based on some test data. And I can't remember where the testing was from, but I'll find that out for you.

CHAIRMAN HORNBERGER: Okay. Any parting comments here? I'm getting ready to --

MEMBER LEVENSON: Yes, let's part.

(Laughter.)

CHAIRMAN HORNBERGER: Okay. We're

adjourned for today.

(Whereupon, at 5:37 p.m., the proceedings in the foregoing matter were adjourned.)