UNITED STATES

NUCLEAR WASTE TECHNICAL REVIEW BOARD

# FALL 2003 BOARD MEETING

Wednesday, September 17, 2003

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Dr. Michael Corradini, NWTRB
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Dr. Ronald Latanision, Session Chair
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# I N D E X

P R O C E E D I N G S

(8:00 a.m.)

LATANISION: I'm Ron Latanision and I am pleased to chair this session this morning.

Let me say before we begin that I want to applaud the wisdom of having this breakfast meeting with the folks from Nye County. This has been really a wonderful opportunity to talk to a number of you this morning. I especially want to mention a conversation I had with Grant Hudlow and with Joe Payer. This conversation is pretty far-reaching. We talked about everything from the beautiful landscape here to Grant's interest in chemistry which is sort of obvious given some of his comments during our meetings, but also to his interest in the politics of Nye County and, of course, in the Project and those kinds of issues. And, as we were talking, I asked Grant where he grew up and he said that, well, he grew up in Las Vegas and lived most of his life in this area, somewhere near this area. It reminded me, given this--you know, we're approaching the political season for the primary elections and it reminded a few years ago of an interview with a tv correspondent and a resident in New Hampshire. This tv correspondent was talking to this gentleman and he looked at him and he said, "Sir, have you lived all your life in New Hampshire?" And, this fellow

looked at him and said, "Not yet." And, it just struck me that that's a very timely sort of point of view on all of these things right now. This is obviously a very important issue to the people who live in the county and in the area. We're delighted that you're here, frankly, and happy to have an opportunity to talk with all of you.

Well, I'm also happy to welcome you to the second day of his meeting and to thank the members of the Board and the public who had an opportunity to talk. We really do value the input of the public in our discussions, as you know. So, these informal conversations are extremely important to us.

I'm very happy to introduce our first speaker, Mr. Henry Neth. It's obvious that another valuable source of information for the Board are the elected officials in the communities near Yucca Mountain. And, today, we're privileged to have Mr. Henry Neth, the Chairman of the Nye County Board of Commissioners present with us. He'll give us a couple of his thoughts.

And, Henry, welcome to this session. I don't see you, but I know you're in the room. There you are. Welcome.

NETH: Some of you may be expecting me to rip my tie off. I'm not going to do that this year.

First off, I'd like to just talk about a study that was done at the University of Minnesota many, many years ago

and it was about the great fears of human beings. During that study what they discovered was one of the top fears for human beings was--or the top fear for human beings was speaking in front of a large group of people. The number two fear was death. So, if I blow my talk this morning and I don't do a very good job, you'll understand why.

I'd like to welcome you guys to Nye County and tell you how much we appreciate you being here. Again, it adds credence to the fact that the Project is located in Nye County and that you would come out here and do your reviews and review the information that's been gathered just gives credence to the fact that you care about Nye County.

Nye County, the land of milk and bunnies, lizards, snakes, and honeys and I couldn't fit legalized prostitution in there, low-level waste storage, nuclear weapons testing facilities, bombing ranges, and missile proving grounds. This, along with legalized gambling, gives rise to some of the most interesting games of chance we'll ever talk about.

We've always recognized the importance of the Nuclear Waste Technical Review Board as a scientific oversight entity. The function that you perform for the DOE program and Nye's oversight efforts is invaluable and, frankly, to me, quite daunting. What I mean by that is with all the things that you know you know and all the things that you know you don't know and all the things that you don't

know that you don't know, when you apply this to the storage of high-level nuclear waste for the next several hundred thousand years within a 50 mile radius of 35,000 of my constituents, I'm just glad it's you guys and not me.

We strongly support these efforts and appreciate very much the support you've given and continue to give our own oversight activities. And, I'll preface that by briefly mentioning Mr. Andrews' presentation yesterday and his acknowledgement of Nye County's efforts over the years with their independent scientific program along with the cooperation of DOE. Greatly appreciated, Mr. Andrews. We trust your function will continue to receive support and full funding from Congress, as certainly hope ours will and any help in this room, John, that can be given us is greatly appreciated. We hope to be able to continue to work closely with this Board, with your staff for the long-term as this program moves forward.

In closing, I'd like to, once again, thank you for your continued support of our oversight and independent science investigation programs and for your recognition of Nye County and it's unique challenges and the fact that the Project is located in Nye County, not Las Vegas County. Welcome and good morning.

LATANISION: Thank you, Mr. Neth.

Our first technical presentation of the morning

will be given by Deborah Barr. She will discuss DOE's planned performance confirmation program. Deborah received a BS and MS degree in geology with emphasis in igneous petrology and geochemistry and has completed the course work for a PhD program. Her duties at Yucca Mountain have included full peripheral mapping, collection of fracture data, preliminary analysis of the fracture data, and writing of summary reports. Currently, she manages various aspects of the science program including the thermal testing program performance confirmation.

Deborah, welcome.

BARR: Good morning.

SPEAKER: Good morning.

BARR: Good, I was hoping I'd get a response. I see some friendly faces here. I have to warn you, I don't wear a watch. So, you might have to let me know.

I appreciate the opportunity to come and talk about performance confirmation. As was mentioned, I have oversight of the performance confirmation area. I also have thermal testing and I also have engineered barrier system. It's quite a span of topics. Until recently, performance confirmation has been probably not one of the greater ones that I cover. However, as we approach licensing, it's becoming a bigger issue. It's becoming more recognized and receiving more attention. And, I'm happy for that because

I've long looked forward to having serious interactions on the content of this program so that we could hear from others, you know, what they thought about the work that we're doing in this area.

Now, although I have the opportunity to give this presentation, what I'll be presenting actually is the great deal of work and efforts that have gone on in this area on the part of the BSC performance confirmation team. Jim Blink is the manager of the performance confirmation area. Ahmed Monib is the performance confirmation lead. As a part of the efforts that we have done in this area, we applied a decision analysis process that I'll talk about a little bit later. In that area, we were very fortunate to have the assistance of Karen Jenni and Tim Nieman of Geomatrix who gave to us their great expertise and experience in this area which I think added a lot of quality to the work that's been done.

So, next slide. So, first off, what I'll talk about today is what our vision of the program is and was as we were developing it. Then, I'll go on and talk about the processes that we used in selecting activities that we would include into the program. Then, after that, I'm going to describe the program itself. The activities that were included in it, I'll group them in areas and then the key components of the program. And, just to kind of give away the answer here, what we eventually ended up with at this

stage is 71 activities and they span the range of all of the barriers that are currently described in our project documentation, as well as disruptive events scenarios. And then, I'll end up with telling you about where we're going from here. We're at a certain stage at this point. It's an evolving program and I'll describe to you what the next steps are.

Next slide. Now, the first thing to understand is that performance confirmation is not the only testing and monitoring program that's going to be in place in the past, now in the future. There are a number of other programs and the ones in that really horrible shade of yellow with no intent to reflect upon the content of them are the ones that are called out by the regulation. Also, on that chart, I show the science and technology program. Now, this is not intended to be a comprehensive list of all of the testing monitoring programs that will be taking place. This is just some of them. In this area, you can see at the bottom at the middle it says "NRC specified tests". That is not intended to be a category of testing in and of itself. That is just to recognize that the NRC has the ability to specify tests in any of the programs that they define in the regulations. In the science and technology program, this is an area where we have quite a bit of interaction with them. We have had successful interactions with them in the past. They have

been very receptive to working with us on the things that can improve our program and they have already made some contributions in some of the technical areas that we have.

Next slide. So, what is the difference between performance confirmation and any of these other programs? Well, the performance confirmation program has activities that are specifically designed to confirm our technical basis for the licensing decision. That is as it's described in the regulations as the purpose of the program. And, also, this program will test the functionality of the total system and barrier performance. So, those are the primary purposes of goals of the performance confirmation program. Other testing and monitoring programs may have other purposes and goals and they may be things like increasing confidence or meeting other regulatory requirements. Now, this is not in any sense to say that performance confirmation activities will not increase confidence; however, that's not their primary purpose. They are to confirm our licensing basis.

Next slide. And so, the role and requirements for performance confirmation is, as I said, clearly laid out in the regulations. The NRC requires that we have a performance confirmation plan as a part of our license application. And then, they go on to say that this performance confirmation program should demonstrate that the system and subsystem components are behaving as predicted. You can see in the

text of the regulation on the bottom in blue that they say that, "The program must provide data that indicate, where practicable, whether natural and engineered systems and components required for repository operation, and that are designed or assumed to operate as barriers after permanent closure, are functioning as intended and anticipated."

Next slide. We've actually been working on performance confirmation for quite a number of years. I joined DOE for the most part in the summer of '98. I was working before that in the tunnel collecting data. But, in '98, that was when I first started working with this program and I worked on or off with it over the years since then. And, there was already a program in place at the time we were, you know, evolving this program over time and it was definitely in place even before I started working with it. So, when we looked at updating the program at this point in time, there were a number of motivations for doing so. The first, of course, was that we now have a finalized 10 CFR 63 that is available to us. So, we needed to make sure that the program was in line with that finalized 10 CFR 63.

We have available to us also the expectations as laid out in the Yucca Mountain Review Plan. We wanted to reflect the barriers that were important to waste isolation and this was, of course, something that is evolving over time. So, we needed to make sure that the program is up to

date in this area. And, we also wanted to use a risk-informed performance based process in determining how we should go about confirming barrier's performance. We also wanted to make sure that the program was consistent and compatible with repository operations. This changes over time. We need to make sure that we're keeping up to date on it. And, this program will continue to be updated over time. This version that I'll be describing today represents a snapshot in time. It's different from it was in the past. Will it change before LA? Probably. Will it change over the life of the program? Without a doubt. This is an evolving program. As we gain new information and a better understanding of things, this program will evolve to reflect what information is available.

Next slide. So, as we were looking at revising this program, what were some of the things that we were looking at having in the program, what was our vision of the program? Well, first off, of course, it's based on 10 CFR 63 and the requirements therein, as well as the things that we can glean from the Yucca Mountain Review Plan. However, we understand that the NRC did not provide for us a checklist of activities that we had to meet in the regulations.

They provided guidelines for us and that the intent was for us to take a comprehensive and thorough look at those things that are truly critical in overall system and barrier

performance. And so, that is what we strive to do in the development of this particular version of the program. Not all activities are equally important. We needed to find a way to determine the complexity, extent, and number of activities that would be included and we did so in a risk-informed performance based manner, we believe.

This program needs to confirm operations rather than imposing substantial design requirements meaning that the performance confirmation program should not drive the design. It should be the other way around.

And then, finally, this program needs to provide DOE with the information that would be needed to support a license amendment for closure.

Next slide. So, I'm going to go on and talk about first the decision analysis process that we used in developing the performance confirmation program. I'll try to keep this somewhat brief because I know I've received feedback that, you know, it's too long, but I'll try to make it short and we'll get on to what you really want to hear about which is, you know, what's in the program itself. However, this is an important basis for our understanding why things are in the program and why they may not be. And so, I think it's an important thing for us to cover.

Now, the decision analysis process that we used is based on performance assessment. And, when I talk about

performance assessment, I'm talking about the process extraction, as well as the total system model. The performance assessment barriers and scenario classes were the bases for this effort, this decision analysis effort. And, performance analysis technical staff were providing technical judgments. Performance assessment managers were providing management judgments that all became a part of this program as defined here.

Next slide. Decision analysis approach has certain advantages that added to the overall quality of this effort here. By using this decision analysis approach, we can provide a consistent logical and defensible basis in evaluating and comparing activities that we might consider for inclusion in the program. This approach acknowledges that there are tradeoffs, potential tradeoffs, between different objectives and goals that you may have to consider as you're developing your program. And, the technical basis for this decision analysis approach was a formal multi-attribute decision and utility analysis. This approach basically is a technically sound mathematical method of evaluating alternatives when you have more than one objective that's important. It's also a tried and true method. It's been used in private industry, as well as the Federal Government, since the late '70s in evaluating complex decision problems.

Next slide. Now, I'm going to be using certain terminology throughout the rest of the presentation and I thought it would be helpful here to give you a little bit of a definition because sometimes it can be a little confusing. I'll be using the word "parameters". And, a parameter is a thing that can be measured or observed. For instance, a parameter might be temperature and relative humidity of the waste package. It might be rainfall. You know, it's something that you would measure. Then, when we talk about a method or a data acquisition method, that's the means for measuring that parameter. So, for instance, for temperature and relative humidity of the waste package, one method might be monitoring temperature and relative humidity in the air in the emplacement drifts. Or another potential method, data acquisition method, might be using a remote operated vehicle to make those measurements on the waste package surface in the emplacement drifts. Or, for rainfall, it might be having, you know, rainfall monitor--you know, equipment out there to make the measurements. Now, when we have a combination of a parameter and a method, a data acquisition method, that is an activity or a performance confirmation activity. So, an activity is both the parameter and the way that it's going to be measured.

Later on, I'll also be talking about portfolios. A portfolio is a set of performance confirmation activities

which is a--basically, it's a potential performance confirmation program. We looked at a number of possible portfolios that I'll describe later. Each of those was a potential performance confirmation program. Then, of course, the performance confirmation program is the selected set of performance confirmation activities.

Next slide. There was a three phase approach that was applied and I'll begin to cover the first phase right here which is activity evaluation. The second one was the development of the portfolios and evaluation of portfolios and the third was the selection, final selection. So, in the activity evaluation stage, this was basically combining technical judgments with management judgments, management value judgments. So, this phase right here, I'll talk about those particular aspects of it.

Next slide. Now, there are countless possible activities that you could have in a performance confirmation program and we needed to develop a way of prioritizing them, of looking at them to see, you know, which ones gave us more benefit, which ones were perhaps of lesser benefit. And so, to do that, we developed activity evaluation criteria. We had to have a clear idea in mind how to determine what we thought was important in an activity, what it is that we thought was truly important to determining whether it was needed in performance confirmation. And so, there was a

workshop held in August of last year in which three criteria were developed and defined that we then used in estimating the potential impact of a performance confirmation activity on the program.

The three criteria here, I'll walk through them. The first is sensitivity of the barrier or total system performance to the parameter. So, for example, if we are measuring temperature and relative humidity of the waste package, how sensitive is the barrier performance to that measurement or how sensitive is total system performance to that measurement?

The second is confidence in the current representation of parameter. If we're talking about measuring temperature and relative humidity of the waste package, what is our confidence in our current representation of that parameter?

And, thirdly, the accuracy with which the proposed activity measures or estimates the parameter. If we say that we're going to measure temperature and relative humidity of the waste package in the emplacement drifts by remote operated vehicle directly off of the waste package surface, how accurate is that measurement, that activity, at getting at what it's intended to get at?

The various people that were involved in this workshop were the technical investigators covering the

various areas, as well as the performance assessment analysts and managers. There was also DOE staff represented there.

Next slide. So, using those three criteria, a set of questions was developed. A questionnaire was developed that we would use in applying to each of the proposed activities. So, every single activity that was proposed, we have this questionnaire that was applied to it. The goal of having this questionnaire was to have the technical input--is determining how well any of the proposed activities meet the three criteria. Also, another goal of the questionnaire was to improve consistency across the model areas. By using the same questionnaire for all proposed activities, we gained a certain amount of consistency across the board.

There were workshops held a year ago this month in which all of the technical groups were represented. There were separate ones for each of the groups. And, in those--in the workshop, the groups would develop a list of proposed activities and it was pretty comprehensive. We started out with quite a number of proposed--well, I'm sorry, they were proposing parameters. Then, they went on to develop the data acquisition methods for each of those parameters and propose one or more methods of data acquisition for each.

And so, it must be senility setting in, I'm sorry. I thought I'd at least last beyond the 30s here, but--okay. And then, also at the workshop, there were--we walked

through the questionnaire for a couple of the activities that have been proposed by each of the groups so that they would understand how to apply the questionnaire, what the questions meant so that, you know, we were making sure that they truly understand how they were supposed to be answering the questions. Not in that we were giving them the answers, but they understood the intent of the question and what it was aimed at achieving.

Next slide. And so, very briefly here, I'm just going to kind of skim past this slide. But, the questionnaire basically was broken up into various things. The overall intent was to develop a utility for each parameter or for each activity. And, a utility, basically we distilled it down to a numeric representation of the utility or the benefit of that activity based upon their responses to these questions in the questionnaire. And so, getting at those three criteria that we talked about earlier, we were looking at things like the value of perfect information of the parameter. If you were able to obtain perfect information which, of course, we know is not entirely possible, what is the value of obtaining perfect information for that particular parameter. And that, of course, was broken down into things like sensitivity of the system performance or the sensitivity of barrier capability, sensitivity of conceptual models, as well as our confidence

in our current representation. So, those cover the first two. Remember the sensitivity and the confidence. Then, when we talked about accuracy as the other criteria, that's the right side of the chart here. There were questions derived at getting--aimed at getting the directness of the measurement and the accuracy of the proposed measurement. And so, at the bottom of the page here, there were some--it's probably too small for you to read from here--but these are some of the questions that got at those aspects of the criteria.

Now, the entire questionnaire is in the backup material and I should have mentioned this earlier. When you saw the thickness of the packet, don't despair. A lot of it is like backup slides. So, you can see the entire questionnaire at the back of the presentation in the back of the material.

Now, these were not open-ended questions. These were not fill in the blank at the end or anything like that. We gave them multiple choice answers and we defined the meaning of the possible choices and the multiple choice. You know, for instance, highly confident, moderate confident, you know, so on, and then we would give examples of what you might consider to be highly competent or moderately competent and so on.

Next slide. And then, somewhat concurrently at

this point, the managers the BSC managers were developing their management value judgments which were going to be added to those technical judgments. BSC managers reviewed the overall process that was being used to date at this point and they endorsed the criteria as being the appropriate criteria to be used in evaluating activities. They then answered a series of tradeoff questions which were designed around the very same questions that were being given to the technical people. These were to establish management value judgments about the relative importance of the criteria because even the criteria, not each one is equal in value, and so we wanted to obtain some management value judgments to determine the relative importance of the various aspects of the questionnaire. Those management value judgments were used in conjunction with the technical judgments, combined with them, to establish an overall utility for each activity. And, again, we have a cast of thousands involved in all this.

Next slide. And so, in summary, in Phase 1, we started off with 237 parameters. In summary of Phase 1. I'm sorry, I'm really not--almost done. We started off with 237 parameters and a total of 360 activities which were initially identified by the technical people. After discussion, evaluation, and consolidation with those same people--we certainly didn't do this in the absence of the people who provided that input--we ultimately ended up with 204

parameters and 287 total activities. Remember, activity is a parameter, what you're going to measure with how you're going to measure it. 287 total activity remained. Once the utility values were developed using that decision analysis process, you know, once they applied the questionnaire and we applied the management values and we came up with a utility for each of those activities, a meeting was held with the representatives of the technical experts. The results were presented to them so that they could see whether it really fell in line with their understanding or their belief in the importance of the various activities that they had proposed. In a few cases, they may have had reservations about the results that came out of the decision analysis process. They may have felt that the utility value which was applied to it was not really in line with their conceptual understanding of that activity. And, if that was the case, then these alternative rankings were carried forward through the development of the portfolios in the next phase. We then went on to do some initial cost estimates of each of the activities so that we could use them in the development of the portfolios.

Next slide. So, the next step, the next stage, was Phase 2 and that was the development of the portfolios. And so, first off--well, let's go ahead into the next slide.

Why do we want to consider portfolios? Why not

just, you know, have a list of activities, have their utility values next to them, rank them in order of the utility values, and just pick some arbitrary cutoff line? Well, there are a number of reasons why we wanted to look at portfolios or possible performance confirmation programs as a whole. You may not get the best portfolio by ranking them by utility and making some cutoff. There are some regulatory requirements which may not be captured in that way. As a matter of fact, in the list of total activities, there was at least one regulatory requirement which was not captured, at all, and we had to add in later manually. And, also, if you consider activities individually, then you may not account for potential synergies between them. Also, when we're looking at the potential costs of a particular program or portfolio, some of those can't be assigned on an individual basis. There's a potential for shared resources and that's for costs and infrastructure, as well, that can be assessed when you look at a portfolio as a whole rather than looking at individual activities. And then, also, by looking at a portfolio as a whole, we can compare it against the regulations and evaluate it for our regulatory compliance, as well as what the total cost of a portfolio might be.

Next slide. So, we developed a number of portfolios and there were a number--when you consider the portfolios, clearly, the idea is that you have some

distinguishing factor between them. There has to be some, you know, fundamental difference between possible portfolios. And so, these were developed in advance of actually, you know, just throwing things into a bin and seeing how they turned out. Some of these portfolios were looking at things like emphasizing, getting the best value for the available, you know, cost. There was another portfolio that looked at hypothesis testing. It had a philosophy of testing certain hypotheses. There was a portfolio that emphasized off-site work and another that emphasized on-site work. There was a number of portfolios that were developed along these lines. Each one of those portfolios was required to address all of the requirements in 10 CFR 63 and so we needed to make some adjustments sometimes to make sure that that was the case. But, every portfolio that was considered in Phase was believed to meet all of the regulatory requirements. And then, of the 11 portfolios that were developed in terms of philosophy, there were six that were then developed in further detail because we felt that they had more potential. And so, in that area, we developed more information as far as scope, costs, and robustness. When I say robustness here, I'm talking about robustness in meeting the regulatory requirements.

Next slide. And so, when we have these portfolios that we were looking at, there was certain criteria that we

looked at as far as being able to assess the differences between them, the potential advantages or disadvantages between them. We looked at things like mapping them against the regulations in 10 CFR 63. As I mentioned, all of them were designed to meet those requirements, but not all of them met them in equal amounts. In the backup material, there is a table where you can see that in the final portfolio that was developed, it maps it against the regulations. So, you can see the number of activities, the type of activities that were aimed at addressing at each of the parts of the regulation. We looked at total activity on numbers within each of the portfolio. We added up the utility value so that we could see what their total utility values were. Then, we also looked at the operating costs for each of the portfolios. We looked at things like the utility values as summed up for how they met each of the regulatory requirements in each of the portfolios. And then, we also did a subjective assessment of each of the portfolios against the requirements in 10 CFR 63.

Okay, next slide. And then, so what we ended up with at the end of Phase 2 was a number of portfolios to carry forward for consideration.

Next slide. At that point, the BSC manager of projects and senior advisors reviewed all of those portfolios and also the detailed evaluation of the six that were more

comprehensive. And, they selected one of the portfolios as a starting point. They didn't feel that any one of the portfolios was entirely satisfactory in and of itself. And so, they selected one of them as a starting basis for the program. They then asked that certain changes be made. They asked that in the areas where this one portfolio was judged to be a little bit weaker in terms of meeting the regulatory requirements, they asked that some activities be added to strengthen that regulatory robustness. Then, they also asked that the activities in the portfolio be described in terms of their relationship to the paragraphs of 10 CFR 63. In a sense, what they were asking to see was how we were going to present it to the NRC? What was the kind of text we were going to use in demonstrating to the NRC that we felt that we were adequately meeting all of the requirements?

Next slide. So, once that modified portfolio was developed, it was brought back before BSC management and in a series of meetings the BSC management then reviewed this modified portfolio in much more detail. They looked at every single activity very specifically and then they made adjustments to that portfolio based again on management judgment and on programmatic considerations. And so, of the initial list of activities that was brought before them, they removed 26 from the portfolio because they determined that those activities were better suited to other testing

programs. That they did not necessarily entirely fit the definition of performance confirmation. They were better suited towards the goals of some of the other testing programs. One was deleted. There were three that were combined with other activities because it was determined that they made a more logical unit as combined. Then, three activities were changed in scope to some extent and two new activities were added. Now, there's a table of these changes that's in the backup. So, you can see the specific activities that were removed, deleted, modified, added, whatever, and what the rationale was for it.

Next slide. And so, now we get to what is in the final program. The list of activities that made the final program is also in the backup and it's on Pages 67 and 68. I am not going to walk through them specific activity by activity, but I'm going to group them in a sense.

Next slide, please. These are going to be grouped in the next few slides into risk-informed categories. I'll start off by talking about activities related to the disruptive scenario classes, those with the highest risks scenario--well, I'll start with the highest risk scenario class first which is the igneous activity scenario class and then I'll talk about the activities related to the seismic. I'm then going to go on and talk about biosphere related activities that are downstream of the nine barriers and this

order is not to imply that these biosphere activities are the next highest risk ones. It's just that they flow better logically because they're somewhat tied to the previous material. Then, I'll talk about the nominal scenario classes and in the order described on this slide. I'll start with waste package and drip shield and then work my way down to cladding, waste form, and invert.

Next slide. Igneous activity is the largest single contributor to the probability weighted annual dose to the reasonably maximally exposed individual. And, because of this, the performance confirmation activities in this area are aimed at confirming the assumptions, data, and analysis of igneous events.

So, in this area, we have them broken up into three categories. The first is the probability of occurrence of igneous events. This covers things like drilling of aeromagnetic anomalies and updating our probability estimate with improved data sets that are available. We then go on and cover consequences of igneous events. So, this would be calculations and analog studies that get at the number of waste packages hit by magma. There's also work activities that relate to the behavior of contaminated ash, a number of activities. And, these get at the categories descried here in the bullets; ash loading, resuspension, redistribution, etcetera.

And then, also under consequences, we would incorporate improved data sets into an evaluation of the area and that may or may not end up being an expert elicitation. It would be whatever was the appropriate vehicle.

Then, there's also an activity related to precursor conditions and that satellite monitoring of regional extensional tectonics which is an ongoing activity.

Next slide. Seismic activity is expected to be a significant contributor to the probability-weighted annual dose to the RMEI. And, because of that, again we have activities in here which are aimed at confirming assumptions, data, and analysis of seismic events. And so, these may include things like extending our existing lower strain data set into higher strains, such as dynamic properties of rock and soil that are associated with major seismic events. Seismic activity in the regional sense and near-field ground motions would be another activity. This would be monitoring for seismic activity and its consequences. This again is an ongoing activity which we have done in the past and would continue on into the future. And then, of course, in the event of strong ground motion, we would have inspection of surface and underground for the presence of fault displacement in the drifts or things like that. This again would be, you know, one of those activities that occurs as needed in the event of an activity or in the event of an

event.

Next slide, okay. Now, the biosphere related activities, these are potential multipliers of dose. And, also, during the period of time prior to repository closure, human activities in the region are likely to change. And, because of that, we have activities aimed at getting at those factors. So, there would be a periodic survey of the reasonably maximally exposed individual characteristics and of occupational dust levels and this would be to conform that we've adequately captured the potential changes to these parameters in the work that we're doing now. This is an ongoing activity.

Also, natural analog studies for nominal and disruptive scenario classes looking at the movement of radionuclides added to soil and their migration back to the water table where there's a potential for them to be pumped back to the surface. Another activity is radionuclide movement to humans by plants and then also the radionuclide movement to humans by soil ingestion. And, this again is for nominal--all of these are for nominal and disruptive scenario classes.

Next slide. Okay. Now, the next categories that I'm going to cover are a little bit more geared towards underground measurements and so because of that I want to set the stage here by describing some of the facilities and the

things that will be available to assist in this program.

Here's a layout of--this is the first panel right here and you can see in red here there's an observation drift. This would be for performance confirmation and then there's also an alcove off of it here. These are part of the performance confirmation facilities. The third and the fourth drift in the first panel would be dedicated performance confirmation drifts. In this case, the plan is that they will be accelerated drifts where we will attempt to have a post-closure condition that we can look at in the pre-closure time period. And so, Drift 3 would be accelerated by adjusting the ventilation and this drift would be looking at near-field processes. On Drift 4, that would be accelerated by waste package aging and derating and the emphasis of that drift would be to look at in-drift processes.

Okay. Next slide, please. And so, in the waste package and drip shield area, we have some activities that are intended to look at both of those. So, I'm going to cover those on this page. The waste package in the environment created by the natural system is expected to isolate the radionuclides from the reasonably maximally exposed individual by preventing water from reaching the radionuclides. And so, in doing performance confirmation activities in this area, we would look at activities that get at the mechanistic details of waste package and drip shield

corrosion. So, these would be things like general corrosion, phase stability of Alloy 22, localized corrosion, and microbial corrosion. These are again ongoing activities, some of these are. Actually, I think all of these are. Yeah. And then, we would also work to strengthen the extrapolation over to 10,000 years.

Lab tests on mock-ups to confirm stress sources on the waste package and drip shield would be done and this would be looking at the consequence of rockfall and seismic activity. Then, again, there are activities related to waste package and drip shield environments and these would be in the thermally accelerated drifts we would use instruments to collect samples and we would have remote operated vehicles to look at the environment in there and do the activities related to waste package and drip shield. These would include things like temperature, humidity, dust composition, gas composition, and so on, you know, as is listed here in the bullets. And then, it would not only be testing that occurs in the accelerated drifts; it would also be testing which would occur in the emplacement drifts, as well.

Next slide, please. Those activities that are related to waste package only would be things like monitoring for radionuclides in the exhaust air. This would be having a sensor at the end of each drift that could measure for radionuclides, as well as measuring for temperature and

humidity. Also, we have the potential of monitoring the pressure seals of all the waste packages or as many as we deem to be important. This is an area where actually we've already benefited from working with the science and technology group. We had a vision of a kind of instrument that could be put between the lids of the waste packages that would be able to indicate a change of pressure. And, when we were working with the S&T group as far as discussing the potential technology needs that would be of assistance to the performance confirmation program, this was one area where they were able to work with us very closely and enable us to gain some information so that we know that this technology is essentially already developed and potentially we can use this in measuring the pressure seals of waste packages.

Okay. Now, next slide, please. For drip shield activities, the ones that relate to drip shield only, we have an activity related to acoustic and seismic tomography which would be looking at rockfall detection. Inspection of the drifts using remote operated vehicles. So, there would be, you know, a visual inspection. And, before you say, well, there's no drip shields in the pre-closure period, that's one of the aspects of the accelerated drifts is that potentially part of the drifts may have drip shields in place so that we could look at the behavior of those. With the remote operated vehicle, we would be looking at the other drifts in

terms of ground support integrity. Drift shape monitoring by remote operated vehicle is another of the activities that would be related to the drip shield.

Next slide, please. Okay. The mechanical, hydrologic, and chemical environment in the emplacement drifts depends on the properties of the host rock in which the drifts are excavated. Because of that, we have activities related to the preemplacement environment. First off, we would have--a lot of these are going on during construction. They would be taking place in all of the emplacement drifts to confirm our host rock assumptions, data, and analysis.

Mapping of fractures, faults, stratigraphic contacts, and lithophysal characteristics are activities that would occur. Hydrologic properties of significant fractures and faults. And, if any of those activities required the need to do some boreholes, those boreholes would not be located above waste packages. We would insure that they were off to the side or in alcoves. So, we wouldn't be boring any boreholes above the waste packages.

And, chemistry and age of pore water using chloride mass balance and isotope chemistry. Those are some more of the activities related to this area.

Next slide, please. So, in looking at the surface and the unsaturated zone above the repository, the activities

here are measuring for seepage into bulkheaded, low temperature alcoves, thermal seepage into the unventilated, thermally accelerated drifts that we described earlier, thermal seepage into ventilated heated drifts. Those would be the regular emplacement drifts. Also, precipitation monitoring so that this would get at seepage data and the inputs needed for that. Infiltration from rare high-intensity and long-duration storms potentially like the ones we had a few weeks ago. And then, also, seal performance. That's when it's explicitly called out in the regulations that we do seals testing.

Okay. Next slide, please. Now, in the unsaturated zone below the repository, we have just a couple of activities here. First would be monitoring for radionuclides in deep bore holes that were near the repository footprint and this gets at monitoring the unsaturated zone characteristics. There's also in situ tests of--and in situ tests of transport and sorption properties of the unsaturated zone and this would be in a drift prior to emplacement.

Next slide, please. Heat added to the underground facility by radionuclide decay will elevate temperatures for long periods and so these have a direct impact on the performance, as well. And so, coupled thermal processes is another area where we have activities. There is a planned thermal test in the lower lithophysal. This would take place

in the cross-drift in the ECRB. And, the primary objective of this test would be to look at thermal and thermal-mechanical processes. Secondary objective would be thermal-hydrologic and thermal chemical processes.

In Drift 3, one of the thermally accelerated drifts, that is one other one of the activities specifically aimed at getting at coupled thermal processes. And so, in that drift, we would look at near-field--we would have a near-field focus here and we would use the observation drift and the alcoves in terms of doing some testing and monitoring there.

Drift 4 again has the emphasis on the in-drift environment and that's the second of the thermally accelerated drifts. That would be looking at the engineered barrier environment focus and would be monitored by remote operated vehicle.

Okay. Next slide, please. In the saturated zone, we have a number of activities here. First would be monitoring for radionuclides in deep boreholes downstream from the footprint. And so, this again gets at monitoring the unsaturated and saturated zone characteristics. Then, also, the saturated zone chemistry and water levels. We would also look at saturated zone colloids and laboratory studies and then also saturated zone fault zone hydrology. These would be deep borehole tests and looking at faults that

affect the flow paths and rates.

Next slide, please. And then, we also have-- lastly, we have cladding, waste form, and invert. These are defined as barriers in our current project documentation, and as such, we have activities related to those. For instance, we would look at the radionuclide inventory in terms of what information we can gain from waste acceptance documents to confirm that we are actually putting in place what we anticipated that we were going to be putting in place. Sorption coefficients for waste form radionuclides. These are laboratory tests. Then, also, we would monitor cladding studies and these would be in terms of information from dry storage facilities and from academic and industrial research. Also, as far as the invert, we would measure the invert tuff gravel sorption coefficients with laboratory tests.

Next slide, please. Now, by the very nature of the decision analysis process, the different barriers that we assess were weighted in terms of their importance to waste isolation and because of that the number of activities in each of those areas reflects the importance of those particular topics to waste isolation. And so, you can see that in the decision analysis process, it was determined that waste package and drip shield were a significant contributor to waste isolation and because of that they have a correspondingly larger number of activities. Igneous

activity scenario class has also a great impact and so because of that it has a correspondingly larger number of activities. For areas such as the saturated zone or cladding waste form and invert, those were determined to be less risk and therefore needed fewer activities to address those.

Next slide. So, that covers the program that's been developed to this point. What I've described, so far, is all a part of what's being documented in Revision 2 of the performance confirmation plan. So, what I'm going to then go on and talk about now is where we're going from here and what the future has for the performance confirmation program.

Next slide, please. So, the next step is Revision 3. Revision 3 is scheduled for spring of next year. In that, we will expand certain areas. There will be expanded definition of the activities that take place or that are in the program. We'll establish the expected baseline for those activities. And, in conjunction with that, we will also establish allowable bounds and tolerances for parameters. Basically, what this means is that we need to be able to determine as we're making measurements, monitoring, testing, things like that when things are what we expect them to be and when we determine that they are significantly or reasonably outside of the bounds of what they should be such that it becomes something that would be of concern. So, we need to establish those allowable bounds for the parameters.

The Revision 3 will also have increased information on the management and administration of the program. It will identify the needed test plans for the activities. And then, also, it will define the--or in the document we will define the processes for reporting variances to the NRC and we'll describe the appropriate corrective action steps.

Next slide. Also, in this revision of the document, there is some information on the performance confirmation program clearly that has an impact on other departments in the project and they need to be aware of these. For instance, we need to communicate the design requirements and further details on some of the testing activities here. So, these would be things like the accelerated drift tests and that includes the Drifts 3 and 4 that are accelerated drifts, as well as the thermal test in the lower lithophysal unit. There will be design requirements in further detail on things like instrumentation and monitoring systems that we would have in the exhaust mains, seepage and water collection systems, as well as rockfall monitoring systems. So, this gets at coordinating between areas of the project here.

Next slide. Okay. We understand that technology changes over time and we know that we can benefit from advances in technology in some of these areas. We're certainly not going to put a system in place that isn't going

to be able to grow or that doesn't take advantage of the current technology that's available. And so, in the development of this program, so far, we have actually incorporated certain areas where we expect that the technology will become available within a reasonable time that we can utilize it. And so, because of that, there are certain activities that require feasibility evaluation in terms of whether the technology has yet been developed and is available and is ready for use. For instance--and this is not to say though that any of these are completely off the wall. I mean, it wasn't like, you know, anybody was sitting around over a beer and saying, wow, it would be really wild if we could do this. You know, these are things where we already knew that these were--we were heading in the direction of having this available to us. And so, these are not unrealistic expectations.

For instance, for remote operated vehicle, we know the technology is already in place for remote operated vehicle. However, we are hoping that the available technology advances to the point where we can have a reduced dependence on infrastructure and greater versatility. Radionuclide sensors with increased sensitivity. For instance, we talked about measuring for radionuclides in the exhaust mains. That's an area where we believe that the technology is out there. There's a lot of nonproliferation

data that's out there, technology that we can tap into and we're hoping that if it's not already available, it will soon be available. Detecting seepage by humidity spikes; that's something that we hope to be able to incorporate into the program if it's available in the time frame that we need it. Acoustic seismic tomography to look at rockfall or engineered barrier system collapse. That's another area where we could benefit from advances in those areas. Faster, more effective mapping. There's always the possibility of doing it in the tried and true sense, yet we hope that there will be techniques available to us that will make this a more efficient type of activity. Then, also, automated monitoring of drift deformation, this is something that we can benefit from, as well. There's always the standard methods, but these are things that we're hoping to be able to improve on as the time comes for us to implement various parts of this. So, the performance confirmation staff is currently pursuing each of these areas. And, although on the bottom, it says some activities may be deleted and replaced as a result, I think in a more realistic sense, it's more like they may need to be modified a little bit, but I'm not sure that any would actually have to be deleted.

Next slide. The implementation of the program, in a sense it's already been implemented. There are ongoing activities now and that have been going on in the past that

are a part of this program and over time, we will implement the various different aspects of it in the time frames that are appropriate for the various steps. This would be in monitoring, testing, and collecting the data, analyzing and evaluating the data, and then if significant variances arise, we would take the appropriate corrective action steps.

Last slide. In summary--oh, that is my last slide. Isn't that great--we used a multi-attribute utility analysis as part of the decision analysis process in selecting the activities for the program. In the first phase, we combined technical judgments and performance assessment management value judgments. In the second phase, we developed the activities with their corresponding utilities into portfolios and we evaluated those portfolios. Then, in the third phase, these were reviewed by BSC senior management and modified as appropriate. I presented them to you as categorized into risk level groups such as the igneous activities, waste package performance, and so on. As I mentioned before, in the backup slides, there's a list of just the activities in and of themselves, not grouped in any way.

Revision 3 of the performance confirmation plan is scheduled for next spring and it will further develop the performance confirmation program by developing more of the detail and establish any information whereby we actually implement the parts that have not already begun.

So, that's it and I'm sure you're very happy that's over.

LATANISION: Deborah, thank you. I want to thank you for a very comprehensive summary. Of course, the efficiency with which you've gone through that means that we have more time for questions which is terrific.

BARR: I can talk some more.

LATANISION: I thought that might be the case. I have Dan and Mark and David and Thure. Dan?

BULLEN: Bullen, Board. Let me echo the comments of our Chair. I think you did an excellent job of summarizing the development of a program that's actually finally got some meat on the bones or at least it looks like it's starting to get some meat on the bones. I wanted to give you compliments there. Now, I want to ask the tough questions and so I compliment and now I'm going to apologize for the questions I ask.

BULLEN: Initially, I'd like to know how does the PC program interact with the design group in the planning process? Specifically, you know, you talked about changes in design that may have to be impacted by the--or may impact the PC program. My example would be that the waste package is continuing to evolve. We've gone from a solution of (inaudible) outer surface to a laser peened surface and now you're talking about putting meters on the inside. How do

you deal with the design people and how do you interact with them?

BARR: Well, I think we've pretty successfully done that to date in the sense that we have close interactions with the various other parts of the project such as the design group where as changes are made in these things, you know, we assess the impacts on the performance confirmation program. I'm not sure if this is really getting at your question, but we share information and, as we become aware of changes in the design that might impact the program, we plan to make the changes that are needed.

BULLEN: Bullen, Board. That's the kind of give and take that I was interested in. I wanted to know what kind of communication you had and were you guys going on separate parallel paths that have to meet at an end point X years down the road for license application or actually for a license amendment to close and, all of a sudden, I don't have the information that I need. Which actually leads me to the next question which is how does the performance confirmation plan confirm assumptions? I mean, you need to confirm some of the fundamental assumptions used in TSPA. And so, I guess, I wonder how you get your arms around that 800 pound gorilla that happens to be sitting in the room. So, you need to deal with the people in TSPA, as well as design, in trying in trying to confirm those fundamental assumptions. And, I kind

of want to see how that's developed throughout the entire process and then how that feeds back into the final TSPA that need be done for license amendment to close.

BARR: Okay.

BULLEN: The question is how do you deal with the confirmation of assumptions?

BARR: Okay.

BULLEN: And so, your communication with the TSPA people and the development of the PC plan to confirm those assumptions?

BARR: Right. Well, whereas some of the activities that are in this list here are intermediate steps--for instance, measuring rainfall, you know, might be an intermediate step, whereas ultimately your final parameter that you're getting at is seepage into the drift--a lot of the activities are end member, sort of, activities, for instance, monitoring for seepage into the drift. And, in the process of developing the models that get us to that point, there are certain assumptions along the way. And, by looking at those end of the line activities and confirming that they are indeed behaving as we expected them to, I believe that that's confirming the assumptions that are inherent in the process models.

BULLEN: Bullen, Board. Just two quick more questions, Mr. Chairman.

If we could turn to Slide 31, please? I'm kind of interested in your temporal variations in the aggressive environments and specifically I'm looking at something that I think might be missing. Your temporal scaling of degradation may be to derate the packages or to blow more air, as I see that. The problem that I run into is we've learned throughout the course of TSPA evaluation that the drip shield is a very important aspect of performance. And, one of the things that concerns me about the drip shield is not the drip shield itself, but the stability of the invert and, specifically, the stability of the metal support structures in the invert that hold the drip shield in place to a nice tight tolerance. And so, if those degrade, I'm interested in the temporal acceleration, if you will, of the degradation process of the invert. And so, I was a little bit concerned when the invert didn't get the highest level in your last slide. And so, specifically, with respect to radiolysis effects which are called out here, but not radiolysis effects on the waste package, but the formation of radiolysis degradation products and their ensuing transport through the invert and degradation of that iron. If someone raised that issue which obviously hasn't been raised yet, how would you see the performance confirmation plan addressing something like that?

BARR: Okay. This is something I think I'm going to

have to defer to someone else. Jim, are you prepared to answer that one?

BLINK: Jim Blink, Lawrence Livermore National Lab. We have an activity on a different slide that looks at the drift deformation and that same activity would also be looking at invert deformation. The drift that doesn't have the ventilation in it will cool down to below the boiling point of water where carbon steel can corrode. So, we should see some decades of corrosion on those beams during the pre-operational period and be able to watch for that and the ROV would go through the drifts.

BULLEN: Okay. Bullen, Board. Thank you. That's exactly what I wanted to know, what had happened during the time frame of operation before you decided to close.

Actually, one last quick question. How much would you envision the PC program changing if you were looking at a lower temperature repository design?

BARR: I think it would be smaller, you know. I think it would be a little smaller, at least. We would probably have less emphasis on the coupled processes type of activities, but I'm not sure that conceptually it would really change all that much, to tell you the truth.

BULLEN: Thank you.

LATANISION: Mark?

ABKOWITZ: Abkowitz, Board. I also want to join the

chorus of thanking you for such a comprehensive and efficient presentation. It was a little painful for me because I was one of the guinea pigs in the class on multi-attribute utility analysis in the mid-'70s that Ralph Keeney talked. So, it's a little bit of a shiver down my spine there while you were presenting that.

In any event, I wanted to just ask you a couple of basic questions here and then kind of a wrap-up question. When this list was being put together and synthesized and ranked, were there any technical experts outside of DOE and its contractors that were involved in that process?

BARR: We had some--we invited some other organizations. I know we invited EPRI. I'm not sure if we invited too many other people. I think, it was predominately internal and--yeah, I would say it was pretty much internal with a few exceptions.

ABKOWITZ: So, it's accurate to say that at this point the program was a reflection of internal priorities that have been defined through this process?

BARR: I think by its nature of how it was developed, yes. Yes.

ABKOWITZ: Okay. Are there plans to broaden the exposure of this plan to others and genuinely accept their feedback and modifying it as it goes forward?

BARR: Well, we've had that opportunity in the past and

we've benefited greatly from it. For instance, there was an EPRI workshop that took place a few years ago, and in that, we had some very good discussion. There was some very good discussion of the program and what the goals of it would be. Just a month or two ago, we met with the ACNW and had a really great meeting, to tell you the truth. I just thought it was an extremely positive and beneficial meeting to us because we got some really good insights from the meeting there. They had formulated a panel of people from external areas and that panel, you know, listened to the presentations pretty much a little bit more in detail than what I gave today. We spent about a half a day basically talking about what was in the program. And, they gave us a lot of really good feedback. So, in that sense, I think that we have had the opportunity to interact with other agencies and receive their feedback.

ABKOWITZ: Abkowitz, Board. I also wanted to echo Dr. Bullen's comments about the need to establish some formal protocols for looping back between performance confirmation and performance assessment and design and I see this as part of an integrated feedback mechanism that needs to be, you know, fundamentally connected to the decision processes that are going on elsewhere.

Finally, I would like to turn to Slide #26. I wanted to first make sure that we're on the same--we're using

the same terminology. I think of risk as kind of a combination of likelihood and consequence. Is that the same way that was being used on this slide?

BARR: Yes.

ABKOWITZ: Okay. And, I notice here that you have implied that there's a rank ordering to these activity groups and that the highest risk group is the first bullet and then the second and then the third?

BARR: No, actually, I did modify that a bit by saying that the biosphere did not necessarily represent the proper order of risk in here. It was more in terms of convenience for flow of information that the biosphere showed up--

ABKOWITZ: Okay. But, the disruptive scenario classes are considered, you know, higher risk category than the nominal scenario classes?

BARR: Yes.

ABKOWITZ: Okay. So, can we infer then that because this has been primarily an internal process to date and that the management and the technical staff have been engaged that we can carry this forward as DOE's position that the highest risk concerns that they have about the performance of the repository are in the igneous and seismic activity areas?

BARR: I would say at this moment in time that would be the case. However, there's a great deal of activity going on in the these areas and that could conceivably change by

licensing in which case we would adapt to the current information.

ABKOWITZ: And then, as a followon question, in the nominal scenario class, can I infer that the waste package and drip shield issue is of a greater risk concern than, say, cladding or the saturated zone?

BARR: Yes.

ABKOWITZ: Okay. So, it's reasonable then to take this forward as kind of my score card to measure TSPA activities against in terms of where the emphasis needs to be placed at this point in time?

SPEAKER: (Inaudible).

ABKOWITZ: No, but I'm talking about TSPA because that's where the greatest risks have been identified, and therefore, that's where the need to resolve uncertainty is the greatest?

BARR: Now, keep in mind that, you know, when I started, I said that the decision analysis process was based upon performance assessment. And so, the fact that these ended up falling out the way they did is a reflection of the input from TSPA.

ABKOWITZ: Right.

BARR: So, I would say that they're entirely consistent.

ABKOWITZ: Okay. So then, you've answered my question. Thank you.

LATANISION: Dr. Duquette?

DUQUETTE: Duquette, Board. Since my colleagues are all referring to choruses, I hope I'm not part of the Greek chorus that usually signals tragedy.

I would like to go, of course, to Slide 31. That's no surprise to anyone on the Board. We'll start with that. I would argue that the third bullet where you say strengthen extrapolation at 10,000 years doesn't have any validity because I don't think you have any extrapolation currently with 10,000 years. So, strengthening, I would disagree with.

Having looked at this slide, I'd like to go to Slide 67, please. Now, no one in the audience is going to be able to read that, but the lower left hand quadrant of that slide indicates the activities that are going to be undertaken to support the corrosion activities and stability activities of the container in the drift. All, but one of them, indicate that they're going to be based on laboratory studies and I presume that that means that you don't anticipate any internal monitoring during the operational period or during the storage period of any possible corrosion problems on the containers?

BARR: Let me see here. Didn't we have activities as far as monitoring in the drifts though? I mean, mostly in terms of just visual though. Let me see what we have here.

Jim? Thanks.

BLINK: Jim Blink, Lawrence Livermore National Lab. We

will have a combination of laboratory and field testing. The field testing will have two components to it. One component has to do with verifying the environment and exposing samples directly in that environment and then recovering them and taking them to the laboratory where we can do the more detailed characterization. The other component of the field testing is this pressure sensor idea wherein the pressure in the waste packages between the Alloy 22 and the stainless steel under normal conditions will be below the pressure in the drift by a psi or two because of the cooling of the packages after they leave the hot cell where they're sealed and brought underground. They're actually warmer when they're sealed than when they're underground. So, there will be a difference in pressure between the drift ambient pressure and the internal waste package pressure. So, the sensing of the pressure integrity of the waste package is an integral measurement of the waste package performance.

DUQUETTE: Thank you. Duquette, Board. One last comment. Based on this laboratory testing which appears to be mostly laboratory testing of laboratory scale samples--and as many people know, this member of the Board and I think some others are very concerned about the possibility of crevice corrosion and the closure aspects of the current closure design for the container as we've seen it. And, I would urge if it's not in the performance confirmation, at

least, in the actual laboratory experiments, that a full scale test be performed in an appropriate environment of the container. All of us who are experimentalists know that small scale laboratory tests often scale up to large scale performance, but often they don't.

LATANISION: Latanision, Board. Just as a followup, it would seem to me that in the interest of monitoring crevice corrosion, for example, you could envision a potential drop monitoring system would look for changes in resistivity as a function of time. So, there may be a way of monitoring this. I completely endorse your comment. I think it's very important.

Let's go forward. Thure, you have the next question.

CERLING: Yeah, Cerling, Board. I was just wondering how you assure cross-talk between all of these groups that are studying a lot of things that aren't related, but some things, a small component of one will have an important implication on some of the other. So, I was just wondering how you're assuring cross-talk.

BARR: Uh-huh. Well, in that sense, you know, there are a whole slough of interaction of integration meetings that occur and I know I attend design and engineered barrier system integration meetings where I bring my performance confirmation hat with me, you know, when I'm there. Anything

that transpires there that could have an impact in that area, you know, I would pass on and I'm sure that there's a number of other integration meetings that occur in other areas, as well. There's standing meetings we've got where basically the idea is to integrate across the various areas.

LATANISION: Priscilla, you're next?

NELSON: Nelson, Board. Could you go to Slide 3? I'm sorry, I might not have been paying rapt attention because it was too early in the slide presentation. But, I look at this and I see a lot of arrows. This is sort of a followup to Thure's question. It seems to me that there's a way of establishing maybe a higher level thinking to make sure that things don't fall through the cracks between what is claimed as part of performance confirmation, what is relegated to engineering, testing, and evaluation or science and testing and evaluation or the science and technology program. There's a lot of remapping of--or revisions, removed items that get pushed off into other areas. I'm afraid that--afraid may be the right word, I don't know, but the sense of interdependencies, the sense of complexity in response, is it necessarily going to get appreciated by having everything parsed out. So, I guess, what I'm thinking is where is the high-level think about all of these different entities and I see five entities up there that are dealing with some aspect from now to closure investigations or monitoring, whether

it's internal or, in fact, like an external advisory group that's actually thinking about this. So, can you comment on that? What kind of overall high-level thinking is going to comfort me on that?

BARR: Uh-huh, yeah. That's a very good question and actually, you know, we've received it before. I would have to say that the response is that some of these programs are not yet developed in detail and that's something that will occur over time at the appropriate intervals for them. When we were doing the assessment of the performance confirmation activities and they determined that a number of them were better suited to other areas, in that case, we contacted the appropriate individuals and said, hey, you know, these are things that are potentially in your area. There's certainly no requirement that they're going to have to put them in, but we passed on that information to them. As far as a high level description of, you know, how all these programs fit together and what their interrelationships are and what their differences are and everything, that it something that is under development.

NELSON: Okay. I think this should be really good to hear--were you going to say something?

ARTHUR: And, Deb, you're doing a great job. I hate to interrupt, but I just wanted to talk to you bout some of your thoughts and I'm just going through to reemphasize some of

Deborah's points, but there is a lot of integration. I was in an update the other week. I was asking about remotely going into the underground with technologists we have and there is, as you're well aware, Deborah mentions good technologies for entry into a high radiation environment, but some of the design folks from Bechtel were there. We were talking about, well, making sure you have the right room and it's laid out. So, I think things are still evolving, as I said yesterday. You know, the design, at least in support for the construction authorization license will be about 25 to 30 percent complete in about, I think, it's April or May of next year, the plan that Deborah talked, and it's still evolving because at least one of the comments I sense from ACNW is it felt that there was no--correct me if I'm wrong-- major issues. Whether there's probably a lot of things in there, we should continue to look at what's going to be really required as part of the license conditions. And, the other point I'd say is remember when the license goes in, it's going to have not just the design and all the pre-closure, post-closure analysis and that, but a reference to, you know, performance confirmation, how is it going to work? And, I think, as we go into next year, it's going to be a lot more details and integration, but it has to be design TSPA and performance confirmation working hand-in-hand.

And, the last point I leave you with is that, you

know, having been in a few other regulatory environments of NRC, what will happen, these will become conditions of a license, and in time, I would assume and I don't know what the frequency will be we'll have to do periodic--you know, this plan will be carried out, and if there's an off-normal, it will require immediate notification to the regulator with what actions are we going to take and I would assume something on a yearly basis that things turn out is your plan. So, there's a lot coming together and I do agree and we're still continuing to enhance all the integration.

NELSON: Thank you. You know, on a chart like this, it's just going to beg it because there's balloons that aren't connected and I just--if you establish the intention to coordinate now and to have other ways--you're just going to have tradeoffs and, you know, parsing things out and missed opportunities and all sorts of things.

BARR: Right.

NELSON: It just--I, pardon me, just don't understand why it's not there now.

Okay. Let me just ask you if there's been any case where you've run across some aspect of performance confirmation where the design is involving something that's very difficult to confirm? You could imagine there would be an opportunity for there to be another way of building something where you could actually confirm performance; so, a

push back rather than a push at. That kind of an arrow out of performance confirmation either to any one of these or to actually design would be an interesting thing to see and to see performance confirmation as a full partner in this overall enterprise.

And, finally, there's just going to be a heck of a lot of new technologies coming out in the next five or 10 years. So, I don't feel the need to go down and sort of micro manage how you're going to make a while lot of measurements today because I'm sure in three years or five years the whole thing is changed.

BARR: Yeah.

NELSON: Great, it's good to hear.

BARR: Thank you.

LATANISION: Thure, did you have a followup to this?

CERLING: I had a followup to one of Dave's questions actually.

LATANISION: Okay. Well, let's take that in turn and we'll go to Mike Corradini.

CORRADINI: I wanted to do an analogy because I think we're all kind of asking the same thing differently. So, I'll try a different attack at it. So, let's take a nuclear power plant. I'll pick many of them these days, pressurized water reactor. They're operating and they--this is a story. So, bear with me. And so, most of them in a pressurized

water reactor use a boron injection tank in case of accident. And, historically, all of those were high temperature boric acid--or, I should say, high concentration boric acid. It was found by PRA analysis, the equivalent, I think, of the TSPA, that from a monitoring and maintenance standpoint high concentration boric acid was a maintenance nightmare and also did not seem to gain anything from the standpoint of safety. So, there was a discussion to change the design to go to low concentration boric acid, to change the boric acid to injection tank to something low temperature. The process by which they went and did this and then asked for a licensing amendment to do that is essentially what I think I'm hearing here. So, I want to draw the analogy. The analogy is you're in the pre-construction phase hoping to go to a construction phase, hoping to go to an operation phase. The performance confirmation process will evolve as you go through those phases.

So, what I'm thinking of when I use my operational example is I listened to all of this and I know you have to do this. I have a hard time understanding it because it's relatively high-level and broad. What I'm looking for and I'm not expecting it now, but just to have you think about it, is case studies where you show how you take something you want to change and work it through the system with all the individuals involved and the people involved and processes

such that a change is suggested, it is examined, we see the risk effect of it through the TSPA, we decide yea or nay, and then it flows back into the design. I think what I've been hearing are all these questions. We've been beating at that elephant in bunch of different ways. And, I think that's kind of how I would characterize it. And, how you do that now when you're going into the LA versus how you do it when you're constructing versus how you do it when you're operating will change, but that process will always remain. And, I think it would be to the project's benefit to think through how you do it and examples of how it has been done and continues to be done as you evolve or else you'll miss the fact that that's the continual circle you have to do with an engineering project. Do you follow what I'm getting at?

BARR: Yes, I do. Yes.

CORRADINI: Okay. And so, I'm not asking for a response as much as unless there's something that just pops up from the current design process that automatically say, yeah, this is how this change came about because it's that cycle which has to be of high quality. I think that's what I think we all have been getting at.

BLINK: I think I have such an example. Jim Blink from Lawrence Livermore National Lab. We have several processes that get at this. One of them is the IED process or the interface exchange drawings and those are drawings that are

signed by the manager of performance assessment and confirmation, Bob Andrews, and by the manager of repository design who is now Larry Lucas. Those drawings specifically cite the particular reference material that will be the source of the need or the aspect from either--going in either direction. So, that's our formal process.

In addition, our procedure AP-214 for interdisciplinary reviews of products requires affected disciplines to be formal reviewers when we make a change or development again on either side. So, that's done both ways. The designers were formal reviewers of the PC plan. We are formal reviewers of their system description documents which is their lowest level requirements document.

In addition to that, we have a senior staff member who attends a weekly design integration meeting on our behalf and the designers have project engineers, three of them for the three different aspects of the design, that are a single point of contact in each of their areas with the affected disciplines including performance confirmation and performance assessment.

Finally, there's a great deal of personal contact. I reside in the same organization with Jerry McNeish who is the manager of performance assessment. We both report to Peter Swift. The design people are only one building over and they reside in Nancy Williams' organization, the same

organization that Bob Andrews' performance assessment resides in. We know each other, the individual leads. The lead for the repository layout came to us when he was doing the layout and said independent of your materials that are going through preparation, what is your thinking right now? How will this look three months from now when my document comes out? Will I already be obsolete? So, in a sense, we're trying to be ahead of the cycle it takes to make these things formal. I think the integration is working pretty well.

Finally, I have to give my DOE counterpart credit. In addition to that internal vectal integration, our DOE counterparts, one of their key things is to help us integrate. There's fewer of them. It's a smaller organization. They talk to each other and kind of give us a grade on how well we're integrating and give us direction and feedback when they see cracks developing.

LATANISION: Thank you. Richard?

PARIZEK: Yeah, Parizek, Board. On this Figure 3, I mean, I don't see a role, say, for Nye County or the State of Nevada or other entities. Maybe they're in the area and say, well, they don't have any responsibility nor response.

BARR: No, this wasn't intended to be comprehensive.

PARIZEK: But, they--there could be other circles added to this?

BARR: Uh-huh. Oh, absolutely.

PARIZEK: Then, you mention that this would have to be a flexible process in order to capture things as they go along. That brings up, for instance, 58e on Slide 67. You have activity monitoring, sampling, and laboratory testing of microbial types and amounts on engineered surfaces as far as viewing the corrosion related issues. Perhaps, yesterday, you caught the discussion about the nitrates in the rock mass that Bo Bodvarsson reported upon. That would have been his Slide 22. The whole question there was that maybe that's vulnerable to microbiological activity once you have underground openings. You could attack that as an energy source and, all of a sudden, not have the nitrate in the interval. And, yet, that's kind of important to have those ratios of nitrate to chloride right in order to minimize package corrosion. And so, all of a sudden, here comes a microbiological testing thing that's maybe different than what was listed, but may be very valuable to make sure that doesn't go away because of biological activity.

BARR: Uh-huh.

PARIZEK: So, I would say these are the add-on things that need to be thought about by a program this dynamic in looking at some of the variables.

BARR: Right.

PARIZEK: I was interested in the fact that you might get the negative pressure inside of a waste package, but how

long, Jim Blink, would that last? What kind of a detection device is that because that's--I guess, other people know that this is doable. But, is that for 10,000 years because it's like monitoring groundwater for 10,000 years waiting to see if something failed.

BARR: Yeah, this a pretty neat area. I was real excited when I heard about it. I'll let Jim talk to it since he actually went up and visited the lab for this.

BLINK: Jim Blink. And, I have to give credit to Tom Keats from the science and technology program. When he was asking us were there any ideas that we had that if science and technology worked them for several years and they succeeded, could they come into the performance confirmation program and give us that step forward, the technology evolution over the next five years that Dr. Nelson talked about.

In return, when we talked about some these ideas, he already knew about some things and was receiving proposals and put us onto a company called Vista Engineering that's been supporting Hanford. And, they have taken the conventional bourdon tube technology that's used in barometers. That's a C-shaped closed tube, closed at one end and open at the other. The open end is in the area where you're measuring the pressure. The tube itself is surrounded by a reference pressure. Imagine in our situation that

you've got a reference pressure of, say, 5 psi, you expose it to the gap between the two packages which should be around 10 psi pressure and it will go up and down as the temperature goes up and down because its density was set at the moment that the package was closed. The temperature in the environment at which it was closed will set that density. The pressure in the drifts themselves is of the order of 12 psi due to the elevation at Yucca Mountain. They're open to the atmosphere. The pressure inside the stainless steel vessel is two bars of helium. So, if this gauge reads 5 psi when we bring our magnet on the robot there and hold it up against the package and look through the 2cm of Alloy 22, then we know the gauge has failed. If the pressure is 10 psi, everything is working fine. If the pressure is 12 psi, the outer barrier of the package has failed. Stress corrosion cracking or crevice corrosion has caused it to have a loss of pressure seal. And, finally, if it reads a bar and a half or two bars, the stainless steel package has failed and vented to the space in between. And, these gauges are reasonable and costs have been produced in some quantity of the order of 500 in nuclear grade stainless steel for the NCO program at Hanford. We took a slab of Alloy 22, 2cm thick, the right thickness, up to their location, put their gauge up to it, and proved that it worked.

PARIZEK: How long though? I guess, the other part of

this you could test it when you brought the waste package to the site, but then again do you leave it there and they can go back and test this from time to time?

BLINK: Yeah--

PARIZEK: And, how do you gain access? Is it remotely--

BLINK: Right, the gauge--

PARIZEK: --gained information--

BLINK: The bourdon--

PARIZEK: Is it going to work for 2,000 years, 5,000 years, 10,000 years?

BLINK: The space that the bourdon tube gauge occupies actually is smaller than the existing space and the design. It fits. We went and talked with the design people before we went up there to make sure that we knew what the geometry was. The only moving part in this is the slightly flexing bourdon tube and a permanent magnet that would rotate on the top of it, no electronics. The reading device is a simple compass which you just have to put against the registration marks on the outside of the package and it looks through the package. So, this is a system that has no electronics. It looks like that the magnet that they've chosen to use is radiation resistant based on its use in accelerator facilities. We need to do some followup because our radiation is steady and not pulsed. But, everything that we saw up there makes it look feasible and the amount of

followup work that we have to do to verify that is pretty small.

PARIZEK: I'm just interested because the idea like at WIPP, there was a pressure drive concern, a resaturation issue, but the question, there's no way to monitor anything without damaging this all, but, you know, that's another issue. But, since these remote devices, methods are in the thought process and so there's new technology coming on, it's exciting to hear this is an option.

There's another one on this 180a activity. This is drilling out the aromatic anomalies is a way to cite, you know, the number of places that maybe have volcanic centers. This is a value added comment I'd shared with you previously. During the drilling to see if, in fact, it is volcanic, there is this opportunity to capture additional stratigraphy to be able to complete a borehole for hydrological observations and testing, for chemical information over and beyond just the intention of deciding whether it's volcanic or not volcanic. So, I really would stress to the program to not in the haste to get on with the aromatic question ignore the other sampling that can be done for very little additional money to the program and whether, say, like Nye County then completed it as a well for their program if it's in their county and so on. It's really value added stuff that needs to be given thought to this process.

Then, I also talked about the question that if, in fact, there are more centers and now you're at the point of, well, the risks from seismic activity which is a high probability concern and there was also volcanism, perhaps then you have to go to backfill as a solution to those two problems. Then, backfill right away creates an interaction process of the engineered environment and it's different than when you started out without backfill. So, the idea of making sure that the confirmation testing program is flexible enough to add on these things as you go along because this interactive process may not be captioned in the present list of activities you've identified.

BARR: Okay.

PARIZEK: Thank you.

CHRISTENSEN: Christensen, Board. Maybe at the risk of repeating a little bit that's been said and maybe at the hope of putting a minor point on comments I've heard from my colleagues and some thoughts that reminded me of a little bit of history, I think it was three years ago that Russ Dyer made a presentation to this Board and we had a panel discussion on the topic of sort of the evolution of the program and the notion of adaptive management. And, I think a lot of really interesting ideas came from that and I really feel to some extent this program begins to in a very specific and substantive way puts some real meat on that discussion.

And, what I see developing is sort of part of an overall and truly meaningful adaptive management program. Here is what I would call the dashboard and it's obviously a complicated dashboard. It's got more than just a few dials on it and I have to say I like the way in which the priorities have been thought through in terms of which dials are most important and how they're situated. It does strike me though that the --and this was a part of the discussion some time ago--that an overall adaptive managed program would truly--would have to do with the integration of this dashboard in a more institutional fashion into the overall program. And, I think it goes beyond just simply the physical proximity of people and their ability to talk over coffee, but, in fact, a much more formalized relationship in which what is learned here and the connections directly influence these other various pieces and I think my colleagues have spoken to that. And, I hear that we're moving toward that, but I think that that's really important.

A third element that's come up in a couple of places that really has to do with, I think, one of the greatest challenges in implementing an adaptive management program in the context of uncertainty is from a variety of constituencies and clearly the NRC is chief among those at those moment, but it's certainly not the only one. And, I think I would echo maybe Richard's point about involvement of

constituencies who are chief stakeholders and at some sense or other need to in the future have confidence that this process of learning as we go, in fact, is really effective. I would only add that the credibility of that depends also in addition to some sort of independent external review and certainly I agree that EPRI, for example, is one of those stakeholders that needs to be involved, but does not represent the sort of external review that I think really would provide to all stakeholders the kind of credibility.

So, I say all this simply to say that I think I see the elements of this developing. I think this needs to be integrated in that more formal way and I hope that we can follow the course of this over the--in future meetings.

BARR: Thank you.

LATANISION: Thure, I think you have the last question.

CERLING: Yeah, I just had one. Dave Duquette nicely pointed out on Page 67 and all along we hear all about the problems and the corrosion issues with Alloy 22 and Titanium Grade 7 and there's a lot of other components that are involved including some of the robotics and things that you expect to last for a long time. So, I was just really wondering where the corrosion issues related to those? Are they being treated with the same concern and attention that Alloy 22 and Titanium 7 are?

BARR: I'm not sure I captured the first part in there.

CERLING: Well, there's a lot of other components that are involved in the emplacement of the waste package and the time in between that packages are emplaced and the titanium shields are in place and I don't think all of those are Alloy 22 or titanium. So, I was just wondering about where that fits into the performance confirmation activities of those elements including the robotics that you want to send in to look at the thing. They also presumably would be subject to corrosion.

BARR: Yeah. Well, clearly, you know, it wouldn't be that hard of a task to maintain the robotics that would come and go, you know, in the drifts. That's something we do have more ready access to. As far as other materials though are concerned, I think we did mention in some of the testing areas that there would be assessments of the ground support, drift shape, things like that, all those things that get directly at the ground support issues. So, I feel like we've captured those, as well, unless there's something that I'm not thinking of that you're asking about.

LATANISION: I want to correct myself. There is one last question. Paul?

BARR: Well, did I answer your question, at all, or

CERLING: Yeah, I just want to make sure that that also was in the performance confirmation activities.

BARR: Okay.

CRAIG: Paul Craig, Board. Deborah, that was a fascinating presentation. I really do like the use of the methodology. And, what I'd like to ask you about is what is the process--maybe it doesn't fit into the performance confirmation methodology or the followon, but what is the process if you begin to find a problem, if one of these little manometers actually shows that there's a problem? You need to have a procedure for pulling out the canister or deciding not to pull it out. Does that fit within performance confirmation or is that a different category?

BARR: Absolutely. No, that does fit within it. Performance confirmation isn't just about identifying, you know, the potential problems. It's about the followon actions. It's the first--what I've described here is just the very first step of what we're going to measure and how we're going to measure it. As we develop Revision 3 for next spring, we will start to develop the kind of detail that you're talking about. We talked about how we need to establish the baseline for all of the parameters that we're talking about measuring and the activities. Then, we need to establish the tolerance levels or the bounds around them which if they were to go outside of, it would become a reportable condition to the NRC. However, it goes even beyond that because it's the responsibility of the performance confirmation area to then assess those areas, not

even necessarily wait until it goes outside of the bounds, but if it looks like it's headed in a direction that's going to take it outside of the bounds established as a part of our license application, we would then--that would then trigger and investigation as far as an assessment of what it is that's happening. Is it because, you know, of something that's fundamentally flawed in our understanding of a particular process or is it, you know--the idea is to find out what the cause is and then to take action on that. Is it something where we just need refine our process models because there was something that we had not adequately captured before? Is it something where we need to maybe be--in the preemplacement period, it may very well trigger some change in design as was talked about earlier. That would be a step that was potentially there. And then, of course, the absolute end member, worst case scenario, is retrieval. It's performance confirmation that would give us the information that would let us know whether that actually had to be an option or not. And, of course, all of this would be done in close coordination with the NRC.

So, by no means is this just an effort at identifying problem areas. We will refine further over time and in preparation for the license application the mechanisms and the processes that are triggered as a result of things occurring deviating from the expectations that we have.

LATANISION: Deborah, I want to thank you and also thank Jim and John for the comments during this discussion. You know, you have the distinction, at least in my history as a Board member, of fielding a question from every member of the Board.

BARR: Oh, wow.

LATANISION: It's a distinction. Thank you very much. This was an extremely helpful conversation.

BARR: Thank you.

LATANISION: We will adjourn for 15 minutes.

(Whereupon, a brief recess was taken.)

LATANISION: We need a little bit of quiet. Thank you.

We're going to next have an update on the igneous program. Peter Swift is our speaker. Peter is responsible for development and performance assessment strategy and for defining and supporting technical analysis of the BSC performance assessment project. His previous responsibilities within the Yucca Mountain total systems performance assessment include serving as lead man analyst for igneous consequence modeling and lead analyst for identification and screening of features, events, and processes to be included in the performance assessment. In addition, his experience includes performance assessment work for the WIPP plant and he was the lead author of the 1996 compliance certification applications to the U.S.

Environmental Protection Agency.

Peter, welcome back.

SWIFT: Thank you. I'm here making this presentation on behalf of quite a lot of other people, some of whom are in the room, many of whom are not. I am the manager of something called performance assessment strategy and scope. This is a group of the project that reports to Bob Andrews that I'm responsible for the team that signs and implements the total system performance assessment. I'm also responsible for Jim Blink's team that produced the performance confirmation plan with Debbie Barr. I'm not responsible for the modeling of igneous activity or the technical basis for it. That's in a group that a man named Jerry King--is Jerry here? No, Jerry King is not here. He's the manager of the disruptive events sub-project that works on both igneous activity and seismic activity. And, within Jerry King's group, Mike Kline who is here. Mike--oh, there he is back there--is the manager of the igneous department. Most of the technical expertise here is at Los Alamos National Laboratory. Frank Perry is the technical lead for that, Don Krear (phonetic) at Gafney (phonetic), Chuck Harrington, and others, and also Eric Smistad from the Department of Energy if Eric is here somewhere. So, I will be referring questions to Mike Kline or Eric Smistad or perhaps Ed Gafney as they come up. I'll answer ones I'm

familiar with myself.

I'm giving the talk because I do have a lasting interest in this from having worked on it as a TSPA analyst a few years ago and because it's important to put this in the context of the overall performance assessment, what it means to activity in that context.

Can I have the next slide, please? All right. What I want to talk about here, I want to start out with just a summary of what the igneous scenario looks like from a TSPA point of view and I'll include a little summary of the existing total dose results that we have from a few years ago. Then, I want to talk about the events of the last few years that have shaped--the last two years have shaped where our igneous program is going, in particular. Agreements have been made between the NRC staff and the DOE that are listed there. I'm not going to read those now. I'm going to come to those in some detail later. The recommendations that came from an external igneous consequences peer review panel the DOE convened. And, I want to talk very briefly about the observations from this Board and its consultants, in particular the consultants who provided information to this Board for over a year now--two years now. The Board itself had suggestions, observations, and a letter in June to Dr. Chu. I'll talk a little bit about the DOE responses here and path forward taking into account all three of these things

I'm going to talk about. And then, I'll close with a little discussion of where we are now and what the status of the model that is going to go forward for license application is.

Can I have the next slide, please? Just a review of--this should be familiar, old stuff, but I like to start out with why we have an igneous disruption or a volcanism scenario in the TSPA. It's because there, in fact, are volcanos in the region. Here's Yucca Mountain and the proposed repository here. The volcanic cones out in Crater Flat that are probably visible, those are quaternary cones shown in Crater Flat. They're about a million years old. There's some older pliocene, buried basalt, and exposed basalts--those are exposed--that are about 3.7 million years old. And then, there's the most recent volcano, the Lathrop Wells Cone, roughly 77,000 years old. And, because these volcanos are here, we must consider the possibility they can reoccur in the future.

Next slide, please? Just a view, this is from the north looking at the Lathrop Wells Cone. We would be somewhere out of the field of view off here to the right and some 20 miles away probably where we stand now. These are not massive volcanos. That's about roughly about 140 meters from there to there. This view from the north shows some lava flows off the side of the cone. There also makes a nice view of it. Although the cones are relatively small, they

can produce ash clouds, ash plumes that cover a fairly sizeable area. This is an estimate of the initial ash deposition from the Lathrop Wells eruption 77,000 years ago.

Two things to note here. One is the scale is in centimeters and this outer ring is the one centimeter ring. You can't possibly read it up there, but you can see it in your handout. And, we're in over a meter in here in the center. The other thing you notice is that the control points are pretty sparse. That one centimeter is--there's a control point out there on it. There's good control in close in this area here where you can obviously have fairly good exposure.

To put this in perspective, the dimensions of this plume here are on the order of 20 kilometers. That would be consistent with the idea that an eruption, should one occur at Yucca Mountain, would produce an ash layer of some unknown thickness, but perhaps on the order of a centimeter out at the location of the RMEI, the reasonably maximally exposed individual, prescribed by the regulation. Note here on the source of this figure here, that document is not yet released. So, this is indeed a draft figure and doesn't say so on it. Thank you.

What this area looks like in TSPA, there are two pathways that we're interested in leading to a potential dose. The scenario begins, say, with a dike that rises up

from great depth in the crust and rises relatively quickly. It's shown here as if it reached the level of the repository and then stopped. That was not actually how the processes could work, but it's convenient for the purposes of the cartoon. In the real world, the dike would raise fairly close to the surface, the first eruption might be a fissure eruption which is then localized into a single conduit and produce a cone, then buried the initial fissure. Parts of the dike away from the conduit would chill and an eruption would then actually form a conduit that moved downwards from that point on the surface and allow the dike around it to freeze. But, the point at which it dipped which a conduit would eventually extend would very likely reach the repository horizon. So, it's convenient to show here as if a dike could reach the repository and a conduit could extend from the repository on up.

The two pathways of interest, the actual erupted cloud which could entrain waste from damaged packages and produce a layer of contaminated ash on the surface could produce an exposure out here of a human. The other pathway of interest is packages within the drifts that could be damaged by magma, but not erupted. These would be packages that were intersected by magma that flowed down the drift away from the point of intrusion. We do not believe these packages would be erupted to the surface, more on that later,

however, we do believe they would be damaged, and therefore, they would leak and it would contribute radionuclides to a groundwater source term that migrated down and then out through the saturated zone to a pumping well and to a potential human dose that way. So, two pathways, the eruptive and the groundwater--the intrusive groundwater.

Next, thank you. Those two pathways show up again here. These are calculated dose estimates from a couple of years ago. This is not new information. You've seen these. You haven't seen this exact figure before, but you've seen the results that led to it. The first thing to know is that these are probability-weighted means and I was not planning to work through how we construct a probability-weighted dose from the conditional dose if the event were actually to occur in any specified time. I've done that before. If there are questions, I can go through it again, but there are two slides in the backups in the very back that explain how we did that. So, these are probability-weighted.

Now, there are three curves shown here. The blue curve is that dose from the eruptive ash plume. The red curve is a groundwater dose from those damaged packages that remain in the drift. The black curve just shown there for comparison purposes was the nominal dose that we were showing two years ago at the time of the site recommendation. That's the dose that you get from the failure of a small number of

packages due to early weld failures.

Now, what do we see here? For the first 10,000 years, the regulatory period, we're interested in that eruptive dose. That's the largest single contributor to the total probability-weighted dose that the NRC will compare to the standard. The standard, by the way, is up here somewhere. We're well-below it there, 15 mrem. By about 20,000 years, that groundwater term two years ago, the groundwater term from damaged packages that stayed in the drifts, began to exceed the eruptive dose. And, in about 80,000 years, the nominal dose, we started to see it's giving numbers of waste package failures in that model, and the nominal dose then became the dominant dose for the remainder of the simulation.

Other points here to note, these are calculated with a mean annual probability of igneous intrusion of $1.6 \times 10^{-8}$, 1.6, you know, in 100 million. It's a small annual probability. That is based on the probabilistic volcanic hazard assessment the expert panel done in the mid-1990s.

And, the last point, a little disclaimer here. The model analyses will be updated for license application. These curves are shown here as a reference point for where we were two years ago.

Next slide, please? I just want to reiterate that those were mean doses and we acknowledge there is uncertainty

in that mean. I show here the example of the uncertainty in only one of those curves. That's the groundwater curve. The red curve here--that's the mean in that groundwater component of igneous dose--should be identical to the groundwater curve on the previous page. I hope it is. That curve was drawn from 5,000 realizations of the model. We only show 500 here. Otherwise, we just turn gray. We show the mean with a 95th percentile, that's the black; a median, 50th percentile; and the 5th percentile just barely making it on the figure. Each one of those curves is a possible outcome of the model. That's the nature of Monte Carlo modeling. The way the sampling works, each one of them could be at appropriate sampling of the input parameters. We do a sufficient number of samples so that the mean stabilizes.

Next slide, please? Now, what contributes to the uncertainty in that igneous dose in the past? This is a very short review of things. The probability of the event, that's a big one. For the eruptive dose, the wind speed and uncertainty in the weed speed matters. The number of the waste packages intersected. This determines basically how much waste is entrained in that ash cloud. The characteristics of the eruption itself, the conduct diameter, the erupted volume, the particle size, these affect the amount of waste along with the wind speed--the affecting amount of waste that reaches a 20 kilometer compliance point

of how thick the ashfall is there. The biosphere dose conversion factors, primarily the term for inhalation, from the erupted dose, the major pathway of concern is inhalation.

Now, for the groundwater pathway from the igneous intrusion, the flow of magma down the drift, again the event probability, number of packages damaged, and all the uncertainty inherent in our groundwater flow and transport model from the unsaturated zone through to the saturated zone.

All right. That's it for review of the TSPA scenario. I want to move now to the interactions with the NRC and the peer panel and the observations of the Board.

Next slide, please? Over the last two or three years, the DOE and the NRC have made a number of agreements with respect to--these are the KTI, key technical issue, agreement items we've heard so much about in the last two days. There are a number of them that are relevant to the igneous scenario. I have chosen here to group them into four major areas. There are many more than four and there are quite a few narrowly focused agreements that don't map into these areas. But, these are the four areas of agreements that have a (inaudible) effect on what it is we're doing right now. I also want to point out that the statements here are not necessarily statements of what our program is actually doing right now. These are statements of what the

agreement said at the time it was written and there will be some examples here where what we are doing now, we believe, meets the intent of that agreement, but it won't look much like that.

Alternative models for consequences of igneous disruption. In particular here, this is the NRC's concern, it's the Center in San Antonio's concern, about the dog-leg eruption pathway. That's a good example of it. But, in general, the interactions of the magma with the drift and the formation of a conduit onto the surface. DOE has agreed that they will evaluate possible alternative models.

Event probability, the DOE has agreed they will further evaluate the impact of possible buried volcanic centers on event probability. These are centers that were not detected because they were buried of buried volcanos out here in the north part of this Valley that had they been known of in the mid-1990s when the expert panel did its work, it might have changed that probability estimate.

The effects of magma on engineered materials, the NRC raised the concern that the treatment that we used in the site recommendation modeling did not adequately account for the possibility that waste package and other engineered materials would be damaged by heat, corrosive action of gases, and perhaps we were being overly optimistic in our extent of damage to waste packages.

And then, this issue of the redistribution of contaminated ash and sediment. If the wind is blowing such that the contaminated ash plume falls upstream in the Fortymile Wash drainage from the compliance point, it is reasonable, the NRC has pointed out, to assume that some that contaminated ash will eventually find its way down the drainage and reach the exposure point. And, yes, DOE agreed we will evaluate the effects of that surface redistribution processes.

Next slide, please? The Igneous Consequences Peer Review Panel, in the last year, as this Board is clearly well-aware of, the DOE has convened and conducted an Igneous Consequences Peer Review. This is an external group that was tasked with addressing specific issues weighted to the consequences, not the probability, but the consequences of igneous event intersecting the repository. They issued a report in February and the report is available. It's on the web, among other places. A very simple summary here of their main points. The first point taken right out of, I think, it's Chapter 5--it's the conclusions chapter of the report--the overall conceptual model is both adequate and reasonable. Indeed, we've heard it. The panel recognized limitations of scientific understanding and current modeling capabilities particularly with respect to the damage of waste packages in the drifts and to the effects of pyroclastic flow past waste

packages in eruptive conduit. In other words, with this adequate and reasonable statement comes the acknowledgement that these are tough problems.

Next slide, please? Notwithstanding either, here come the recommendations and what to do from the panel. Future modeling should focus on developing a 3-D model for dike propagation, dike/drift interaction, and attempt to quantify the dog-leg scenario. This more sophisticated model should address gas/vapor evolution in the magma, the gas/vapor cavity length behind the dike tip as the dike is--a dike is propagating, opening a crack through the rock. It's going to open a small void behind the tip which we fill with gas in the vapor phase before the magma comes in and what is the nature of that dike tip. Coupled models for the unsteady flow of the dike into the drift. And, make sure the models include the effects of gas pressure loss through the permeability of the host rock. I'm not going to try to explain here yet what the DOE is doing with respect to either these recommendations or the NRC agreements they just got to.

And, the panel noted that the approach taken in the PVHA of heavily weighting the most recent volcanic events in determining event probability is a reasonable one, but the panel recommended that additional age dating should be performed to further confirm that estimate.

Next, please? The panel recommended considering

design modifications to minimize impacts of igneous events. And, the panel recommended further work to reduce uncertainties. Specifically, laboratory experiments on the evolution of a decompressing magma. They have ugly magma, magma that has high volatile content in it. It expands into a gas filled cavity. They're asking here for experimental work on that and analog materials. And, experimental work on the chemical and mechanical effects of magma on waste packages. And, the panel also recommended comparing ASHPLUME--that's the computational model used to simulate the ash plume--comparing those predictions to other computer models, basically benchmarking tests.

Next, please? And, observations from this Board. First, consultants to this Board--I don't know if any of them are here today; I hope they are--provided observations both before--to the Board, not directly to the DOE, but to the Board, both before and after the peer panel was convened. And, prior to the peer panel, here are some recommendations from the consultants. The first one was convene an expert peer panel. That's good, expert review panel. Here's a case where we'll just say what the DOE did. It's obvious the DOE convened one. Another recommendation, develop more robust and realistic models of dike/drift interactions. This coincides with the recommendation of the peer panel and reconsider the conservatism of damage to waste packages and

waste form.

Next slide, please? I apologize for all the words here, but it's hard to have pictures of future volcanic events. The observations from the Board would be in their June letter and these are my paraphrases of what's in the June letter. I assume someone will tell me if I got it wrong. The Board noted that the panel's work was independent and of high technical quality. We note that. The Board had recommendations that the DOE emphasize updated models of dike/drift interactions including the effects of compressible magma. This would be a magma that had a high volatile content or a transition to a pyroclastic magma. Further evaluate the effects of magma on waste packages and waste form. This reiterates and restates the consultants' recommendation to reconsider the conservatism. This, however, is a neutral statement, just evaluate those effects again. And, a recommendation here to evaluate the effects of the aeromagnetic anomalies. These are the anomalies that may indicate undetected buried basalts. Evaluate those anomalies with drilling and dating programs. Thank you.

All right. So, here's the path forward and I think this is where the most interest is going to be. Well, what is the DOE going to do here? First of all, the primary emphasis of what we're taking forward to LA will be to address the NRC agreements and to develop and appropriate

abstraction for TSPA. We acknowledge certainly the observations the panel and the Board. The primary target for the LA is to meet the NRC's expectations to address those agreements. And, you'll see how that plays out here. DOE agrees with the panel that the overall conceptual model is adequate and reasonable. We thought so at the time of the site recommendation. The model will be revised for the LA taking into account recommendations from the panel and from the Board, but we will be considering the importance of those recommendations to risk. The risk here, as I use it, yes, it is the total probability-weighted dose. Which of these things have a potential to change that? In particular, which of these things have a potential to make it go up? There are some examples here where we're going to--as you see, we're going to stay conservative. We're not going to try to lower that curve because we don't see--immediately anyway, we don't see a path forward that will get us there any time soon.

And, specific recommendations here, enhanced modeling of dike/drift interactions. The DOE's position here is that recently completed modeling is sufficient to support submittal of a license application. Specifically, that the dog-leg eruption is not plausible. And, I realize there's an addition here that needs to be clarified. It is not plausible for the effusive low volatile magmas, the lavas that we've modeled now. We are evaluating the need for

further work to look at compressible magmas.

Next slide, please? Design alternatives, in general, the DOE is not undertaking large scale design alternatives now prior to submitting the LA, as someone mentioned otherwise earlier. If such turn out to be desirable, that will be addressed through amendments to a license should one be obtained. However, there is one specific example that's in progress now. The project is evaluating possible modifications to the backfill in the access mains. The current design does call for backfill in access mains and we're looking at possible modifications that increase confidence in the conclusion that magma will not flow from one drift to another through that backfill.

Laboratory studies of waste package and waste form behavior in magma are not currently planned. In this regard, the TSPA-LA model will remain conservative. This is a large piece of work which is not being done in the next year. however, the outcome of that, I think, will convince you is surely conservative.

The ASHPLUME validation has been undertaken by additional natural analog comparisons rather than by benchmarking these other codes. We actually found that not such an easy thing to do. However, we have produced analog comparisons now with the Lathrop Wells Cone and with a cone in the (inaudible) volcanic field, I believe.

And, the largest piece of new work we are undertaking, new aeromagnetic and drilling data will be obtained and the impacts on event probability will be evaluated. I'm going to talk a little bit about that one right now.

Next? This is not my field, at all. So, I field what questions I can, but it won't be very many. This is just a representative map of those who haven't seen what a aeromagnetic survey map looks like and why it shows anomalies that may turn out to be very volcanic centers. The repository is up in here. This is the Crater Flat area here, Jackass Flats over here, the Amargosa Valley down here basically showing the strength and the local magnetic field. Volcanic centers in Crater Flat show up nicely on this. As you get further east into the Yucca Mountain Solitario Canyon area, the signal is complicated. It's hard to interpret. And, that's the nature of the complex local geology. However, out in the Armagosa Valley, it's pretty easy to interpret where anomalies are. They've already been circled here with--you know, noted as anomalies. Some are noted as targets for future drilling.

Next slide, please? The 1996 PVHA did acknowledge the possibility of undetected buried centers and there were eight anomalies that were known then that were considered to be possible volcanos. So, it's not appropriate to think that

the PVHA was unaware of this issue. They certainly took seriously the idea that there were more volcanos than what you could see out there. In 2002, some modeling analyses, sensitivity analyses considered 20 and 24 buried anomalies, the one shown on the previous page, as if they were all possible volcanos and then used the PVHA experts own individual models to recalculate the event probability. If all 24 additional anomalies are additional volcanic centers, the PVHA mean event probability for eruption rate at Yucca Mountain, approximately 1.4 times greater. That's not a huge change. It's something that's on the order of $10^{-8}$. However, it's a change. And those, I believe, the Board has probably seen those analyses. In 2003, this year, more sensitivity analyses were done that looked at the possibility of adding more purely hypothetical volcanic centers. There's no aeromagnetic data that support these; just what if there were more centers in those areas that were noisy on the aeromagnetic map where we don't have very good data.

Can I go back to the colored map, two slides back? What the latest sensitivity analyses have done is start out with the assumption that all these things up in here are volcanic centers and then take the density from that and apply that density of volcanic events to the areas up in here where the signal is not good. Hypothetically--and there's no reason to believe it's real--but, hypothetically, that would

produce nine additional volcanos in western Jackass Flats where none are known nor are there any surface manifestations and another five in Crater Flat. Doing that and recalculating event probability raises the event probability about 5 times to about $8x10^{-8}$. That crossed our threshold, the Department's threshold, for a level of concern that says, all right, we're going to go out and--next slide, please--and do work to identify, characterize other potential volcanic buried centers and evaluate their impact on probability. A new aeromagnetic survey, low altitude, high resolution, using latest available techniques--again, I'm not the expert on this; we'd have to get somebody from Los Alamos to describe it--a drilling program to test--starting out by drilling anomalies that are already known from 1999 survey and getting age and chemistry samples on them. Data analysis and documentation, of course, and then an update to the expert assessment based on whatever new information we have.

Next slide, please? That work has already begun. We are in the process right now of documenting the sensitivity analyses just described and we are planning the new magnetic survey and drilling program. Assuming the money is available and it's planned, this is planned to be a funded activity, in 2004, initiate drilling, complete the aeromagnetic survey, continue drilling taking into account new survey results in '05 and conduct that update of the

expert panel, wrap it up in 2006. Clearly, this needs to be worked through with the NRC because we have a license application submittal date in December of '04.

Next slide, please? All right. The last portion here, I'm going to talk about where we are with the model we're going to go forward for December of '04. The first point, I don't have any results available, whatsoever. So, the question, I'm sure you would like to ask it, well, what's this going to do to those dose curves? What's going to go up, what's going to go down? I don't have any answer. I really don't. I'd like to know, too. However, the underlying technical basis is essentially complete. I think we know what we're going to be modeling. I know we know what we're going to be modeling. But, any information I provide here is definitely draft. These documents are not finalized. And, I apologize this is all going to be words and these not easy. I try to say them in fairly precise language for you people to be reading them carefully later. So, pay attention to the words.

Next, please? Okay. I'm going to start off here talking about the magmatic effects on the repository. The number of waste packages entrained in eruptions--this is just the part that goes up into the ash cloud--is being reevaluated based on the modified footprint. You've seen other examples of how the layout of the panels has changed.

That requires actually rerunning a spreadsheet calculation that overlays the probabilistic orientation and length of dikes on a footprint to calculate where dikes might cross it and where conduits might form.

The damage to waste packages and waste form during eruption--these are the ones that are erupted out--is essentially the same as we've had in the past. Always packages in the direct path eruption are fully compromised and the waste is fully fragmented. So, if a package is in the path of a conduit, it's available and potentially going to come out and that waste is going to end up in the ash cloud.

Damage to the drip shield for both the eruptive and that intrusive event is unchanged. All drip shields in the intruded drifts are fully compromised. They're gone. That's an assumption and that the drip shields were not intended to withstand moving lava.

Next, please? This page now I'm mostly talking about those packages that are damaged in the drifts and are part of that groundwater source term. That's what I mean by damage to waste packages and waste form and portions of intruded drifts away from the path of eruption. This has extensively changed from where we were in previous analyses. This addresses one of the NRC's concerns. They wanted us to reconsider, reevaluate our treatment of the damages waste

packages due to contact with magma. Indeed, we have and where we are now is that what analyses we have which are essentially conceptual--there are no tests here, there's some simple modeling work looking at effects of heat and static pressure. The waste packages will be extensively damaged. So, the assumption here and this is not a data input, it's an assumption, is that all waste packages in all drifts intersected by magma will be sufficiently damaged, they provide no further protection. So, if a dike crosses a drift somewhere, we are assuming that magma flows all the way down the drift to the other end and all those packages are fully compromised. That doesn't mean the waste has erupted; it means it's available to be contacted by seepage and become part of the groundwater term.

The waste form in those intruder drifts once the drip shield and the package are gone will be exposed to seepage. The seepage will be modified. It's not simply the seepage. In the site recommendation we used the same sort of nominal seepage. Well, that's not very realistic. Things will change in a drift that's had magma flow down it. We're still working a little bit on exactly what that will be. We have a model for degraded drift seepage. If we can support that, we'll use it; if not, we may have to go directly to percolation flux as if the--the flux of the rock further on. That would be the more conservative approach.

The barrier effects here that possibly and very likely will be provided by the remnants of a damaged package which will be extensive--a package isn't going away; it's just going to be damaged. The remnants of that package and the effects of the chilled magma--remember, the package and wastes will be entombed in frozen lava--we're not trying to quantify that. We don't have enough data or a model right now to quantify that. Therefore, it will not be modeled. Essentially, the waste form will be in the model exposed to that modified seepage term.

The last point here on this page, we have looked, as suggested by the NRC and we agree it's an appropriate thing to consider the possibility that heat and corrosive gases may affect packages in drifts that have not been intruded. If a dike crosses some fraction of the drifts in the repository and doesn't cross others, could the heat and gas effects still damage packages further away? I've done some modeling work and that is--that augmentation is nearly complete on that to look at gas flow both through the wall rock and through the backfilled access mains and also looked at direct heat conduction. Both those effects are minor, very minor, and we feel confident that it's reasonable to treat the waste packages in the rest of the repository as if nothing had happened to them.

Next slide, please? Regarding the NRC's concerns

about surface redistribution of ash, the DOE is developing a new model to include in the TSPA that will account for these effects. We've done field investigations in Fortymile Wash. This is worked on by Los Alamos and analog studies at the Lathrop Wells Cone looking at the way ash moves down slope and along ashes, looking at the geomorphology of the alluvial fan on Fortymile Wash, and we believe we do have a technical basis now for such a model.

The model will include approximation of consequences of transport by sedimentary processes, i.e. floods down Fortymile Wash, stuff moving in the wash, and stuff being brought up by rare major floods out into the divide areas.

And, the TSPA model will also include removal of contaminated ash because field evidence shows that those are quickly the divide areas which are almost 80 percent of the geomorphic surface out there, are basically erosional surfaces. They're not depositional. So, we will be looking at erosion processes.

Wind direction will not be assumed to be fixed toward the location of the compliance point. In past TSPAs, we have had no explicit model for surface redistribution effects. We argued in the site recommendation that fixing the wind to the south so that no matter what happened, the eruption blew an ash cloud directly on the compliance point--

we argued that was a sufficient compensation for lack of the redistribution model. The NRC disagreed. So, we will produce the model, but we will also, therefore, allow the model to work as it reasonably should. Sometimes, the ash cloud might land upstream in the wash and only come down by sedimentary processes.

Next slide, please? A couple of other minor changes worth noting. We are making some modifications for those who follow the (inaudible) model, the ASHPLUME model is being modified to allow an improved treatment of the eruptive column. In the past, column height was calculated as a function of eruptive volume. Now, it's going to be calculated as a function of mass discharge rate. This is more realistic. And, some the input parameters, most of it will be wind speed, are being updated. And, the biosphere dose conversation factors are also being updated. This is consistent with some NRC comments they didn't mention that fell in the biosphere area, concerns about inhalation mechanisms. So, we will see a change in the dose due to changes there.

I think a summary slide and that's it. All right. Where I went through here, I'm sorry I didn't have more details for you, but I have what I have. The consequence of igneous activity will be included using updated models. The key phrase here, of course, is updated. Do not assume they

will look the same as the dose results I showed back on Slide 5 or whatever it was. And, those changes do include the DOE's own work taking into account the agreements with the NRC and comments and observations from the peer panel and this group.

And, this last bullet here is probably one of the greatest interest. We believe that the models are reasonable and appropriate to support licensing decision and we certainly acknowledge that we have conservative assumptions where information to support realistic models remains unavailable. The overall intent, however, is still to provide the reasonable estimate of possible consequences for the NRC to use in decision making.

And, that's it.

LATANISION: Thank you. Paul?

CRAIG: Peter, I was going to ask a question, but it turns out that you've got the answer in your backup slides. So, it's more a comment. In the spirit of the ghost of Jerry Cohen, wearing Jerry's hat, a fair portrayal requires--could you turn to 28, please? A fair portrayal requires that one think about both probability-weighted dose and the actual dose and you've provided exactly the right figure here which says that the actual dose, if the event occurs soon, might be in the neighborhood of 10R and then declines rapidly. It is important, as Jerry has said about a thousand times, that

both of these numbers be presented.

SWIFT: And, there it is.

CRAIG: There it is. Thank you for the backup slide.

SWIFT: I should comment just in the interest of full disclosure that this is a different model than the one that produced the doses back on Page 5. This is an earlier generation. It actually requires a different run of the model will generate these plots than the probability-weighted one, and I'm sorry, I apologize for not having wholly consistent comparisons there.

LATANISION: Mark?

ABKOWITZ: Abkowitz, Board. This is somewhat related to Dr. Craig's comment. So, I wanted to go back to Slide #7 and make sure that I have a good understanding of what is shown here. If this is the uncertainty in the probability-weighted dose for the igneous intrusion category, the mean looks to be at or above the 95th percentile of uncertainty. And, I'm having trouble understanding what--how that is.

SWIFT: Well, it's a strongly skewed distribution. This is a possible and normal state for distributions that are driven by a relatively small number of the outcomes. Let's say there were, in fact, 5,000 total curves in there, and at time 100, let's say that--I should pick an easier number. Let's say there were over 1,000 of them. Apparently, more than 950 of them were zero at that time; therefore, the mean

is merely 1/1000th of the largest rather than the--as long as more than 95 percent of the total contributors to the mean are zero, 95th percentile will fall below the mean. That's a correct and plausible thing to have happen.

ABKOWITZ: Okay. And, is 95 percent confidence the criteria that you're using right now for this application?

SWIFT: No. This is not 95th percentile confidence in, what is that, a 95th percentile. What that black curve tells us is that out of that set of model results, 95 percent of them are below that curve at any point in time. The way the regulation is written, it will license on--only the quantitative measure will be the location of the mean and, although it's not written into this regulation, some measure of the confidence that that is a true mean of this population. Getting at the confidence in the value of the mean as a true mean of this population is a different question than where the 95th percentile lies. That could be done by multiple replicates of the modeling system. Repeat the (inaudible) and realizations and see how closely that mean overlies it.

ABKOWITZ: Okay. Now, what I'd like to do is go to Slide #6 and I'm assuming that we probably have similar error bounds in the rungs that are made for igneous eruptives as we did for igneous--

SWIFT: Uh-huh. Yeah, I just chose not to show those

for time.

ABKOWITZ: So, had you shown those, we would have seen some simulation runs that would be showing probability mean annual doses in the neighborhood of 100 or higher?

SWIFT: I'm sorry--

ABKOWITZ: If we go back to Slide #7, you'll see that there are observations that are three orders of magnitude higher than the mean within the regulatory period.

SWIFT: Yeah.

ABKOWITZ: And so, if were to transpose that similar process on Slide #6, then we would see some of those lines up in the 10 to $10^2$ area. Is that a reasonable transformation?

SWIFT: In principle. The distribution about the eruptive mean is narrower than that about the groundwater mean in large part because the ASHPLUME is more linear model. It's a better behaved model. But, yes, there would be a spread of about an order of magnitude--

ABKOWITZ: Well, there clearly was a reluctance to show that in this presentation and I guess what I'm getting to is in the presentation that was made prior to yours by Deborah, there was an implicit recognition that the igneous issue is the biggest uncertainty issue at this point in time. If I transpose this as I wanted to here, it tells me that the uncertainty bounds are broaching where the regulatory limit is. So, where I'm going with this is TSPA. Everything

you've told me, I think, in how the projections would change based on what's new is, if anything, the means will go up a little bit because you have 1.4x5 increase in event likelihood. The other things that you're doing, so far, to TSPA seem fairly nominal role to that.

SWIFT: Yeah. Let me--

ABKOWITZ: I'm just going to share my thought and then I'll go away. So, we're on ongoing with this since there's clearly an uncertainty issue that could drive this whole TSPA bananas. And so, since you're now telling me that there's a comprehensive program to drill and do other things to try to narrow that uncertainty, I'm having a hard time understanding how that information is going to become available by December 2004 to make any meaningful difference to the license application. So, going back on my comment yesterday about taking the time to do it right, could you, please, respond?

SWIFT: I want to clarify that 1.4 or 8 times--or, sorry, 5 times the initial mean probability, those were hypothetical sensitivity analyses. We've not proposed using that $5x1.6x10^{-8}$. We do not propose using that as our licensing basis because that is simply a hypothetical sensitivity analysis. What we're doing is gathering the date, we hope, to tell us what it really should be. The licensing basis will be that $1.6x10^{-8}$. However, in a separate agreement with the NRC, we will also show them a case simply

run at a probability they asked for which is $1x10^{-7}$ per year which is higher than 8--$10^{-8}$. So, although we believe that based on current qualified information, $1.6x10^{-8}$ remains the right type of a licensing basis. We will show the NRC consequences at a higher probability. At this point, we're beyond the realm of technical decision making; this is a regulatory decision and obviously the NRC will have some say in that.

Is there more I should go to there?

ABKOWITZ: No, thank you.

CORRADINI: I have a few questions. But to handle Mark's question, there is a document we were given a year ago called risk information on support prioritization of performance assessment models. Figure 37 has, I think, what Mark is looking for in terms of 95th percentile versus the mean. So, just to get back to the--

SWIFT: Okay, thank you. Yeah, unfortunately, I actually had that figure in this presentation and then I swapped it out with the next one because I thought it made it clearer display of uncertainty. But, no, I fully acknowledge the uncertainty about that mean and your point that--although I would reiterate that the NRC has stated in regulation they will regulate on the mean, clearly the uncertainty distribution about that mean is of interest. And, if we start seeing a significant portion of that distribution

falling close to or above the compliance point, you know, it will enter the qualitative decision making process.

CORRADINI: So, now, some other questions. So, the first thing you said, I guess, I want to go to Page 13 or Viewgraph 13, excuse me. So, the last bullet, reconsider conservatism of damage to waste packages and waste form, and then that was the end of the TRB's observations prior to the--

SWIFT: It was one of your consultants. Yeah, one of your consultants' observations, yes.

CORRADINI: Excuse me, right. And then, following, I think you have on the next slide if I've got these slides in order--maybe the next one after that, excuse me. There was one of them that said that after this at the end of your TRB, consultants again suggested to look at the waste package interaction. You made a point which was that at this point no additional modeling data gathering or analysis will be done for that. It will essentially be reconsidered that if there is a--I've got to get these right--not an eruptive event, but the other one, intrusive event--

SWIFT: Yes, groundwater side.

CORRADINI: Intrusive event where it goes in and entombs a drift that anything that the magma touches essentially is assumed to completely fail. Have that I got that approximately right?

SWIFT; Uh-huh, yes, that is correct.

CORRADINI: Okay. Would it be beneficial or essentially a--so, I think you have an answer or maybe you've not thought of this--beneficial to look at other data from other sources on this? That is there's a good deal of effort by the NRC that's spent over the last 20 years on safety analysis looking at essentially this. That is groundwater release of severe reactor accidents where the materials are almost identical, okay, and doing--I don't want to say full scale testing, I'll say prototypic testing of these materials and looking at essentially this in two ways. One which is is there any sort of--what is, I'll call it--I'll use the word "decontamination factor" of this frozen material; and two, a fairly detailed groundwater transport model of leaching from this material into that. Would that be of some use?

SWIFT: Of course, it would. I believe the model we've taken here is arguably a bound. Therefore, I think any work done would either leave the consequences where they are or reduce them.

CORRADINI: Okay. So, I guess I'm encouraging--and again I understand where you're coming from relative to what you have to do in the time you need relative to the LA, going back to Mark's point about time versus your schedule, but I really do think this past data is available. In fact, essentially, Sandia--I'll pick on you guys--were the major

contractors for the NRC that developed most of this detailed prototypic data. That's point one.

Point two is on data. You made a mention--and I can't find the right slide for this maybe Slide--is this Slide 15, yeah--that there was some need to go back and look at compressible flow modeling. My memory tells me that there were investigators in the aeronautics and the GALCIC, the Graduate Aeronautics Laboratory at Cal-Tech, that have been doing work in volcanic eruption modeling for, at least, two decades and compressible flow modeling has been particularly what they've been doing. And, in particular, I'm thinking of Professor Sturdeyvant who has now passed away, but others have been doing it. I'd again recommend since you're not going to look at new data or developing it or new modeling that, at least, going back from a literature standpoint may benefit you in terms of this compressible flow modeling in the eruption zone because, if I remember correctly, this was the major part of their analysis in terms of volcanism. So, that's the second point.

The third point, I guess, on this slide, is the dike/drift intersection--you say DOE agrees that the overall conceptual model is adequate and reasonable. Is it reasonable or conservative?

SWIFT: Speaking of the model for the intersection of the dike with the drift and then the eruption, I would stick

with reasonable.

CORRADINI: Okay.

SWIFT: The conservatism comes here in, I believe, that number release from all the damaged packages. And, when I said--

CORRADINI: But, with the actual modeling of the process?

SWIFT: Yeah. I'll stay with that.

CORRADINI: Okay.

SWIFT: When I said I thought we had a true bound here, I was referring--I want to clarify that. I was referring only to the treatment of the damaged waste form and waste packages for that groundwater term. I think the rest of our model is within something reasonable.

CORRADINI: The reason I ask it like that is that in the--I can't remember if it was January or February where your review panel made its presentations. I tried to pay attention. This is a relatively complex area. But, I came away with, at least, the panel's feeling that reasonable may be a tad on the--I guess, I didn't come away with reasonable. So, hearing you use that terminology made me think a bit to ask, but this is excluding the waste package interaction?

SWIFT: I have--well, we have others here in the audience if somebody wanted to jump up and comment on that, I could ask them to.

CORRADINI: They're letting you hang yourself.

SWIFT: No, actually, I'm enjoying this, but I see some people here itching. There's one. This is Eric Smistad from the DOE.

SMISTAD: Eric Smistad, DOE. Peter's right. There were, you know, components the panel pointed out, technical and engineering side. The waste package was one area where they thought we were perhaps conservative by moving forward with the assumption that the packages were gone essentially. There was one area more on this, sort of the natural system side, and that is the conduit and the incorporation of waste. They perhaps felt that when a package is hit by a dike that all the waste in that package goes up and out and isn't available for a plume. So, they felt there might be some conservatism there. So, there were aspects that they felt were conservative, but overall they thought that we'd put together a reasonable model.

CORRADINI: And then, one last question and I'll stop which is these disruptive events look to me like, I'll call, a natural accident to use a term. Is looking at the regulatory limit of 15 mrem per year and probability-weighting the event the right way to look at this versus the way I look at an accident from a manmade structure which is the integrated dose to an individual at the site boundary? The NRC requires--this is not your regulation, but from a

standpoint of just pure common sense. The NRC requires in current operating class that you cannot expose a member of the general public to any sort of event from any probability to more than 25 rem at the site boundary. Has anybody backed out what that would be for these sort of disruptive events? I'm getting back to Paul's question relative to unraveling the time-weighting of this. You see what I'm asking?

SWIFT: Sure. And, first, part of the target audience for your comment would be the NRC, not the DOE and certainly not me.

CORRADINI: Of course, but you're there and so I've got you.

SWIFT: Is Abe Van Luik in the audience? He may have already left. Oh, there you are, Abe. Abe, would you like to comment on this? This is something you have thought about. Sorry to put you on the spot, Abe.

VAN LUIK: Abe Van Luik, DOE. What we have done is we have looked at some of the ICRP recommendations on intervention levels where they say that if you have even an unlikely event that produces between 10 and 25 rem that perhaps you ought to take into consideration that you can do something about this before you construct whatever facility you're constructing and you can do something like the backfill issue, for example, which we have talked about. We felt that the Slide 67 showed that we were right on the cusp

of one of those levels. So, we felt pretty comfortable that if we refine our modeling and get a little bit more realistic, we would definitely be below that level and probably this is not an intervention situation. But, this has nothing to do with the NRC regulation. It's just we are looking at the international advice on a generic level on how to manage this kind of risk and uncertainty.

CORRADINI: But, the international, what you quoted the 10 to 25 rem though, is still what has historically been the level below which the events have to be to be considered acceptable from the standpoint of what I'll--I'll again to use this not good work, but natural accident, so to speak.

VAN LUIK: Right. If we look at the language of the ICRP, they say that generally you would want to consider if it's more than 10 rem that you expect from this event that you would try to do something in the design to ameliorate that. However, if it's 10 rem or below, you probably would not want to because it is, after all, a very low probability of that. They were looking mainly at human intrusion, but in talking with some of the ICRP members, they say this should generically apply to other things, as well.

SWIFT: Steve Hanauer from the DOE also has a comment.

HANAUER: Steve Hanauer, DOE. I spent a long time working in the NRC and I believe you have mischaracterized the regulation. The 25 rem comes from a deterministic

regulatory scheme, but there is an underlying probabilistic basis in that the accidents which you are required to analyze and which are subject to this limit are a defined list, and although we didn't have the probabilistic technology when we developed this as we do today, this is not true of all accidents that one can conjure and, in fact, one can think up accidents for which the calculated doses are much higher. They are required to be made incredible which is not at the moment associated with a defined numerical probability, but in fact, there are whole programs to insure that these accidents don't occur which in modern days we would say that their probability is below some screening criteria. So, it is not true that all accidents, manmade accidents in your parlance, have to be managed so that the dose is less than 25 rem, but only a defined set.

CORRADINI: Within the design base?

HANAUER: This is the design basis.

CORRADINI: Okay. But, this is in the design base?

HANAUER: You're comparing not apples and oranges, but apples and airplanes. This is a probabilistic approach to safety analysis and safety regulation in which the NRC has established limits on the probability-weighted risk. The other was an entirely deterministic basis in which some unarticulated probabilistic scheme was used to decide which accidents are within the design basis.

LATANISION: Thanks Steve. I'd like to take one more question from Dan and then we're going to have to move on.

BULLEN: Okay. Bullen, Board. I'll make this a real simple question because this is out of my area of expertise also. I just had a question on Figure 17 which is the aeromagnetic anomaly survey data. Specifically, with respect to the fact that you made a comment about the impact of the buried volcanic age on the probability-weighted distribution or whatever you're going to use to calculate the effect. If you drilled the potential anomalies and you dated them, is there a possibility that the probability could go down instead of up?

SWIFT: I doubt that. If it all turned out to be older than, say, 5 million years, then I suppose the eight that were originally included in the PVHA estimate should be struck from their list. This seems improbable to me.

BULLEN: Okay, just wondering.

SWIFT: Mike, do you want to comment on that or Eric? I may have misspoken there.

SMISTAD: Eric Smistad, DOE. It appears essentially correct. The one aspect of that that could change that in the regard you're talking about is reconvening a panel and that panel may look at the information that was available in '96 for PVHA and all the information since then including the information for this new survey and come up with a different

probability and that probability could be--

SWIFT: Okay, thank you.

BULLEN: I've reconsidered and Richard has the last question.

PARIZEK: Yeah, Parizek, Board. I'm going to short list which--and just get on with one case of the schedule for 2006. That's about the time when this--

SWIFT: Two slides on from this?

PARIZEK: When this work--that's a good slide--when this work will have been done in terms of the aeromagnetic survey and drilling. In view of the importance of the issue and then the impact mitigation options that may exist and affects design, then all of the characterization efforts tied to that shouldn't--wouldn't it be reasonable to sort of accelerate this plan because it is one of those key areas? I mean, again to get to the end point quicker--

SWIFT: Yeah, I'm going to let Eric take this. Go ahead, Eric?

SMISTAD: Eric Smistad, DOE. I apologize, Peter. One of the things we are looking at, Dick, is to pull that up into '05, if we can. Another important point here that may get at what you're talking about is that, you know, the culmination is the reconvening of a panel, but we'll have information prior to that. We'll have an idea of whether or not these anomalies we're going after really are buried

basalts and we'll have the ages, as well. So, we'll have a really good indication of what we've got prior to, you know, the '05 period even.

And, if I may, I wanted to answer another question that was asked earlier if that's permissible. Sorry about that. There was a question. I can't remember who asked it, I apologize, about the 1.4 when we looked at the new anomalies and got a 40 percent increased and we assumed all of them were buried basalts and that would increase the dose. I mean, it's essentially a straight multiplier. There's other things that may actually bring the dose down. I didn't want to leave you here with the impression that that dose is going to go up necessarily. It could go down. There's several things on the eruptive side that could cause that. Peter mentioned the wind direction. Before, we had assumed it was all blowing south. Now, we're going to do a 360 degree look at that so that will reduce the amount of contaminated ash in the plume. It will get down to the RMEI in terms of an ashfall. The other area is the conduit placement. We had made a conservative assumption on conduit placement in SR where we essentially took the worst location for that conduit which was straddling a couple drifts. Now, we're randomly placing that conduit. So, we'll have a reduction in the number--we've actually have had a reduction in the number of packages hit.

The other area that--and that's stuff we perform. There's an area we're evaluating right now which is the number of drifts intersected, and in that particular AMR, we had assumed the worst case. We had intersected as many drifts as we possibly could. We're looking at what I think is a more reasonable approach and not fixing that on the maximum number of drifts, but looking at more of a way of placing that--randomly placing that around so that you don't absolutely have the most conservative look on that. So, there are areas that can actually bring the dose down.

LATANISION: Peter, thank you very much.

SWIFT: Thank you.

LATANISION: Our final speaker this morning is Greg Lanthrum. Greg was recently named director of the Office of National Transportation--of National Transportation Program which gives him the responsibility for developing the transportation infrastructure needed to move spent fuel and high level radioactive waste to Yucca Mountain. Greg was formerly the director of the environment management national transportation program in Albuquerque where he was responsible for managing the transportation of a broad range of nuclear and radioactive materials.

Greg, welcome. I have the feeling we're going to see a lot more of you in the future, but welcome to the session today.

LANTHRUM: Thank you. I can tell that you folks haven't had much (inaudible) yet. My name is actually Gary instead of Greg. So, I get the first punch in here. I'm sure there will be more coming back the other way.

LATANISION: Just call me Sam.

LANTHRUM: Okay. I'm one of these geeks that has to push my own buttons and I know you're going to want to push my buttons later, but for now I'm going to push them myself. But, I'm going to tell a little bit of a transportation story I heard last week to kind of set the stage for this.

SPEAKER: Well, you need to be miked.

LANTHRUM: Need to be miked on, okay. The story is about an airline flight out of a southwest city in the summertime, probably Tucson. And, as most of you that have been in the southwest in the summer, they have thunderstorms that come rolling through and one of these small very intense thunder cells came across the airport with wind shear. It shut down operations for a fairly extended period of time while people were already boarded on the plane and sitting there twiddling their thumbs. And, about an hour passed, the weather cleared, the airport started operations again, and they had a mechanical problem in the cockpit. It was going to probably be another hour before the plane could pull back from the gate. So, the flight attendants allowed the passengers to deplane for a bit and stretch in the lobby, to

stretch and get a little more comfortable before the long flight. One of the passengers was a blind person and they had their seeing eye dog there in the airplane with them. When the flight attendants came back and they asked if he wanted to deplane, he said, no, it's more problem than it's worth for me.

A little bit later when the pilot was walking up and down the aisles asking the folks that had remained if everything was okay, the blind man asked if perhaps his dog could be taken out off the jetway down onto the tarmac and to go to the bathroom because the dog didn't have the kind of endurance that he did. And, the pilot said, sure, he'd be happy to take care of that for him. So, you can imagine the shock on the people in the terminal looking out the window when they see this pilot with those dark aviator sunglasses and the seeing eye dog coming down the ramp. I feel a little bit like that. I think those people that were in the airport, if they had just seen the pilot performing his job, would have felt pretty comfortable. He could probably take off and land planes fine. But, seeing him out of context and seeing him walking with these dark glasses and a seeing eye dog gave kind of a bad impression to begin with.

I feel a little bit nervous because you guys haven't seen me operate. I haven't had a chance to go to rapport with any of you yet. I'm hoping to do that over time

if I don't lose my head quickly in this program. But, I haven't really gotten operational. You haven't seen me fly yet. What we're going to talk about is not so much flying, but the things I'm doing to get the program to where it can fly. And, with that as a context, I'll jump into this.

I'm going to talk about four things in the transportation arena today. I'm going to talk about the management approach that I'm trying to implement. I'm going to talk about project planning which I think is very key and John Arthur has set a very good stage for me and a good example that I can fold into and become part of the overall program. So, transportation is not something off by itself, but the project planning that we're going to do to make sure it's part of a greater program and works seemlessly with the other aspects of RW is going to be important. The institutional programs that will be responsible for, that's a very significant and important part of my job. And then, finally, the procurement plans that we've got or, at least, the procurement activities that we've got.

I'm new, as I just indicated, and we've got a new deputy director working for Margaret Chu (phonetic), Ted Garrish. He's my actual boss. And, Ted and I are working together right now to define the management approach for transportation as it fits into the context of the overall program. That's very important. There's been a lot of

effort done in transportation in the past and Margaret is fond of saying that there's lots and lots of dots, lots of good little activities, lots of work, but there's no coherent line of management thought that connects all those dots in a meaningful way and that's a big part of what Ted and I are trying to do for transportation right now.

I have a proposed mission statement. I'll go ahead and throw it at you here. That is that, "The Mission of the office of National Transportation is to provide the OCRWM and the public with safe, secure, and efficient transportation support. That support includes planning, developing, and operating a transportation system. This system will be used to move spent fuel and high level waste from private and Federal facilities and storage sites to a repository at Yucca Mountain."

It can look like a fairly canned capturing of what the mission is, but I think it's pretty important to recognize that safety really is a hallmark of what we're trying to do. One of my goals--and there wasn't much of a background introduction for me to give you a little bit of fuel from where I come from so you know I'm not just a guy with dark glasses walking a seeing eye dog. I started off in nuclear engineering and I worked in the utility industry for five years. I was the licensing engineer for the Trojan Plant and got the plant through the licensing process and

into operations. I quit for a year and traveled on a sailboat because that was a real pain and I really needed a break.

So, I took a year and circled the Pacific on a small boat by myself, came back, and I decided that the nuclear business maybe not was so bad, after all, and I went to work as a project manager at Puget Sound Naval Shipyard. There, I worked with a lot of ship defuelings and refuelings and so was involved in getting spent fuel out of the submarines and surface ships and then back then we used M-130 casks. They've migrated to M-140 casks now. That's how long ago it was. But, we were involved in spent fuel shipping to Idaho at the time. As the nuclear Navy shrank in size at the tail end of the Reagan years, the overall defense spending went down considerably. They went from a 600 ship fleet to a 300 and some ship fleet. The work for the shipyard shrank dramatically and we went through several rounds of RIFs. I got the pleasure of actually handing out pink slips and I went through that twice and it was more painful than the licensing process of the utility and I departed for DOE at that time. They were hiring.

And, in DOE, I worked mostly in environmental management program. I worked with the waste isolation pilot project and transportation and packaging issues. Then, I transitioned over to work with the secure shipping operation

within DOE that moves the weapons and special nuclear materials. So, I've dealt with transportation and packaging for a long time in my career. And, I understand the importance of safety and one of my real goals--and I'll jump down to here, the next slide.

Continuing, I have a vision of creating a transportation program that effectively addresses stakeholder concerns as safe, compliant, and operates so efficiently that the customers can take the system for granted. There was a huge amount of turmoil associated with getting the waste isolation pilot plant opening and making the first shipments and they did an awful lot of background work with all of the emergency responders and the lands that they passed through. They did a lot of work with the shippers. They did a lot of work with receivers. And, all that work paid off because after that first shipment, things have become very routine there. Transportation is not a focal point from the waste isolation pilot plant's operations anymore and that really is the goal for me to get to for the RW shipping program. I would like to have done all this homework adequately enough that when we get into operations, those operations can be deemed as fairly routine. And, I have the underscoring here that I understand that that vision can only be achieved in a cooperative effort with the institutional groups in our customer base. That's likely where the bulk of my attention

is going to be in the first year because the actual shipments are far enough away. There's a lot of effort to build the program. One of the focal points of that building is going to be with our institutional groups.

Strategic planning and other plans. I think in the past,there's been a discussion about a whole lot of planning documents that transportation would come up with and there's been mentions of things like communications plans and institutional plans and campaign plans and shipping plans, just a plethora of plans. Before we get into what plans actually come out, decisions on the actual management approach that's going to be taken have to be settled. I think we're very close to having that done. As the decisions on the management approach are set in stone, the strategic plan and the strategies for implementing that management approach can be articulated more clearly than they have in the past. That's what's holding up the strategic plan right now and I'll raise my hand in saying that I'm guilty. Part of it was because despite my involvement in transportation in general, in the past, I haven't had a whole lot of direct involvement with RW transportation. And, there's a lot to learn. Like I indicated, there's a whole bunch of dots, a lot of work had been done in the past. That body of work has been pretty tough to absorb. I feel I have to absorb and understand that history and the current management approach

and synthesize the two to come up with the actual strategy for being successful in the future. We're pretty close.

One of the things I had a problem with in the strategic planning environment before I came on board was that it was focused on creating a program somewhat ex nihilo and I think it's important to understand that we're not building something from scratch, we're building something that progresses from what's been done in the past. The lessons learned from the WIPP Project are lessons that I want to take directly to heart. There have been very good things and a few things that may not have worked so well, but I want to make sure that I accommodate the good things that came out of the past and build from that rather than trying to start something from scratch. And, that's one of the reasons for a delay in getting the strategic plan out.

I'm also working to define all of the pieces of the program and how they will work together. As I mentioned, this idea of all these dots of work that have gone on before, connecting the logical line through those dots and how we'll manage the program as it moves from planning into infrastructure development and then into operations is very important. And, I can't be successful with any of those pieces until the planning is actually coherent and has that management thread of thought that connects all those dots. And, again, this is reiteration that my focus is on getting

those pieces to work together.

How many other plans will there be? There's clearly a need for lots of strategic and operational planning, but there's a difference between planning and plans. I think that it becomes problematic if you capture all that planning activity in separate documents. If you have a dozen different plans, configuration control becomes an absolute nightmare, particularly because these plans all become very interlinked. If I have a dozen plans that I have to manage and I change one through some sort of a revision control process, I have to worry about how that change affects all the other plans that may be out there. As a consequence, I'm working to maximize the effectiveness of my planning efforts, but minimize the number of actual documents that get issued out of that process.

My goal is to issue one, comprehensive management document that will have a number of elements, whether those elements are chapters or appendices, or what have you, that address where I stand in the maturity of the planning activities for various functions that I am responsible for. Then, I have a single document, hopefully, so that when one part changes, I don't have to go fishing back through a bunch of files to find out where other documents might be affected. I would like to have a more easy to control documented system for what we're going to be doing.

And, the first portions of this master plan, I'm expecting our master document in the 2004 time frame, and as I indicated earlier, one of our initial focal points is going to be on developing the institutional programs because there's a huge amount of interface that's going to be required there.

And, this just highlights there's lots of transportation information that's available. A lot of work has gone on and it's been good work. It's just pulling all that work together into a cohesive program with a good constant management thread that ties it all together into something that can be deployed as an operational activity rather than just as a set of separate plans.

The other thing that I'm working on and it's becoming more and more important is interfacing the transportation planning with repository planning because transportation is a service organization. I'm not what's driving the program. I'm there to make sure that the program is successful at providing a service. And, one of my main customers, in addition to the shipping sites, the utilities, and the DOE sites that have spent fuel and high level waste, there's the actual repository and I have to make sure that what I develop both in terms of casks and in transportation capability matches up very well with what the management capability and operational capability are at the repository.

John conducts these monthly operating reviews and I'm going to start doing that both internal to the headquarters organization between the strategy group and the transportation group to make sure that what they're looking at in the realm of waste acceptance is tied in very well with what I'm doing in transportation infrastructure development and again tying in more directly with the operating reviews that are being done at the Yucca Mountain Project to make sure that their facility development plans and what they're rolling out for operations, the transportation program is going to be there to support that, as well.

What I've done is I've broken down the program and right now I've got five projects. The number may change over time. What I wanted to do was to drive a logical approach to breaking down the work into the smallest activities that we can conceive of at this point. And, it's going to be in an integrated process. The five projects I have right now were just to get the ball rolling. I've got an institutional project. I've got an acquisition project which looks at the cask and rolling stock requirements. I've got a separate project for looking at the requirements and need for a fleet maintenance facility. That may wind up getting rolled into one of the other activities or any other projects later on as we decide how best to tie these pieces together. The important thing is that I've got my staff looking at a very

structured approach to rolling out the program where you take large lines and you can call them product lines, for want of a better term, like the institutional product line and how we will interface defining all the things that we think are important, all the milestones that we're going to have to meet, all the requirements that are out there, and then drawing the interactions between the activities in one product line with those in another and drawing the interactions between all of my product lines and the things that are going on at the repository and the things that are going on in strategy development within RW. A lot of that work had already been done on identifying activities, but structuring them in a projectized (sic) context hadn't been done before and that's one of the first things that I'm working on.

There's also some indirect infrastructure that's needed. It's pretty easy to understand that to do shipments you have to have casks, you have to have rail cars and/or trailers that can haul the contents. Those things are pretty straightforward. There's some indirect infrastructure that we have to be thinking about, as well. One of the things is what are the capabilities at the actual shipping sites? There was a survey done almost 10 years ago that captured, I think, the term was the site's requirements documents, SRDs, was the terminology used, but they captured a lot of the

capabilities that sites had 10 years ago. But, things change over 10 years. One of the things we've got rolling out at the beginning of the new year--provided that the funding is as adequate as we've all got our fingers crossed for--is to do a reanalysis of those surveys and look at the pieces of that data collection that really are critical to transportation and then start asking questions about what elements of that infrastructure has changed, modified? Maybe some of it's been lost, maybe some new capabilities have been added. But, I have to be very aware of what the shipping site capabilities are to make sure that I can interface with that. That may actually drive some of the capital procurements that I have to do. If a site has lifting requirements that they don't have current crane capacity to meet, I have to make sure that I'm in a position to be able to support the interface between getting a package onto a trailer if the site can't do it.

A second thing is integrating with other DOE transportation activities in EM and in SA, the environment program and the National Nuclear Security Administration. There's a lot of interface there. Right now, the EM program manages the foreign research reactor program that got a national spent fuel program. They have some other programs that certainly have significant overlaps with what we're going to be doing. I can't go marching off and develop an RW

plan without a full recognition of what's already in place. We have to make sure there's consistency there.

The connection with the National Nuclear Security Administration may not be quite as clear, but one of the things that's evolving in requirement space is the threat protection environment. We're kind of escort is going to be required? There are some requirements in place now. They start off as interim compensatory measures that the NRC put out. They've developed in the requirements and I suspect between now and the time we actually start shipping, those requirements are going to expand significantly. Probably, the best experience that the Department has in providing security for shipments is in the Office of Secure Transportation. That was an area that I've supported before. I know a lot of the people, a lot of the managers there. And, even though the needs are not identical, a lot of their security is around preventing theft of items and it's hard to believe that somebody could pick up a spent fuel cask and steal the thing, but the idea of protection, they also do design basis threat assessments. And, understanding how they proceed with that and how they manage those threats and what they do to mitigate those threats is something that we need to be dialed into. Again, it's not something that we should be trying to create on a blank sheet of paper. We need to pick up from what's already been done in the past.

The other thing is development of clear regulations and standards that will affect our shipments. There is an ANSI N-14 effort that's looking at new standards development. A number of things I'm concerned may not get the amount of support and follow through that they need, there was a standard for shipment of damaged fuel, a standard for shipment of high burnup fuel, other standards that were in the development process and I think a lot of that work has stopped. I'd like to make sure that that work can proceed so that when we get to the point of actually making shipments or doing cask procurements to support those kinds of shipments that we have an informed base. I would really like to see RW be an implement that complies with the regulations that are established and vented through other processes rather than us being the ones that determined the requirements. In many cases, it's better if there's an independent body that sets the requirements that you just meet. I just have to make sure that those requirements get developed in time to support my procurement needs.

The product of all this effort is going to be essentially a series of resource loaded transportation projects and schedules and each of those project plans will be a living document because between now and 2010 when we hope to make our first shipment, a lot of things can change, but the interfaces that we're putting in place right now and

the connections between activities in my project plans and the connections for activities of the repository and the connections in the strategy development office are very important. And, as long as those connections are still there as changes get made in any area, I can update my project plans accordingly. And, that's what change control is all about. If you've got a good base that you're building from and you understand where you are and why you're there, as other changes come in and are driven--come as external drivers to you, you can accommodate them in some sort of constructive way.

There's a number of drivers that may come. I've talked about the interface between the repository and other parts of RW, but there is regulatory drivers that are definitely presumably going to change between now and the time we start shipping. I expect that to be a fairly significant thing. Funding has always been a challenge for RW in the past, and even though I'm optimistic about the way 2004 is going to look, there's a lot of years between 2004 when we would actually start shipping and if budgetary constraints or budgetary excess drive changes in my program, I have to have ways of accommodating those.

And, on institutional programs, there's no question that the institutional groups that we will deal with will have a significant impact about how we transition from

planning an infrastructure development into operations. OCRWM resumed funding for the State regional groups in 2003 and for the transportation external coordinators' working group in 2003. In fact, Margaret attended a meeting of the TEC in, I believe, it was August--July or August--

SPEAKER: July.

LANTHRUM: July in Washington and that's going to be an area that we will be more involved in in the future along with funding of four of the regional State groups that provide significant input that will help guide us as we start working towards both our operational planning and the emergency response plan that we're going to have to coordinate with the States and the Tribes.

Funding complications precluded making all the progress that the program had hoped to make this year. 2003 was just an ugly year by any measure looking at the length of the continued resolution and the way that the funding was constrained. We're hoping a lot of those challenges will be behind us as we get into 2004. Certainly, I'm anxious to see a fully funded year. We've got, at least, the financial capability to move forward a lot of the things that we're developing strategically.

The other thing was the permanent management team was not in place for the bulk of 2003. Ted Garrish is going to be an immeasurable aide to me in helping get some of the

things that I want to do vetted through the Department as a whole and that will give me more of a chance to be technically successful. But, now that both Ted Garrish, the deputy for the strategy office in RW is in place and I'm in place, that gives us a lot more latitude once we have the funding to move out.

And, this just reiterates the fact that things look like 2004 is going to be a great year. So, this will be the year where I'm no longer walking the dog down the tarmac. I'll be back in the plane flying it. Hopefully, that will be the measure that we'll be graded on.

There's a number of substantive activities that we have had peripheral discussions with the State regional groups about engaging them on. They've raised a lot of issues over the years and the program has not been in neither a financial position or far enough along in development of the program to address a lot of the things that they'd asked about.

But, some of the things that we are looking at now and will be proposing is an update to the protocols. DOE has a transportation manual that goes with an order and it's the 462.2. There are transportation protocols in that manual that talk about the interface. The protocols that will affect the RW operations probably need to be updated. That's an area that we can have substantive engagement with our

stakeholders on.

Another one is defining the expectations and outlining the program for technical and emergency preparedness under Part 180c. There's a lot of uncertainty about how early you start that process. My intuition is the earlier you start the discussions, the better chance you have of actually having something that can be rolled out in time to be supportive of operations when you get there. A big part of that is coming to agreement about what the scope has to be. One of the things that I'm concerned about right now and I had some discussions out in the hallway yesterday with a couple of folks is on emergency responders, a lot of those folks are volunteers, particularly as you get out into the rural counties, and those volunteers are emergency responders not just for RW. They are emergency responders for their counties or their localities. And, if they are volunteers, if they have to attend FEMA training, then they have to attend DHS training, and then they have to attend DOE training. That becomes a fairly significant burden. So, one of the first steps that I anticipate making in this 180c arena is looking at what currently exists out there. What are the current requirements? What are the drivers? And, how do we piggyback onto that rather than creating something separate from what is already there that becomes a burden rather than a help.

Another area is developing uniform safeguards and security expectations. There was just an EM shipment of spent nuclear fuel that was done from Oak Ridge to Idaho. In that shipment, there was a lot of hand wringing about how to implement the security and escort requirements. The original thought was that they would use trained hired guards for the escort purposes. The problem is that getting the weapons permits with all the jurisdictions you have to cross, they would have had to have dealt with each jurisdiction that had control over that along the way, and in the time frame that was available, that became an insurmountable problem. And, understanding problems like that far enough in advance to address them is going to be an important part of how we roll out our expectations and make sure that we have a program that's able to be operational when the time comes. The way the Idaho shipment was handled was the Officer of Secured Transportation stepped in. They provided on Federal agent that was the armed escort with a number of contractor backups for that armed agent. But, having a Federal agent that has arrest authority provides a significant delta in your ability to transit all the jurisdictions you have to go through. Things like that have to be considered well in advance and be part of our planning process so that when we get closer to operations, we can be there successfully.

Another thing that has come up over the past couple

of years, there was a pamphlet or a paper that was prepared on extra or severe accidents that possibly could exceed the design requirements of casks. I'm not convinced that those severe accidents would, in fact, present a significant threat to casks, but conducting analysis that's peer reviewed to say yea or nay or to address the questions is something that we could probably take a close look at.

Now, this is just my sort of looking at things that I know have come up in previous meetings and I've been to a lot of those meetings in my previous EM capacity, not in an RW capacity, but I've heard all the questions raised. There haven't been many answers that have come back. We've got this as a bundle of things I've extracted from previous interactions with the State and regional groups, but will probably be going out fairly soon and asking them what are your current concerns? Are these still on your radar screen? Are there other things that you would like us to address? And so, it's not going to be just DOE heard you before, here's what we're going to deal with, but we'll have a significant interaction with them about are there more immediate concerns that they've got at this point in time rather than the ones that I've synthesized here from previous meetings.

On the procurement front, a big part of that is going to be my efforts to update the shipper infrastructure

information. We know the population of material in total that I'll have to deal with at some time. So, my first stab is going to be to come up with some internal ideas about the fleet of casks I would have to have to bound all of those contents. Once I've got that fleet of casks, then I start talking to both the folks in the strategy side and looking at the existing contracts and seeing what waste forms we think might be in the first cue. The existing contracts talk about who has priority, but in many cases, that who is a corporate entity and that corporate entity has a lot of latitude in selecting what fuel actually gets shipped. So, there's a bit of guesswork involved. We'll wind up probably doing some fairly significant modeling to make sure that I can bound. And, unfortunately, I don't have a lot of cool graphs that look at Monte Carlo simulations and whatnot, but at some point we'll get to the point where I can discuss more effectively all of the potential shipment arrangements that could come up between fuel types and fuel conditions and repository capabilities as far as facilities go and look at how that might drive my initial selection of casks. I do know that regardless of what comes first in the cue, I'm going to have some challenging casks I'm going to have to get. Some of the cask requirements are already bounded by what the industry has currently. There are some truck casks and some rail casks that conserve a fairly good sized portion

of what we need to ship. We do have high burnup fuel out there and, undoubtedly, there will be a need at some point to ship damaged fuel. We don't have casks that can effectively address those concerns.

And so, as I look at the cask procurement requirements, I'll look both at this total fleet, I'll look at what we expect or what we think the first shipments might be, and then I'll look at what my bounding requirements are for really long lead procurement casks, and determine from that which casks we have to go out and procure actually in the first round of procurements. It will probably be a series of procurements just because the total fleet that we're looking at, if you tried to procure all of those in one year, would be a whopper of figure that would be tough to justify. And, again, since the program is going to be going on for a considerable period of time, I think there's a logical approach to having a phased acquisition process that addresses what you expect your first shipments to be with some conservatism to bound some "what ifs" around that and have that be your procurement strategy.

Some of the factors in driving my cask selection are the waste acceptance decisions that will have to be made and the negotiations that have to be done and the Yucca Mountain facility capabilities. We have both commercial fuel and the DOE's spent fuel and the high level waste to consider

in our procurements. I want to make sure that we can support the procurement far enough in advance of casks to support this initial waste acceptance cue and the shipper and the receiver facility capabilities, but I'm not going to limit the initial procurement to just that set because that is at this point still somewhat of a guess. There's going to be changes between the time that I procure casks and when final decisions are made about what actually will be shipped initially. So, I have to be able to bound that uncertainty with a little bit of extra capability.

This is a rough--well, it's not even much of a time line. The time line ends the next month, but it shows that the review of the total requirements is getting underway now and will be more fully underway as the new fiscal year starts. But, at some point, decisions from the facility capabilities and from the waste acceptance then will drive what my real needs are going to be and the larger procurements as far as quantity goes for the initial fleet.

And, I believe, that takes you through all the subjects I said I was going to talk about.

LATANISION: Gary, thank you very much.

LANTHRUM: Now it's time for you to touch my buttons.

LATANISION: Okay. First up is Dan Bullen.

BULLEN: Bullen, Board. Actually, just a couple of quick questions. The first one being we heard from, I guess,

it would be your boss's boss, Margaret Chu, Dr. Margaret Chu, in May that there would be a record of decision on mode and route eventually. The date that comes to mind is--

LANTHRUM: Eventually, there will be.

BULLEN: The date that comes to mind is November of this year. Do your plans still call for a mode and route decision by that time or do you maybe want to defer to the parties that be that are sitting behind me?

LANTHRUM: Well, the mode and routing decisions are important decisions and there will be some work that I'll be doing that will help inform those decisions this year. I don't think I'll be in a position to make solid technical recommendations, particularly on a Nevada route, if rail is used. The EIS, the final EIS, did say there would be a mixture of rail and highway shipments. Right now, if we wanted to use that mix, it would have to be intermodel. We can't get rail all the way to the repository. That does have a constraint. I haven't been able to quantify what the impacts of that constraint are on the total capability for thru-put and I can't do that until I finish this complete project planning and map out all the activities that I've got and then put dollar figures on things. And, that's part of the decision process that has to go back in. If Margaret asks me this afternoon after this discussion what's my recommendation, I'd have to shrug my shoulders because I

can't--I don't have a technical basis for making one. I've got a good strong gut feel, but I don't have a solid technical basis. And, I have to build that technical basis before I can give them the ammunition to make informed decisions and I sure don't want my bosses making decisions without them being informed.

BULLEN: Okay. Bullen, Board. Just one last quick question and this really doesn't deal with your realm except for the fact that it's cask procurement. But, the Nuclear Regulatory Commission is actually interested in performing what's called a package performance study--

LANTHRUM: Performance testing, right.

BULLEN: --which would be full scale or large scale testing of cask performance. How does that affect your planned procurement?

LANTHRUM: Well, I can't really answer that. We do support the casks, the package performance testing. We were supposed to have wanted to provide funding for that last year, and then with the funding shortfall, we weren't able to. Right now, our budget calls for providing some funding for this year, but that's really a NRC activity. If out of that activity regulatory requirements change, our procurement will comply with those regulatory requirements because we're driven by the Act to procure NRC certified casks. If those tests don't change the regulatory requirements, then my

procurement doesn't change.

BULLEN: Bullen, Board. You actually touched on something that I'm interested in. Does the procurement for-- excuse me, does the payment for the package performance study money that's provided by DOE come from your budget or is it from a research budget or a science and technology budget that--

LANTHRUM: It comes from my budget.

BULLEN: From your budget, okay. Thank you.

LANTHRUM: And, there is no particular logic for that. It was just where it was plugged in because RW has no direct interface except for the funding interface. We're not providing any technical guidance of any other interface to the NRC for those tests. It's their tests, they're running it. All we're doing is providing money and I was just a placeholder for it.

LATANISION: Priscilla?

NELSON: Nelson, Board. You talked a little bit about a relationship with DHS and its agencies that you anticipate working with regarding emergency response, other agencies like Department of Transportation. And, what I, from the standpoint of National Science Foundation, perceive as a compounding difficulty of having some central way of dealing with State DOT efforts since the last big bill that really changed the flow of funds and control to States as opposed to

National causes a complication and ease of contacting and working with State DOTs. But, one question that I have is your thoughts on working with DOT, nationally and state, in terms of part of your project?

LANTHRUM: Well, DOT to the extent that we exercise highway shipments, they bound the requirements and so any involvement we have in route selection is going to be tied to the DOT requirements. That's the absolute minimum. States do have the opportunity again for highway shipments to specify preferred routes as long as those routes meet DOT requirements. But, the big complications that I've got right now are more NRC oriented with the cask procurements and certification process than with DOT. There's an open door and I've met with Rick Boyle from the DOT, but more of that was talk about the rule changes that are coming up, the DOT regs in 49 CFR and the 10 CFR regs. The 10 CFR 71 are being changed to harmonize more directly with IAEA regulations. My discussions with him, so far, have been just to the extent that that harmonization may impact our operations. And, it doesn't look like the areas that I'm concerned about right now are going to be directly impacted initially.

NELSON: Okay. Well, let me just follow up on that for a minute. I know from the research community that there's a tremendous interest in the idea of extreme events, complex systems, the increasing piggybacking of information

technology control systems on the physical infrastructure, and vulnerabilities becoming realized or not that make prediction of responses increasingly complex. Some of that is expressed through some research projects that have gone on, some of it in sessions at transportation research board and other areas. There's a lot of interest in this.

LANTHRUM: Uh-huh.

NELSON: And, not just single hazard, but multi-hazard. And, this not likely to be reflected in regulations that exist now, but it's stuff that's going to be happening in the window of planning that would be of interest to you maybe five, 10 years out. So, I'm wondering what your thoughts are about that and how you intend to track this and actually think about this?

LANTHRUM: A bit part of that is building the network of conductions. And, Rick Boyle is the manager of the research and special projects administration within DOT. So, a lot of that work will fall under his purview. And so, having the contact and having a familiar face to work with, hopefully, as things come up that would impact us, he'll give me a call. We maintain informal contact now. I do participate in an awful lot of the forum. I was involved as a presenter at the last Institute for Nuclear Material Management presentations in Scottsdale and I'll be involved in a lot more of those national and international forums because a lot of the ideas

that you're talking about are presented there in conceptual space long before they become involved in regulatory space. So, right now, there's not a formal relationship or connection, but the informal networks become fairly critical in making sure that we have a chance to provide some kind of feedback to those loops and influence to the extent that it makes sense, the decisions that get made.

NELSON: Well, that's good. I encourage you to stay on that because I think it's going to be an interesting five years.

LANTHRUM: It's very interesting. Some of the stuff is going on, and in fact, on the international side there's a lot going on. The package performance testing that the NRC is doing is of considerable interest both to myself and to the private sector. The cask manufacturers are very engaged in that because they're a little concerned about exactly how the test procedures are developed because they're going to be donating casks for the testing or selling casks. And, if they are, in fact, selling one of their casks and they don't like the way the test procedures are set up, they have a lot to lose and not much to gain. So, there's significant interactions there. But, there's also international tests. The Germans are getting ready to a 25 foot drop test of a spent fuel cask to simulate a handling accident in a facility and I'm very interested and concerned about that.

NELSON: Because Sally Devlin asked me to ask this.

LANTHRUM: Okay.

NELSON: She's very interested in your thinking about performance confirmation regarding your program and will you be developing a performance confirmation strategy for the way you think your system is going to operate?

LANTHRUM: I've scratched around with that. I've gotten a lot of preliminary feedback that says since we are going to be using casks that are certified by the NRC and they have a performance basis that that performance basis is what we are going to be meeting and not something that would require an in-depth performance confirmation of our own. I haven't reached any conclusions about that yet. That's something I need to take more of a look at.

NELSON: Good. And, thinking about the overall system instead of the individual component--did I get that right, Sally?

(No audible response.)

NELSON: She's not even here. Forget it.

LANTHRUM: You lose the kudo for having asked the question now.

NELSON: I'm not going to ask any more.

LATANISION: Great. All right. Thank you, Priscilla.

Mark, you're going to have the final question.

ABKOWITZ: Okay. Abkowitz, Board. First of all,

welcome.

LANTHRUM: Thanks.

ABKOWITZ: And, I look forward to working with you. I'm a believer of systematic approaches to complicated problems and I recognize a lot of very good things that you're intending to do.

That having been said, I wanted to explore a couple of issues with you. If we could go to Slide #5.

LANTHRUM: Yeah, this one.

ABKOWITZ: The commitment--you say a commitment was made to issue a strategic plan in 2003. Are you maintaining that commitment? It was a little fuzzy to me.

LANTHRUM: I'm doing everything I can to get a strategic plan out in calendar year 2003. I won't be successful in getting it out in fiscal year 2003.

ABKOWITZ: Understandable.

LANTHRUM: And, that's the burden that I bear. I think it's important to get it right and we talked yesterday--you talked with John and others about are you going to worry about schedule most or worry about getting things right most and currently I'm worried about getting it right more than getting it out on a schedule.

ABKOWITZ: Okay. If we could now turn to Slide #9?

MR. LANTHRUM: Okay.

ABKOWITZ: And, the foremost bullet there is your

statement that the States, Tribes, and affected units of local governments and other stakeholders will impact transportation decisions. There was a transportation external coordinating meeting that was held this summer, as you mentioned, and that convened 60 to 70 different stakeholders. I thought it was a very impressive group. And, there was a, you know, a series of facilitated small group discussions which basically was oriented at giving these stakeholders an opportunity to express their concerns and so forth and so on. One of the things that was--I attended as an observer. Believe me, it was very hard to observe and not say anything.

LANTHRUM: I bet.

ABKOWITZ: But, nevertheless, one of the things that I heard quite a bit on the sidelines was the concern that was expressed that by the timetable that was being discussed, there would be no possible way for those stakeholders to have an opportunity to review a strategic plan before it came out. And, it looks to me like the schedule that you've espoused to maintains that concern. And so, if you're really planning to walk the talk about having the States, Tribes, and affected units of local units of local government and other stakeholders impact the transportation decisions, I would strongly encourage that you start with Square One doing it the right way.

LANTHRUM: I appreciate the input. Do you want me to respond or are you just giving--

ABKOWITZ: Sure, please do?

LANTHRUM: Okay. My view of strategic plan, it's mostly about strategy and the strategy really couldn't be nailed down until the management team was in place and Ted Garrish and I and others have had some discussions about what our strategy is. I don't think it would have been beneficial to get it out until we had internally gone through our thought process about how to strategically approach the challenges that we have. It would have been, I think, more harmful than helpful to roll out a strategic plan before we'd thought through the process internally. That said, we also have this deadline that's been set that's a schedule and I'm going to be late as it is. You're absolutely right that the opportunity to have effective and meaningful interaction with all of our stakeholder groups on that strategic plan before it goes out and still get it out as close to the anticipated deadline as expected, it's not going to be possible. Now, there's been no shyness on giving comments to anything that we've done whether it's been issued as a draft or as a final document. I'm expecting this document to be fairly high level to talk about again the strategic approach to things, that we will be safe, we will be interactive, and it's going to set the framework for what I'm hoping will be when I start

flying, my getaway from walking the dog and actually start flying. And, hopefully, in the line of getting judged more by those activities as we actually start interfacing with our stakeholder groups on substantive issues rather than on the fairly small and fairly high level strategic plan. But, that's a fair shot and it's just--I came into the program at the wrong time to help that work the way it probably should have worked.

ABKOWITZ: If I might respond and I understand the timing of your arrival, but we were told yesterday that quality would not be sacrificed and that engendering public confidence in repository planning and operations was of utmost priority. And so, I have a little bit of difficulty when you tell me that it's impossible with the schedule that you've been given to do these things when we both know that absent doing those things at the beginning of a process is going to set you back considerably in engendering any kind of public confidence when it comes to transportation planning.

LANTHRUM: A fair shot.

ABKOWITZ: One other thing I want to do and I know it's getting late, I apologize. I wanted to ask you how long do you believe it takes to construct a railroad spur once you've been given the go-ahead to put the first, you know, shovel in the ground?

LANTHRUM: I don't know. That's an area that I don't

have a lot of expertise in. There's not a lot of detailed information available to me on the construction requirements. Two years has been a number that's been tossed out, but I don't have a solid technical basis for standing behind that number. I expect in 2004 to be doing some preliminary work that will help me answer that question more effectively than I can right now. That's part of the challenge on, I think, the lack of decisions is that I and my predecessor didn't have a clear enough technical basis to say that there are significant drivers. Once I have that information, I'll be perhaps a better advocate for getting decisions made.

ABKOWITZ: And, once you have that infrastructure in place and the last golden spike has been nailed in, how long from your operational experience would it take before you would actually consider, you know, moving a product on that line?

LANTHRUM: My experience hasn't been involved with rail. So, rail is a new area for me. I suspect that the time required from when we hit our last spike in place to when we could begin shipments of some kind would be fairly short because we have the capability to do shipments that we understand and have been doing for some time. Building on the experience that EM has with doing rail shipments of spent fuel and the experience that the Naval Reactors program has on shipping spent fuel by rail, once the rail line is in

place and has gone through its operational readiness review, I think that that would be a fairly short time horizon. But, until I've laid that out and looked at all the requirements because rail is an area where--the interactions for rail are significantly different than they are for highway and the rail lines themselves currently have a lot more latitude on routing decisions since it's all through private land. The rail line owns the land. The process is something that I'm not familiar enough with to give you a good answer for.

ABKOWITZ: Okay. And, I understand that a rail spur would not be able to be started until you have a construction permit?

LANTHRUM: That's the current--

ABKOWITZ: And, you can't get a construction permit until you get a license?

LANTHRUM: That's the current thinking.

ABKOWITZ: So, when would be the earliest you could possibly expect to get a construction permit?

LANTHRUM: Well, right, John--right, right. It would be after construction authorization and that's anticipated to be--December of '07 is the--

ABKOWITZ: Okay. So, if I could do the math under the most ideal of scenarios, the earliest you would get authorization to construct would be December of '07?

LANTHRUM: Right.

ABKOWITZ: The earliest that it would be complete would be December of '09.

LANTHRUM: You're looking at a rough ballpark figure of two years.

ABKOWITZ: The earliest that you would be able to even try to do something with that would be in 2010.

LANTHRUM: Which meets the current requirements.

ABKOWITZ: Well, but that is assuming, as I said, an ideal scenario.

LANTHRUM: Absolutely.

ABKOWITZ: So, what I would strongly encourage even today, especially given that you've decided to delay for some period of time the mode and route record of decision, is to at last acknowledge to the citizens of Nevada that there is a strong possibility that you will be trucking spent fuel into this facility if you indeed start your campaign in 2010.

LANTHRUM: Okay. Appreciate the feedback.

ABKOWITZ: Thank you.

LANTHRUM: You bet. I wish I had some more definitive answers for you, but those will be forthcoming.

LATANISION: Do you have a question for Gary?

CORRADINI: A short question.

LATANISION: Go ahead?

CORRADINI: I'm not as versed in all this, but the one group that we did hear about through questioning, I think,

two meetings ago, maybe it was three meetings ago, was the Office of Naval Reactors. So, I'm curious about since they had experience with rail shipments and so--I'm not you and so I'm not standing up there. It seems to me being not a transportation expert that rail shipment seems the most logical way in almost any category from your mission statement. But, that's a comment.

What I'm curious about is the Office of Naval Reactors' experience and how you can draw on it relative to rail shipments, relative to a single cask that essentially packages the material, then takes it and disposes of it. Because if I misunderstand, the members will--my colleagues can tell me if I'm remembering wrong. It was two or three meetings ago we were told by questioning that Office of Naval Reactors is going to have the same thing that is transported that is disposed of. Am I misunderstanding?

LANTHRUM: That's correct, I think.

CORRADINI: So, is there something to be gained by looking at their expertise and their planning? Particularly, at least, in my curiosity, the single canister to be the transport and the disposal canister? It's a question that you don't have to answer now, but that's the one interesting thing that has gotten me since we first heard about this about two or three meetings ago.

LANTHRUM: And, actually, that's kind of gone like a lot

of things in this program. The program has been around long enough, a lot of the questions that will likely come up under my tenure have come up before and have been either deferred or addressed or closed. The question of a multipurpose canister came up previously some years ago, a canister that could be used for storage, for transport, and for disposal. At the time the disposal configuration wasn't well enough known to proceed and funding was cut. So, nothing came of it. The questions are being asked again, and as we move closer to finalizing the license application and the configuration of that disposal canister, that is something we can look at. We do have the challenge of there's an awful lot of fuel that's in canisters currently that is not set up for disposal. And so, we'll still have to deal with the backlog that we have and additional waste is being generated all the time, but if we can get to a position and if it makes business sense which is going to be one of our drivers, it would be nice to see a program that could accommodate a cleaner flow with less impact to all those affected. And, to the extent that it makes a good--a good business case can be made for it, it would be pursued.

LATANISION: Gary, I want to thank you on behalf of the Board for being with us today. This early stage in your tenure, I think you can sense from the questions that we're very, very interested in this issue and we look forward to

hearing from you again in the future.

LANTHRUM: I'm sure I'll be up here a number of times.

LATANISION: I think that's probably right.

LANTHRUM: Hopefully, I'll bring an indication of progress each time I come so that I can allay some of your fears, but this was a bit of a trial by fire since I'm still, like I said, trying to get my hand around all those dots of work that's gone on in the past.

LATANISION: Thank you very much.

LANTHRUM: Thank you.

CORRADINI: Mr. Chairman:

LATANISION: Yes, sir.

CORRADINI: Into our public comment period and we have three individuals that wanted to make comments.

First of all, Mr. Grant Hudlow?

HUDLOW: Yes, I'd like to put into perspective some of the--one of the things that came up in the igneous talk. I'm talking about having an event that causes maybe 25 rems to get out to the boundary. Each of these fuel rods has the equivalent fallout from several Hiroshima bombs. We're talking about one heck of a lot more than 25 rems on the boundary. One of those things from the bombs here, one of them landed in Utah, killed some sheep, and ultimately I don't know how many people. Another one landed in New York. So, we could expect the same thing from an igneous event.

We could expect the same thing from a terrorist attack on the transportation route. The public senses this Chernobyl size accident that we're dealing with and the possibility of it. And, that causes a lot of concern and just outright fear.

The other thing that I wanted to mention is that in Deborah's talk an awful lot of what she was talking about in industry we would call design build. And, when you go to a regulator with a design build project, we would call it that. Now, the nuclear industry does not. They don't call it that, but the rest of the industry does. We would call it that and then we would provide people like John Arthur that have the experience with design build so that they would then have confidence in what we're doing. Bechtel also has people like that and I think I would recommend that Bechtel be told to provide people like that so that their people are used to handling--in a design build especially where the physics and the chemistry isn't known yet like this project. For example, in a design build, you have some really nasty incidents and you need people that have the experience and the background and the toughness to jump in there and straighten them out and get it going again. The electronics industry's space age kind of thing, those all have those kind of people in it. People that have done that are also addicted to that sort of thing. It's really exciting. And, anything else is so boring that they won't bother with it.

CORRADINI: Thank you. Our next speaker is a Mr. Jacob Paz.

PAZ: I make just very briefly two comments. The first one, it would be interesting what is the effect of elevated temperature on zeolite, sorption, and migration (inaudible).

The second comment which I'm going to make is on the (inaudible) standard effect and this is a new emerging science where if you irradiated cell, the neighbored cells are being affected. We talked about 25 to 30 generations would cause mainly is instability in the chromosome which consequently can lead to cancer transformation. We talked, in effect, in 100 mrem and lower. This has been challenged in the new traditional risk assessment.

Last, I'd just like to cite a paper from Mothersill (inaudible) Seymour. For the past 15 years, it is--has been only recently become apparent that chemical in the natural environment can also induce state of (inaudible) instability in cell and enhance low dose chemical toxicity and probably involve a (inaudible) standard effect. And, this is very significant and it was earlier discussion what is the effect of radiation. This area should be looked very careful by DOE and other regulatory agency because we don't know. If you're going to rely on the traditional risk assessment, you have a very potential, very serious errors.

Thank you. If anyone, by the way, I am submit a

paper for publication which include all the references. I gave it to Ellen Benson and I gave it also to committee, a copy of it, which have the references.

CORRADINI: Thank you. Our final comment is from Ms. Sally Devlin.

DEVLIN: Mrs.

CORRADINI: Mrs., sorry. Ms.

DEVLIN: I'm Sally Devlin and, once again, I want to thank everybody for coming to Armagosa, Nye County, Nevada, the home of Yucca Mountain. And, I hope you'll come again. I love these meetings because I get to see you all and have fun and tell you new jokes. So, I gave it to Dan. It's for everybody I share. And, also, a copy of my NRC report and a copy of my transportation report.

And, I am really so terribly thrilled that this Board has finally broken it's maiden and you know I'm an old race tracker and that is you finally have someone on board--and this goes to Mr. Arthur and for Margaret, too--you've got someone on transportation. And, we've been trying to get you to that for 10 years. So, it is a wonderful thing to really win a race and you just did.

I do have two comments. And, where is Gary? There, okay. And, welcome aboard and I know that pursuant--I was talking about looking for oil in Railroad Valley which may affect Yucca Mountain and it may be going on in Lincoln

County, also another host area, but not very much like us. And, that is my favorite term which I was castigating everybody about, performance assessment. I am the perpetual student and you don't know me, but I do everything by teleconference and I cannot imagine that you cannot involve the country in a teleconference on this very important subject. It is one thing that could be taped, it could be on disk, it could be everything, and get to the nation because we want the information you're working on. I just proposed to two new gentlemen who were here for the first time and both of them were experts on the railroad. And, you don't know me, but I've learned to build railroads, to build barges, and to build all kinds of roads on transportation. The only thing I don't know is the cost. And, of course, when we start talking permit and so on, one of the things in Margaret's packet is from the National Conference of State Governors and there are 27 of them. At the last conference in Vegas, my boyfriend from Denver presented this and I have given her a correct copy. What this is is terribly important because every state of the 27 charges anywhere from $5 to $26 for permitting waste going through. And, you're going to run into this stuff. Now, in Nevada--and I can speak for Nevada because I did my homework--and that is they charge $500 for a permit and then there's somebody in the back room in motor vehicles that if you do have an accident puts the accident

money on it. So, it's very strange. Every state, I'm sure, has their own idiosyncracies. In Nevada, we only have one agency that's open 24 hours a day besides the brothels and the casinos an so on and that's the highway patrol, nothing else. Our health division, it's closed from 5:00 until 8:00 on Monday. So, all you have is the highway patrol. Our roads are nine hazard roads. WE have no railroads. So, this is the stuff you're going to run into in just Nevada and the test site itself is 18,300 square feet. So, the State is 300--I mean, miles, yeah. So, you're getting into enormous distances. You've getting into all that stuff. So, I really do want performance assessment because that's what's important to the public. So, I hope I've given you a hint not to ignore us because we will not be ignored. I don't see in modern education and everything else, every university is teleconference, all this stuff. We want these meetings. We learn more from the four NRC meetings on transportation and then they sent me 1200 plus pages of transcript. I cannot tell you how much I learned from them regarding transportation because I've been living here and I don't know about tunnels 10,000 feet up which might occur and what happened. And, the Baltimore Tunnel fire July 17th, 2001, that was all documented, 190 pages. I never knew any of that stuff. I gave to Dan about the drilling for water in New York. I never knew it was built in 1911. So, you're talking

about really fascinating stuff that is coming out that is instant communication. All of this is instantly at our fingertips and I hope you will do it. And, again, I welcome you on board.

And, I had one other question and, of course, I throw this at the Board every meeting. And, that is I love you all for making such a fuss over my bugs and the colloids. I just can't believe it. I have a million questions on the colloids because if that hot stuff is in the mountain, won't it affect everything and how will it affect the Alloy 22 and so on because I know the bugs will eat the Alloy 22, but I don't know about the colloids. And, I'd like more information on the colloids that you found. I just think that's so wonderful.

The other thing was on the volcanism or the igneous activity. How do you like that, Dan? And, my question is, of course, about the volcanism and the rhyolite and so on. And, I'd like some more on that, too. And, we will be reviewing this stuff and I will be meeting with the university. And, I want everybody to know one of my friends said what do you with all that paper? I can assure you I have a 20 foot shelf at UNLV in the Reed Building and every piece of paper I have gotten including some stuff from 1962 on Death Valley--but, every piece of paper that I've gotten since 1992, '93, until the present day is in my library at

UNLV. And, whoever wants to get a PhD can really get it because this stuff is fascinating and it gives you the whole history, particularly on transportation which goes back to an Idaho report of 1994. And, they're all at the university. So, this is fun.

Anyway, again, thank you. I know everybody is starving. And, thank you, Margaret; thank you, Mr. Arthur; thank you, Board, my buddies over there. And, come again very soon. Thank you.

CORRADINI: Thank you. So, to wrap up, I wanted to thank our presenters from the DOE, from Nevada, from Nye County, and to thank the Board's staff. I think the meeting went quite well and thank the Board members. And, we'll see you in January.

Meeting is adjourned.

(Whereupon, at 12:34 p.m., the meeting was adjourned.)