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ADVISORY COMMITTEE ON NUCLEAR WASTE & MATERIALS

October 17, 2007

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON NUCLEAR WASTE & MATERIALS

(ACNW&M)

183rd MEETING

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WEDNESDAY,

OCTOBER 17, 2007

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VOLUME II

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The meeting was convened in Room T-2B3 of Two White Flint North, 11545 Rockville Pike, Rockville, Maryland at 8:00 a.m., DR. MICHAEL T. RYAN, Chairman, presiding.

MEMBERS PRESENT:

MICHAEL T. RYAN, Chairman

ALLEN G. CROFF, Vice Chairman

JAMES H. CLARKE, Member

WILLIAM J. HINZE, Member

RUTH F. WEINER, Member

NRC STAFF PRESENT:

NEIL M. COLEMAN

TIM McCARTIN

JOHN FLACK

BRET LESLIE

OSVALDO PENSADO

ANTONIO DIAS

KEITH COMPTON

MARK DELLIGATTI

THOMAS FREDRICHS

JAMES SHEPHERD

KEVIN O'SULLIVAN

LATIF HAMDAN

ALSO PRESENT:

RON JANETZKE

ROLAND BENKE

LIETAI YANG

JIM WINTERLE

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

(8:35 a.m.)

13) OPENING REMARKS BY THE ACNW&M CHAIRMAN

CHAIRMAN RYAN: This is the second day of the 183rd meeting of the Advisory Committee on Nuclear Waste and Materials. During today's meeting, the Committee will consider the following: the NRC's total system performance assessment code for review of performance assessment of the Yucca Mountain site, draft proposed rules and guidance on preventing legacy sites.

Note, a portion of the second session may be closed pursuant to U.S. Code Title V, Section 552b, subsection C, item 90 to discuss predecisional documents.

The meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Neil Coleman is the designated federal official for today's session.

We have received no written comments or requests for time to make oral statements from members of the public regarding today's session. Should anyone wish to address the Committee, please make their wishes known to one of the Committee staff.

It is requested that speakers use one of the microphones, identify themselves, and speak with sufficient clarity and volume so they can be readily heard. It is also requested that if you have cell phones and pagers, you kindly turn them off. Thank you very much.

Feedback forms are available at the back of the room for anybody who would like to provide us with their comments about this meeting.

Without further ado, we will turn our attention to the NRC's total system performance assessment. I am not sure who is going to lead off. Bret? Okay. Bret Leslie will lead off and introduce his colleagues as they come forward. Welcome, Bret. Thanks for being with us.

DR. LESLIE: Yes. Thank you.

14) NRC'S TOTAL-SYSTEM PERFORMANCE ASSESSMENT (TPA) CODE FOR REVIEW OF PERFORMANCE ASSESSMENT OF THE YUCCA MOUNTAIN SITE

DR. LESLIE: I'm Dr. Bret Leslie. I'm a senior project manager.

CHAIRMAN RYAN: Bret, I'm sorry. We have a couple of folks on the bridge line. And I guess I would ask the folks on the bridge line to introduce yourselves and your location for the record. Do we have any folks on the bridge line?

MR. JANETZKE: Yes, sir. Ron Janetzke here in San Antonio.

CHAIRMAN RYAN: I'm sorry? Say that again.

MR. JANETZKE: Ron Janetzke in San Antonio, CNWRA.

CHAIRMAN RYAN: Great. Thank you, Ron.

Anybody else?

MR. BENKE: Roland Benke, CNWRA.

MR. YANG: Lietai Yang, CNWRA.

CHAIRMAN RYAN: Okay. Anybody else?

MR. JANETZKE: That's it from here.

CHAIRMAN RYAN: Any other locations?

(No response.)

CHAIRMAN RYAN: Okay. Thank you all for joining us today. We appreciate you being with us. Go ahead. Thank you.

DR. LESLIE: I will start all over. I am Bret Leslie. I'm a senior project manager in the Performance Assessment Branch. And we will be talking today for the next four and a half hours on the total system performance assessment version 5.1.

If you go to the next slide, Jim Winterle, as you will note, Jim Winterle is the manager for performance assessment down at the center. And what you are going to hear today is a story of a joint product, jointly developed between the NRC staff and the center staff.

And my first bullet is I always enjoy the opportunity to brief the Committee but not often for four and a half hours. So one of the things that we need to decide up front is logistics.

It is a three-part presentation. There is a logical break at the end of part one. It's the longest portion, but it should take us up to right around 10:00 o'clock.

The meatier portion, the technically meatier portion, will be given by Chris Grossman from the NRC staff and Dr. Osvaldo Pensado. So that will allow us to change the logistics after that break. But that is kind of where I am heading in terms of that.

CHAIRMAN RYAN: That sounds great. We will plan on a break at about 10:00 o'clock, whenever your first portion is done. And it will be a 15-minute break.

DR. LESLIE: Right. And then the third portion of the talk is very short. It is about four slides. And that shouldn't be a problem finishing up after they are done with part two.

CHAIRMAN RYAN: Okay. Great.

DR. LESLIE: So three-part presentation today. The first part, as I suggested, is we are going to talk a little bit about the development and the purpose of the TPA code to make sure that the Committee and the audience are aware of why we developed the code and how we developed the code and some of the lessons that we have learned as we have developed this review tool.

The second portion of the talk, like I said, will be given by Chris and Osvaldo. And as we interacted with the staff of the ACNW as we developed this, we had originally thought we were only going to talk about three technical areas: igneous activity, especially ash mobilization; colloids; and drift degradation.

But as we went back and looked at how we developed the code, we realized we needed to do a little more integrated presentation. And so while the area addressed is broadly source term, I am basically talking about everything that is very close to emplacement drift.

So we will talk about waste package corrosion. We will talk about water chemistry. We will talk about seepage. We will talk about drift degradation. And we will talk about colloids. And then we will talk about igneous activity remobilization.

The third part of the talk is really what are the next steps for the staff. And, as I said earlier, it is going to be a very short portion. We wanted to have most of the presentation about the developmental process and what is in the TPA 5.1 code and what is in the user guide. And I think that is a very important point to take away. When we are talking about TPA 5.1 and the development, it wasn't just the code. It is also the user guide. And then I will finish up with a summary.

Going on to slide 3, because it is a long presentation, I thought I would give you the punch line right now. The key messages are that the TPA version 5.1 code is a review tool.

And the choice of the term "review" is very deliberate. It assists the staff in conducting a review of a license application. It helps us in the prelicensing time frame. And I have several slides going over that purpose a little bit further.

But one of the other things that I hope will come out as I go through this presentation and as Chris and Osvaldo go through the presentation is, really, the development of both the user guide and the code was a large developmental task for our staff.

As everyone knows, a performance assessment takes into account a lot of different expertise. We have material scientists. We have hydrologists. But what we are going to be doing if we receive a license application and docket it and review it, we are going to be reviewing a performance assessment.

And so that is different than saying, "I am going to review the hydrology." It is going to be reviewing the hydrology within this framework of a performance assessment.

And so one of the things that we did, we made a conscious decision in developing our code not to just have the PA folks develop the code, but we wanted the technical staff. We wanted them to struggle. We wanted them to understand how you can make mistakes as you develop a code because that is going to make them better reviewer. They are going to understand how DOE might make mistakes or identify areas where integration is very important.

And so we will provide you a couple of examples as we go today to really identify that we think our capability to review the performance assessment has been quite enhanced by this process of developing it.

Following also that TPA 5.1 is a review tool, we made a conscious decision to add a lot of flexibility or increase the flexibility within the TPA code to assess a lot of different things.

So we will get into the details, but that is really one of the things that I hope the Committee realizes is that the code is flexible, allows us to do a lot of different things to assess a lot of different potential processes and approaches.

And, finally, because this used a lot of the staff, 75 staff participated. And one of the things that we did is -- and you will hear about this -- we basically developed 5.1 code and the user guide on a time frame consistent with the development of the SER as outlined in part 2. So it allowed us to work out some of the kinks in terms of production, review, scheduling.

So, moving on to slide four, which is just the title of the first part -- Jim, you can go ahead to the next slide, which is slide five. Because you are going to have about another 24 slides, I figured I would provide an outline for the first part.

To kind of refresh the Committee on where we are in terms of both the TPA code and our presentations to the Committee and the risk insights, which is a key part of how we have used the code in the past, I am going to spend some time talking about the recent developmental history.

Next I am going to spend a good portion of time talking about the purpose of the TPA code, both in the prelicensing and also the purpose during the review and how we might use that. I will talk some about the developmental process for how we developed the code and the user guide.

The Committee had indicated that they wanted to know what were the major areas of change and what are the anticipated effects. And so those of you who were looking forward for dose calculations, you're not going to see that. We're going to be talking about the anticipated changes in a qualitative sense. And we will spend a few minutes on each of those areas to explain that.

And when we get there, I will reemphasize that one of the things that as we prepare to develop and potentially review or develop our capacity and potentially review a license application, we are being very careful so that what we say and what we do does not and will not allow us to be compromised in the sense of conducting the review.

So you are not going to see us saying, "This is the dose result, and this is how the repository is going to behave." We can't do that. We have to make our decision based upon the information DOE provides. And so you are going to hear a lot about how we use our code to inform our review but not as a basis for decision-making.

I will talk a bit about the general approach that we used in developing the code itself. And then I will talk about the user guide because development of both the code and the user guide really is where a lot of people began to really understand how they are going to have to review the DOE's performance assessment.

So, moving on to slide six. And the other thing is I will entertain questions along the way, rather than waiting until the end. That will give me a chance to drink some water and think.

Let's bring the Committee up to speed. On this slide and on the next slide, I want to talk a little bit about user guide, code versions, and risk insights.

The last full presentation to the Committee on just the code was back in 2003. And we talked to the Committee on where we were headed with 5.0. The last user guide was published back in 2002. And that was on version 4.0.

The one version that we used for the risk insights baseline that was widely distributed, we gave copies to the state. We actually had a meeting with the state to explain what was in 4.1. J was TPA 4.1j. And so we used 4.1j in our prelicensing activities from about 2002 through 2004.

The risk insights baseline report, very important to understand that the risk insights baseline report was not based solely on our TPA code. We used other people's analyses, DOE. We looked at EPRI results. So our risk insights baseline report is based upon the information that was out there, not just TPA code results.

Between 2003 and 2005, we developed and used the TPA 5.0 code. One of the reports that may not have gotten a lot of visibility, I think Budhi talked to the Committee back in 2005. But we did I think eight or nine different discrete analyses, where the risk insights baseline had identified key uncertainties. And we used this risk analysis or risk insights progress report to kind of test some of the conceptual models that later show up in TPA 5.1.

In 2005 and 2006, we completed a beta version of 5.0.1. And moving on to slide number seven, let's talk about the recent past. Just like DOE has to lock down their parameters when they develop their performance assessment, you have to realize what is in the user guide was locked down in terms of the parameter values back in January or February of this last year. It seems so long ago.

But what it means is, for instance, for dust deliquescence, when we go into that portion of the model, we are using the information that was available to us back then.

For instance, at the Goldsim conference in May, USGS presented some new information on different compositions of dust chemistry. That is not included in the user guide.

But the code has the capability to address those changes. So that is important. When I say "lockdown," we are locking it down because we need to develop the code.

5.1 code was delivered to NRC in June, a user guide one month after. And as a result of going -- again, this parallel process of the people who developed the code, tested the code, and wrote about the code, we found a few minor issues when we had the user guide. And so, in essence, the version that is publicly available is 5.1a. We found four small things associated with it when we read the user guide that we needed to change in the code itself.

So I think that is where we are at in terms of the developmental history. Moving on to slide number eight, this sentence is straight out of the user guide. We thought it was very important to clearly identify what is the purpose of the TPA.

It is a review tool. It is useful both in prelicensing, and it has a purpose in our license review. The process and the code itself allow us to develop our independent review capability.

The process of developing the code and the user guide allows staff to better understand how not only to put together a performance assessment but to review a performance assessment, become familiar with the data that would support a performance assessment.

So, for instance, if the team on unsaturated zone was out there to develop the input for our code, they reviewed a lot of the Department of Energy data and their own data to come up with that. One of the main things is that the code supports a risk-informed, performance-based approach consistent with the regulation, part 63.

So I would like to move on to slide number nine, where I want to talk a little bit about the prelicensing use of TPA. As I said before and I will say again here, you learn by doing. And so by integrating and involving both the performance assessment staff and all of the technical staff, they have come to a much greater understanding of the little hiccups, you know. "Oh, this team needs to be talking to that team because if you don't integrate how drift degradation might affect the flow processes and the thermal processes and the chemical processes, things could come apart."

Also, through this process of having the staff work with the performance assessment staff to develop the abstractions, they begin to understand. The staff, the technical hydrologists and material scientists, begin to understand the whole abstraction process. And that is an important part of what DOE is going to be doing.

In their performance assessment, they are making an abstracted model. They are going from data through the processes and putting it into a model. And so this process of going through and having to not only develop the abstraction but to test it gives them insights into terms to how to test other people's performance assessment.

I will give you another example. Even last week, there was an appendix 7 meeting with the Department of Energy on drift degradation. Our staff helped prepare themselves by looking at an using the 5.1 code. In other words, there were things that we thought "We think we need to talk about this. Let's do an analysis and see if it is really important. Do we really need to talk about it?"

So that is an example of where we can use this to focus what we are going to talk to DOE. Either it would be a letter or in person and focus our understanding of what they are doing.

And, last, I would like to say that we could use the TPA version 5.1 to update the risk insights baseline report. And I'll come back to this at the very end on part three. And that probably is the best place to discuss what we want to do and how we go forward with the TPA code.

So, moving on to slide ten, it is important with that purpose of the TPA code in terms of a review tool and implementing a risk-informed, performance-based approach to understand how NRC uses risk information.

For the high-level waste program, as a

result of part 63, DOE has a requirement to use multiple barriers in performance assessment as a basis for determining compliance with the individual protection standard.

In 63.115, we outline the responsibilities that DOE has for describing multiple barriers. And basically the DOE's multiple barriers capability and their description is really an articulation of their safety case for post-closure performance.

And so, like all things we do, we focus on what the licensee proposes as the basis for what is going to be safe. They are proposing. We are reviewing whether it is safe. But that doesn't mean we just blindly say, "Oh, yeah, that's what is important."

We also use our own risk insights. And this is engineering judgment. But the risk insights baseline in areas where we think something could be extremely important and DOE is not taking credit for it, we might really convince ourselves that DOE is not taking credit for it.

You know, they might have just written, saying, "We're not going to take credit for the saturated zone for retardation." Well, we are going to look in their performance assessment to really make sure that they haven't taken that credit.

So we have developed this logic of, you know, if DOE is taking credit for as a barrier in our risk insight to say this is extremely important for waste isolation, our staff is going to be focusing their review there.

If there is a place where DOE has identified that they're not going to use it as a barrier and we have identified that it could be potentially extremely important to waste isolation, we're going to ensure that they have not in their code taken that credit.

Finally, if there is an area that we don't think the repository might be very important to waste isolation and DOE is taking credit for it, we obviously are going to be spending a lot of time there to make sure that the basis that DOE has provided is sufficient.

So I just --

MEMBER WEINER: Bret, could I --

DR. LESLIE: Yes. Go back to the --

MEMBER WEINER: -- ask a quick question?

DR. LESLIE: Sure.

MEMBER WEINER: Are you using inputs from your risk insights or are you using DOE's inputs since

DOE has to make the safety case? What are you using as the input to your TPA?

DR. LESLIE: That is actually a time-dependent answer because you are asking about risk insights, which is the application. As I said up front, our risk insights based on report are behind us. We use 4.1j. We use DOE results. We use EPRI results. We use different types of analyses. Okay. So that is then.

Right now in terms of developing the TPA code, depending upon where you are in that code, we use DOE results. We used our results. We used whoever's results. I shouldn't say "results." Data, information. Okay.

So at this point, if we update the risk insights baseline, we are going to be updating it relative only to TPA 5.1. We don't want to confuse the two. We are not going to presuppose that DOE is going to take this as their barrier.

And I can walk through this logic again on our next steps at the end, but I think perhaps that answered your question for now. We can come back to that in part three of the presentation.

Okay. Let's move on to slide 11. This may also help to address. The use of the TPA version

5.1 and license review, of course, we read the Yucca Mountain review plan a couple of years ago. We didn't have 5.1. And we thought better of putting in any particular version.

So in there, we are going to conduct this review consistent with agency policy and regulatory philosophy. And there are three things. And the Yucca Mountain review plan states it very clearly on page A.4 of the appendix.

DOE is responsible for determining the design in a safety case. NRC is responsible for reviewing what is in that safety case. And it is what is in the license application, not what is in our code, that is the basis for our decision. That is extremely important to remember. We are reviewing their license application. That is the basis for the decision.

However, there are portions in the Yucca Mountain review plan -- and they are small portions of our review -- where we identify how we might use the code. And, again, remember, the Yucca Mountain review plan is guidance to the staff. It's not a requirement of the staff, but it outlines potential uses of what we would do.

Well, there were three areas, basically, that independent performance assessment, that, a code could be used to assess what is in or in this case. It is not really assess. The word is "confirm." And it is like a check. Indeed, the very capabilities that DOE provided in their license application and the support they provided, do they make sense based upon your own independent analysis?

Also, confirming the scenario screening. Did indeed DOE consider all the relevant scenarios; i.e., faulting, seismic, volcanism, nominal?

And, finally, the third place where it is called out is in the individual performance assessment portion that's at the end of the line, not at the model abstraction, not at the process level, but at the end. And there are a couple of things that it identifies.

It is always in the terms "confirm." Okay? So that's different than saying, "base your review upon your results." And that is an important language distinction.

All right. Let's move on to slide 12 and begin our talking about the developmental process for TPA 5.1. Okay?

The center operates under a quality assurance program. And so the development of the code and the user guide were guided by those quality assurance requirements that are primarily captured in the center's technical operating procedure, TOP-018. And you will see that acronym later.

It is a really important thing. And kind of one of the things to take away is that there is a parallel. A quality assurance program in terms of when we are developing it allows for increased transparency and traceability.

The same thing is expected in DOE's program, that our review won't just focus on their information that they provide in their model report but that we may need to go over and look at something in the software validation report to really have confidence that something is correct. So as we developed the code and the user guide, we were guided both by the software development process and also how we write reports.

One of the things that was very important to this is, again, past versions primarily written by performance assessment with input. This time we had our review teams that we expect to use to conduct the license review develop their abstractions, center, NRC, PA technical teams.

And the other thing is some of the issues that we dealt with required integration across teams. So while in the past we have really focused on, oh, well, the unsaturated zone hydrologists do their stuff and the saturated zone hydrologists do their stuff, once you start to get in that performance assessment and they say, "Oh, well, similar equations are used," well, you had better make sure it is the exact same equation and the same things are right in each.

And so, in fact, this integration, we found bugs in the code basically that had existed for a long period of time until we actually had people who were new to the code come in and say, "Well, is that really the right matrix or grain density term?" We found this one very late in the game.

This is the advantage of bringing in new people, training them because that is what they are going to be reviewing. They are going to be reviewing a performance assessment.

The other thing is we are transitioning into a licensing organization. Historically NRC has a very strong project management approach in licensing. And so one of the things -- it was a learning experience, that there was a very tight project management on this because we were trying to accomplish a lot in about a year.

And so we had advisory groups that helped us, both on the code side and on the user side. We had a lot of management oversight. And we will talk about the user guide some. And I will talk some about the software descriptions and software validation.

So slide number 13. I talked a good deal about this before, but let me focus on a couple of things, on second and third sub-bullets. Again, we had the teams develop and test the code and then have to write the user guide. So they had to have a thorough understanding of the inputs and outputs, the data, and writing it.

And one of the things that we did is we wanted to hold ourselves accountable and the center accountable for meeting a deadline. And so what we did is for each chapter, we had these teams deliver a product to us so that we could review it.

The project management, again, active and strong. We had the senior-level advisers here at NRC: Tim McCartin, Britt Hill, Mahendra Shah. At the center, we had Gordon Wittmeyer and Sitakanta Mohanty as kind of senior gurus.

Chris and I were responsible for the user guide and the code. So when there is an issue technically, "Is this the right approach?" we would brief those guys. And we wouldn't leave the room until we had a decision. Okay? That is the kind of fast decision-making that we are going to need to approach on this very limited time scale for developing a safety evaluation report. So we were testing out some procedures that we might use as part of the license review process.

In addition to the TPA gurus, we also put together a user guide committee. And that committee was responsible for saying what is it that we want in all of these chapters and giving early feedback to saying, "This is" -- you know, we are trying to write a multi-author document with one voice. It is not easy to do. And so one of the things this user guide did was to help both the center staff and the NRC staff come up with this one voice and address the same issues.

So let's move on to slide 14. On an earlier slide, I had indicated that we had finished 5.0.1 as a beta version. At that point in time we looked at what was in 5.0.1. and decided, you know, here are some issues that we really want to address better. Basically what we wanted to see is a much better integration of the process-level abstractions of drift degradation. And you will hear about that later as Chris goes through it.

The other thing is what we identified is that the methodology for low-probability seismic sampling, we had some questions on whether the approach that was in the code was going to be sufficient for long-term calculations. And we can talk about that later when Osvaldo is up here since he is one of the persons tho addressed this issue.

We also wanted to make sure 5.1 had the capability for long-term climate and net infiltration, the flexibility to address whatever might come out in an EPA standard, and what would be implemented in an NRC standard down the road.

The other thing that we felt when we looked back at the 4.0 user guide is that there were tables of parameters. And there might just be a reference.

CHAIRMAN RYAN: Just a quick note, Bret. You maybe are going to cover it later, but are you going to go into a little bit more detail on the long-term climate, net infiltration issues?

DR. LESLIE: A little bit. And there will be a slide with a bullet on it. And we can entertain --

CHAIRMAN RYAN: I guess what I am thinking ahead for is that we would like to hear the range of coverage that your code now has. What is long-term?

DR. LESLIE: I will wait until Chris and Osvaldo take a look at it. When you come up for the second part, take a look at the user guide. But I am pretty sure it is either a constant or a variable.

And this is one of the flexibilities that, you know, you may have a range in the tpa.inp file. That range can be changed. So I will make sure those guys come up and address that when they talk about it.

CHAIRMAN RYAN: Great. Thank you.

DR. LESLIE: So, anyway, back to input parameterization. We felt that we really wanted the teams responsible for the abstractions to own the data or the approach that went into the models in TPA. And so we wanted the teams to be able to better document, have a traceability issue of this is how we did it or refer back to the primary document where that information came from.

And, finally, the last thing we wanted to do was the input and output transparency and traceability. And that is one of the primary reasons why we developed the user guide.

We also went back and looked at the input and output files and looked at the headers. And if a new person couldn't understand what was in there, then how useful is that information? And so the center spent a lot of time trying to clarify and make those input and output files clear.

Let's move on. Developmental process. Again, as I said before, TOP-018, which is the technical operating procedure the center uses for quality assurance, identifies that a software requirements document; i.e., an SRD, is required when significant code changes are made.

In the software requirements document for 5.1, there are 18 separate modules that are identified where there were major changes.

MEMBER WEINER: What's a significant change as distinct from an insignificant change?

DR. LESLIE: Jim, can you take that question, Jim Winterle from the center?

MR. WINTERLE: Yes. More or less if it adds a new functionality that the code didn't have before or expands on an existing functionality or adds a parameter that didn't exist before, those would be examples of something that is significant. And the fact that multiple such changes were significant that necessitated identifying a new code version and new software requirements, which then gives NRC the ability to review what we plan to implement in the code and approve it.

MEMBER WEINER: Okay.

DR. LESLIE: Thanks, Jim.

So in the software requirements document -- and this is a QA that is available that gets swept into LSN -- is a description of the software, the technical bases of the models that they are going to be developing, and the computational approach.

Now, often in a software requirements document, they will add that technical basis. We identified in this SRD that the technical basis for the models would be documented in a user guide.

So the technical bases for what we implemented in those changes was in the user guide. Those actual changes then also get implemented in software change requests. And, again, it is another document that people can go back to and look at what we actually implemented.

On slide 16, again, SRD software -- in addition, under TOP-018, software validation is required. And the purpose is to gain additional confidence. As a result of the software requirements document, where we identified that there were 18 areas where we were changing, the software validation had 18 validation tasks. And you might say, "Oh, this is just a task." Some of these tasks had four, five, or six different analyses that were conducted to test the implementation.

And, again, this goes back to we had hydrologists going back to saying, "Well, you know, how would I test to ensure that this equation was properly implemented?"

And this goes directly to their ability to go into the DOE's TSPA and say, "Oh, here is what they have written. This is the equation. Is this properly implemented? How would I test to ensure that?"

In addition, in addition and beyond what TOP-018 requires, NRC requested -- and the center graciously said yes -- we were going to do some system-level tests. And so, again, the process level is modeled. Does it all hang together? Does it all fit together?

And so what we did is we had four system-level tasks on waste package. And basically we said if we understand the waste package failure modes and radionuclide release rates and we're looking at it both from the waste package unsaturated zone, saturated zone, if we can understand the flow of mass, if we can look at radionuclide doses, do these seem to make sense, and the numerical stability, those were the four areas that we wanted to look at at a system level.

Each of these tasks, both the process level and the system level validation tasks, were documented in a software validation report. An important point is software validation is done on a beta code, beta version. And so each of the software validation test reports describe what was done on this beta code. All right.

Let's move on to slide 17. I have already talked that we obviously changed, but why did we change? In addition to those five technical areas, where as a group we felt that we needed to do better, I mean, some of the areas that we were updating were in response to recommendations, including some of your own. An example is the wind doesn't always blow to the south for an igneous eruption. Okay?

So we took recommendations not only from you but our risk analysis or risk insights report, where we started to test some of those uncertainties that we identified in a risk insights baseline report. We used the insights from some of those analyses in what we call the RA/RI, risk analysis or risk insights, report.

We also wanted to increase our flexibility to evaluate alternate potential design features and alternate conceptual models. And these are all consistent with how we have developed the code in the past in terms of when you have an updated understanding of potential processes, you want to bring that in. So that came in.

We really wanted to make sure that we had incorporated drift degradation and alternate conceptual models of drift degradation and its impacts on everything that is close or affected by that. And we also wanted to make sure that the code had the ability to assess performance for periods longer than 100,000 years.

Let me stay on 17 for a second. An example is one of the things that we did for the code is -- and we will talk a little bit more about this, but we wanted to have the flexibility in case DOE was approaching things differently. An example is DOE now has a new redistribution model.

And one of the real good things about TPA 5.1 is we updated our redistribution model with an approach that is consistent with how most geomorphologists model redistribution and fluvial redistribution aolian. It gives us the capability to review DOE's new redistribution model.

So let's move on to slide 18. All right. Also in the user guide up front, I think in chapter 1 or even in the executive summary, we talk about these are kind of the major areas of change.

Obviously we have a million-year simulation period. Let's step back for a second. I am going to go into each one of these bullets in the next couple of slides.

The point that I wanted to point out here is the one in italics. The detailed discussion I am leaving to Chris and Osvaldo. I will provide some input here, but the majority of your questions should be directed to those two gentlemen.

So, without further ado, let me just start to walk through them. I am not going to walk through them in the same order. The Committee had told us, informed us that they really want to understand: Okay. Those are the changes. What are the expected impacts?

Kind of from the million-year simulation, based upon our understanding of the equations that go into it and based upon our own validation testing, we expect different dose contributors. And I will get into that in a subsequent slide why we expect different dose contributors, but it's effect of the changing of the dose conversion factors and a more robust colloidal model. Well, that says it right there.

The other thing is that in TPA I think 4.1j, certainly we had a different repository footprint and emplacement drift panels. So we had to update our code to match the emplacement panels of what DOE has identified would be their design for the license.

But what that meant primarily is that it affected the spatial distribution of net infiltration. We changed the geometry of which sub areas. And we are not going to get much more into that, but Chris might.

And if we change the layer thicknesses in transport pathways, we actually don't expect much changes from just changing this geometry. Mountain's the same, basically.

Slide 20. Okay. So why might the dose contributors change with time or change between versions? Well, we updated the dosimetry consistent with the proposed rule and implemented new dose conversion factors.

Not everything goes up. Some go up. Some go down. So the neptunium dose conversion factor is lower in the updated dosimetry approach. Iodine-129 and tech-99 are higher. And so because dose conversion occurs at the very end, what is likely you are going to see is a lower contribution from neptunium-227 relative to tech-99 and iodine-99 if everything else upstream remained the same. So that is some of the insights of what we expect in terms of the different dose contributions.

For igneous activity, including the redistribution, this new approach, obviously variable wind field results on average, less deposition at the reasonably maximally exposed individual location, but it doesn't necessarily mean that the dose is different. It just may be time-dependent because now what you are doing is you are filtering it through these redistribution processes. And so, again, what we want to emphasize is that there is a time-dependent change associated with this.

And, again, if you have got questions, I am sure when Chris and Osvaldo get up here, that is an appropriate time to ask further questions on that because they have got a couple of slides.

Moving on to slide 21, knowing that you are going to want to talk -- I think drift degradation is on the agenda for next month's ACNW meeting of some sort, I have two slides here under drift degradation, one under the nominal scenario and one under the seismic.

Again, what is put in the code is the flexibility to assess time-dependent drift degradation. We have switches we could turn off drift degradation, we could turn on drift degradation. We can use the reference case of data for when thermally induced drift degradation is on. And it is variable.

You can change that time frame over what should occur. You can put it all in the first 100 years. You could go all the way out to a million years, again, the flexibility to allow us to review what DOE is proposing.

But based upon what we put into the model without seismicity, basically we think the rubble loads are not sufficient to cause mechanical breaching of the waste package. And, again, the basis for why these statements are basically in the user guide and from our understanding of the equations that we use and the process-level models that went into this.

Failed drip shields. And the way we approach this, failed drip shields we model allow water contact with the waste package for potential localized corrosion failure. Failed drip shields and failed waste packages are modeled to allow partial protection from seepage, again allow. We're not saying it does, but it gives us the ability to review if DOE chooses to take credit for each of these things. And you will see this in a couple of slides. Again, I am laying a lot on Chris. I hope he is up to the task.

Slide 22, drift degradation under the seismic scenario. Seismic activity increases the rock load on the failed drip shield, mechanically failed drip shield. The number of mechanical failures depends on the simulation time, longer simulation times, allow more time for low-probability, large-magnitude seismic events to occur. And basically the average number of waste packages contributing to release increases with time under this.

And I will go on to slide 23. Generalized corrosion. We updated in TPA 5.1 how we model the generalized corrosion. It is temperature-dependent. And it results in much longer waste package lifetimes. The temperature increases thermally early on, increases the general corrosion rate during that thermal period but based upon the information that we have and use does not appear to be enough to cause failures to the waste package.

For localized or crevice corrosion, again, I will talk about this flexibility. We have a dust deliquescence method in there. Take the chemistry. If the chemistry is appropriate; i.e., if there are not enough inhibitors, the dust deliquescence can be turned on early. Again, I think there is a slide in here that Chris will talk about these different environments and go into detail.

Localized corrosion requires seepage water contact and cannot occur if the drip shields do not fail before the end of the elevated-temperature period. Again, this localized corrosion is temperature and water and crevice. Those all three are needed.

MEMBER WEINER: This may be answered later, but when you talk about the temperature dependence, do you take into account the heat of vaporization, water; in other words, the fact that you are going to heat the water up and it is going to be water vapor and --

DR. LESLIE: Yes. We have process-level models using I think MULTIFLO and other codes to assess that. All of those parameters go into the thermal modeling of the mountain. We do both kind of drift-scale and kind of mountain-scale modeling that goes into the temperature estimates at the waste package and at the drift wall.

As I was saying, the average number of waste package affected by localized corrosion is small. That is what our expectation is based upon the reference data set that we used. Localized corrosion damage mainly occurs on waste package welded areas. And, again, we will have additional information later.

I think I have got a couple of more slides on anticipated effects. Moving on to slide 24, the glass waste form isn't actually new to TPA, but one of the things, again, we wanted to do is to be able to describe it. So in the user guide, we treat it as a new capability.

We don't expect any significant effects. The glass inventory, radionuclide inventory, is small compared to spent fuel, but the volume could be significant. Again, we have the capability to assess different amounts of waste form, either in spent fuel or glass, in the code.

For cladding, we have an exploratory, partial-credit model added. It is not part of our reference case. It can be turned on. Should DOE decide that they are going to take credit for cladding, we have a way of assessing that.

CHAIRMAN RYAN: Just to be clear, by "exploratory," you mean it has been through the vetting process and the quality assurance process, it's just not --

DR. LESLIE: And the flag is turned off.

CHAIRMAN RYAN: And it's just off now. Okay. Thanks.

DR. LESLIE: That's right.

CHAIRMAN RYAN: All right.

DR. LESLIE: All right? Slide 25, last one on the anticipated effects of the updates, the colloid model. We implemented this model. It has thorium and plutonium, americium, and curium isotopes in it.

The way we implemented, it increases the effect of solubility. We allow a permanent filtration for transport once place to be effective of wherever it's filtered. And it includes reversible colloid sorption.

From our process-level modeling and from our understanding of the equations, reversible colloids are anticipated to have a minimal effect on overall results. Irreversible colloids, we expect that the dose contribution from plutonium-239, thorium-230, and americium-243 is anticipated.

And I guess one of the things that will be interesting as we go forward is to look at the Department of Energy supplemental environmental impact statement model to see how things play out. We will talk about that at the very end.

Slide 26, the general TPA 5.1 approach. We use available data -- and it's critical -- available data use to construct the approaches for modeling. We try to simulate a range of potential performance outcomes of the repository.

But we are not doing a compliance case. And so one of the things that we need to do is we need to be conducting a review in a very timely manner.

And so we try to incorporate computational efficiency where warranted. And, really, the bottom line is we have added a lot of flexibility in the code to assist our review capability.

Slide 27. And, again, what I am doing is starting to describe kind of at a high level some of the things that Chris and Osvaldo will talk about, but our general approach is that we conduct probabilistic dose calculations for specified time periods.

That is controlled by the user in the

tpa.inp file. It incorporates essential features of the engineered natural barriers, chemical and physical processes affecting degradation and releases to the biosphere, uncertainties and variabilities, and the biosphere characteristics.

The way TPA 5.1 is set up, we have scenario classes. We have a nominal scenario that includes the climate change, long-term climate change, a disruptive scenario involving seismic events, a disruptive scenario involving faulting, and a disruptive scenario involving igneous activity, where you can turn on and off intrusive or extrusive. We just slump them that way. It allows you to test for both.

All right. I have only got two more slides. If you guys don't have a lot of questions, we will be way ahead of time. I am hoping. No.

On slide 28, I want to talk a little bit kind of as a wrap-up of the user guide before we get into the details of the presentation on our approaches and example.

Again, what we wanted to do, we have a lot of new staff that have come on board since 2002. And when they opened up the old user guide, there are new people. And they said, "We want a document that is going to help us use the code."

And so we outlined that we wanted to have an introduction, we wanted to have a general overview. We want it to be read by a lot of different people at a lot of different levels.

If you just want to understand kind of overall how we are approaching our modeling approach, you can read the first couple of chapters. Chapter 3 talks about installation, and chapter 4 is kind of the nuts and bolts for the people who are programmers, the architecture of how we developed this code and it is implemented.

The meat of what the review teams did was primarily in the module descriptions. And it walks through the code for each of the main modules, describes certain things. And, finally, one of the things that we found a little hard for previous users was to have all the inputs and outputs and a good description of them.

So let me talk a little bit about the module descriptions. And, again, the user guide committee came up with what is our goal. Our goal in describing the conceptual model is to clearly and concisely describe the flow of information into a module and out of the module. How do I turn this module on or turn it off? And so you will see at the beginning of the user guide just one paragraph about that topic alone.

The next area or subsection in the report was called "Model Support and Assumptions." We wanted to be explicit about our assumptions. What did we assume when we developed this model?

Now, the models support. You know, when we talk about model support in the review of a license application in the Yucca Mountain review plan, we are talking about DOE providing the information that supports the results of their model.

Thinking back now, I would have liked to have changed model support to model approach because there are two things that we wanted to do. For some areas of the code, there is a lot of data and a good reason for approaching it this way. For other areas, drift degradation and some others, we wanted to build the flexibility in.

So it's more a description of we made a decision to go this way and this is the reason why. We need the regulatory flexibility to review. That is the model support. So don't get caught up too much in the phrase "model support" if you read the user guide. That is one of the things that we tried to address.

Then the implementation of the conceptual model. What equations are the ones that are really crucial to describing what the model does?

Finally, remember we had those teams lock down the parameters and provide those parameter values early on back in January and February. Between January and June, they had to document it.

And basically in each chapter is a list of the tpa.inp parameters, their basis, any equation that they are called out in, the type of parameter, is it a constant, what type of sampling is it, the range of the values. And then over on the far right is the basis of the reference.

And, again, for each of those scenarios that we identified up front, the disruptives and the nominal, we provided a reference case value.

So for those for igneous intrusion, we have reference case values. For drift degradation turned on, we have reference case values. If drift degradation is turned off or which values would you use depending upon the geometry, all of those are documented in the user guide and the basis for that.

Also, we thought we could clarify whether not all the input for a particular model is in tpa.inp. We have some supplemental files that provide input that allow the code to run. And so we wanted to identify if any external process models were used to develop the input.

Again, just as an example, there is a parallel between our approach and what the Department of Energy is doing. They have a bunch of kind of external process models that they would supply as DLL files into the Goldsim model. And so we have done some process-level modeling on the outside that supports. We wanted to clearly explain how that fits in.

One of the other things that we wanted to do is, again, for integration purposes, we need to know where the information is flowing downstream. With that in mind, we have a section in each of the user guide chapters that talks about the intermediate outputs, describes them, what kind of information. Again, understanding of the results is very important for our staff. And so we did a good job. I think we did a good job of trying to explain those things.

Finally, again, we wanted more people than just the PA folks to really use the code. So we asked them to also -- okay. Here is your module. How would you try to understand what the results are or what techniques would you use? What things do you think are going to be sensitive? How would you run it? And, finally, all of the references. Okay.

MEMBER WEINER: Bret, before you go any further, you have talked a great deal about the modules and how that works. But critical to the results of any PA models are the inputs. And you have pointed out that DOE has to make the safety case.

How are you making judgments about DOE's inputs? In other words, what criteria are being used to make some judgments about the input parameter values that DOE uses in case they don't match the ones that NRC is using?

DR. LESLIE: That is a good question and deserves a good answer. We're not making judgments on it. We don't have a licensing case. And let me go through this example to really clarify. Okay. You might want to hear about drift degradation. Okay?

We have an approach that incorporates thermal effects on drift degradation. Okay? We have a reference case that says, "When you do this, drifts collapse under a short period of time."

We are going to use our regulation and the Yucca Mountain review plan that says how one might review relative to that regulation to determine what happens. Okay? Let me back up for a second.

There is a process, a performance assessment process. You start with features of instant processes. There is a regulatory requirement that allows DOE to screen things out. Okay?

So if they screen out a feature and event process thermal effects, we are not going to evaluate it in model abstraction. Okay? It is never going to get to the model abstraction. We are going to review their technical basis for why they screened it out. That could be one DOE licensing case if they screened it out. Okay?

Let's say they screen it in. Okay. So now it is going to be part of their module. Okay? Well, they could screen it out based upon data. They say, "Our data doesn't support that thermal effects are important. We have nominally incorporated it."

We are going to review that argument based upon what DOE has said. And we are going to use the acceptance criteria for data uncertainty, for instance, or model integration on data support.

They can do it a different way. They could say it's an alternate conceptual model, but it has no impact. Okay? We have to review what is in their license application. We are not reviewing what is in our code. We are going to review however they make their licensing case consistent with our regulation and consistent with our guidance.

So hopefully I gave you one topic. And depending upon how DOE puts it in their licensing case, we could review it three different ways. We can't make any judgments. And we can't make any judgments until we have a license application that is docketed.

So that is the answer.

MEMBER WEINER: That is understood. I guess the question I have, you say you are going to review. Let's take your example of screening out an event or a process.

DOE screens one out. You are going to review that, why they screened it out. You are obviously going to use some criteria in that review.

DR. LESLIE: The acceptance criteria in the Yucca Mountain review plan relative to screening out features, events and processes.

MEMBER WEINER: Thank you. That's it.

DR. LESLIE: Okay.

DR. LESLIE: At this point I will entertain questions. And I had assumed that there would be a lot more questions.

CHAIRMAN RYAN: You shoved a lot of stuff to the other speakers.

DR. LESLIE: I may have, but I think that is fair because those are the detailed questions. What I hope the Committee comes away with is what is the purpose of our code. It impacts how you should be asking those folks the questions.

CHAIRMAN RYAN: Let's go around and see if we have any questions for you, Bret. Professor Hinze?

MEMBER HINZE: Thank you for your presentation. Very understandable. Let me ask a couple of questions. TPA has many attributes and many uses. And one of the principal uses, at least in my mind, is that of determining what you know, what you don't know, and what you should know.

I am wondering what you have learned as a result of your new TPA about what are the critical weaknesses and the largest uncertainties that you believe are most important to the licensing situation? And what are you going to do about those in the near term?

You have four years or so to still collect data, still analyze. What is being done with TPA to determine what are the critical uncertainties and how you might and whether they are important to decrease?

DR. LESLIE: I like the question. I am

going to defer it to the third part of our talk, when we will talk about that. I will give you a short answer now. And then you can re-ask it later --

MEMBER HINZE: Okay.

DR. LESLIE: -- if I don't do a good answer. The risk insights baseline report basically, again, it wasn't just -- a lot of people don't understand this. The risk insights baseline report was use our own TPA code, use DOE's results and EPRI's results.

We identified it in two areas. We identified things important to waste isolation based not only on the impact on dose but what were the uncertainties.

So the risk insights baseline report is our baseline of our understanding of that.

MEMBER HINZE: Could I interrupt you for a moment?

DR. LESLIE: Sure.

MEMBER HINZE: The risk baseline report, as I recall, is a 2004 document, --

DR. LESLIE: That's correct.

MEMBER HINZE: -- several years old. I believe we heard at one of the presentations here before the Committee not too long ago, where nothing had been done in terms of changing of the risk on some items.

Has the work that the center and the various contractors to you and your own studies changed the risks and/or the criteria that you use in evaluating the risk?

DR. LESLIE: No, no.

MEMBER HINZE: No risks have changed?

DR. LESLIE: Well, the criteria --

MEMBER HINZE: That is amazing.

DR. LESLIE: Well, actually, I don't think -- I mean, I went through the anticipated effects. All right? I mean, from our understanding, there are things. You know, we implemented what information we had up through January-February of this year into our analysis, into our code.

The question we have -- and we will pose this question to the Committee -- is, are we going to update the risk insights? Basically we are not presenting results today, but in not so many words, we kind of identified things might change here and there.

In a major sense, I don't think so. I mean, we don't have a new mountain. We basically have done these analyses starting in 2005 with the risk analysis for risk insights to address those uncertainties. We don't see any new uncertainties necessarily.

MEMBER HINZE: Okay. Well, let me give you an example of an uncertainty that I might think is quite important. One of the things that has changed, although the mountain hasn't changed, is the time frame from 10,000 to apparently something of the order of magnitude of a million years.

As a result, the transport models, groundwater transport models, for example, should have a much greater dependency on the subsurface characteristics between the mountain and the RMEI. There are uncertainties there. And I am just wondering. They are much more important now because of a million years.

DR. LESLIE: You are assuming that they are more important, but there are no releases why DOE is suggesting in their SEIS, their supplemental environmental impact statement. That is a capability that is unused.

MEMBER HINZE: But you must be prepared to handle the --

DR. LESLIE: Oh, we are.

MEMBER HINZE: And the question is, where do you see critical information that is not available at this point in time or information where you can decrease the uncertainties? Is that incorporated into this?

DR. LESLIE: Yes. I am going to let Tim answer this one, Tim McCartin.

MR. McCARTIN: Yes. And Bret has alluded to these. I think where you're pointing to -- and I wouldn't call them -- you identified them as critical weaknesses or things. I'm not sure I would call them that but areas of concern look at the revisions to the code.

One, there's still a concern about projecting long-term lifetimes of the waste package. You saw some enhancements to the corrosion models and drift degradation as a possibility for damaging the waste package. So that's an area. That continues to be a concern, continues to be improved.

Colloids in terms of the transport, I wouldn't point so much to the dissolved radionuclides as much as colloids is a way that, okay, transport could have an impact. And colloids is a way to defeat some of the benefits of the geologic system. And so, I mean, if you look at the changes --

MEMBER HINZE: Do you have the Calico Hills incorporated into it now, the high zeolite formations?

MR. McCARTIN: That has always been in the code from the very, very beginning. We have always had the Calico Hills vitric unit in the zeolitic. The zeolitic unit has never been as important because the matrix permeability is very, very low.

So you have fracture flow. But the Calico Hills vitric is much more porous, much more permeable. You have matrix flow in that, at least in our version of the code, depending on the significance of matrix diffusion.

I think look at the revisions that Bret has pointed to and obviously Chris and Osvaldo will discuss in more detail later, but I think if you're looking at are there some things, uncertainties, that we think are important, it would be areas where we have modified the code because that is something we want to have a little better capability and flexibility on.

MEMBER HINZE: But exercising the code permits you to determine where the uncertainties are. Assuming that you have now reached the point where you have the code, this allows you to do exercising to understand where those uncertainties are, et cetera, et cetera.

DR. LESLIE: We will talk about that in the next --

MEMBER HINZE: Let me try a different set of concerns. You talk about integration. And that is a lovely word, and it is great to hear and all of that sort of thing. But it is like motherhood.

Bret, how do you really bring integration about? How has this really been accomplished in the production of this TPA? I mean, it is great to talk about, but it is hard to put in, to implement.

DR. LESLIE: Kind of from a project management standpoint, you hold people accountable. I mean, in 501, one of the things that we saw was that we thought there was not sufficient integration between drift degradation, the flow people, the corrosion people. We basically said, "You shall by this date do it."

One of the other things is our review teams are composed of performance assessment staff and technical people. And one of the things that happened, as they, these technical people, were told, "You have this date. You are responsible for developing it and writing a user guide" -- and Jim can pipe in with this -- is that those technical staff really made best friends of the PA people, who kind of understand this process. How do I interpret what is in this code? What is a good way of doing validation testing?

And another thing that we did in terms of the integration is when we had areas, for instance, drift degradation, we would hold -- I don't know how many meetings we would have, but we would have the review teams, the four review teams that were involved in that, together. And we would actively manage and say, "Okay. Today we just want to talk about the conceptual model. And this is what we want to get out of this meeting."

And so a lot of it was much more effective project management using our senior advisers, who are supposed to take that integrated look and pipe in and say, "Well, we need to do that."

But, really, I think by incorporating the performance assessment staff with the technical staff on these review teams, making the technical review teams responsible for the product and understanding that we had a schedule to meet and that everyone's you know what was on the line, that is a strong motivator for integration.

Jim, do you want to add anything in terms of the integration aspect?

MR. WINTERLE: Yes. As Bret alluded to, integration doesn't just happen by itself. That is a powerful lesson that we learned.

And the project management approach that we adopted for 5.1 was to designate certain people. The senior-level scientists at NRC acted as sort of counselors, if you will, to review all of the changes and make recommendations.

I can't count the number of meetings and presentations we had before any change got incorporated into version 5.1. It must have had to have been presented five times and discussed with all the various groups in the meetings.

The colloid abstraction is a good example of that. There must have been a done presentations that gave everybody the opportunity to voice their concerns about if assumptions were reasonable, if we considered all of the right data, are we being too simple, are we being too complex, and to strike the right level of balance that, as Bret suggested, still allowed us the flexibility to examine different assumptions about colloids, you know, their source generation, their fate in the far field, how much they're filtered, and such.

MEMBER HINZE: Well, a word that closely

parallels integration is the word "coupling." Ten years ago "coupled processes" was the swing word in this Commission. I have been waiting to see the word "coupled" here, "coupled processes," in your 25 slides. And I don't see it.

And there are many examples where you turn something on here and it affects all the way through. That is part of integration, but there is more to it than that. It is understanding the chemistry, the physics, the geology of the processes and making certain that they are in there. Of course, you have had these gurus, as you put it, to help you with that.

Give me a warm, fuzzy feeling that you have captured the coupled processes. When you study drift degradation, you have studied seismic. But have you studied the igneous activity and how this may impact on it and so forth? Tell me how you have approached the concerns about coupled processes.

DR. LESLIE: I am sorry. I should have used several times on these slides "coupled," instead of "integrated," because, in fact, the issue of integration was the lack of coupling in 5.0.1, in particular, in terms of we had a drift degradation model that wasn't necessarily completely coupled or didn't necessarily reflect the flow processes or the thermal processes.

And so one of the key things, it wasn't just, oh, the teams are working together. We are working together on the coupled processes associated with that.

Now, in terms of the example you gave, one of the things where coupling is really kind of integral would be the example of drift degradation. The example you gave is, does the code have the flexibility to integrate the processes of drift degradation with, let's say, the igneous scenario? The answer is yes. Okay? But was it hardwired into the code? No. We wanted the flexibility because do the drifts degrade and fill in or, like DOE's approach, the drifts stay open the whole time.

So, for instance, for the intrusive, if you obviously had drift degradation, that obviously affects the ability of any magma going down a drift. So, rather than saying, "We're going to do it this way," we have the flexibility in the code to assess both.

MEMBER HINZE: If I can have a few more moments?

CHAIRMAN RYAN: Please.

MEMBER HINZE: You have described to us

and to Dr. Weiner how you are going to use the PA. And I am going to ask you to do that again for me. I understand where this comes in the prelicensing, but during the licensing, I need to know more about how you are going to use, to modify the processes, the models that are used, the equations, if you will, the input parameters once you get into the licensing arena.

DR. LESLIE: That's fine.

MEMBER HINZE: We talk about evaluating alternative scenarios. One of the things I heard is you are only going to evaluate what the DOE brings to you. Yet, on slide 17, one of the reasons for updating was to increase the flexibility to evaluate alternative potential repository and design features and I assume processes.

DR. LESLIE: Okay. That's a good question. Let's assume that DOE submits a license application and gets docketed, goes through the acceptance, gets docketed. We are supposed to conduct a risk-informed review. And we can use our code. Okay?

Let me give the drift degradation. It's one that I worked on. So I can explain it.

MEMBER HINZE: I'm going to give up mine, right?

DR. LESLIE: Okay. So, again, let's just for the purposes of discussion assume that DOE has included and has not screened it out, but it is part of their model abstraction. And so we are going to be reviewing it relative to the Yucca Mountain review acceptance criteria associated with model abstraction.

How important is it that they have that correct? And instead of having the drifts open for a very long period of time, that perhaps the drifts degrade very rapidly.

What we hope our staff will do and we hope that our senior-level scientists are going to push on us is how important is it? Do we need to ask this question? How do we best ask the question to get the information necessary to make the finding relative to those acceptance criteria?

So it is an example of guiding us in terms of conducting the review, but it is not the basis for our decision. We are using that information in terms of risk information to understand how to focus our review, going into a license application but also to kind of help us in the actual review process in terms of RAIs.

The agency does not make safety

determinations based upon staff calculations. It is based upon the information in the license application what the applicant is proposing.

MEMBER HINZE: If the TSPA that is given to you in the license has in the view of your senior scientists, et cetera, a better set of equations for handling the process, are you in the mode where you will be changing the TPA during the license, your TPA, during the licensing process, so that you can judge better what the DOE is doing?

DR. LESLIE: No, that is not our intent. Our intent -- and you will get this in part three -- is at this point in time, we are focusing on what DOE is going to be doing. We intend to go into a minor maintenance mode for TPA.

Again, the big thing is there is a lot to do that you can do in Golson that you can't do in TPA. They can present us the results. And we can use the results to get further information from there.

The equations are in there. We can look at the equations. We can review them. We are not making a decision based upon our TPA codes. So it doesn't require us to make changes to how we parameterize or incorporate equations. What we are doing --

MEMBER HINZE: You are using your TPA to evaluate what they are presenting to you.

DR. LESLIE: No. No, we are not. We're not. We're using the information that they supply to evaluate what they have given to us. We are using our risk insights baseline report to identify. We want to spend resources over here. We need the staff to do a very good review over here.

In terms of the Yucca Mountain review plan, it is really a very small role of our code in the overall review. And it is at a very high level. It says, "confirm that they have chosen appropriate scenarios," "confirm." It's not, you know --

MEMBER HINZE: Go ahead.

DR. LESLIE: Go ahead. You want to add something.

MEMBER HINZE: I suspect I am repeating myself, but the DOE has a lot more resources to study corrosion, for example, than does NRC and presumably has studied a lot more. They come up with certain input parameters. Will you take these and then put them into your TPA?

DR. LESLIE: No.

MEMBER HINZE: No. Okay. Thank you.

CHAIRMAN RYAN: Thank you, Bill.

MR. McCARTIN: I guess, Dr Hinze, one quick addition. And Bret talked about this. We draw a big distinction between I think the information and knowledge we have gained through TPA development over the last 20 years versus the TPA code that sits there.

And I think the fact that we have built our own TPA code and we have learned a tremendous amount, it also is our code. So in terms of the development of requests for additional information, let's say, gee, I wonder, gee, what if the corrosion rate changed that much. We might be able to do some things in our code quickly with parameter changes to give us a better sense of how to ask DOE the question of, gee, we believe, we have reason to believe, that if the corrosion rate is ten percent lower or greater this is going to happen or certain chemistries or something, but we will be able to, say, modify our code if we had to or look at different chemistries that are already in our code to get a sense of how best to ask a question of the DOE. And that is really looking at their technical bases, their results. How do we want to ask questions of them in terms of questioning and probing their analyses?

But to me, will we ever run the TPA code during the review? I don't know. But I can guarantee you the knowledge we have gained and information we have gained over the past 20 years, well, that is what is being put to bear in reviewing the DOE code.

MEMBER HINZE: What I am hearing is somewhat different than the term "locked down," as I think I heard from Bret.

DR. LESLIE: Well, we locked it down for development purposes. And clearly in the user guide, it basically says, in every chapter, there is the list of tpa.inp parameters. And it basically says, "We can change this at will." But for development and documentation of the user guide, these are the parameters that we use. Here is the basis that we use. We're not tying our hands.

MEMBER HINZE: Thank you.

MR. McCARTIN: Yes. Locked down is a documentation aspect.

DR. LESLIE: Yes.

MR. McCARTIN: It continues to evolve.

CHAIRMAN RYAN: Allen?

VICE CHAIRMAN CROFF: I think I heard the answer to this indirectly. The TPA has the capability to simulate "hot" and "cold" repositories, in quotes, of course?

DR. LESLIE: The staff have the capability of doing that. We develop TPA in the thermal model and the process-level modeling consistent with the Department of Energy's design of a hot repository, which they have told us that they are going to submit for a license application.

We have the capability should they go to a lower cooler repository to reassess and do the process-level modeling, but it's not a simple switch in TPA to say, "We've got a cool repository. Just go do it."

We would have to do some process-level modeling. But we had to make some fundamental decisions in terms of that flexibility. We have been told by DOE that they are going to come in with a hot repository, so to speak.

VICE CHAIRMAN CROFF: Okay. Second question, you mentioned high-level waste glass logs as having been considered. What about DOE spent nuclear fuel?

DR. LESLIE: I'm going to have Osvaldo -- go ahead and identify yourself, Osvaldo.

DR. PENSADO: Yes. Osvaldo Pensado.

The impact of the glass, the glass is important from a volumetric point of view, but the inventory is limited. So what we have done, we have considered the DOE spent nuclear fuel, inventory-wise, and pass that to the spent fuel.

So the inventory is considered, is considered. And the important aspect is to consider the number of curies that you have in the system.

VICE CHAIRMAN CROFF: There isn't a separate modeling of degradation processes for DOE spent nuclear fuel? I mean, it is treated like LWR spent nuclear fuel?

DR. LESLIE: Right, correct.

VICE CHAIRMAN CROFF: Okay. Thank you.

CHAIRMAN RYAN: Bret, back to the risk insights baseline report and progress report in 2005. You hint at the idea that you are thinking about an update at this point. Could you talk a little bit more about that?

DR. LESLIE: Yes, in section three.

CHAIRMAN RYAN: Section three?

DR. LESLIE: Yes.

CHAIRMAN RYAN: Okay.

DR. LESLIE: We basically will identify that there are four areas that we are thinking about. It is a question that I do want you guys to think about because we have got a lot.

This last year we focused internally. We have got a license application coming out very shortly. We have an SEIS model that apparently will be the license application model.

How best do we spend our resources? That is something that we can talk about in part three.

CHAIRMAN RYAN: Okay.

DR. LESLIE: In terms of going through and revising the risk insights baseline report could again take a lot of attention and time away from preparing to review a DOE license application.

CHAIRMAN RYAN: To give some extra thought to that, though, I guess you could also look at it from the other point of view that you have done a number of changes and the whole goal of transparency in your work and how the review process goes forward, so to speak, a risk insights update of some kind. Now, whether it's a rewrite the whole thing or have another progress report or have an addendum that talks about key issues that have been addressed in your recent work seemed like a good thing to do.

DR. LESLIE: Right. I've got a note for slide 47 when I get there I'll have an hour to think about a very good answer.

CHAIRMAN RYAN: Yes. Frankly, you know, first of all, let me add on behalf of the Committee and all the staff and everybody here that you have done an awful lot of work preparing for today's meeting. I really appreciate having your team here to interact with us. It is obvious you have really thought through communicating thoroughly with us today. So we appreciate that.

DR. LESLIE: Thanks.

CHAIRMAN RYAN: Ruth, anything else?

MEMBER WEINER: Yes, I do have some more questions. Bret, you talk about validation. And in some circumstances, validation of a code means the code represents the physical world appropriately.

Well, you can't really do that with PA codes, where you are projecting into the future. So I would like you to expand a little bit on what you mean by validating your code and how you're going to make judgments about the validation of the TSPA when DOE submits it.

DR. LESLIE: Okay. I am going to start. And then I am going to give Jim an opportunity to talk a little bit more about the software validation process.

Model support is the acceptance criterion in the Yucca Mountain review plan. It is also the regulatory requirement. It doesn't say model validation. It says, "DOE has to provide adequate support for its model." So that is the big picture. The TSPA and the things that go into it, they have to provide the support for their model. We don't. We are not required by part 63 to do that.

What we are required under our contract with the center is to implement a quality assurance program associated with that is software validation.

We obviously don't have a million-year record to compare our results. We have 20 years of information of doing calculations. You can do back-of-the-envelope calculations. Are these results believable?

I mean, part of what we did this time around for 5.1 is we didn't just focus on the process-level task. We actually did system-level task to ensure that the pieces seemed to fit together. Based upon this equation, we would expect this type of release.

So we did that, strictly speaking, to have a little more confidence in the overall thing. So that wasn't a requirement in TOP-018 or the technical operating procedure.

Jim, do you want to say anything more? Did I characterize the --

MR. WINTERLE: I think you gave a good overall summary. If you want more details about the process we went through for validation, I would be happy to answer any.

DR. LESLIE: Let me add one thing he reminded me this morning. You thought the user guide was long. There are 700 pages of user guide. There are 700 pages of the validation model report. So it goes through what was tested.

Again, it's software validation. That is what is required. And what we are asking of DOE is something different. We don't say validation in the regulation. They have to meet the regulation. We talk about support for their performance assessment.

MEMBER WEINER: I think the thing that still troubles me is what you can do with the code, what you normally do, is the first thing you do is to make sure it does the math right. Validation has got to be something beyond doing the math right.

And what I am confused about -- and I understand the reviewing DOE part of it, but what I am confused about is when you use the term -- and you used it repeatedly in your presentation, Bret -- "validating the code," what is it that you are actually doing beyond just recognizing that the equations work? Are you making sure in some external with some external comparison that you use the right equations? I am just confused about it.

MR. WINTERLE: Yes. I would be happy to answer that. Jim Winterle here.

What our quality assurance requirements call for is that the validation testing should ensure that the requirements specified in the software requirements description have been met. Now, it is very important to NRC that our software requirements specify that results have some degree of reasonableness, are explainable, and they make sense.

So we had a set of 18 tasks, which each task consisting of several tests focused more on specific modules, not only that the mathematics were correct but that the results were explainable.

And then at the end, probably what you are more interested in is the overall system-level tests run out to a million years, within/without volcanoes, within/without seismic, set everything to extreme values and see what happens, set everything to the minimum value and see what happens. And in each case look at not just the ultimate dose reporting but intermediate output along the way.

And because it's a stochastic code, you

are looking at ranges of results. And so you want to look at does your mean result make sense. Does the fact that you changed this parameter and that result happen make sense? How can I trace that back and make a judgment as to whether it was reasonable?

And in the end, all the reports and testing together, well over 700 pages, that will be available on the LSN network. It wasn't a formal deliverable.

CHAIRMAN RYAN: One of the things, Jim, that I think is of interest in all of these calculations is the common problem of you're subtracting two numbers that are nearly equal, for example, or you are dividing by something close to zero.

You know, you can get these explosions in the calculations. The math might be fine, the equation, but computing sometimes gives you numerical headaches. Have you guarded against those kinds of things?

MR. WINTERLE: Well, we try. That is one of the reasons that we test things at their limits of parameter values.

CHAIRMAN RYAN: Yes.

MR. WINTERLE: And there are some error

flags built into the code so that if you set something to zero that shouldn't be zero, it will give you error messages.

CHAIRMAN RYAN: That's the kind of thing I think keeps you more close to the center line on the calculation than scuba diving in the oatmeal.

MR. WINTERLE: A thousand input parameters. You know, there's an infinite number of permutations of --

CHAIRMAN RYAN: Sure.

MR. WINTERLE: -- how you could set up the model. But, you know, we really try to stress it.

CHAIRMAN RYAN: Well, that key flagging issue and some of those tools are I think good voices.

MR. McCARTIN: Could I add one thing? At the heart of this, I think -- and I think we have said this a few times over the years, but I would like to reiterate it.

Just because a number comes out of a code, we don't believe it. I mean, that is our job as reviewers of the DOE TSPA certainly in terms of our results. You get an interesting number at the end of running this code.

The question and what, really, all of the capability is about, looking at that, why should I believe that number? And it's not only the technical bases that people provide the support, but I would maintain all of the models that we have put into our TPA code.

There is some credible information that we looked at, be it code comparisons -- you know, there have been years for the hydrologic models, a lot of work done in comparison codes. NRC has participated in that, DOE has, around the world in terms of trying to understand, well, does this make sense?

Likewise you have experiments from spent fuel dissolution. You get results. The code, is this consistent with what I am seeing in laboratory experiments, et cetera?

All of that is brought to bear to why should I believe this number? The software validation is primarily, as Ruth said, yes, you want to make sure you weren't making errors in the code, that, gee, you subtracted two numbers when you should have added two, but we believe it is working right in terms of it is doing what we are asking it to do.

But the other part, there is a hole. I mean, look at the LSN, how many millions of documents are in there. And all of it is gathering that bases for why I should believe the saturated zone transport looks like this, the release from the spent fuel, corrosion on the waste package.

But, first and foremost, that is why we have such a long review process. That is why we have been getting ready for the past 20 years. It is not an easy problem to actually understand that, yes, I believe that number is reasonable for these reasons. And that is essentially the review in my mind.

MEMBER WEINER: Are you going to talk any more later on about the colloids because I have some questions about colloids? And I can easily --

DR. LESLIE: Thankfully Chris Grossman will address those, hopefully.

MEMBER WEINER: Okay. One more question. Reading the material that we got, I understand you are using your sampling on your input, on your distributed input, parameters using Latin hypercube sampling. And I just wondered why because normally the only reason to do stratified sampling is if there is so much computer time involved in any realization that you can't do very many. Why are you using LHS and not Monte Carlo sampling?

DR. LESLIE: I am going to turn this over to Osvaldo Pensado from the center.

DR. PENSADO: Yes. What is known is that

Latin hypercube offers faster convergence than your random sampling and is a very efficient way to get that the whole distribution function of any given parameter is well-covered.

So it is a well-known, well-studied approach. It doesn't increase any -- there is no penalty that you pay for this extra efficiency. So it is reasonable to use it.

MEMBER WEINER: The reason I am asking the question is it also emphasizes the tails of a distribution.

DR. PENSADO: Not really, not really. The Latin hypercube, what it does, it ensures that each parameter is well-covered. And it also ensures that you have a uniform coverage of the parameter sampling so that you are not overemphasizing some tail over the other.

If you want to emphasize a tail, then you have to do what you referred to as a stratified sampling. That is some kind of sampling where you are going to emphasize what would some parameter do. And then you make a tail that is heavier, but, again, you compute the average and you reduce down the consequences by some scaling factor.

It is something actually worth considering such an approach for special cases, like the seismic scenario, decided to emphasize some tails of some distributions to get some good statistical sampling to do consequence analysis.

MEMBER WEINER: Have you compared your Latin hypercube sampling results with Monte Carlo sampling? Did you do Monte Carlo sample on any of your inputs for comparison?

DR. PENSADO: Yes. We don't regularly do that. I suspect that we would derive our results that are quite comparative, but I think that we get more interesting results.

From time to time, we find some interesting combinations, realizations that are giving us some high release, high consequence, more frequent with Latin hypercube that you were going to do it with random sampling.

So that guides us into the direction we want to dig for, the what is making this particular realization so outstanding. And I don't think we would get those cases with the random sampling that often.

Do you want to?

MR. McCARTIN: Well, I mean, it is efficiency. That is exactly right. That is why we did it. I mean, LHS, the code we used was developed in the early '80s, late '70s for the high-level waste program by Sandia for just that purpose, that the understanding was that to run them any realizations in a reasonable amount of time would require efficiencies along the way.

And obviously computers have gotten faster, but we have added more processes. And two codes in the TPA code that exists still today, NEFTRAN and LHS, are there strictly for efficiency purposes that to do all the realizations, you need to be able to solve some of these equations quickly.

MEMBER WEINER: Thank you.

CHAIRMAN RYAN: Dr. Clarke?

MEMBER CLARKE: Just a couple of comments. For what it is worth, I liked your response to Ruth's question about validation. I think you have hit on a lot of the key things that you can do when you are trying to predict way beyond your headlights and that you have to do.

When I used to do this in a former life, I think getting the math right was called verification. And then validation was something else if you could do it. In this case you can't, obviously.

I think the point has been made, but if Mike would have started at this end, I would have started with the baseline report on risk insights as well.

You asked us, should you update that? And my response would be you should update that if there have been changes. And I am looking at slide 10, which says "NRC's use of risk information." And, in particular, "Risk insights assist in focusing staff's review."

I think that is a pretty important statement. And, again, given what you have told us about how you plan to use the TPA, I think it is all the more important you really take a hard look at all of the work you have done since the baseline report and what has come out of that.

For example, in a meeting several months ago, we had Bo Bodvarsson on the phone, the late Bo Bodvarsson. And he told us that the work they are doing convinces him that you don't even need the engineered barriers based on the vadose attenuation.

Well, you know, we have kind of gone from looking at a geologic repository because of natural barriers to a need for engineered barriers as well. And we don't have a standard, but based on what we have been given as a proposed standard, now if we are going on a million years, it would seem that we are back to looking at the natural barriers even harder and the transfer through not only the saturated zone but the vadose zone, where in many cases we or they or whoever didn't take credit for some processes that could turn out to be pretty important.

So, you know, for what it is worth, you are going to ask us again later, but I would certainly encourage you to look at the risk insights baseline report.

DR. LESLIE: Okay. I'll take that as a compliment.

MEMBER CLARKE: Thank you.

MR. McCARTIN: I guess -- Tim McCartin, NRC staff -- I would like to offer one perspective. The increased time period has not changed the NRC's views on engineered and natural barriers. We were looking at natural barriers the same with a 10,000-year time period. As if we have a million-year standard, we would do the same. The requirements are the same.

We were not looking at any less rigor on the natural system versus the engineered system. The regulations require both an engineered and natural system. And we have that we would maintain that that was not a time-dependent kind of review. The review was for both.

MEMBER CLARKE: Thanks for that, Tim. My thought was not time. It was how important the process was given a longer compliance period. And perhaps I was not recalling correctly the NRC's position, but I believe the DOE didn't take much credit at all for attenuation. And vadose zone could turn out to be pretty important.

MR. McCARTIN: Right. And if you look at our risk baseline report, we had retardation of neptunium, very important. And that was back with a 10,000-year standard and waste packages that survived past 10,000 years. And one could say, "Well, gee, there weren't any leaky containers. How is a high-risk contributor, retardation of neptunium, in the saturated zone?"

And so I would maintain the barriers. And partly the reason for this is that was one of the lawsuits against part 63 that we did win in court on, was the way barriers and how we were looking at barriers in the regulation.

You know, if you look at it, it is the capability of the barriers. And that capability is there. Regardless of whether a waste package for the natural system, whether it lasts one year or a million years, there is still a capability for that barrier of the natural system. And our review looked at both.

MEMBER CLARKE: That is an important finding.

MEMBER HINZE: Can I ask another question if we're --

CHAIRMAN RYAN: Okay. One.

MEMBER HINZE: One. I accept it.

CHAIRMAN RYAN: We are going to try and get through the presentations if we can.

MEMBER HINZE: I am just trying to make certain that I understand how you are going to use TPA in the licensing process. Let me take an example.

We had an excellent presentation by Gene Peters a couple of meetings ago regarding the infiltration at the site. And we heard that we have a couple of different scenarios using the same models that end up with quite different results.

DOE is going to have to make a decision about how they are going to sort that out and present that in the license application. In view of the information that you have on infiltration, how will you use the TPA in any sorting out of the validity of what DOE has in their license application?

DR. LESLIE: I would answer it with kind of a trite phrase, but it is the process and not the product. Gene is now manager, but that team had to go out and look at all of the data and make their professional opinion of what data to incorporate in performance assessment, our TPA code. Okay? That process of becoming familiar with that information, that was a critical thing.

Again, we are not going to take that data that DOE used and put it in our TPA code. We are going to review according to the acceptance criteria, did DOE adequately consider data uncertainty?

The reviewer is going to take his knowledge base that he has acquired over the years and say, "Based upon what DOE has written" -- and let's just say that there are 20 data sets for infiltration and they pick one. And if they make the argument that this one is representative of the uncertainty or of the full range or variability and that is their argument, that is what we will review.

It is hard to say, you know, we are going to put it into our code and use it. That is not how we are supposed to conduct our review. We are supposed to conduct our review relative to what they say.

And so we are going to take that knowledge that we have acquired from developing the performance assessment and from how we have been familiar with the information that might support a model. That just goes into our ability to review.

MEMBER HINZE: That is helpful. Thank you.

Will you use that? Will you use the code, your code, to determine the significance of this variation of this uncertainty in determining risk? Is that part of the process to update the risk baseline report?

DR. LESLIE: That may go into the consideration, but, again, we -- and I think Tim answered this before -- are going to use our code to ask intelligent questions, you know.

And if there is an area where, for instance, they appear to have missed the boat and this is an important area, we are probably going to use our risk insights and the results of our code to inform how we ask the question.

We are always going to ask it relative to what they have proposed, their basis.

MEMBER HINZE: Thanks very much.

CHAIRMAN RYAN: Okay. Thanks. Okay. Where are we? Oh, Neil. I'm sorry. Excuse me.

MR. COLEMAN: Neil Coleman, ACNW&M staff.

Tim McCartin mentioned some of the international efforts in code comparisons over the last couple of decades. Some of the people here participated in those. But I have a more specific question about code comparison.

Now that you have the TSPA, is there going to be an exercise, an internal one, a comparison of certain scenarios, to make sure that you get generally the same results with TPA versus TSPA?

DR. LESLIE: No, no.

MR. COLEMAN: Why not?

DR. LESLIE: Because we have taken different approaches. We don't expect things to -- I mean, the DOE has a licensing case. And we will conduct our review of the licensing case when we get a license application.

I mean, right now we can look at what is in the supplemental environmental impact statement model to understand things. We are going to use what we have done in the past to inform how we are going to review that.

Again, our code is to help us review. It is not to determine compliance. What is the purpose of comparing dose numbers? If the staff were to do that, then we could be rightly accused by the state of saying, "Hey, you have prejudged whether it is safe or not."

That is not our responsibility, and we are not going to do that. Our responsibility is to review it independently, take the information, approach it in a risk-informed manner, and determine whether what DOE has proposed is safe or not.

MR. COLEMAN: Well, I mean it in the sense --

DR. LESLIE: Tim is going to --

MR. McCARTIN: Yes. And let me give a specific example because Bret is absolutely right on this. But what we are trying to say -- and I will give a very simplistic answer. And it's obviously not as easy as that. For example, let's look at infiltration.

In the development of our TPA code, when we look at infiltration, the important aspect of infiltration is how many packages get wet and how much water gets to the packages that are dripped on. Those are two very important aspects related to infiltration.

So when we look at the TSPA in the Goldsim model, those are the things. Okay. How sensitive is the number of packages dripped on? And how much water gets in there to infiltration, which might help us determine, are we worried whether infiltration increases 20 percent?

And it is the information we have gotten in the development. And I realize that is a very simple answer that people might say, "Gee, you really didn't need a large TPA code for that." But the example is one of you have learned things by running TPA but comparing the two.

I don't know. I mean, it's just I stress the knowledge that has been learned and all of the information that will then look at aspects of the Goldsim model with that more intelligent pair of eyes.

MR. COLEMAN: I mean, I suppose if there was a -- you pointed out, even fairly recently, you have identified a few minor bugs in the code. But if there was a significant one still lurking somewhere in the TSPA or in TPA comparing some relatively simple scenarios, just now that you have both codes, I mean, it is the sort of thing I would do.

Anyway, I did want to mention I have had the chance to set up and run the code. And it works just fine. The instructions that were provided work well.

One little thing, you have to set two environmental parameters in it. And what it wasn't clear about is that you have to do that every single time.

There is a way to set it up where you don't have to do that, but that is not clear from the documentation. So I will just put that on the record that people know that if they run that, do that every single time, they won't have any trouble running the code.

I had a question about the data sets that are in there. And this goes back to a presentation Tim McCartin gave last year talking about conservatism in the data sets and that if I remember correctly, Tim, what you said was they're not really meant to be conservative or strongly conservative but that they represented the staff's best estimates of the various parameters that are in there. Is that still the case?

DR. LESLIE: I will let Tim answer that since you are paraphrasing his comment.

MR. McCARTIN: Well, yes. And I don't know if I remember exactly what I said, but I believe it was related to something that I have heard John

Garrick say. You should take your best shot.

And I believe that when we develop the TPA code, we are taking our best shot. And that has been our approach since the very beginning.

MR. COLEMAN: Well, I'll just try one --

MR. McCARTIN: Remember, there is flexibility to look at it from a lot of different ways. And that also is part of that approach.

MR. COLEMAN: Well, I'll save some of these other questions for later, but one specific thing -- and I am not buttering up our Chairman with this.

CHAIRMAN RYAN: You don't want to do that.

(Laughter.)

MR. COLEMAN: He has written with Dade Moeller a couple of papers on the degree of conservatism and analyses studying iodine-129, in particular. If I read a paper, no matter who writes it, I read it critically. And I think those were pretty good papers.

I just wondered how that was considered because you noted that iodine-129 now has a higher dose conversion factor in the code.

MR. McCARTIN: Right. And that is due to the newer dosimetry. It has very little to do with --

you know, in terms of the inner workings of the TPA code, there are certain dose conversion factors that we take from federal guidance. And they get updated all of the time.

CHAIRMAN RYAN: Should I just clarify?

MR. McCARTIN: Yes.

CHAIRMAN RYAN: The sensitivity of iodine-129 is based on dietary intake of stable iodine.

MR. McCARTIN: Right, yes.

CHAIRMAN RYAN: You have not accounted for dietary intake of stable iodine.

MR. McCARTIN: That is correct, yes. Yes. And it went up. It still is a relatively small dose contributor, though. And so from a risk-informed standpoint, we tend to improve things in areas that have more significant contributions to the dose.

CHAIRMAN RYAN: And, actually, you know, just to correct the point, actually, based on the dietary intake, the current dose factor could be conservative or non-conservative based on dietary intake. So it's not just a conservatism.

Typically for a lot of diets, the stable iodine intake is such that it would be conservative, but there are dietary intakes in certain groups that it would be non-conservative. So that is the important part there is that is something that would affect it.

MR. COLEMAN: A suggestion for the code documentation on this, I mean, in this sense, iodine is very different from other radionuclides, from neptunium, for example.

CHAIRMAN RYAN: Add carbon and radium to the list, too.

MR. COLEMAN: Right. So just noting this effect and how the dose occurs --

CHAIRMAN RYAN: Sure.

MR. COLEMAN: -- and that, in reality, the dose would probably be smaller.

CHAIRMAN RYAN: Could be. I'm sorry. I just want to ask another question. I take away from the discussion and the conversation that -- and I appreciate and I think agree with the difference in your writing a code than you using a tool to make an analysis. That is a very important point.

And I think, Tim, you articulated that to us many times over. And the take your best shot aspect that Dr. Garrick used to talk about is a real important point of how you get to understanding what is important and what gives you an important risk insight and what is a not so important risk insight to make an evaluation.

All of that is so important to me. The way you described it here today, as you updated in 5.1, again, it leads me to the conclusion that that all ought to be clearly laid out in your risk insights update, whatever form it might take in writing, because that really is a critical basis that needs to be carefully documented of how you are going to conduct a review. And I think that will help you withstand any challenge to what were you thinking when you did that.

So just a thought that that sets a foundation for your preparation I think would be real useful. We are going to talk about that some more.

DR. LESLIE: Yes.

CHAIRMAN RYAN: Thanks.

Are we ready for phase two? Oh, I'm sorry. John?

MR. FLACK: John Flack, ACNW&M staff.

I am coming from the reactor worlds. And I heard some of the responses to some of the questions. And I assume that the process works the same way. License application comes in. We have separate. Agency has its own codes and does confirmatory research that performs the basis for the acceptability of the application.

So it is this separation of church and state. In other words, I assume that we are the church and the state --

(Laughter.)

MR. FLACK: -- the application. But, I mean, this is still the case here. I would assume that the word "confirmatory" research or confirming the applicant's and that forming the basis for the acceptability still applies, I mean, just to clear. I thought there might have been some misunderstanding about that.

Just a question to follow up on Dr. Hinze's questions on uncertainties and what is an important uncertainty. When you exercise these codes, do you take them to the point of failure where it is unacceptable and then move backwards from there to say this is how much margin I have between what we're expecting and where it would take us to a place of unacceptability?

I mean, is this part of this in understanding how important the uncertainties are or how do you determine what we mean by an important uncertainty? I guess that is the question.

DR. LESLIE: Well, I'll take the first shot at it. And then probably Tim or Osvaldo will or even Jim Winterle will help me when I stumble.

The risk insights baseline report, the risk analysis update for risk insights, we do a lot of different tests. And we do run a lot of sensitivity analyses, a lot of important analyses. I don't think we ever go to failure. We try to identify using these multiple techniques, what are the most sensitive parameters. Okay?

And, again, we're not in a place. We're not in a license review. We are in a pre-licensing period. And so our regulation doesn't require explicitly that they have to have a safety margin. They have to meet the performance objective in light of the uncertainties.

And so there aren't always direct parallels between what is happening in reactor space and what is happening in part 63, which is a risk-informed, performance-based standard. I don't know if that addressed the issue.

MR. FLACK: Well, it's just that the more margin you have, the more comfortable you feel about the acceptability. And it usually helps during the review process to know what that is. That is just a comment at this point.

DR. LESLIE: Okay.

CHAIRMAN RYAN: Last question before our break.

MR. DIAS: Hi. This is Antonio Dias from the ACNW&M staff. This is more like a comment.

I understand philosophically. I understand when you say that truly you don't have to compare the two codes. Okay? However, you also stated that you are going to use your TPA to pass judgment on if you agree with DOE's decisions on how they set up their input to their TSPA.

DR. LESLIE: No. I did not say that.

MR. DIAS: Well, you are going to have to use some way I could agree or agree with DOE's models. And I can --

DR. LESLIE: We have to assess what they provide and the basis for what they provide. It will not be based upon what is in our tpa.inp data. That information has made us familiar with the information suite of data that DOE might choose.

MR. DIAS: I can see situations where in some cases or another, you are going to be running your TPA. You are going to find situations that you do not understand how DOE is coming with a specific number. That is going to become an RAI. You are going to send it up to DOE. DOE says, "Well, this is what we find. I don't know how we are finding this one."

So even though philosophically you don't need to do that, I think from a practical point of view, it would be very interesting that you somehow see how the two codes compare because honestly this is what everyone does in any other type of licensing effort.

I mean, yes, I'm following what John just stated. In all the other offices, we basically have our own tools. And we had better know that are tools are indeed to be trusted. Okay?

Thank you.

MR. McCARTIN: I mean, if people want to compare the answers coming out of the two codes, they can. I mean, I personally believe that in terms of defending our decision, that is a very, very minor part.

I will maintain what we as the staff need to be able to walk through the DOE performance assessment and identify what is going on, how it works through the system, and the technical basis why the infiltration is so much, why the corrosion rates are so much, resulting in X failures of the waste package, the release rates.

We need to be able to walk through that problem and point to the information they have given us. And at the end of the day, you walk through that explanation. And you see a dose of X that is consistent with everything that preceded it.

That to me is our licensing review. And whether we both end up with two millirem, well, so what? And I will give you a comparison that in previous versions of the TSPA and our code, we got similar release rates from the waste package for completely different reasons. The fact that we got similar release rates, the numbers were the same for completely different reasons.

Well, you had better know what those reasons are and why you should believe the assumptions in the models. And that to me is what the essence of the review is.

MR. DIAS: And that is what I was saying. I mean, it seems to me that both TPA and TSPA are made up of a string of modules. And it seems to me that you would be following these modules' input and output, which becomes input to the following model, and so on and so on and so on.

CHAIRMAN RYAN: I wonder if it's a matter of semantics, in part. I mean, comparing a model directly to another model, you know, you can think about it. You know, I run this one, I run that one, I look at intermediate or final outputs or whatever and analyze that.

I think my own view -- and, again, I am sticking up for what we have heard so far this morning -- is that using a tool to guide one's thinking in analyzing a case on something is what I am hearing they are going to do.

Now, I view that to be the goal of the same. Does the case that you are reviewing or you are asked to review and under the regulations and all pass the test of, for lack of a better word, reasonableness in accordance with all of the requirements that are specified?

And so I am just asking that we think about the -- maybe part of what we are thinking about is semantics, rather than the actual substance of what is going to happen.

MR. DIAS: Okay.

CHAIRMAN RYAN: So I am hearing a little different story. And I appreciate your comment. And I think Tim has expressed it many times to this

Committee that the answer itself isn't the story. It's the answer itself and how you get to that answer and does it pass the test of assessment.

DR. LESLIE: And one thing for the record, and I think we will be ready for a break. I know I am after a liter and a half.

(Laughter.)

DR. LESLIE: Last Friday we sent a letter to Bob Loux. Neil indicated he had been using the code. And I wanted to just let people know that we sent a copy of the code and the user guide to the state and to everyone on our mailing list. And so if you haven't received a copy already, it probably passed you in your airplane flight going the other way.

CHAIRMAN RYAN: Okay. Well, thank you very much.

MEMBER HINZE: Can I try to make certain that I understand what I have heard here? And that is that there has been an emphasis on the prelicensing and the use of TPA. TPA still will be a tool but not necessarily in its entirety to come up with a final figure for comparative purposes. Is that --

DR. LESLIE: There is a big transition between using prelicensing and --

MEMBER HINZE: That's essentially where you are.

DR. LESLIE: Right.

MEMBER HINZE: I want to make certain that my understanding is correct.

DR. LESLIE: Right.

MEMBER HINZE: All right.

CHAIRMAN RYAN: With that, we will take a 15-minute break and return at 10:20.

(Whereupon, the foregoing matter went off the record at 10:06 a.m. and went back on the record at 10:25 a.m.)

CHAIRMAN RYAN: On the record. I think we're going to be led by Chris Grossman in part two of today's presentation. So, Chris, without further ado, I'll turn it over to you.

MR. GROSSMAN: All right. Thank you. I'll give a short introduction here. I'm a member of the Performance Assessment Staff here at NRC. I've been with the program now for about six years, but somehow I'm still one of the junior members.

(Laughter.)

MR. GROSSMAN: My colleague here with me today is Osvaldo Pensado. He's one of our scientist at the Center and he was our principal contributor here on the TPA code efforts.

What we'd like to do in the second part of this talk as Bret mentioned is you heard about kind of the approach for TPA, what has changed and how we plan to use it, etc. We're going to get into some of the technical details of what has actually changed in the conceptual models in the abstractions. We're going to focus on areas where some of the big changes have occurred. We've briefed the Committee in previous years on older versions of the code and where areas haven't changed we're not going to focus on that as much. We're going to try and identify a few examples where some of the major changes have occurred. So go on to slide 31.

As Bret mentioned, we're going to talk to five areas. One of the largest areas to be discussed deals with the drift degradation and seismicity scenarios. This has introduced a new failure model to the code that was previously there in a different manner and has expanded upon the capability in terms of the mechanical damage to the drip shield and waste package. We're going to look at how that is modeled and talk a little bit about some of that.

The second area we're going to talk about is flow modification processes and we pulled this in.

This wasn't originally on our radar screen to discuss, but this gets to some of the integration and coupling questions. This is one of the areas where we previously had flow modification processes for the near-field environment where we accounted for convergence and divergence of flow, drift wall effects, etc. But when you start factoring in drift degradation and collapse of the drifts we realized that this was an area that we needed to update and we thought that it would be prudent to discuss this with the Committee, what some of the improvements were to the code in this area.

We're also going to talk along this vein of integration with talking about the near-field environment and some of the corrosion processes. There's been some recent data and modeling regarding both the chemical environment and some of the corrosion processes and Bret alluded to some of these earlier with the temperature dependence on corrosion. I'll discuss a little bit as well about how this is coupled with a drift degradation scenario and this is something we spent a fair amount of time on over the last year to ensure that we had the drift degradation and the corrosion processes lined up.

We'll talk about colloid releases of

actinides and then also transport of radionuclides attached to colloids through geosphere and how that is implemented into the model or to the code. Excuse me.

And finally, we'll finish up with our alternative igneous consequences abstraction which was added regarding redistribution in wind-field variations. And so we can move onto slide 32.

MEMBER HINZE: Chris, if I could ask you, interrupt you for one moment. Is this last bullet the only area where you've changed the igneous activity is in the redistribution in the wind-field variations?

MR. GROSSMAN: This is the major change. We retain actually the old abstraction that was implemented in the code and we've added this as sort of a flag that you can run an alternative route through the model. So this would allow us to assess both scenarios if you will.

MEMBER HINZE: Okay. So this is the only change then in this activity area. All right. Thank you.

MR. GROSSMAN: As I go through each of these topics, I'm going to hit upon the five points you see on this slide. The first one really gets to the purpose of why we added this particular conceptual model or feature into the code. What we have written here on the first bullet is flexibility in TPA Version 5.1 and what you're hear and you've heard a lot this morning is this is common purpose for a lot of what we've added and changed in the code.

To allow us to be somewhat of a rapid response kind of organization, we've tried to include flexibility where we felt it was prudent to do so to assist us in pre-licensing applications as well as potential uses in the licensing review. So you'll hear that again and again and I have it on the slide to emphasize that. I'll also discuss some of the other purposes in terms of addressing uncertainties that we have may have identified in the risk insights baseline or evaluating DOE conceptual models, etc.

The second topic or the second area I'll focus on for each of the five technical topics deals with the overview of the conceptual model. I'll just quickly run through how it's implemented, some of the major calculations, etc., to give you a flavor for what's going on there. And then I'll talk a little bit about where we couple things and how they're integrated among the different modules that handle calculations.

I'll spend a fair amount of time on the general approach and data support. What this will get into is why we feel that the conceptual model we implemented was a reasonable approach and some of the bases for that to give you a flavor of where this is coming from and the work that we've done to get to this particular abstraction.

And then I'll end with a little bit on the software validation. We talked at length this morning about that and I think it sounds like the Committee has an understanding of what we did for software validation. So it may not emphasize that as much in my talk.

The first technical area we're going to cover is drift degradation and in TPA 5.1 we added the capability to assess mechanical damage to the waste package. As I mentioned, this was previously in there in a different fashion in the past. It focused more on rock block impacts from seismic events. This capability expanded what the capabilities of the TPA code in the sense that we can now assess rock fall and rubble accumulation from excavation induced, thermally induced and seismically induced stresses and then evaluate their impacts on the lifetime of the engineered components and as well here, we get into some of the coupling as well as the near-field thermal hydrology. So how does it affect the temperature history of the repository as well as flow into drifts?

The way the abstraction is built -- Let me step back actually. I've already gotten off the topic. I told you I'd talk a little bit of the purpose of why we implemented this. One was to address some of these areas with the induced stresses and the rubble accumulation and to give us the flexibility to consider the impacts of these. This was also an area that we identified in the risk insights baseline that had some uncertainty associated with and the staff felt the need to from a system level perspective evaluate some of that uncertainty. So this abstraction was included to assist our interactions with the Department and to help us ask more intelligent questions of the Department.

The way the code works from a conceptual model point of view is we have a rubble accumulation in the drifts and then we compare the demands that that rubble accumulation places on the engineered systems to the expected capacities of the engineered components. So it's a very simple relationship there. The demands that are placed on the system were represented in a basic sense by the equation as shown here where you have the vertical pressures that are applied to the drip shield and/or the waste package are a function of the density of the rock.

The height of the rubble (H_{rubble}) which is a function of the bulking factor and the bulking factor is essentially in the intact state. You have a volume of rock and as that rock degrades and potentially collapses it may occupy a larger volume than it originally did and so there is some bulking in that volume. That affects then the height that the rubble may achieve from a thermal degradation point of view.

MEMBER WEINER: If I could ask a question at this point. What are the limits of uncertainty, for example, to the height of the rubble that you would consider reasonable, realistic? I mean I assume that that H_{rubble} is going to be a distributed input parameter. Is that correct or are you going to use a single bound?

MR. GROSSMAN: The H_{rubble} is actually calculated. The bulking factor is the input parameter that we look at to assess the height of the rubble and off the top of my head I don't recall some of the rubble heights we were seeing there are. I don't know if --

MR. PENSADO: This - the weight - the uncertainty is in the bulking factor. So the question is if rubble happens, then what is the gain in volume? The assumption that is made in the TPA code is there is some void space and then the process is self-arrest until there is no more volume. So all this volume is occupied. So there is some degradation and the volume is occupied until there is no more volume. So that would allow more rock to degrade and it could be a few meters to probably 10 or 15 meters of rubble that could accumulate.

MEMBER WEINER: My question is what is the range of uncertainty in whatever parameter you are distributing as an input. Whichever parameter is distributed, what's the range of uncertainty that you would consider reasonable?

MR. PENSADO: Yes. Here the main driving of uncertainty is the bulking factor.

MEMBER WEINER: Yes. Okay.

MR. PENSADO: And then that bulking factor is there is some liability that is accounted for in this bulking factor and that's guided with some field measurements and it's a relatively narrow range of uncertainty for this parameter and that is in the user guide. It's the one that you can check for this bulking factor and it will tell you precisely what is the distribution. I cannot tell you on top of my head.

MR. GROSSMAN: I think, Ruth, we're looking on the order of meters to ten of meters for the higher level.

MEMBER WEINER: I'm having trouble asking this question right. But my question is just to take off from what Osvaldo said are you looking at the range of field measurements to give the uncertainty range or are you extending your uncertainty outside the range of field measurements and, if so, how? In other words, what do you consider -- Just taking this one as an example, what would you consider a reasonable uncertainty range?

MR. PENSADO: Yes, it's based on field data and based on the volume of rubble.

MEMBER WEINER: Okay.

MR. GROSSMAN: Okay.

MEMBER WEINER: Sorry. Go on.

MR. GROSSMAN: No problem.

The code is also capable of evaluating drift collapse from seismic induced. I'm going to focus mostly on the thermally induced stresses and the resulting collapse. Seismic events occur. They can also add rubble and collapse of the drifts and increase the accumulation on the waste packages over time.

In terms of the -- I talked a little bit about the demand in terms of the loads that are placed on the engineered system. Now I want to talk a little bit about the capacity and what affects the capacity of the engineered components to withstand those loads. What we've considered here is through some modeling work at the Center as well as review of DOE information.

We've looked at the -- The expected capacity is affected by three areas where we see some coupling. One is in the temperature and so as the drifts degrade, rubble fills up, the drift heats up and this is reflected back on the engineered system. And as the temperature increases, that can affect the material properties to withstand the rubble loads.

Another aspect is creep. Over long time periods, creep may begin to play a role and so we modulate the expected capacity to account for the influence of creep as well as general corrosion of the engineered components. Here we're looking at the thinning of the components over time from the general corrosion processes and these components thin, their ability to withstand loads is diminished and could potentially lead to failure of these components.

Finally, one of the other aspects we looked and I mentioned is the thermo-hydrological estimates for the near-field environment. As the rubble accumulates, we evaluate the effect on temperature and then we look at that impact on seepage into drifts and so we have an abstraction in the code in which we approximate the collapsed drift and the rubble accumulation radially and we simulate that and its effect on temperature. And if I could move onto slide 34.

On this slide, I talk a little bit about the general approach and some of the data support on how we got to the conceptual model. The drift degradation abstraction and this gets to the demands or the loading in the abstraction is inferred from results of the center of thermal mechanical analysis and the diagram on the left here is an example of one of these analyses. It's based on a linear elastic continuum model and in this case what we see here is a drift profile in the white and then the colors represent different stress-to-strength ratios of this particular rock. And they analyze these for various grades of rock in the lithophysal zones.

And then the orange color here you see we're into an overstress situation where the stresses are exceeding the strengths. So the analyses for the thermal degradation which the thermal-mechanical analyses included the change in temperature and the effects of the stress in rock, these informed our thermal degradation abstraction and the accumulation of rubble which we model as basically a linear progression that a user can set the time frame to reach the height of maximum rubble and then it progresses linear. The basis for that is partly on these thermal-mechanical analyses.

In terms of the mechanical interactions for the structural performance, we based the ability of the engineered system to withstand the loads or the capacity on some finite element modeling work that has been done at the Center. Looking at the effects of temperature, creep, general corrosion processes on the ability of the drip shield to withstand the loads and then also if the drip shield were to collapse potential interactions between the drip shield and the waste package and what that would mean for the waste package delay of time and whether a waste package would be breached mechanically.

For the thermal hydrological aspects, the temperature abstraction which we model the change in temperature with rubble accumulation is based on a study at the Center using a two-dimensional, dual-continuum, drift-scale model in which the rubble accumulation was integrated with the thermal modeling to arrive at temperature profiles and that serves as a support for an abstraction that we ultimately implemented into the TPA.

MEMBER HINZE: Before you leave that, could I ask you a question or two?

MR. GROSSMAN: Sure.

MEMBER HINZE: Have you differentiated between stress corrosion? Have you provided for a difference between stress corrosion that might be caused by impact of the larger block on both the drip shield and the waste package and just simple local corrosion, the stress corrosion part of your act?

MR. GROSSMAN: In this particular scenario, what we're more interested in is keep in mind about 85 percent of the repository is lithophile --

MEMBER HINZE: I understand.

MR. GROSSMAN: And based upon these analyses, we're looking at and this picture doesn't give a great scale but you can kind of see there's a thin skin of overstressing. So the idea behind the conceptual model is that small amounts of rock would fall off over time and build up to exert pressure on the engineered system. So we don't directly consider the impacts of large blocks in the code at this time and therefore they result in the stress corrosion cracks.

MR. PENSADO: There has been some assessment of the stress corrosion cracking on titanium alloys and it appears that the possibility for stress corrosion cracking on the titanium drip shield structure is low. We have done some analysis.

MEMBER HINZE: It's low?

MR. PENSADO: Yes. Thank you. On titanium. We have done also some analysis on Alloy 22 and these are reports that are available.

MEMBER HINZE: What about on the waste package, Osvaldo?

MR. PENSADO: Right. The stress corrosion cracking waste packages is possible. However, there are several valuables that are needed for stress corrosion cracking. You need environmental conditions, appropriate chemistry, high corrosion potential.

MEMBER HINZE: But that's what TPA is about, isn't it?

MR. PENSADO: That's right. But this is

also about summarizing what we understand and what are the conclusions for process level modeling. So the process level modeling is telling us that the chemistry that is needed for stress corrosion cracking is difficult to obtain chemistry.

MEMBER HINZE: I'm really looking here at a more generic question than just this. One of my questions -- The question really is you are making a decision to exclude this from your TSBA.

MR. PENSADO: Sure.

MEMBER HINZE: And what are the criteria that are being used to make that decision and are they consistent throughout all of the themes that are involved in the process? I don't know. That may be a Bret question.

MR. LESLIE: Bret.

MEMBER HINZE: Bret question.

MR. LESLIE: Bret Leslie, NRC staff. It is a question. I mean, basically every team has their team of experts that are coming together and reviewing the information and determining which features or processes are screened in. Where there's still uncertainty and I'll give you an example we could have a team that looked at the deliquesce data, dust composition data and said "You know, based upon the data right now, we don't think dust deliquesce could ever occur. Let's not include that in the code."

You'd better be pretty sure that that's not going to happen. If you could potentially get dust composition that could induce dust deliquesce you probably would want to maintain that flexibility in the code. So it is a judgment call but it's based upon looking at the available information. Is it possible that this is going to change? How robust is the state of knowledge associated with certain processes? Is it going to be driven by data or is it a fundamental issue?

MEMBER HINZE: Is this advisory committee that you're talking about and the gurus, are they looking over the shoulder? Are they part of the consistency approach here? I mean, I'm concerned here in your TPA that there may be different levels at which you are eliminated and certainly this is problem you've thought about. How do you help yourself?

MR. McCARTIN: Well, yes, we have looked at the different models and what they're incorporating in and not and the desire is to make sure the processes that are most relevant are in the code and there are certain processes that --

MEMBER HINZE: How do you determine which are the most --

MR. McCARTIN: As was indicated, you look at can these chemistries develop and the extent of stress corrosion cracking is one that is also the size of these cracks and whether water can get in and whether there would be significant releases, whereas other processes for failing the waste package are more significant and included and you're absolutely right that certain things are excluded and certain things are included and that's part of this. When you look at that results what's your bases, why did you get the numbers you did, and it's all -- There is -- If you have another group doing the modeling, you may end up with a different set of processes. I'd like to think the key processes would be common between everyone and this is one where we felt it wasn't that critical to have.

MEMBER HINZE: Did you ever go through the process of putting something into the TPA and then finding out that its effects were so minor, so minimal, that you excluded it?

MR. McCARTIN: Many times over the years. Diffusional releases are one of them.

MEMBER HINZE: Are those referenced as such then because this is important because they had been analyzed then by a TPA cohort and they're just not in TPA 5.1.

MR. McCARTIN: Sure. Yes.

MEMBER HINZE: Is that references in this?

MR. McCARTIN: Some of the analyses are. I will say over the last 20 years have we documented everything? I'd like to say all the important things, yes. There may be a few that we haven't.

MR. PENSADO: I just had a chapter in the user guide where there is model support and then questions such as stress corrosion cracking are acknowledged as a potential degradation model. There would be an explanation of why that is not explicitly included.

MEMBER HINZE: I apologize for the diversion, Mr. Chair.

CHAIRMAN RYAN: You're welcome.

MEMBER WEINER: Could I ask just one?

CHAIRMAN RYAN: Just one.

MEMBER WEINER: Just one right now. How are you going to use this? Now you've worked out this model of drift degradation and you have some backup for your model. Now how are you going to use this to make a judgment about DOE's models of drift degradation? Suppose they come in and say "We don't see this red line at all." How are you planning to use this as a review tool or aren't you?

MR. GROSSMAN: One of the things I think with the drift degradation in particular --

CHAIRMAN RYAN: That was four questions by the way.

(Laughter.)

MEMBER WEINER: I thought I got away with that.

MEMBER HINZE: Well, it's semicolons.

MR. GROSSMAN: With the drift degradation and potential for different approaches, I think where we'll be using this is to help focus our questions on the Department's approach and so one of the reasons that we brought this to TPA code was to evaluate the uncertainty that may exist and its impact then on the life time of the engineered barriers.

And we wanted to see from a system level perspective could this have an impact. If it does, then we may need to pursue these things and I think that's one area where at least in prelicensing we have been using the knowledge we've gained from implementing this abstraction into the code to help inform. Our questions of DOE as they lay out their new approach for drift degradation and seismicity in their TSPA.

MR. PENSADO: Just more specific examples, you can envision a series of consequences, a couple processes that would be affected by drift degradation. It could affect the temperature. It could affect the amount of water flow rates. It could affect the mechanical interactions. We can use the TPA code and say flow rates and temperatures as secondary effects. So probably we should focus more of the interaction with the DOE, more of the questions on mechanical interactions.

CHAIRMAN RYAN: I'm going to suggest to plan our time that I think there's four or five topics in your section that are detailed technical topics. I'm going to ask members and others to let them present their information on the individual topics. Then we'll take a brief question from members on those topics if there are any and kind of proceed that way and leave some more generic and general questions for the end of the session on the particular technical topics. Is that okay? All right.

MR. GROSSMAN: Let's move onto slide 35. So with the possibility of drift collapse from either thermal induced stresses or seismically induced stresses, we looked at our flow alternation processes and in TPA 4.1 we had some abstractions for flow alternation from convergence to structural features, etc. and that was broken up into a very simple approach where you had a couple of parameters that you would use to evaluate that.

One of the things we wanted to do with the advent of the drift degradation is to expand upon that in the sense of making it more transparent. Some of these parameters lump several processes previously and we wanted to break that out so it was a little more explicit where the credit may be coming from in there to help us evaluate the potential impact of -- We lost the screen.

(Off the record discussion.)

MR. GROSSMAN: That's fine.

CHAIRMAN RYAN: Everybody has the handout so just if you can use that one computer that would be great.

MR. GROSSMAN: Sure. And one of the things we wanted to do was to kind of enhance the transparency of where the impacts may be focused in terms of their impact on the flow processes and so we split this up and we also are looking at time dependency and so forth. If we could actually move onto the next slide. I think it will this discussion a little more clear.

On slide 36, we have a diagram from our user guide of a drift in a repository and you can see here the flow modification processes that may be going on. We're looking at large scale effects like flow convergence/divergence processes due to structural features such as fractures and faults. We're looking at the impact of the drift wall and the impact of capillarity or film flow along the drift wall.

Now one of the aspects here of drift degradation is if the drifts collapse your drift wall which was roughly a nice smooth surface has now roughen quite a bit potentially and that could impact the amount of diversion or not of the flow. So we wanted to include that aspect.

The introduction of rubble into the void space of the drift could impact the flow processes as well as the possibility of the drip shield or the waste package diverting water after failure due to the presence of small openings from mechanical stresses or potentially localized corrosion in terms of waste package. And so you can see here where from two parameters we've expanded the list but it adds an air of transparency to the approach and allows an analyst to better understand maybe where the impacts are most focused.

These parameters are based on experimental observations, some numerical analyses, and staff judgment and as a simple abstraction most of these are input parameters in the TPA code and allow a user the flexibility to consider the range of options that are reasonable. So I think that's all we had on the flow diversion.

CHAIRMAN RYAN: Any questions there? Jim?

(No response.)

CHAIRMAN RYAN: On we go.

MR. GROSSMAN: So the next area where we made some alternations as a result of recent data and some new modeling as well as to make sure that we are still coupled with the introduction of the drift degradation was in the near-field chemistry and the corrosion of a waste package abstractions, the waste package corrosion abstraction, it estimates the waste package thickness as a function of time and the near-field chemistry.

And one of the things is that we've had this construct for corrosion in the code for some time. What the diagram here shows is as your relative humidity changes with time you can enter different corrosion modes. So on the left at low relative humidities, you have drier oxidation of the Alloy 22 and as the humidity levels increase you may move into humid-air corrosion phase and then at some threshold you'll reach what we term aqueous corrosion which is one of the predominant processes in terms of the time frame of the simulations that we see.

Within the aqueous corrosion, we added the flexibility to evaluate three different chemical environments and their impacts on the corrosion of the package. And so I'll talk a little bit about those environments in a second, but within the aqueous corrosion environment there are also two corrosion modes. One is a general uniform corrosion that we see and one of the changes we made was bringing in recent data and implementing an arranged relationship to estimate the temperature dependence of that corrosion rate with time and this is again coupling it to the temperature which is coupled with the drift degradation to make sure that these aspects are represented reasonably in the code from assistant level perspective. The other corrosion mode is localized corrosion predominantly from crevice corrosion and we see this in the simulations when water and appropriate chemical composition contacts the waste package and this is where the three environments come in to evaluate the impact of the near-field chemistry on the corrosion processes.

The first environment, Environment 1, is what I'm term the dust deliquesce environment and so this environment typically will exist in simulations where you have no water reaching the waste package but the humidity is sufficient that dust from the packages could potentially deliquesce water, moisture, from the air and lead to the initiation of corrosion.

The second environment is what we term the seepage evaporation environment and this environment is at a point where you have water is reaching the waste package for whatever reasons it may have arrived there, but the temperatures are such and the relative humidities are such that significant evaporation is still going on and so you'll have potentially some concentration of salts and so forth which could potentially lead to aggressive environments and localized corrosion.

The third environment then is what we call just the normal seepage environment and this is typically environment we believe would be more dilute chemistry. So as you exit the thermal period and temperatures return to ambient, we would expect to see water coming back more on the order of the background of chemistry, I'll call it. I think that's it for this.

CHAIRMAN RYAN: Any questions?

(No response.)

MR. GROSSMAN: I'll move on to some of the support for this approach. Some studies have indicated the transition relative humidity from the humid air and drier oxidation to the aqueous corrosion. Because of the possibility for deliquesce of nitrate brines that could occur at low humidity we've selected a relative humidity to be consistent with that and it tends to be towards the lower end of the spectrum. And that is an input parameter available to the user.

In terms of the localized corrosion model, so once aqueous corrosion initiates when you've surpassed your relative humidity boundary then there are two things that play. One is general corrosion is occurring and its rate is calculated by the code. The second is we're evaluating based on the chemistry and the temperatures the potential for localized corrosion or aggressive corrosion of the package and that model essentially compares a calculated corrosion potential to a critical potential and when that corrosion potential exceeds that critical potential then the code initiates localized corrosion of the waste package and the corrosion potential calculation is based on measurements by the Center, Darrell Dunn and others perform it and the diagram on the left here indicates a pH dependence of that corrosion potential and how the data that they collected compares with the range we see in the TPA code for the corrosion potential.

In terms of the chemical compositions for the three environments that we evaluate for initiation of localized corrosion, for the Environment 1 which is the dust deliquesce, those observations are from several studies of the corrosion inhibitors in the dust from Yucca Mountain looking at the ratios of nitrates to chlorides.

The seepage environment chemistries are largely developed from simulations of evaporation of pore waters, starting with pore waters and then numerically evaporating to arrive at potential concentrations. And then finally as I mentioned for the third environment, we're looking at dilute pore waters which are based largely on measurements by Yang, et al., in several different publications.

The chemistries in the code, we have flexibility to evaluate other chemistries. These are all input parameters that the user can select to evaluate. So that kind of concludes this.

CHAIRMAN RYAN: Any questions on that? Jim?

MEMBER CLARKE: Just to follow up on a question Dr. Hinze asked earlier, using either term integration or coupling, is this process coupled to drift degradation? In other words, I think you responded when he asked. But potential rock fall damage on the drip shield and accelerated corrosion as a result of that.

MR. GROSSMAN: There is some integration in the sense of as drift collapse were to proceed there would be an insulating layer on the engineering system. If corrosion were to occur, aqueous corrosion on the waste package, that temperature would be reflected in the corrosion rates that we would see on the waste package. So that's one area where I think we have some integration between the drift degradation and the drip corrosion abstractions.

I think another area where we've looked is when you have the potential for mechanical failure the package from rock fall and overstressing and then you have the potential for corrosion, these failure mechanisms could actually occur on the same set of packages depending on the timing of --

MEMBER CLARKE: That was really my question.

MR. GROSSMAN: -- the particular failures. And so in terms of the release we do consider the possibility for, say, like a localized corrosion failure to occur on a package before the packages may fail later from mechanically induced like a seismic event or something. So that integration is implemented in the code in terms of how we evaluate flow into the package and then release from.

MEMBER CLARKE: Thank you.

MR. PENSADO: Very important, coupling is if the drip shield was going to be compromised by some drift degradation, then you would allow seepage to come into contact with the waste package but could potentially lead to the formation of some concentrated solutions which could induce localized corrosion. So that coupling is taken into account.

CHAIRMAN RYAN: Ruth?

MEMBER WEINER: Are all of your input parameter values distributed? Can you distribute them all or are you forcing some to be single parameter values?

MR. GROSSMAN: In the reference case, we

do have some that are set to constants. But the flexibility is there for a user to --

MEMBER WEINER: To get them all.

MR. GROSSMAN: Almost every one. There are a few flags that would blow the code off if you just tried to just shove it now.

MEMBER WEINER: And again, how are you going to use these data, this model, to review what the Department of Energy comes in with?

CHAIRMAN RYAN: Could we defer those more broad questions to the last session?

MEMBER WEINER: Okay. That's fine. I was specific to this model, but we can defer.

CHAIRMAN RYAN: Okay. Well, it's a general question though. I'm trying to get through the presentations and the technical details before we get back to that which is important. Allen?

VICE CHAIRMAN CROFF: Can you discuss a little bit more the discontinuity in the middle of that graph? What's causing it?

MR. PENSADO: Yes. It's -- This is the corrosion potential. So it's the balance between the anodic and cathodic processes. So at high pH, the oxidant is always oxygen. Now at the low pH, you have oxygen but it's mediated with hydrogen ion and there is a different kinetics, so the cathodic reaction at low pH and high pH, and those are -- Most likely, it's not a sharp discontinuity as we are modeling TPA code. It would be a smooth transition. But we clearly saw the high corrosion potential at the low pH and we explained those to be due to the different kinetics of the cathodic reaction.

VICE CHAIRMAN CROFF: Thanks.

CHAIRMAN RYAN: Professor Hinze.

MEMBER HINZE: Thank you. Going back to Dr. Clarke's question, is there built into this a provision for an enhancement in the dust volume during rock falls? I've worked in mines and there's a lot of dust with rock falls and is this coupled? Is the rock fall coupled in to enhanced dust availability?

MR. GROSSMAN: The flexibility exists in the code to evaluate that. The chemistries that you would see in the those three environments discussed are input parameters and so the possibility to address that particular question is available in the code. In terms of the current values, I can't speak to the numbers exactly off the top of my head because there's over a 1,000 different parameters. But what we've seen is the investigators listed here have gone out and collected observations from the Yucca Mountain region of dust and so forth to evaluate -- What we're interested in is the relative ratio of chlorides to nitrates.

MEMBER HINZE: Right, but certainly the dust you collect in there at the present time is hardly the kind of dust that you're going to get when there is some seismic activity rattling the cage.

MR. GROSSMAN: The volume, the composition, I don't know if that would be significantly different.

MEMBER HINZE: Yes, I don't know either, but it could be because you may be getting into different stratographic horizons. Thank you very much.

MR. GROSSMAN: Okay. So on the fourth area, what we'll discuss a little about is colloid release and transport. This is something that is new to the 5 series of code, in particular, 5.1. We did not have this capability explicitly in the former versions of the code. We were able we felt to evaluate off-line the impact of colloids and by using the code in an imaginative way. But we felt because DOE had shown the colloids and had discussed previously this idea of a contributor in their analyses, that we felt we may need a more explicit representation in the TPA code. So the decision was made to include to give us that capability to examine more explicitly the impact of colloidal release and transport on the results. It also gives us the flexibility to evaluate that. So that's kind of the basis for including this in the code.

What we knew here is there are two aspects to this. There's the release portion and then there is transport portion. The release portion focuses mostly on the actinides. This is where we had some evidence of potential colloidal attachment formation in the waste package. So we're looking at americium, curium, plutonium and thorium and their attachment irreversibly to colloids.

The reason that we disparatize our colloidal abstraction into irreversible colloids and these would be radionuclides that are bound to a colloidal material and effectively are never released and then you have reversible colloids in which any radionuclide beyond the actinides can attach to colloid particles and be transported along that and in some cases this may enhance their transportation through the geosphere.

The reason to draw this distinction between reversible and irreversible is based on observations of kinetic experiments with colloids. In some of these kinetic experiments you see slower kinetics in which the irreversible attachment is meant to emulate and you also see fast kinetics absorption. So a reversible attachment is an attempt to model that observation.

One of the enhancements added for the release portion deals with the aqueous phase for the radionuclide. So the way that the model works is the waste form degrades. Radionuclides are released into solution and they are limited by their solubility limit. For the actinides, some of them could then sorb to colloidal material in the waste package and sources for that colloidal material, the abstraction is based largely on iron hydroxide colloids. The potential exists for natural colloids or waste form colloids as well and the model has the flexibility to evaluate those. But most of the abstraction is based off of iron hydroxide colloids and I'll explain why on the next slide a little bit about that, but not yet.

MEMBER CLARKE: Dr. Ryan, before he leaves that slide, can I ask a quick question?

CHAIRMAN RYAN: Okay.

MEMBER CLARKE: Your graphic, I'm having trouble understanding the different colloidal forms that you just mentioned. It would seem that you ought to have the reversible area between aqueous and colloidal. You could have a direct release of a colloid.

MR. GROSSMAN: Okay. Maybe I may not have explained that clearly. The figure is meant to depict that the waste form degrades to aqueous and as radionuclides in the aqueous reach their solubility limit some may precipitate out.

MEMBER CLARKE: Okay. But you have an exchange between aqueous and colloidal.

MR. GROSSMAN: So then what you have is yes.

MEMBER CLARKE: For reversible colloids.

MR. GROSSMAN: For the irreversible colloids such as the actinides you have attachment to colloids which would then be a permanent attachment and what that effectively does in the model is it alters solubility limit of the aqueous phase. So you could actually release the total amount of radionuclides higher than just the aqueous phase the solubility limit would allow because you are removing from the aqueous phase to the colloidal phase and that was something I hadn't gotten to yet in the description. But thank you for pointing it out.

MEMBER WEINER: Can I ask a specific question on this?

CHAIRMAN RYAN: Please.

MEMBER WEINER: What was the databases for your colloidal model? I'm asking because what we've observed with plutonium is that it doesn't go through the aqueous through a solubility phase first. It forms, plutonium-4 forms, an intrinsic colloid and I wonder what the bases of your model, the databases, experimental bases, for your model is.

MR. GROSSMAN: I'll get to some of the bases on the next slide and I understand the concern about the intrinsic colloid. I think this abstraction even though the diagram shows going through the aqueous to the colloidal can still capture that possibility. As I mentioned, it's largely based on sorption to iron hydroxide colloids. It does allow the flexibility to evaluate both the intrinsic colloids, attachment to groundwater colloids or waste form colloids. But the current abstraction as it exists is not built.

MEMBER WEINER: Because there has been considerable work done on colloids particularly colloids involving the actinides in the WIP program and just wondered whether you -- and it's all open publication work and I wondered whether you had used that as the bases for your model.

MR. GROSSMAN: I can't answer that in regards to what the investigators considered from the Center largely but maybe Osvaldo can add to this.

MR. PENSADO: If I may. Is -- there is -- there was consideration of information and literature and so consideration of what would be the concentration of available colloidal size and sorption size to the colloids and that's based on the investigations like the one that you're referring to. So, yes, we considered the literature, information from the literature, to come out with these abstractions.

MR. GROSSMAN: And I think Bret wanted to add. No? Okay.

From the transport aspect then in terms of -- For the transport we still have the two classes of colloids. You have the irreversible attachment and reversible attachment. The irreversible attachment for transport purposes are treated as a separate species and they have their own properties for transport. At the end then they are combined back with the elements in those that are calculated.

For the reversible colloids, again any

radionuclide could attach to a colloid as it's transporting along. So the way we model the reversible attachment is through a retardation alternation. That accounts for the retardation of the colloidal material to the solids as well as the number of sorption sites available and so forth and I listed the equation here at the bottom which comes from the abstraction which essentially finds that.

I'll move onto the next slide which talks a little bit about some of the model and data support. I mentioned that this abstraction is largely based on the iron hydroxide approach. The reason for that comes from the two ticks on the top here. Data for sorption efficiency of various corrosion products suggest that the iron hydroxides tend to be even stickier if you will than some of the other potential colloidal material as well as just the relative abundance in waste packages. The fact that we have stainless steel internals, inner container tad, there's a lot of material there potentially for sorption of radionuclides. So that was kind of the b basis for why we built the abstraction the way we did.

In terms of the transport, we used -- the transport is modeled as equilibrium sorption, but we've used kinetic models to help guide our parameter selection and this gets to some of the aspects I talked about with seeing slow sorption versus fast sorption to some colloidal material and representing the two different components in our model. Do we have any further questions on the colloidal model?

(No response.)

MR. GROSSMAN: Okay. Let's move onto the final topic here, the igneous redistribution. Previously in the code in version 4.1 the igneous scenario involved a potential for extrusive release of radionuclides to the atmosphere and then deposition at the RMEI. And one of the assumptions in that analysis was that the wind blew south toward the RMEI and there is some uncertainty about how realistic that may have been. So there was a desire to have an alternative analysis in which we potentially more realistically considered redistribution processes and the effect of wind-field variation on igneous consequences. So the ashery mode with the name of the model is our attempt to represent this redistribution and these processes.

This model is focused on inhalation dose which we've seen in previous versions and in sensitivity analyses to be one of the principal contributors for the igneous extrusive. So we didn't feel the need to include the minor pathways.

We're looking at breathing rates in individuals for the dose. The H_{RMEI} is the loading that we see and that --

CHAIRMAN RYAN: What do you mean by "loading"?

MR. GROSSMAN: Let me step back here. Sorry. That's the concentration of the radionuclides at the RMEI.

MEMBER WEINER: Radiation in air?

MR. GROSSMAN: This is the airborne concentration of the high level waste for inhalations. And so what we're looking at is estimating what that concentration may be and we consider three sources. We consider direct deposition from the volcanic event. We consider fluvial remobilization. So the RMEI lives near the 40 mile watershed and as ash deposit in that watershed could be potentially remobilized to the RMEI and contribute to the concentrations they may experience.

CHAIRMAN RYAN: They get back in the air though.

MR. GROSSMAN: That would be from surface disturbing activities that the RMEI may engage in and I'll talk a little bit to that here in a second.

The third area is Eolian redistribution

and so both within the watershed and outside the watershed you may have winds kicking up tephra, ash and depositing that in the vicinity.

So when you have these three contributions then, we're also looking at where the RMEI is getting these concentrations from. So some of these will be from indoor activity. Some will be from outdoor activities and some will be more offsite. So we're looking at those three possible sources as well.

CHAIRMAN RYAN: How do you get indoor exposure? Sloppy housekeeping? I don't understand how you get indoor exposure to ash.

MR. GROSSMAN: Indoor exposure, I can envision following deposition you have dust in the air and that can settle.

CHAIRMAN RYAN: If it's deposited, how does it get back in the air? There has to be something to get it back in the air in the respirable range for an extended period of time.

MR. GROSSMAN: Right, and I think there for the indoor you might look at activities that people engage in inside, cleaning activities, etc. I don't know if Tim wants to --

CHAIRMAN RYAN: I don't get it.

MR. GROSSMAN: Tim, would you like to?

MR. McCARTIN: Yes, there's an assumption that a certain percentage of the outdoor air will end up inside and you'll have dust inside your house from dust that was outside.

CHAIRMAN RYAN: Okay. In the respirable range? That's the other big question. What's your respirable range?

MR. GROSSMAN: That I don't know off the top of my head.

CHAIRMAN RYAN: Up to 100. Let me finish.

MR. McCARTIN: Boy, that I'd have to check, but we are assuming that --

(Several speaking at once.)

MR. McCARTIN: We are only tracking the dust that can be inhaled.

CHAIRMAN RYAN: Yes, anything above 10 is not in play as far as I'm concerned. It's just too heavy.

MR. COMPTON: Keith Compton, NRC. That would come into play in definition of mass loading, I would think. I mean, you would have to use a mass loading that is consistent with your respirable size fraction.

CHAIRMAN RYAN: Yes, and again the number is key because a lot of this material is going to be way, way above ten and ten is kind of the outside of the respirable range.

MR. COMPTON: Yes. But I mean I didn't directly answer your question but it gets in as Tim said by people tracking it in, by just air exchange, carrying dust in -- and then basing it on an appropriate mass load is how you would define your exposure to that.

CHAIRMAN RYAN: I guess I want to think some more about the fact how you get dust airborne inside and keep it airborne particularly if you have a filter on your heat pump or whatever kind of system you have to handle air conditioning and those kind of things. But it's really -- I would imagine -- I don't know. You guys can tell me your insights, but that's a really low fraction contributor to exposure even though it's a 16 hour a day kind of exposure.

MR. McCARTIN: Right, and generally you're correct. When we do the dose calculation, it's the outdoor exposure that dominates the calculation. But sometimes you want to have -- This is one of those ones that you want to have all the pieces.

CHAIRMAN RYAN: No question. I'm not arguing that point. I'm just trying to understand the relative significance of each one based on what you're assuming.

MR. McCARTIN: Yes. In general, and we're not as familiar with the results of the current version but previous versions of the code it was the outdoor exposure, heavy disturbance activities that tended to cause the biggest significance to dose.

CHAIRMAN RYAN: But again, just to simple things like a vacuum cleaner going over the rug once and a while takes a lot of it out of play.

MR. COMPTON: Also kicks up a lot too.

MR. McCARTIN: Right.

CHAIRMAN RYAN: And then you vacuum. But housekeeping can take a lot of this out of play and if you don't have a reasonable assumption for that --

MR. McCARTIN: Right and that's okay.

CHAIRMAN RYAN: I'm not arguing with it. But some of these things you have to look at the realism.

MR. McCARTIN: Sure, but, you know, in terms of does someone use a vacuum cleaner or do they use a broom and rather than getting into a lot of those things --

CHAIRMAN RYAN: I hear you.

MR. McCARTIN: -- we're dominated by the outdoor heavy disturbance activities.

CHAIRMAN RYAN: Okay.

MEMBER WEINER: Can I ask a question?

CHAIRMAN RYAN: Sure.

MEMBER WEINER: What is the source of particle size distribution and how sensitive is your model to particle size distribution because as Dr. Ryan just pointed out large particles aren't going to play a role in your inhalation dose at all>

MR. GROSSMAN: Keith.

MR. LESLIE: Actually if Roland Benke is on the line, could he answer that from San Antonio?

MR. BENKE: Yes, but this is Roland Benke, NRC staff. The question is regarding the particle size distribution which is important and the way we addressed it in the TPA 5.1 code was through the selection of input parameter values for the dose coefficients. One of the steps in making improvements for TPA 5.1 was to incorporate the updated dose metric models of the ICRP, International Commission on Radiological Protection, and those models have different inhalation dose coefficients based on the particle size. The particle size selected for the igneous scenario was an aerodynamic, median diameter of 10 microns and that's so that indeed it reflects the expected larger particle size distribution of resuspended tephra or ash.

CHAIRMAN RYAN: Did you use a distribution or a single value?

MR. BENKE: The dose models are based on a distribution that is specified by the AMA parameter.

CHAIRMAN RYAN: So you're distributing around a mean of 10?

MR. BENKE: That's the way their models operate and that's the way that we would have it incorporated as well. Yes.

CHAIRMAN RYAN: That doesn't work right because if you look at the ICRP above 20 it's a dashed line. There's no data to support that extrapolation in ICRP 20.

MR. BENKE: Yes. That's a very good observation that Dr. Ryan makes and the observation relates to the ICRP 26 methodology and ICRP 30 dose coefficients. One of the things I failed to mention just previously was that the updated dose coefficients from the ICRP that I refer to were those from Publication 72 and the new lung model is --

CHAIRMAN RYAN: Yes. No, that's all fine in the lung models and the updated dose coefficients, but the way you assume the particle size is going to have a big, big influence on the calculated dose. You know, 0.3 micron is the most penetrating particle size for what's inhaled into the lung and stays there or gets to the deep lung tissue and there is a whole lot of particles down to like 0.1 micron and even 0.01 micron even though they're diffusing a little bit more than the 0.1. Anything up ten and above, you can almost forget it. It doesn't contribute to dose because it falls out of the air so fast or it gets stuck in the nose and it's expelled from the nose.

MR. BENKE: Right, but the nasal pharyngeal contribution is included in both the ICRP 30 dose coefficient as well as those in ICRP 72. The main difference is the treatment of a distribution for the more updated ICRP models.

CHAIRMAN RYAN: I'm not arguing with the dose coefficients. If you pick the mean of ten and you're distributing around ten, you're including lots of particles and in essence aren't going to be in what's inhaled.

MR. BENKE: Not into the bronchial tubes and into the deep lungs. That's correct.

CHAIRMAN RYAN: Not at all.

MR. BENKE: That's the way their models work. There is a contribution from the upper parts of the respiratory system that those models include.

CHAIRMAN RYAN: But you're not hearing my point. My point is that above 20 microns stuff isn't in the air very long. You can resuspend it. It's going on the ground real quickly. So having it suspended for an 18 hour or 24 hour inhalation just doesn't make physical sense unless you have a fan blowing from the floor up into the air.

MR. McCARTIN: Right. I guess one -- And maybe we've diverted to an area not as relevant to what you're getting at. But there have been measurements made for mass loads and I guess, Roland, could you talk to the data you've collected on mass loading and I don't know if that's --

MR. BENKE: Sure. Because it is so important, the team decided to conduct field work at the Sunset Crater. I believe this will be probably presented on slide 42.

CHAIRMAN RYAN: Yes. We're looking at that now.

MR. BENKE: But we can discuss it now and there we have an analog site. Tephra has blanketed the landscape from an eruption approximately 900 years ago and the team went to the field and conducted airborne resuspension measurements using personal samplers over both tephra covered regions as well as non-tephra covered or alluvial soil regions and perform these measurements over different surface disturbing activities to characterize and quantify the magnitude of the mass loads, some of the particle size dependence of those measured mass loads and some of the sensitivities to environmental parameters such as the activity level that the investigator was imparting onto the surface. An example would be digging which would be a heavy disturbance activity compared to a lighter disturbance activity which would be walking around with the sampler being worn by the investigator and also to capture the full range the samplers were placed on a tripod and left alone without human disturbance activities. This work can give us additional confidence in some of the input parameters that we have for mass loads and also inform us of additional information that might be helpful in reviewing the DOE work.

CHAIRMAN RYAN: Has any of this been published yet?

MR. BENKE: No. We are very close to sending that in. The final documentation is being prepared. I think within the next few weeks we may be sending that out.

CHAIRMAN RYAN: We look forward to a

presentation on that. How's that? By the way, I compliment you on the fact that you're doing field measurements to get at realism in the measurements. That's very, very helpful and I applaud that. Ruth, you had a question.

MEMBER WEINER: Yes. The density of contaminated ash is going to be quite a bit bigger than the density of uncontaminated ash because the only way that you can get a dose is if that ash is contaminated with radionuclides from spent fuel and the Center's own 1996 report points out that the extent to which you can get incorporation and I guess what the question is have you -- In any particle size distribution, you have to consider the density of the particles as well as the diameter and when you do field measurements at Sunset Crater you're not looking at contaminated ash. You're looking at uncontaminated ash which has quite a different density. So has this been incorporated into your particle size distribution?

MR. BENKE: This is Roland Benke. I would like to respond. I think it's a very important point. The earlier work done with the TPA code and some of the waste incorporation parts of the performance assessment calculation obtain a range for the amount of high level waste that's attached to tephra particles. The amount of high level waste tends to be very small and we're looking at a per gram of tephra, maybe 10^{-5} to less than 10^{-7} grams of high level waste attached per gram of tephra. So it's almost like a trace space contamination and in that sense the density isn't radically changed from a contaminated case versus a noncontaminated case especially at the distances that would be of concern 18 kilometers away near to a receptor location.

There probably are larger -- There could potentially be larger particles of waste that wouldn't get very far because the tephra that would have attached to those larger waste particles would fall out much quicker during the airborne transport part of the volcanic plume. But those deposits would be localized near the vent.

CHAIRMAN RYAN: That's really the secret part of it, too, I think, Roland, is that a large fraction of the radioactive material part could end up coming out pretty quickly as bigger stuff and what fraction ends up with any version of respirable ash is really a tough thing to estimate. So I'm sympathetic to that problem. But again, that's just another interesting way to maybe have a range of exploration there and see what fractions become important or risk significant or not. That's -- And the fact of building all that in at this point I think is great. Lots of work to do there, I guess, or some anyway.

MR. GROSSMAN: Okay. The deposition to the three sources were the initial deposit, fluvial watershed zone or the AON is implemented in the code from a look-up table and we've run offline probabilistically simulations using the tephra code to look at stratified wind-fields and their effect on the deposition of ash and then that is used as input through the three source regions I mentioned. The stratified wind-field there is based on data from Desert Rock Airstrip for the upper atmosphere and that was implemented into that model.

I also would like to mention that the tephra code in terms of support for our approach has been benchmarked against the Sierra Negro eruption in Nicaragua and as Roland mentioned, a lot of our mass load work is in ongoing studies but we've used data we collected from Sunset Crater to inform that and at this point, if you have any additional questions.

CHAIRMAN RYAN: Star Professor Hinze, any on this whole segment?

MEMBER HINZE: No.

CHAIRMAN RYAN: Allen?

VICE CHAIRMAN CROFF: I have one. You talked about colloids. After having exercised your model on colloid migration, how much does it contribute to dose or impact however you want to measure that? Is it important or is it modeled but turns out to not be important?

MR. GROSSMAN: Preliminarily we see some impact from colloidal transport and where you see probably the biggest impact is from the irreversible transport of the actinides. Those radionuclides tend to be in the aqueous phase fairly heavily retarded and do not tend to move very far on their own. However, when you add the colloidal element to it, this is a way to kind of short circuit the geosphere in a way and this potentially leads to their arrival earlier and then quantities that could potentially be significant to the dose.

VICE CHAIRMAN CROFF: Okay. Are you saying something like significant but not dominant?

MR. PENSADO: It can be -- Actually, they will appear to be dominant and they are controlling lots of the uncertainty part of this discarded that we may see in releases and doses. This discarded comes mainly from colloidal transport and again it could according to what we see they have the chance to be the dominant in some time frames.

VICE CHAIRMAN CROFF: Okay. Thanks.

CHAIRMAN RYAN: Jim?

MEMBER CLARKE: Just following up on what Allen asked you about, it seems like there are two pieces to the colloidal transport. One is travel time and the travel time would be not only accelerated but it might actually get there as opposed to not being attached to a colloid. You have incorporated filtration processes as well, have you not?

MR. GROSSMAN: We have. I failed to mention that in the transport. We do consider the possibility for filtration of colloids through the geosphere. Our abstraction, the conceptual model, is based largely on the idea that colloidal particles moving from fracture transport into the matrix would tend to be more difficult for colloids in an aqueous species and so we apply filtration factors to the colloid for the entire geosphere.

MEMBER HINZE: Mr. Chairman.

CHAIRMAN RYAN: Yes.

MEMBER HINZE: Neil has been studying this rather intensely. I would like to defer my questions to him if I might.

CHAIRMAN RYAN: On what topic?

MEMBER HINZE: On this topic.

CHAIRMAN RYAN: Colloids, sure.

MR. COLEMAN: It's actually just a brief comment. If you would go back to 41, I just wanted to mention the Committee documented in a letter that there is a very significant conservatism in this model approach. You see the, I guess, it looks like a carrot, the area outlined in white. This is sort of a bucket approach where all of a sudden --

CHAIRMAN RYAN: I'm sorry, Neil. I don't know where the carrot is.

MR. GROSSMAN: Are you referring to the deposition region or --

CHAIRMAN RYAN: Yes. Okay.

MR. COLEMAN: The area of deposition here, that's it outlined in blue. The way this is modeled all of the sediments that come down are assumed to be deposited there and nothing is permitted to go beyond that and we know from even the very short geologic/hydrologic record of flooding in this area that very large floods in the Fortymile Wash system have gone way beyond that into the Amargosa River system. These floods preferentially transport the finest grain sediments, those of the greatest potential health physics hazard and they introduce orders and orders of magnitude of dilution to all of those particles.

So when -- We talked earlier about conservatism. I just wanted to point out this is a very conservative approach that significantly enhances the dose through this model.

CHAIRMAN RYAN: Okay. Any comment or reaction?

MR. McCARTIN: You throw out a lot of terms there that I don't -- that I think we would not agree with. I think you made an assumption that that aspect is conservative and it significantly changes the dose. I don't know about that. Generally, the direct deposition right after the eruption when the short-lived radionuclides are there is more important depending on the time frames you're talking and for the fluvial redistribution. There's a lot of complexity to the model, but I would maintain that as with everything we've done in the TPA code, there are certain aspects of the model you try to do better than other areas from a conservative standpoint.

We believe in terms of conservatism, yes, maybe it is a little conservative. I don't know. I don't believe it's dominating the dose from this scenario. So it's one that we have a model there. We can adjust it and look at different -- We can increase it, decrease the redistribution, and get a sense of how significant it is. But I think our understanding to date though it's not as significant as I think you're suggesting that the doses would change a lot if we adopted a different model there.

CHAIRMAN RYAN: And there may be a simple way to address that question and ones related to dilution redistribution of the material itself and that's just change what you inhale and rather than try and tie that to a specific process, I think Neil is right that there is some -- Clearly if there is a process to take it out of the blue carrot and spread it out, that's going to reduce the dose. Now whether it's a lot or a little, let's leave that for another time.

MR. McCARTIN: Sure, and we can look at different things.

CHAIRMAN RYAN: At the end of the day, it's what is the fraction of inhaled dust that has X pecocuries of whatever in it.

MR. McCARTIN: Right, and what the actual overall dose we're seeing to begin with because you do come to a point where you want to put your resources in terms of refining the problem.

CHAIRMAN RYAN: The point is to capture the fact that it's not a fixed number. It really is probably a very large variable of what could be inhaled based on where you are and when you are at a particular place and what's happened to the material.

MR. McCARTIN: Sure. And I think what we've done though and I think the key part is rather than having the wind due south all the time we have now accounted for it can blow in other directions and you have some redistribution in it.

CHAIRMAN RYAN: That's a big one.

MR. McCARTIN: Yes.

CHAIRMAN RYAN: And I think there are others one, you know, these secondary processes.

MR. McCARTIN: Right.

CHAIRMAN RYAN: And again, I'm not necessarily saying you need to think about modeling exactly what that secondary process might be. But you certainly can address it by changing what the dust is that you inhale and dealing with it in that sort of way.

MR. McCARTIN: Right. Absolutely, and that's sort of the purpose going back to Bret's beginning. I mean, we got something there to look at the wind blowing in other directions and we got that one in there. Now we can look at different scenarios and see how significant that contribution is or isn't as well as other things like the mass loading.

CHAIRMAN RYAN: I think we heard some interesting insights from a couple of folks, I don't know, a couple of years ago on some work on resuspension at the Nevada testing site and what remains airborne from folks that blow stuff up on purpose and so on. So there's a range of data to look at and again I applaud the fundamental data you guys are undertaking to do at an analogous site. So all that should come together to address this question hopefully in a good way. But thanks, Neil, for that clarification.

MR. COLEMAN: I would just briefly suggest the staff go back and look at the presentation materials from Sarah Rathburn from Colorado State an expert in arid system fluvial systems and one of her conclusions was in these kinds of systems the largest floods completely dominate the flow and transport of water and sediments.

CHAIRMAN RYAN: Thanks. Ruth, do you have another question?

MEMBER WEINER: Only to keep in mind that a small shift in the particle size distribution is going to have a major impact on the inhalation dose and I'll save my question for the end. Just so you keep it in mind, how is this going to be used to look at DOE's distribution?

CHAIRMAN RYAN: You'll get to ask that all in a few minutes.

MEMBER WEINER: I just asked it.

CHAIRMAN RYAN: Anybody else on these technical areas? Again, I think this has been real informative and very detailed and we appreciate it. Yes, Tim?

MR. McCARTIN: And I guess, Ruth, I'm sympathetic to your question. We have been trying to answer it, I believe, and in terms of how are we going to use this to review DOE. In terms of actual numbers we've used I don't know. I mean, there's no -- DOE can't say take our TPA code, run it and give it to us and say, "Well, NRC, it's your code. So you're not going to check anything in this code." I mean that's not going to work.

But having put this in there, we now have a way of seeing how significant is it if the wind blows in different directions and we get a sense of that significance. That's what we would take to review the DOE and it's those kinds of -- And the bottom line is having our own code clearly we developed it. We know it better than anyone hopefully and so in terms of if we have questions in our mind during the review there may be calculations we can do with our code because we know it so well to enhance the way and assist the way we ask the question of DOE, "Gee you need to consider it this way" and that's the value.

CHAIRMAN RYAN: Tim, I couldn't agree with you more and I think the dialogue about these parameters and how to vary stuff and what you need to make sure you're going to be able to vary and all that is part of that. It's not to come up with the answer. It's to come up with a method to evaluate a submittal. I think that's fair. But what we're trying to do, I think, in this case is add some of the technical issues to your arsenal and stuff to think about.

MR. McCARTIN: And it's helpful to us if you are aware. You guys have concerns and questions. Absolutely.

CHAIRMAN RYAN: All right then. I think we're up to phase three, Bret.

MR. LESLIE: Yes.

CHAIRMAN RYAN: Thanks again, gentlemen.

We appreciate your presentations.

MR. LESLIE: I'm going to lavalier mike. So I'll be focused to sit at the table and that's fine.

Three things I wanted to talk about on our next step: TPA activities for this fiscal year on slide 45, kind of some of the analyses, some of the suggestions you've just made to assist our prelicensing activities and kind of focus some time also on applying our enhanced staff performance assessment review capability to actually start to review the information that we have available and now there's a lot of information that's available as of this week.

So on slide 46, I laid out kind of what are potentially the things that are on our list and from a PA perspective things. At this point, we don't intend to further develop the code. We're in a minimal focus on code maintenance. One thing that again, we want to look at, I think, there are either 399 or 400 sample parameters. Of course, when you're trying to focus on efficiency it's a question of do all of those parameters actually need to be sampled. So for calculational purposes and flexibility, we may actually revise the TPA INP file after we've done sensitivity analyses to say, "Well, these 200 parameters really don't matter over their range and so we're going to pick the mean."

That just will allow us to use our code in a more efficient and effective manner once we get into license application. It doesn't mean that we can't go back and then rechange that parameter again. But again, we're focusing on an efficient and effective review.

Osvaldo talked about it briefly and I also said something earlier, the seismic scenario probability analysis, this is slightly different than igneous scenario where you can do it a certain way because the dominant dose drops off very rapidly with time. You can have large probability seismic events throughout time and Osvaldo has written a paper about this, but we want to finalize and clarify and document this is our understanding of how to incorporate the probability for the seismic scenario because from our understanding of the Supplemental and Environmental Impact Statement seismic scenario drift degradation is the predominant way for their release under "the nominal scenario." So we want to ensure that we understand how to appropriately review that and that's all I want to say about that. Next slide.

On slide 47, I told you we'd come back to this on the risk insight baseline report. I think what we've identified at least so far and what we're planning to do, we've identified basically four areas and again we're in the very early stages. We've talked, Jim and I talked, yesterday about what are we going to do, how are we going to do it. But we had identified four major areas that we think are probably where things might change in terms of the risk insight update, million-year calculation, colloids, strip degradation and igneous activity, primarily redistribution.

The effort to put together the risk insight baseline report itself is nontrivial. The information certainly needs to be available if there are changes and to remind the Committee, we identified the risk insight baseline report in the various areas and we said high, medium and low.

What we're primarily focused on are any of the things were mediums high and where any of the highs that were medium low. We don't really care about the lows unless they jump up to the high. We don't see anything that comes out right now that was -- Dr. Hinze had said, "Has anything really changed?" Well, no, there's nothing that's gone from a low to high. There might be one or two that have gone from high to a medium or a medium to a high. We need to explain that, but is it the best use of the staff's time to expend a lot of effort to write it in a risk insight baseline? What's the appropriate mechanism for documenting it? But certainly we're going to be sharing the information from our results to the review teams. That information is an input to how we're loading our resources. So definitely we're going to need to do that, but we have primarily -- I mean if we spend a lot of effort on updating the risk insight baseline we're doing it at a cost of being prepared in the sense of having all the time necessary to review all the DOE documentation.

CHAIRMAN RYAN: The point there on that point, that's a good point. But I have to tell you my own view is I don't think you can afford not to document and get updated.

MR. LESLIE: Yes, and whether it's a risk insight baseline report or something else.

CHAIRMAN RYAN: Whatever mechanism, but the risk insights that you've developed from this additional work and are continuing to develop, I might add, to me it seems like you need to put a mark in the sand and say before you start on a license application you need to be fully documented on what the basis you're going to use and what tools you're going to use and so forth as we've discussed today and so forth. I think that's essential for a good benchmark on how you're moving forward.

MR. LESLIE: Right.

CHAIRMAN RYAN: To answer any challenge that will come.

MR. LESLIE: That's a fair comment.

I'd like to move onto 48 and we can come back to questions and discuss it some more.

CHAIRMAN RYAN: Fair enough.

MR. LESLIE: In case the Committee did not know, the Supplemental and Environmental Impact Statement model is currently available to the NRC staff at 178 gigs.

CHAIRMAN RYAN: We just got the memo and I've asked staff to provide it to all the members for weekend reading.

MR. LESLIE: Okay. So we are in the process of now we have a lot of information that is very relevant to a potential license application review. There's a lot of models. The GoldSim model is available. So there's a lot of stuff that we're really having our staff focus on to be prepared to conduct that time-sensitive review.

We're also not only looking at the model, but we're also looking at the documentation, TSPA-LA document, related documents. There's a lot of information that's out there that's been put in LSN, the technical work plan, the TDFs which are a technical data information packages which are the basis for the data that's going into our license application. There's a lot of familiarization that our staff needs to do because they've changed a lot of things and really right now during the prelicensing period for that information that's available to us it behooves us to make sure that our staff are ready to review it to the extent that we can.

We're also really focusing on taking some of the lessons learned we gained from this process of developing an integrated team product, the production of documents under a very tight time frame and we're incorporating this in how we are actually going to operate as a licensing organization. So we're also doing some process, when I mean process level top, I mean project management type of enhancements.

So on slide 49, I think the Committee heard this many, many times, but TPA 5.1 is a review tool and that's to help us review. It's to help us create and update our risk understanding or risk insights to help guide our review. We really focused in terms of the modifications to increase our flexibility for conducting a review.

We certainly tried to get away from hardwiring things in there. Although we have reference parameters, those parameters can be changed from a constant to sample, different values of sampling. And really it was a joint effort and it was important that the reviewers of the performance assessments were the developers and testers and writers because you can never really do a good job until you're tried to do it yourself and this overall has really led to an enhanced capability of our staff, not only to review about a performance assessment but to write about a performance assessment and that's one of the jobs that our staff will be conducting if we have a license application to review.

And right now, again as I just said, our focus is now where the dominant focus over the last fiscal year was internal, it's now external. We're now really gearing up to prepare to review DOE's license application. So that's the end of part 3. That's kind of where we're headed, summarized where we were and what we've done and at this point we'll, Chris and I, will certainly entertain any other further questions you might have.

CHAIRMAN RYAN: Okay. Jim?

MEMBER CLARKE: Well, let me, as the newest member of this committee, ask a new member question, although I'm going on three years now. Your interpretation of how you will use the TPA, is that a new interpretation or have you always --

MR. LESLIE: It's been in there since 2003 basically in the Yucca Mountain Review Plan. I mean that guidance document came before the committee. The committee basically endorsed. In fact, they said, "We don't want you to only use DOE's risk information. We want you to use your own risk insights and DOE's information to inform it." That language has been in there for a long time. I just don't think people have paid a lot of attention to what it says and how little it says that we're going to use an independent performance assessment. It's been in there since we put it out for public comment and then subsequently finalized it and published it in 2003.

MEMBER CLARKE: Okay. And to correct the record, I'm going on two years. Thank you.

CHAIRMAN RYAN: Ruth.

MEMBER WEINER: First of all, thank you

very much for your presentation. This was extremely helpful and it certainly corrected a lot of my misconceptions and maybe I'm the only one who had them. But there it is.

I noticed that in your list of references and I would assume this is not a complete of the references for the TPA you have relatively few normal peer-reviewed publications. Most of your references are to Center reports, laboratory reports and so on. Are you weighting -- Because you're going to be reviewing, asking, DOE to justify basically the license application, are you going to weight internal versus external, gray literature versus peer-reviewed literature differently or how are you going to look at that?

MR. LESLIE: I guess I'm kind of taking a little bit of offense that I couldn't be considered scientific peer. The Center, I think, would and they certainly know this as a result of the staff review we conducted of the user guide and every other technical document, we review this before it gets out and so to kind of say that we're not peer reviewing --

Is it in a publication? The Center tries to publish many of the things. We have to look in ways, in imaginative and timely ways, to get information out. Sometimes that is in Center report. That it doesn't go a rigorously technical review or an internal review by NRC before it's allowed to be released, that's not correct.

MEMBER WEINER: And I didn't mean to imply that and if you got that implication, I do apologize. What I meant to say is there is a body of literature which is available to the public which is published in peer-reviewed journals and I was using it in that sense. I recognize that all the laboratories do internal peer review, very rigorous ones as a matter of fact.

MR. LESLIE: Right.

MEMBER WEINER: So this is not a criticism of your internal review process. It's simply that to the public a journal that is available to anyone has a certain weight that an internal laboratory publication, however, well peer reviewed doesn't have. That was my only concern and I wondered if you in your review of the Department of Energy's background documentation would make any distinction and maybe won't.

MR. LESLIE: It's a good question. I'll answer it a different way. 10 CFR Part 2 identifies documentary requirements. So to say that the Center reports aren't available, that's factually incorrect. In fact, they're all in the Licensing Support Network that's available to anyone on the network looking for localized corrosion. You do a word search on localized corrosion, you're going to get Darrell Dunn, Osvaldo Pensado. That information is available.

Again, what information the Department of Energy uses is up to them. Whether they want to rely completely on journal articles or completely on internal Lawrence Livermore lab reports, we're going to evaluate their information relative to our regulatory requirements. If they treat data appropriately or not, it has nothing to do with the availability or publication forum that it was presented.

MEMBER WEINER: I'll hold.

CHAIRMAN RYAN: Thank you. This is it. This is your last shot.

MEMBER WEINER: If it's my last shot, I have one more. Are you planning -- I've been trying to read the relevant sections of Part 63 in between listening to the presentation which wasn't easy. Are you planning to issue any further guidance that explicates some of the requirements in Part 63 or is this all done as part of the guidance for license review?

MR. LESLIE: Let me try to explain in a couple of ways and I'm sure if I say it not quite correct someone will correct me from that side of the room. I think a technical change about a month ago with, it might have been on the quarterly management meeting, but in essence I think the Department of Energy asked "Are we going to be publishing any more Interim Staff Guidance?" Interim Staff Guidance is guidance that identifies how something in the Yucca Mountain review plan might change if we were to revise that document.

At that meeting, we identified that we didn't plan on any other interim staff guidance. The question is always once a rule is finalized how would be address the updating the Yucca Mountain review plan and I don't think that how it would be updated has been entirely laid out. But that would be the only area in which we plan to update. If we updated the Yucca Mountain review plan, that would be the area that we would be updating either through an ISG or redoing it. But that decision how it's actually going to be documented has not been decided but the scope of any updating would be focused on that necessary for the updated rule.

MEMBER WEINER: Thank you. That's it.

CHAIRMAN RYAN: First of all, it's been a great briefing, very thorough, very comprehensive. We appreciate it. I know the Commission is going to ask us if you're ready to review an LA. They ask that pretty much at every briefing we get. So that will come in November.

MR. LESLIE: And what's your answer?

(Laughter.)

CHAIRMAN RYAN: I'm getting to there.

MR. LESLIE: Okay.

CHAIRMAN RYAN: I think mostly is the answer. I think technically you certainly have a good tool. You've developed that over decades as Tim has pointed out and I think there are some things that we've talked about today that would be further enhancements particularly in the igneous activity area. We get into some additional ideas and maybe some other ones along the way.

I think I've heard every member of the committee talk about the idea that updating the review plan and how you're going to --

MR. LESLIE: The insights report you mean.

CHAIRMAN RYAN: I'm sorry. The insights report is probably a good idea for a lot of reasons.

One is it updates your technical thinking and, two, it puts a mark there for you do to do that. Having said that, we recognize time is short. So there may be some mechanism where you want to do that as expedited a way as possible without creating a lot of additional cycle time of some sort there. So I think that's probably a good idea. It certainly puts your thinking in a concrete way on paper and all of that.

There was a couple of areas too where I think an update to the Committee even before the LA just to get us technically up to speed with what you're doing with the igneous activity if possible. You're doing field work and how that might fall out might be one. There might be a couple others. So I just offer that as you finalize your documentation of an update and maybe some of the technical points we covered today it would be helpful for us because we're going to get the question as we get even closer to the LA, again have they addressed everything and are they ready to go, that would be helpful. And that doesn't need to be this length. In fact, it can be very focused on the key issues and the documentation might be the center piece of how you do that because I know this is a lot of preparation. But I think that's something to plan ahead that might be useful to do.

And just a personal note that having recently published a NUREG with a couple of co-authors from the staff, I'm going to vote for a very rigorous review process within the NRC for a publication. So I think it's as rigorous as any peer-reviewed journal article I've published. So I give it a thumbs-up.

With that, I'll turn it to Allen.

VICE CHAIRMAN CROFF: I just have a point of curiosity. Does TPA conserve radionuclide mass in its calculations?

MR. GROSSMAN: That was one of our validation tests was to examine that and make sure that was. Yes.

VICE CHAIRMAN CROFF: Good.

(Laughter.)

CHAIRMAN RYAN: Professor Hinze?

MEMBER HINZE: Thank you. Two very specific questions come to me, one for Chris on his slide 43, the bottom bullet, "the approaches are based on data when available." I don't really understand that and you didn't discuss that with us.

MR. GROSSMAN: Right. We didn't get to that slide. What I mean by that is "data when available" is we try to extend practical data is available to use that as part of our abstractions. In some cases, our abstractions are built on modeling results, etc. And so that's kind of what we were getting at there is when data is available we try to apply the available information to the abstraction. In some cases, it's not and we rely more on modeling approaches.

MEMBER HINZE: Thank you. And one for Bret. Your slide 47, the bottom bullet again, "igneous activity primarily redistribution." I note that since 4.0(j) I believe the Center and the staff have published reports and journal articles on a number of items regarding consequences and I don't see consequence as part of the updating.

MR. LESLIE: This is just purely shorthand for this ash remo which goes all the way out to consequences. And one of the other points that I need to clarify is --

MEMBER HINZE: Would you repeat that? I guess I want to make sure I understand.

MR. LESLIE: This is shorthand for saying everything associated with igneous activity in the sense that when we implemented it in the model this was ash remo --

MEMBER HINZE: I'm going to ask you. So primarily redistribution just can be crossed off.

MR. LESLIE: Yes.

MEMBER HINZE: Okay. Thank you. That's my question.

CHAIRMAN RYAN: Anything else? Any comments or questions?

MR. COLEMAN: Yes.

CHAIRMAN RYAN: Okay.

MR. COLEMAN: I just wanted to add a little cautionary note about the use of the code especially to people that were not involved in developing it and I've only run it a few times and ran into an interesting situation. I changed one parameter and was able to model a completely implausible scenario with no warning flag at all and I have mentioned this to the staff.

The suggestion would be there are some situations where it would be easy to put in a warning flag and the example was Professor Hinze and I went to Appendix 7 last week on drift degradation. So I was looking at that the weekend I got back and found that the base case involves fairly rapid collapse.

The assumption right now by the rock mechanics folks here is that you get full collapse of the tunnels in just a few thousand years. Now to be fair to them, they saw all kinds of information, results, model results, that were unpublished. This was last week and they may reconsider what they were thinking.

But what I did was I thought what if I change the -- also run the igneous scenario. So that's what I did. Except what I did is I made sure that it would initiate after the tunnels had collapsed and then what the model proceeded to do is magma proceeded to in merry fashion down the collapsed tunnels which is an implausible scenario.

So the user's guide has warning statements all through it to be very careful about what you change. But there was no flag to indicate "Oh, by th way, the tunnels were all collapsed and there should not be 5,700 waste packages inundated by magma causing severe damage to them."

MR. LESLIE: I'll let Tim McCartin respond to that.

MR. McCARTIN: Yes, I mean, first, you can describe it that way but first our code does not simulate magma going down tunnels. Okay. For the igneous scenario, there are options for selecting the number of packages effected by intrusion and you're right. When you turn that on, you left the base case values that are assuming intact drifts. And so, yes, you did that scenario in a way.

But it's not like -- I don't want people to think we actually have a model in our TPA code that is simulating magma moving down drifts. But the igneous scenario is a very specialized scenario. We typically run that. When we run igneous activity, we run it as a very specific case and you have to be careful of the input parameters.

We can put something possibly maybe a later change in. I don't know about flags. But certainly in the input file, we can say be careful of how you simulate igneous activity.

MR. COLEMAN: This might be a good example, in fact, if there's any update to the user's guide of a specific example of what to watch for. You know the major implication of this is if the rock mechanics staff here, depending on what comes out of the LA review, if they are convinced that the tunnels will only last a few thousand years before rubble-ization occurs, then the igneous intrusion scenario is only significant for a tiny fraction of the million-year performance period and becomes a really minor scenario. Igneous extrusion, the small volume volcano scenario, would not be affected by this.

CHAIRMAN RYAN: You know, to me it's in a way a good example of an insight and I guess I would have to agree with Tim. It doesn't really predict flow. It's a switch that's on or off and you can interpret it that way but it's not calculated that way.

MR. COLEMAN: The only way you could inundate 5700 waste packages is with magma flowing freely.

CHAIRMAN RYAN: Let me finish. But the model doesn't model it that way. Physically, that might be what has to happen but the model doesn't tell you that.

MR. COLEMAN: Agreed.

CHAIRMAN RYAN: But there is an expert factor here that you can't discount, folks that have been developing and using this model for decades. You have to be careful. Buyer beware on any model and you just have to be careful and I think all the cautions, caveats and flags in the world don't prevent somebody who is not knowledgeable and experienced from scuba diving in oatmeal with the model.

MR. COLEMAN: It also shows the importance of integration that was discussed earlier between, in this case, rock mechanics folks and volcanologists.

CHAIRMAN RYAN: Nonetheless, the fact is

that that's exactly why I think it's important for the staff to document as best they can where they are in their thinking as we go forward so all of those kinds of things that know about and have studied and have learned and have improved get laid out. And again the cautionary statements are as important as the factual statements to lay all of it out.

That's just an example of there's one view and there's another view and we thought of it this way and that way. There's a good insight in there, but it has to kind of collect together and I think you really are at an advantage if you document all that.

Done, Neil? Thanks. Bill, are you finished? Ruth, did you have a little question?

MEMBER WEINER: One quick comment and that is that the more flexible you make a model the easier it is to get ridiculous results and I'd like to commend the staff for having a model that that's flexible because you can make a model rigid and then you can't do things.

CHAIRMAN RYAN: All righty then. With that, any final comments?

MR. LESLIE: Just to let people know that as I said earlier on that we had sent out copies of the CD containing the code. If anyone in the audience here does want a copy, just see me afterwards and I'd be glad to send it in the mail to you all.

CHAIRMAN RYAN: Any other final comments? Questions? Observations?

(No response.)

CHAIRMAN RYAN: With that, we will close for the lunch break and we will reconvene at 1:30 p.m. Thank you all very much. Off the record.

(Whereupon, at 12:14 p.m., the above-entitled matter recessed to reconvene at 1:34 p.m. the same day.)

CHAIRMAN RYAN: Okay, we will reconvene the afternoon session and our cognizant member for this session is Dr. Clarke. And Dr. Clarke, please take it away.

MEMBER CLARKE: Thank you, thank you, Ryan. Well, as you know the committee has been following a number of initiatives in the general area of decommissioning and today we'll hear from you on preventing legacy sites draft proposed rulemaking. Let me introduce our presenters. We will have some opening remarks from Mark Delligatti, Chief of Rulemaking Branch B in the Office of Federal and State Materials and Environmental Management Programs. He will be followed by our speakers, Kevin O'Sullivan, also in Rulemaking Branch B, Jim Shepherd, from FSME's Division of Waste Management, Environmental Protection. Jim is the principal contributor for the rulemaking in the area of observations and Tom Fredrichs, now with the Office of New Reactors, who is the principal contributor for the rulemaking in the area of financial insurance. So, Mark?

MR. DELLIGATTI: Thank you. I just wanted to open things up and explain what our presentation is going to be like and how it's structured. Kevin will be speaking about the status and schedule for this proposed rule. We've sent the proposed rule up to the Commission. We have not had Commission action yet. And therefore, we are somewhat limited in a public session of how far we can go into details on the rule at this time. We are constrained, for instance in a way the NRR is not on how much we can discuss of predecisional information. However, we will be able to discuss in much greater length and that is why we're grateful to have Tom and Jim here, the development for the technical basis for this rule, and that technical basis really does explain to you a lot of what we're trying to do and why we're trying to do it the way that we're doing it and with that, I'll turn it over to the gentlemen at the table unless you have any questions for me.

MR. FREDRICHS: I'm Tom Fredrichs. I'm going to talk about the financial assurance parts first and then Jim and Kevin will talk about other parts. And there are a couple of letters that the committee sent to the Chairman that we want to respond to and try to respond to in development of the rule. One of them was more fairly recently on August 13th, a recommendation that the guidance for this rule includes some of discussion of how applying the guidance on monitoring and cleaning up in early life will help them to save money in license termination and the decommissioning costs. We -- and we're going to include a discussion like that with the guidance document. The other one was financial incentives in an earlier letter that we should -- we were trying to find some financial incentives if there was something that might motivate licensees to implement the rule more fully but we weren't able to really fine any for a couple of reasons that as far as the amount of financial assurance it has to cover cost. There's not much we can do to reduce that.

We considered things like maybe fee waivers on licensing fees if they would fully implement some of these approaches but that would require fee waivers and because we're a cost recovery agency, if we give a waiver to once licensee others will have to pick up that cost. So that didn't seem like a likely candidate or incentives.

Much of the incentive is really going to be on the licensee's part to recognize that stopping contamination in the first place or if you contaminate an area to clean it up early rather than let it spread and increase the volume is in their financial interest. And we think adding some discussion of that in the guidance itself will help them recognize that if they haven't already thought of it themselves. Next slide.

The sort of things that we wanted to -- some of the problems we've seen in the past that we wanted to solve with this rule was the need for more detailed cost reporting. We have guidance and, in fact, much of the new rule will be codifying the guidance itself, so that we get more standardization in the funding plans that we've got and that licensees understand that they are requirements, really after we bleed out about 20 years of experience with the guidance that some of these are better just turned into rules.

There was also a number of things we did that are under the general rubric of tighter control of financial instruments. Some of the things we were trying to solve were -- well, the detailed cost reporting was really one of the biggest problems of legacy sites in the past has been that they haven't adequately estimated some of their decommissioning costs, especially subsurface soil contamination. The new rule will essentially require them to take a better look at that and give us a better estimate.

We also believe that there are certain operational indicators that during the life of a licensee things happen that are likely to increase decommissioning costs and then we have a list of those in the proposed rule if certain things happen, spills, for example, that they would assess those for the effect on ultimate decommissioning cost. There are also some financial risks that we were concerned with and that goes more towards the tighter control prong of our rule.

One of them, in fact, an important one is the unavailability of funds in bankruptcy that some -- our experience with bankrupt licensees in some cases it was difficult to get money and part of that was because of the way the financial instruments were set up. So we tried to make some changes to make that less likely in the future. We also wanted to get better and more adequate financial disclosure some of the risks that a company might face. This was partly motivated by some of the large bankruptcies of very large companies five or six years ago and it's particularly applicable to parent company guarantees where on the basis of a financial statement, and a bond rating a parent company of a licensee can guarantee decommissioning costs without actually putting any money aside. So we've made some changes to those financial instruments. You get better information, you get more expert information so that it's less likely that that sort of thing would result in unavailability of funds.

We were also concerned about corporate reorganizations. At least one case the licensee did reorganize, particularly to rid itself of liabilities, wanted subsidiaries which as it turned out was successful from the licensee's -- former licensee's point of view but we've now added some words to license transfers to take, you know, decommissioning costs into account and have commitments by the transferee to honor those.

We've had some cases where there were investment losses in account balances that licensees weren't monitoring. So we've put in some monitoring rules and some criteria as to when they would have to make up market losses rather than waiting to see if the market makes it up on their own. And we also looked at and originally in the decommissioning costs in the context of an accidental release and how that might, you know, contaminate the site to the extent that they'd have to shut down and decommission. The decommissioning fund was never intended for accidental releases. The intent was that after they shut down under normal circumstances that the money would be adequate. However, in our technical basis looking at that, we found on the material side, that there just weren't any reported incidents where insurance would have helped. In fact, there are hardly any at all where there were any releases of note. So in that particular case, there was no need to add any type of -- I should say property damage insurance to the financial assurance requirements.

The committee also mentioned that some other agencies have used trusts for decommissioning of various sorts. We did get ahold of the EPA because a number of the documents or financial instruments that were used were originally modeled with those in mind because EPA had decommissioning and cleanup rules before the NRC did. And in discussion with them, we found that escrow accounts in particular were never used by the EPA as a financial assurance instrument because they maybe vulnerable to bankruptcy. So since that also fit in with one of our goals, one of our recommendations was to eliminate the escrow as a financial assurance instrument.

We talked about this at our public workshop in I think January of '07. And the people there, some of whom used escrow accounts found it wouldn't be any burden to them, so that will probably go forward in the proposed rule. Next slide, please.

We revised the NUREG 1757 Volume 3 which is where the financial assurance guidance is to reflect the changes in the rule and also to add in a discussion about how early detection and cleanup of contamination can save money on the license termination. That's in review by the staff and it will be released with the proposed rule so that people can comment on the guidance as well as the rule when that's published.

And with that, I'll turn it over to Jim Shepherd, who will talk about the technical basis of some of the monitoring remediation.

MEMBER CLARKE: I would ask the Committee if we want to entertain a few questions now and then leave some time for general questions at the end. Does anyone have any questions for Tom? Bill?

MR. HINZE: Well, let me ask a quick question. What's your procedure for evaluating the cost estimate? How well is that prescribed and have you and your colleagues actually made an estimate yourself to see what the problems are?

MR. FREDRICHS: We -- well, I think the problems are identified more by experience in looking at estimates that have come in and seen what the actual costs, reported costs have been and where the cost drivers are. When a license sends in the cost estimate, we have some guidance and ask them to break it down into certain formats to make it easier for us to decipher these in terms of labor costs and hours of labor, volumes of contamination to be cleaned up, volumes of rad waste to be disposed of and that sort of thing.

We can compare those with costs we receive from you know, various different licensees to see if they're reasonably in line. We can compare them with cost estimating sources such as RS Means that will give you guidance as to how much it would cost for truck drivers or things like that. The more specialized radiological type professions, you probably would get better information by comparing the two licensees and we have some guidance back. A study was done by PNNL to -- on various sorts of materials licensees, how much would it cost to decontaminate and dispose of a lab bench for example, if it was carbon 14 or tritium or other nuclides.

So that how we go about it, comparing between licensees and using published rates for disposal rates, for example, and we have some guidance on types of licensees and, you know, component.

MR. HINZE: I don't mean to be turning old ground, but let me ask a follow-up question to that. How long of a period of time is a lifetime? Is this prescribed by you or is this prescribed by the applicant or -- and because there is certainly a cost of -- a cost of living change associated with increasing time. So is there a prescribed time and who determines that?

MR. FREDRICHS: What we expect in a decommissioning cost estimate is basically current cost and the rule was changed in 2003 to require them to update that every three years for a cost estimate. There's also the category of prescribed amounts where if you're under certain ceiling limits, you just --

you prescribe how much you're going to have to put up in financial assurance. And those have been looked at from time to time, well, I should say once really since an increase also in 2003.

My experience with those is that it just hasn't been a problem with smaller licensees. The large ones are where the problem is and those are required to be updated every three years.

MR. HINZE: So there isn't a need for an inflation factor because you do this on a current basis and then it's updated every three years; is that right?

MR. FREDRICHS: That's right.

MR. HINZE: Okay, thank you. Thank you, James.

MEMBER CLARKE: Anyone else?

MS. WEINER: No, nothing.

MEMBER CLARKE: Okay, I'm going to hold mine till later, so Jim, I guess we'll turn to you.

MR. SHEPHERD: I'll start with some of our previous interactions with the committee that have influenced the rule. First, they explained to us that there was no reasonable way to come up with a set of action limits, such as we had earlier thought of at which point a licensee would be mandated to conduct prompt remediation, simply because of the varying site specific conditions and the varying amounts and types of radioactivity that might exist across the whole spectrum of NRC licenses.

Mandating remediation also has other potential negative impacts which as rarely impacting underground systems that the exact location may not be known but they are adjacent to or very close to an area contaminated by a spill or leaks such as underground transfer pipes or in the case of underground conduit whether it be electrical systems or communications systems that could open an additional pathway if those inadvertently ruptured. And we saw something similar to that, although it wasn't exactly a rupture, at Indian Point where contamination got into a cable room and into some of the conduits and they went far beyond what we thought it might be. So we deleted that concept of prompt remediation from the proposed rule.

We moved rather to a rather broader spectrum of telling licensees that they must do a reasonable job to identify the contamination throughout the site both in terms of location, concentrations and volumes and to report that either in decommissioning files or perhaps if they decided to do something, an action plan which could be referenced by the decommissioning file and we feel that once a licensee becomes aware of the extent of contamination they have at their site, they go to the senior management and they're looking at a piece of paper, they are quite capable of making their own decision as to whether it is better for them to remediate that contamination promptly or to leave it until some later date or to leave it all the way until decommissioning.

As Tom said, the cost factors change over time but we're not going to specify how and when to spend their money. The committee also recommended that we get active participation from the agreement states which we held a public meeting in January and the agreement state representatives were specifically invited. We also had a member of the agreement state on our working committee to develop the rule. And he provided some very interesting insights and things that were perhaps not considered because of the focus of the types of licensees that we deal with and the types that the states deal with.

CHAIRMAN RYAN: Did that reflect any changes to the original guidance or what work went into the guidance as a result of that interaction?

MR. SHEPHERD: Thank you for that lead-in, Dr. Ryan.

CHAIRMAN RYAN: Okay.

MR. SHEPHERD: Next slide. Yes, it did go into the guidance. Originally the guidance focused very much on subsurface monitoring because at the time we began this in response to the SRM from the Commission on the -- actually the whole legacies or the whole license termination rule, review, the focus of the issue was groundwater contamination, that it caused increases in cost above what the licensees were able to deal with after they had ceased operation.

So the guidance was focused on that issue. As a result of these other interactions, we have broadened that guidance, lessen somewhat the detail. We figure people who are going to drill wells will hire somebody who knows how to drill wells to do that. And focused on first identifying if any changes at all need to be made in the program as a result of the proposed rule. In some cases they don't.

If changes may need to be made, how to go about determining what changes are appropriate and also an increase in information on the actual recording. This, of course, is related to the Tritium Task Force recommendations specifically to 50.75(g), the decommissioning files for nuclear power plants which the staff recommended that there be more definition put into what should go into those files. That concept is reflected in the guidance for the rest of the facilities as well.

The guidance is still actually being revised from comments from the working group in terms of what structure and what emphasis it should have. The final version of the guidance won't be available till we see whatever action the Commission takes on the rule. If the proposed rule is approved by the Commission in essentially the form that exists today, the guidance is essentially done. If the Commission decides to make some changes to that, then they'll have to review the guidance to see how to implement those changes.

But whatever those changes may be, we will publish the guidance along with the proposed rule for the public to comment on. Currently there's planned a 75-day comment period for the rule itself. We want to hold a workshop on the guidance so rather than just getting blind comments, we can actually discuss things with the public as to what they feel the strengths and weaknesses in the guidance are. And I would propose to do that about halfway through the comment period which would allow people time to read the guidance, but also allow us time to start implementing some of their changes before we get to form the comments.

MEMBER CLARKE: Jim, in the past we have had the opportunity to work with you in reviewing guidance and I think we've -- at least we're convinced that we're in a position to be most helpful when we can do that. And so will we have an opportunity to hear from you on the guidance as well and provide some comments?

MR. SHEPHERD: Well, the simple answer to the question is, yes, the committee will obviously receive a copy of the guidance and comment on it as anyone inside the agency or outside the agency can. I presume you're directing the question of, can you do it before we get to the final.

MEMBER CLARKE: Well, I think we would be in a position to be most helpful if we could do that.

MR. SHEPHERD: Sure. Yes, certainly we can provide a revised version. I'll have one probably in a week or so and supply it to the committee for their --

MEMBER CLARKE: And again, if we could have a meeting with you and a presentation from you, I think that would be --

MR. SHEPHERD: Okay, as Mark said, we have certain constraints on the rulemaking so we may need to do it in closed session but we're certainly willing to talk to the committee and appreciate their input.

MEMBER CLARKE: Yeah, we certainly want to honor those constraints but we would be in the best position to help you, I think, if we could do it that way.

MR. DELLIGATTI: I would just add that keep in mind the rules with the Commission right now and I'm not sure how easily the timing will fit together. We may have to work on that a little bit with you. If the Commission approves the rule, we've got to get it out for public comment, and you know, that would be my one concern. We don't know how long that's going to take, but that will be something we'll have to look at and we can get back to the staff on that.

MEMBER CLARKE: Okay, thank you.

MR. O'SULLIVAN: My function in this activity is as the rulemaker and in that regard what I do is I manage a working group and it discusses the technical basis and then prepares the documents that comprise the rulemaking package. The responsibility of the rulemaking package is within our division in our office which I will describe as FSME/DILR, D-I-L-

R.

And if you recall the overall objective of this proposed rule is to prevent legacy sites. And what staff did back in 2003 in SECY-03-0069 was to recommend a two-pronged approach on this. One of the prongs, as Tom mentioned, was to change financial assurance requirements, and that was in Attachment 7 to that SECY. The other prong goes to clarify licensee operating requirements with respect to minimization of waste. And this was in Attachment 8 to the SECY. All that is public information in ADAMS.

Both of these prongs are needed. Without one, the other one really isn't as effective. Either one of them, whether it's Tom's or whether it's Jim's we need them both. When this rule was originally scheduled the date that they wanted to give it to the Commission was September of 2006, about a year ago, but we received two deferrals on this.

The first one came from the EDO in May of 2006 so that staff could integrate information into the technical basis from the Tritium Task Force that Jim described and that final report came out August 2006 and that's public information. The second deferral was granted by the EDO in January of 2007. And this was to include again, in the technical basis for the proposed rule, information gathered from stakeholders during a public roundtable discussion of the technical basis and this meeting was held January 10^{th}, 2007. The meeting was well attended. There was about 70 people from outside NRC representing several intervener groups, and multiple types of NRC licensees, including broad-scope academic, medical, source manufacturing, fuel cycle and power reactors.

Summary notes from this meeting are on the decommissioning website under public involvement. Now the technical basis for the proposed rule, this proposed rule was finished at the end of February 2007. Last month Patty Bubar, Deputy Director of FMSE/DILR, discussed with the committee that the technical basis lays out the scientific, legal and technical information that supports the decision to undertake rulemaking. The technical basis really is the method to risk inform the proposed rule. A substantial amount of information is in the technical basis for this proposed rule, including stakeholder input from the public meetings, risk assessment, regulatory guides and staff assessment of the effectiveness of current regulations to identify subsurface contamination at operating facilities.

The committee also was very helpful in

contributing to the proposed rule technical basis through its open sessions addressing the topic of legacy sites. There's one in 2005 and two in 2006. Now from the completion of the technical basis which is in February until the end of August 2007, the working group reviewed and approved draft rule text, the Federal Register notice, the regulatory analysis, the environmental assessment, and the OMB Paperwork Reduction Act supporting statement. The working group included a very helpful and proficient attorney from OGC, subject matter experts in FSME, NMSS, NRR and NRO, who all deal with inspection and licensing issues, a subject matter expert from Research who's working on draft guide 4.012 which deals with the 20.1406 A and B for license applicants that's been in front of the committee, a subject matter expert from the Office of Information Services, OIS, who reviewed our burden estimates on all the licensees, a materials inspector from Region 3, a agreement state representative from Kansas and technical assistance from a contractor, ICF International.

The quality of the proposed rule package is really dependent on the participation of subject matter experts in the working group and this proposed rule had superb and timely input from and discussion among the attorney and subject matter experts. The rulemaking package was distributed on July 11th for office concurrence with a copy to the committee. The next day, July 12th, FSME/DILR sent a letter to the agreement states informing them that the draft Federal Register Notice was posted to the technical conference form website for comment over a 30-day period.

We received concurrence with comments from all the offices, all the NRC offices. We received no feedback from the agreement states. Dr. Miller, the Office Director of FSME approved the package on September 21st and sent the package to the EDO. A briefing was held with EDO staff and the Deputy of EDO Marty Virgilio, on September 27th. Mr. Bill Kane, the acting EDO, signed the package on October 3rd, which was two weeks ago today, and the package was delivered to the Commission shortly thereafter. If the Commission approves publication of the proposed rule in the Federal Register, it and the guidance documents will be released with a 75 day public comment period.

To summarize, the working group released this proposed rule and the two guidance documents released with the proposed rule will be effective to generate public comments to fine tune a final rule with the objective of preventing future legacy sites.

The proposed rule is risk informed and performance-based. It is risk informed by addressing the two primary reasons that operating sites become legacy sites, the first being inadequate surveys of the site during facility operations when there has been instances of significant sub-service contamination.

And the second being the vulnerability of not having adequate funds for decommissioning. The rule of guidance are performance based by allowing licensees to have choices. They have choices in their financial assurance requirements and in the extent and type of sub-surface monitoring based on site characteristics. In conclusion, we look forward to receiving the Commission SRM on this proposed rule and further dialogue with the committee on the proposed rule and guidance documents. That concludes our presentation. If there are any questions, we'd be glad to answer them.

CHAIRMAN RYAN: It sounds like it went along pretty smoothly.

(Off the record comments.)

CHAIRMAN RYAN: Jim, I would like to ask you to maybe explain on that Slide 5, you mentioned at the first bullet, that be polluted action limits mandating prompt remediation. Could you talk a little more about that?

MR. SHEPHERD: Well, initially when we started writing this rule, it was first we were going to make people go out and evaluate what they actually have at their site. Then the next obvious thing is okay, if they find something, who's going to do what? One option is some licensees will say, "Yeah, sure is a mess". So we considered back that at a number of sites what we had seen was a long-lived contamination that was continuing to be dumped into that ground over essentially the entire operating live of the facility. It was expanded, transported primarily by the groundwater in a very large volume that exceeded any reasonable clean-up cost. So we said, maybe we should come up with an idea of saying if there is a certain volume of material or a certain concentration of material, and it's migrating at some rate, we should tell the licensee, "Now is the time to fix it. You no longer have the option of your choice of waiting until decommissioning". And what we determined in discussions with the committee was defining those limits in a straightforward regulation was not a straightforward process.

There are simply too many variables in site conditions, rate of transport, solubility of materials, volume of materials, the difference between vertical and lateral migration and how that would effect cleanup cost to write a succinct regulation that says when you fall within this box, you will clean up. So we decided not to pursue what would have been a rather extensive effort of defining a set of limits by which a licensee must clean up at the time it was discovered.

CHAIRMAN RYAN: So will the guidance have any version of really cleanup or prompt cleanup, or why let it get to be a big mess instead of a little mess? Is there anything at all there on that?

MR. SHEPHERD: The guidance will say that, you know, we believe, we, the staff, believe it is more cost effective to clean up sooner rather than later in many cases. Now, there are cases where there may be what we call a significant volume, significant being anything that you actually are going to have to clean up in order to meet unrestricted release criteria. At a facility like Trojan, for example, which has a very basaltic soil form, things simply don't go anywhere. If they're not going to go anywhere, you probably don't have to do anything about them until you get to decommissioning because the volume of whatever results from the spill or the leak is going to stay pretty much the same.

If you go to another site where they're leaking uranium, for example, a soluble form into groundwater that's moving several centimeters a day, it would probably be a whole lot better to have some kind of interdiction. Of course another problem with the action level is okay, what are we going to do? Well, we can put in extraction wells. We can put in interceptor trenches. We could put in barriers. We could get a backhoe and pretty soon we're off into the technical analysis which really doesn't belong in the regulation.

CHAIRMAN RYAN: If I -- and I appreciate the fact that bidding, you know, action plans or action limits would be tough. That's a tough row to hoe but it seems to me though that maybe that struggle shouldn't end there. That having some way to say, you know, it's encouraging or actually kind of steering the licensee to addressee what is, you know, could very well be a real headache 10, 20 years down the line, that it ought to be a little bit more explicitly put into the regulation and the guidance.

MEMBER CLARKE: Mike, if I could, we also gave them some reasons not to do that.

MR. SHEPHERD: What is in the guidance is a statement that as part of the review to determine compliance with this proposed regulation, is that licensees must re-evaluate what they're doing now and in some cases modify their existing monitoring plans to do that. Within that, there has to be a statement of response, what licensees are going to do and so we are strongly encouraging licensees to identify their site conditions and what they're going to do about it. It doesn't have the force of a statement of a "You will", but I believe it will certainly have the flavor of, "The NRC thinks it would be a really good idea if you guys did this". And that's something against which we could write a violation if they don't but I think our intent is to strongly encourage them to consider the consequences, really, to them if they don't, primarily economic.

CHAIRMAN RYAN: Will the rule allow an increase of their financial assurance requirement if they don't take the steps?

MR. SHEPHERD: The intent of the rule is that financial assurance must reflect the latest cost estimate to alleviate all of the contamination at the site to unrestricted use. On my side I'm saying, "You guys have got to go out and find what the actual extent of the contamination is. If you believe you can clean that up within your existing financial assurance, okay. But that volume is one of the line items in the cost estimate. That volume goes up to the point that it's more than a few percent different from the existing cost estimate, then that increase need to be reflected in the updated cost estimate".

Given the nature of spills and leaks and so on, again, at one point we were contemplated immediate, whatever immediate might mean, but we decided that you know, bar somebody breaking open a major tank, in which case a lot of other things would kick in anyway, the change over the three-year period would not be so great that the three-year update wouldn't be a reasonable way to address the potential increase in cost.

Likewise, say a licensee comes out and they find something this month, so they increase their financial assurance. But come springtime, they decide, "Well, you know, we've got this and this and this and here's what our revenue string looks like, so we're going to go out and we're going to clean up some of it." Having done that, they can then in turn reduce what's in their financial assurance because they won't need as much when they get to decommissioning because they've already cleaned up some of it. And that will also be reflected in the guidance.

CHAIRMAN RYAN: So it ultimately boils down to a financial decision.

MR. SHEPHERD: By and large.

CHAIRMAN RYAN: And a cleanup decision.

MR. SHEPHERD: We have had one site where they have contaminated multiple aquifers vertically and down to 70 feet. We now get into how technically feasible is it to clean up an aquifer that's 70 feet below grade? Well, you can probably do it even though it's spread out more than the others, you know, within extraction wells or whatever, but it will just take a long time which we can then equate back to money. So we haven't found something that is really not technically feasible. It would just get very expensive and we believe the longer you wait the more expensive it's going to get.

CHAIRMAN RYAN: I guess I'm struggling a little bit because I've never seen a site that's contaminated that didn't get worse all the time, an active site. It just gets worse all the time.

MR. SHEPHERD: I agree, yeah.

CHAIRMAN RYAN: So the idea that you wouldn't have more aggressive, you know, options, you know for either enforcement or clean-up or, you know, a clean-up with --

MR. SHEPHERD: Well, because of the nature of the regulations, I have more options in dealing with a material site, for example, than I would a Part 50 site. Financial assurance is defined in 50.75C that says, "You're financial assurance is equal to this equation which is your power times a constant that we identify."

CHAIRMAN RYAN: Right.

MR. SHEPHERD: I can't change that.

CHAIRMAN RYAN: Yeah, I do appreciate the fact that I know --

mR. SHEPHERD: When I go to a material site, where I don't have the Part 50 overlay, I have much more leeway in coming in and, you know, there's no backfit provisions, at many of these sites, so I can walk in and say, "We think it's a good idea for you to do this. You know, if you don't want to do this, I can encourage you up to and including an order if I think it's necessary to protect public health and safety", but then that's the other issue is it becomes very difficult to push something through enforcement if there's no immediately measurable effect on public health and safety.

Regardless of the concentration and contamination, from what we've seen it's not a public exposure risk, rarely a worker exposure risk. And if it's an operating facility, the limit is 100 millirem, not 25 millirem, which it becomes at decommissioning. And a licensee would be very hard-pressed to make enough of a mess that would approach the 100 millirem dose at the fence line from stuff that was inside the site.

CHAIRMAN RYAN: Right.

MR. SHEPHERD: And a worker exposure is five times that. So it's -- we can encourage them but we don't often have the -- a bigger stick than that, unless there is some actual or potential exposure.

CHAIRMAN RYAN: Thanks, that additional explanation is helpful.

MEMBER CLARKE: I want to give the others an opportunity to ask some questions, too, but first, that was a very helpful exchange, by the way, I think because when we mentioned to you the concept of financial incentives, that was where we were obviously going. I mean, if you're not going to require them to clean up early and I assume we understand the difficulties associated with that, and then in fact, as I mentioned, we encouraged you not to try to action limits as well. That was a committee response for a lot of reasons. But then how else do we deliver that message and you know, as Mike asked, is the guidance going to be good strong reasons and a lot of encouragement to do that? Are there other vehicles to do that? If they could reduce their financial assurance, if you have the flexibility to do that, I mean, that would be something to consider as well. That's where we're -- that's what we're thinking about and we've been asked by the Commission to think about that. They were very interested in that topic.

MR. SHEPHERD: Having attended a couple of EPRI meetings on basically tritium releases and EPRI guidance documents that came out recently on their groundwater monitoring initiatives, I'm very comfortable that the power industry is taking hard steps forward and is doing at least as much as anything we've contemplated in the rule. So I think the word has gotten out and again, there's not -- not that I'm aware, any axilar or potential health and safety threat from the tritium releases identified so far. I mean, even Braidwood, the highest number I've seen was half of the R20 release limit for effluents but the industry is spending a lot of time and a lot of money responding to this and the incentives are primarily financial.

What are we going to do and how are we going to deal in their case primarily with the public perception problems? And I think the idea that people have a perception that if an organization, be it the power or the materials side is having unplanned, uncontrolled releases of anything, that's not good. I think that word is getting out and people are looking much more carefully at it than they did five years ago.

MEMBER CLARKE: I wanted to ask you a very basic question. I guess my first exposure to a legacy site, I came away from it with the understanding, my understanding that a legacy site was simply a site where when it came time to decommission, you didn't have enough money to decommission and the concern was financial. In looking at the regulatory analysis, and this may be where you're speaking from, Jim, it says, "A legacy site is facility that is in decommissioning status with complex issues and an owner who cannot complete the decommissioning work for technical or financial reasons".

And you know, as I went through the regulatory analysis and the notice in the Federal Register, I thought, you really did an excellent job on the financial side and the vehicles that could be expected to work and the vehicles that wouldn't be expected to work for the reasons that you mention. I just wanted to ask you a little more about where you were coming from on the technical piece. Is this what could be called a technical practicality? You're just not going to be able to clean it up to an unrestricted release?

MR. SHEPHERD: Within a reasonable time.

MEMBER CLARKE: Because I didn't see much in the --

MR. SHEPHERD: We got the site that was contaminated, multiple aquifers and when you get to the lower one, the contamination levels were above release limits. Technology does exist but when you start trying to extract from anything greater than atmospheric pressure, you know, you're into down-hole pumps. What are you going to do with the waste? How are you going to handle it? What happens if the pump breaks?

MEMBER CLARKE: I'm familiar with the problems, yeah.

CHAIRMAN RYAN: You can also end up with unintended consequences and higher doses than if you leave it alone.

MR. SHEPHERD: Well, yeah, and even without doses if you stare pumping a sub-surface aquifer, what are the hydrologic and geologic potential impacts over a long period of time.

CHAIRMAN RYAN: Sure.

MR. SHEPHERD: You'll end up with Salt and Sea.

MEMBER CLARKE: I'll just make one more comment and then I'll turn it over to the others, but one of the things I think pump and treat has shown us over and over again is that it's a good way to keep contamination from spreading but it may not be a good way of restoring an aquifer.

MR. SHEPHERD: Oh, right. I mean, the harder you pump it, you know the concentrations go down and --

MEMBER CLARKE: You'll get a mass transfer limitations.

MR. SHEPHERD: -- then as soon as you pump off the -- back out of their little cracks and --

MEMBER CLARKE: Yeah.

MR. SHEPHERD: -- and pretty soon, you're right back where you started from. That can go on for decades before you --

MEMBER CLARKE: If you're concerned about it going off-site, it has proven to be pretty effective there. So I'll stop and Ruth, do you want to go?

MEMBER WEINER: Yeah, do you ask the applicants or do you ever look at doing a risk benefit ratio or risk benefit comparison of some sort for the cleanup of some of these sites where it's difficult to do?

MR. SHEPHERD: We haven't formally asked for that. We certainly talk around the ideas of doing what I keep referring to, you know, "What are you guys going to do and how are you going to pay for it"? So it's -- I would say it's an informal analysis that considers the same factors. We have not yet said, "You must use this equation or this set of equations", because if we do, they're going to calculate an answer and then the next obvious question is, "Okay, is that answer good enough or do you have to do something else"? And again, how do we define what's the right answer or where the limit is?

MEMBER WEINER: Well, you've really answered my question which is informally this is part of any cleanup consideration. The other question I have is, and I'm not sure that there is any such site now, but what happens in the case of a grandfathered site? What happens in the case where there is a site that has had several occupants and the contamination can be traced back to some previous occupant who is now gone or out of business or whatever, bankrupt or whatever?

MR. SHEPHERD: Well, that concept is really an EPA issue or our opinion and we've actually looked at this in what about in the case of offsite contamination. If you own it, you're responsible for it under NRC regulations. It's that simple.

MEMBER WEINER: So even if --

mR. SHEPHERD: I don't care who put it there. I don't care why they put it there or when they put there, you own it, it's your problem. If you don't have an NRC license, we may invite you to apply for one.

MEMBER CLARKE: Well, CRCLA has joint and several liability and it sounds like you're getting to the same place.

MEMBER WEINER: That's where my question was going.

MR. SHEPHERD: Right. Now, Tom, do we have the authority to go back to a previous owner and say they have to clean up the site?

MR. FREDRICHS: We have, occasionally,

terminated a license or gone back to former owners and say, "Well, as the last licensee, you are still responsible for cleaning this up", and that's produced some results, but in the context of joint and several and CRCLA, it is, no, that we really don't have a concept like that because our position is that the licensee has to clean up and for whatever reason, it's on the licensee's site, they're responsible for it. So we haven't in any of our legacy sites, for example, tried to find some previous owner who may have contaminated it and try to ger more money from them.

MEMBER CLARKE: In CRCLA, that's what the principal responsible parties do, they try to find other people and see them for cost recovery.

MR. FREDRICHS: Yeah, it's just different statutory authority and not clear that the AEA necessarily gives us that authority. At least I don't think we've ever tried to exert it.

MEMBER CLARKE: Mike, do you have anything?

CHAIRMAN RYAN: Yeah, I was thinking about the agreement states. Different agreement states have slightly different rules for how they calculate financial assurance requirements. I know Tennessee has a caries in square foot formula, you know, and all of us do it differently. How -- is there any effort going to be made in this rule to kind of unify that in any way or are the agreement states still going to be free to develop plans to, you know, have their own strategy for assessing requirements, financial assurance requirements?

MR. O'SULLIVAN: Where there are changes in the regulations, all of the changes are identified in so-called compatibility table.

CHAIRMAN RYAN: Yeah.

MR. O'SULLIVAN: And many of these compatibilities are Compatibility D. So they will have their own options as to how they want to proceed.

CHAIRMAN RYAN: Okay.

MR. O'SULLIVAN: We did have two information notices that were sent from FSME/DILR out to the agreement states. One of them asked, "Of these type of facilities that we were considering, how many do you have in total and how many do you think would have sub-surface contamination issues", to kind of get a handle on what the population was at that time when we were looking at this. And the second information notice asked agreement states, "Of the guarantees that you have out there, how many do you have and what's the total value", so that we could get a handle on, you know, the volume of dollars with respect to the guarantees.

CHAIRMAN RYAN: Have you got any of that information back?

MR. O'SULLIVAN: Oh, yeah, we had pretty good response. It's identified in the regulatory analysis as to what the total dollar amounts are that we estimate for the agreement states for guarantees. We have a number for the NRC licensees.

CHAIRMAN RYAN: Okay, thanks.

MEMBER CLARKE: Allen?

VICE CHAIRMAN CROFF: I think I'll just say that I was going to go down Mike's first line of questioning, so I won't do that again. I appreciate your response on it. It sounds like we need a stick someplace.

MEMBER CLARKE: Dr. Hinze?

MEMBER HINZE: Brief question, if I might, you discussed, I believe the membership at least in terms of agencies or units of your working group. But I missed, was industry represented on that working group? Was the applicant represented?

MR. O'SULLIVAN: The only time industry and the applicants were represented in providing information for the technical basis was in two public meetings. One of them was in May of 2005. It was a two-day session hosted by DWMEP on decommissioning financial assurance and legacy site issues with respect to subsurface contamination. It was a very successful, well-attended, I'm guessing couple hundred people for two days.

The other times was in January of 2007 where we had the 70 representatives.

MEMBER HINZE: Well, it sounds like there was a fair bit of interest. Did you make an attempt to have an industry representative on that briefing group to be involved in more in-depth discussions?

MR. O'SULLIVAN: No.

MEMBER HINZE: Has this happened in the past? Does it work?

MR. O'SULLIVAN: We'll allowed a certain number per statute. When we're developing a rule, we're allowed a certain number of contacts with the outside world. I understand that's -- I believe it's eight independent contacts to get information to help develop a proposed rule. And we had enough subject matter experts within the agency and the agreement state and the NRC Region 3 that we thought we had enough information internal to go forward with this.

MEMBER HINZE: It might have a different

culture though with a different viewpoint. I gather that you're looking forward to if this does pass through the commission of getting their response via the comments; is that --

MR. O'SULLIVAN: Absolutely. We all agree, everybody on working group, with what the intent of your statement is, is that we don't know everything and to a large extent they know better than we do.

MEMBER HINZE: You know, they're facing it and they're having to comply with this regulation or guidance and sometimes that's a different attitude and I think that we really do have to keep in mind their approach.

MR. O'SULLIVAN: We have that attitude.

MEMBER HINZE: Okay.

MEMBER CLARKE: I have one more and then Latif, you're next. You mentioned that -- and we did I think encourage you the last time we heard about preventing legacy sites, that there was an experience from the Superfund arena with setting up trusts for long-term monitoring and surveillance if nothing else and there's kind of cross-section of how people did that. I know one site they set up this trust for five years which I guess that's at least putting your foot in the water but you said you did go to the EPA with that.

Was there -- has their experience been positive on that? I'm not asking you to speak for the EPA. I'm just wondering what you heard.

MR. FREDRICHS: I'm trying to recall. I'm not sure we talked about the experience with trusts so much, although we can recognize that in a lot of cases, one of their difficulties at EPA is that they, you know, put out regulations but the states implement them, so they try to be very prescriptive in order to get the states to line up with them, and we don't have that extra step so we can be, I think, a little more flexible in our arrangements.

But they did like the trust. They thought that was a good financial mechanism. The money that's in there is safe at least as long as the trust is going to be in existence and they contrasted that with the escrow account where the property in escrow was still the property of the licensee in our case and therefore, at least potentially subject to attachment by creditors if there's a bankruptcy situation.

Whereas, in a trust the property belongs to the trust and the licensee's creditors can't reach it. So for those reasons, we agreed with EPA's assessment. In fact, I think we -- in the FRN we refer to that as one of the reasons why we're going to eliminate the escrow.

MEMBER CLARKE: Thank you. Latif?

MR. HAMDAN: Yes, I think this was you, Tom, who said something about how you evaluate the financial sureties and you mentioned you compare estimates by the licensees and using some cross-table it will tell you. The question that comes to mind is, don't you look at the experience that you had with legacy sites that you already have and probably many of them have the financial surety. Why don't you visit that database and see what went wrong with those estimates and correlate that with the rules so that you don't repeat the mistake that you have in the first place?

MR. FREDRICHS: Well, that's the goal of this rule is to use that experience. The under-estimation for the legacy sites wasn't in unit cost. They didn't -- it wasn't because they underestimated you know, the cost of labor or even the hours of labor necessarily. It was more fundamental, strategic if you will. They didn't realize there was the extent of contamination in the first place. But the rules is now structured so that they need to account for subsurface contamination in particular because that's the major cost driver, major unanticipated cost driver to, you know, extend the cost.

If they do that, you know, if they're reasonably accurate on estimating the extent of contamination, small differences in the unit cost of moving a cubic yard of dirt or an HP technician is not going to cause such a shortfall that they'll be unable to complete the job.

I think earlier one of the concerns as well, you may not have a stick, if you will, to force licensees to do things but the key really is to recognize what your actual cost is and licensees may have a certain disincentive to look hard enough for contamination because then they will have to make some arrangements, you know. There's some financial cost in carrying these instruments.

Occasionally, well, on one site, I guess, the -- we had a contractor do an estimate on what it would cost to clean out and prepare that licensee so there was a large difference. The difference was pretty much entirely due to the fact that our contractor had the direction that when you're estimating the subsurface contamination, we want you to be -- you know, take the position that unless you show it's not there, we're going to assume that there is some.

The licensee is, in the absence of they are showing that it is there, we assume it's not and you have a settling time which has a liner that may be leaking and you don't take a sample, if it's somewhere in that vicinity, you say, "Well, there's nothing to prove the leak", whereas our position here is, "Well, you're going to have to do better than that. You're assuming it's not there, there's a potential. Show us that you have a reasonable estimate of the extent of contamination". So that' really our experience is that they made fundamental strategic errors and not small estimating errors.

MR. HAMDAN: Exactly, and then you prove that they take care of that?

MR. FREDRICHS: Well, we certainly hope it will, that is the intent. And some of the increased reporting requirements are going to include things like, well, you know, what is -- you know, make some estimate of the extent of some surface contamination, keep track of your spills.

If there is a spill, assess that, where did it go, does it have a likelihood of increasing decommissioning cost? And then even when they get into these initially, we want them to compare their actual costs with the estimated costs and make sure that they're reasonably accurate and that sort of thing and increase financial assurance. Experience is showing that they're --

CHAIRMAN RYAN: Tom, that's a good example. If I may just add a question. You know, that kind of process, let's say you have a spill. All right, you've evaluated the spill. You decided to rope it off, cover it with a tarp and wait to decommission it. Is there any obligation that I need to verify that condition periodically, every year, every five years?

MR. FREDRICHS: Well, there's a three-year update that you have to do.

CHAIRMAN RYAN: The reason I ask is if I do have a spill, I do cover it up, it's going to spread out. I can't imagine a near surface system where that's not going to happen.

MR. SHEPHERD: Well, that was one of the discussions at the EPRI conference by one of the concrete experts that if you spill liquid on a floor, it --

CHAIRMAN RYAN: It's going to get through it.

MR. SHEPHERD: -- it will get into the concrete. It's not if, it's only when and how far it's going to migrate after it does, which in turn is going to increase the cost of disposing because now you're going to have more contaminated concrete and, you know, so then, "By the way, when it turns brown, it means it's starting to rust out the rebar, too".

CHAIRMAN RYAN: So I think all those kind of indicators are -- you know, the spill itself and documenting a spill is not hard. What's hard is making the decision to spend money today to solve a small problem. Every business faces that and I think if we don't give an incentive to do that, we're missing a real opportunity to prevent these spills from becoming real headaches. Instead of having, you know, a 55-gallon drum of soil to dispose, we've got, you know, 17 B-25 boxes or more.

MR. FREDRICHS: And I think that kind of follows up on the committee's recommendation to put more discussion and guidance, you know, to point this out and also, of course, for our reviewers, to look at these sorts of things and then ask those questions when the two-year updates come in, you know, "Have you checked," because they should be doing surveys in any case.

CHAIRMAN RYAN: Then really that gets it into the inspection and enforcement arena. I would think that the guidance could be beefed up. If you're not going to put something up front that really makes them clean it up, sooner rather than later, recognizing going to be a headache, or very likely to be headache, then the inspection enforcement requirements ought to be beefed up to make sure that the Commission and its agents have better information periodically based on is it getting worse, is it getting into the concrete, is it turning brown, are the samples coming back with more contamination?

So you can certainly address it in inspection and enforcement. And I think --

MR. SHEPHERD: In terms of the inspection, NAAR (phonetic) changed their inspection procedure over a year ago. This is the first time there was a procedure that actually required the NRC to look at the decommissioning files.

CHAIRMAN RYAN: And I think that's a great step.

MR. SHEPHERD: That change is being moved other license types as well.

CHAIRMAN RYAN: Sure, it is going into the other license types and will eventually go into the agreement state requirements as a higher compatibility?

MR. SHEPHERD: I'm not sure what the compatibility level would be.

CHAIRMAN RYAN: The reason I ask is, we all know there's, you know, tens of thousands of agreement state licensees at all levels of course, but, you know, the reactors, I think have pretty robust financial assurance and I think recognize the value of let's get ahead of the curve here and certainly the tritium task force was a real, you know, eye opener on that score.

So I don't have a much, you know --

MR. SHEPHERD: Enforcement, again, is a challenging issue because by and large, enforcement is done for reasons of health and safety. I mean, certainly --

CHAIRMAN RYAN: Maybe that needs to be thought through.

MR. SHEPHERD: And you know, a small spill or even a large spill that's on concrete at the corner of a plant, somebody puts a ribbon around, there's -- it's difficult to motivate enforcement to say they're violating -- there's a violation of something that's worthy of penalty.

CHAIRMAN RYAN: And I agree, it's so slopey, you don't know where to put your stake in the ground to hang on, but I think we need to wrestle with this a little bit more, I think. It just seems like we're letting an opportunity to, you know, put a brighter light on some of these things that will only degrade. They're not going to get any better unless you've got, you know, something that's got a 30-day half life. They're just not going to degrade, I mean, not going to improve, they're going to degrade. So I'm wrestling with that.

MR. SHEPHERD: Part of the action limits that we talked about we were discussing, you know, half lives of interest.

CHAIRMAN RYAN: Sure.

MR. SHEPHERD: And something with say cobalt, you know, it's going to be gone essentially in 50 years from today typical time from start of operation to decommissioning.

CHAIRMAN RYAN: And it's immobile by the way for the most part.

MR. SHEPHERD: So that one probably wouldn't be of all that great of interest in that context but you know, the first few days you probably don't want to be over in that corner. You know, how do we say that and where do we put it on the enforcement scale? You're right, it's difficult, but we should keep trying.

CHAIRMAN RYAN: Well, you know, I guess, Jim, I'm going to suggest that we continue to think about this and then read, you know, the formal material that comes out of the Commission and maybe visit with you again and think some more about it. And I think we recognize, I certainly do, it's a tough problem so it's not a criticism, it's really something to, you know, create the incentive.

MR. SHEPHERD: We appreciate the insights because it's always good to get a slightly different perspective and see if we can find a way to strengthen the position.

MR. O'SULLIVAN: I mean, there's good communication within our division and because of the experience of the NARM proposed and final rule, with respect to the compatibility designations, we had a close eye on this table that's in the Federal Register notice for compatibility agreement. And we went through every paragraph as identified on that table and we used the management directive identifying the criteria for choosing Ds, Cs -- Ds and As are not really relevant here, but some of them are health and safety and in that respect we went through each one of these with somebody who interacts with the agreement states from our division.

That's not to say that everyone is going to agree with these compatibilities, but we put a lot of effort into that table.

CHAIRMAN RYAN: Sure. No, I appreciate that. That's good information.

MEMBER CLARKE: I agree, Mike, we do want to continue this dialogue and we do want you to come back to us with the guidance when you can, so we can take a look at that and give you some comments as well. And it struck me when Mike was talking that, you know, my reaction to the term action limit is some numerical quantity associated with some particular radio-nuclide in some environment and it may be that you can get t the same place with guidance on classes of material and certain scenarios or whatever. I'm not -- I haven't thought about that long enough to suggest it, but you know, there may be some middle ground and there may be some fruitful areas for further discussion.

Let me ask, any more questions from the committee? Latif, you have one more?

MR. HAMDAN: Actually, I have another

question if we have time.

MEMBER CLARKE: We do.

MR. HAMDAN: But before I ask the question, I really want to make the point that because of our experience with our last meeting on financial surety, this issue of having adequate financial surety for a project is so important, I don't think it should be deferred to the guidance. I think you have to put it somewhere in the rule somehow so that you can have enforcement.

So enforcement can go not only to the health and safety but if the financial surety is not enough you have a mechanism or a way to go back to the licensee and request financial surety be increased. This is a fundamental problem. I know from experience on the limited program and since you have a new rule you have a golden opportunity to fix that problem. So that's that.

The only other question I have is it was mentioned that agreement states don't make any comments of their own and we have, what 55 agreement states? Yeah, why is that?

MR. O'SULLIVAN: Thirty-six or so.

MEMBER CLARKE: Thirty-four.

MR. HAMDAN: Yeah, why is that? That

doesn't make sense.

MEMBER CLARKE: Why is what?

MR. HAMDAN: Why don't the agreement states comment in a rulemaking like this?

CHAIRMAN RYAN: Well, to be fair, Latif, you know, agreement states don't have the extensive staff and people that deal with these issues. Typically a state -- you know, I've worked in a lot of agreement states, and have been a licensee in an agreement state, so I'm not necessarily defending them but I understand their constraints. They've got X-ray programs, they've got material programs, and sometimes collateral responsibilities in other areas and some agreement states have very small staffs.

Some agreement states have, you know, five or six people.

MR. HAMDAN: Mike, if --

MR. SHEPHERD: Well, the other possibility, Latif, is this, that not directly known to us but they phone their comments through the agreement state representative to the working group and they get back --

MR. HAMDAN: Oh, okay.

CHAIRMAN RYAN: I've just got to mention, they really work through the Conference of Radiation

Control Program Directors, which is a centralizing organization, the Organization of Agreement States, so they're not going to participate here on an individual basis. They work through those organizations.

MR. SHEPHERD: And, in fact, we have, to some extent, not just in this context but others, encouraged agreement states rather than send us 35 different comments on the same subject, to consolidate among themselves what they really think and then send us a -- that consolidated opinion, so I think they sort of picked up on that mode and are probably following their thought through our working group.

MR. HAMDAN: Thank you very much.

MEMBER CLARKE: Well, thank you for a very interesting discussion and we look forward to future discussions. Thank you very much and Mr. Chairman.

CHAIRMAN RYAN: Okay, again, thanks, gents, we'll see you soon. Thank you. We'll just take a five minute, a comfort break and be right back at 3:00 o'clock. I might mention before we leave for members, I think first off, Chris Brown has organized a brief presentation on the regulatory guide spreadsheet and letter and has some recommendation for us, so Chris we'll take that up right after the break.

MR. BROWN: Okay, that's fine.

CHAIRMAN RYAN: Okay, great. We'll close the record here, and we don't need for Chris' presentation to be on the record, so we'll close our written record here at this point in time.

(Whereupon, at 2:50 p.m., the above-entitled matter concluded.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Nuclear Waste & Materials 183rd Meeting

Docket Number: n/a

Location: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Charles Morrison
Official Reporter
Neal R. Gross & Co., Inc.

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Protecting People and the Environment

Total-system Performance Assessment (TPA) Version 5.1

183rd Meeting of the
Advisory Committee on Nuclear Waste & Materials
October 17, 2007

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Introduction and Outline

- Logistics of the three part presentation
- Development and purpose of TPA 5.1
- Areas addressed in TPA 5.1
  - Source term, including drift degradation and seismicity, near-field environment and corrosion processes, and colloidal release
  - Igneous activity ash remobilization
- Next steps for staff
- Summary

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Key messages

- TPA Version 5.1 is a review tool
- Development of TPA 5.1 increased staff readiness
  - Capability to review performance assessment
  - Flexibility to assess alternatives
  - Organizational capacity

Part 1
Development and Purpose of TPA Version 5.1

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Part 1 – Outline

- Recent developmental history of TPA
- Purpose of TPA Version 5.1
- Developmental process for TPA Version 5.1
- Major areas of change in TPA Version 5.1
- General TPA 5.1 approach
- User guide for TPA Version 5.1

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Recent Developmental History of TPA Versions and Risk Insights Documents

- January 2002 – TPA 4.0 user guide published
- 2002 thru 2004 – TPA 4.1j used
  - Risk Insights Baseline Report July 2004 (Appendix D in NUREG-1762)
- 2003 – 2005 TPA 5.0 developed and used
  - Risk Analysis for Risk Insights Progress Report (June 2005)
- 2005 – 2006 TPA 5.0.1 completed as beta version

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Recent Developmental History of TPA Versions: 2006 – 2007

- Input parameter values for TPA Version 5.1 "locked down" in January 2007
- TPA 5.1 delivered to NRC June 22, 2007
- TPA 5.1 user guide delivered July 26, 2007
- Revised user guide September 25, 2007
- TPA Version 5.1a September 27, 2007

Purpose of TPA

- TPA Version 5.1 is a review tool developed to assist staff in prelicensing activities and reviewing a potential U.S. Department of Energy (DOE) license application
  - Provides independent review capability
  - Enhances staff understanding
  - Supports risk-informed and performance-based approach

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Prelicensing Use of TPA Version 5.1

- Developing staff review capability
  - Reviewing a performance assessment
  - Increased familiarity with model abstraction
- Preparation for interactions with DOE
  - Drift degradation Appendix 7 interaction
- Could be used to update portions of the Risk Insights Baseline Report

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NRC's Use of Risk Information

- DOE's multiple barrier capabilities are used as a basis for determining where to focus NRC review of the DOE performance assessment
- NRC's risk insights assist in focusing staff's review
- Staff review of barriers will determine whether the technical basis in DOE's performance assessment is consistent with DOE's description of barrier capability

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Use of TPA Version 5.1 in License Review

- Use guided by Yucca Mountain Review Plan (NUREG-1804)
  - Consistent with NRC regulatory philosophy
- Potential uses of independent performance assessment analyses – a part of the review
  - Confirmation of barrier capabilities
  - Confirmation of scenario screening
  - Confirm estimates of repository performance

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Developmental Process for TPA 5.1

- Guided by quality assurance requirements [e.g., Center's Technical Operating Procedure (TOP-018)]
- Integrated team approach
- Project management and advisory groups
- User guide
- Software Requirements Description
- Software validation

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Developmental Process for TPA 5.1 (continued)

- Integrated NRC and Center team approach
  - Developed around the review team structure
  - Developing and testing code and writing user guide
  - Deliverables for each chapter of the user guide
- Project management and advisory groups
  - Active and strong project management
  - Senior technical advisors for TPA 5.1 changes
  - User Guide Committee provided guidance and reviews for consistency

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Primary Considerations in Developing TPA 5.1

- Integration of process abstractions for the drift degradation scenario
- Methodology for low-probability seismic event sampling
- Long-term climate and net infiltration
- Input parameterization
- Input and output transparency and traceability

Software Requirements Description (SRD)

- SRD required when significant code changes
- 18 separate modules addressed in SRD for TPA 5.1
  - Software description
  - Technical basis for models
  - Computational approach
- Changes documented in software change requests

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Software Validation of TPA Version 5.1

- Required under TOP-018
  - To gain additional confidence
- 18 process-level software validation tasks
- 4 system-level software validation tasks added
  - Waste package failure modes; radionuclide release rates; radionuclide doses; and numerical stability
- Each documented in a software validation report

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Reasons for Updating to TPA 5.1

- In response to recommendations
- Insights from sensitivity analyses
- Increase flexibility to evaluate alternative potential repository and design features
- Updated understanding of processes
- Consideration of drift degradation and its associated effects on engineered components
- Assess performance for periods longer than 100,000 years

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Major Areas of Change in TPA Version 5.1

- Million year simulation period
- Repository layout
- ***Drift degradation and seismicity***
- ***Near-field environment and corrosion processes***
- Glass waste form dissolution
- ***Colloidal release and transport***
- ***Igneous activity, including ash redistribution***
- Updated dosimetry

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Anticipated Effects of Updates

- Million year simulation period
  - Different dose contributors, affected by updated dosimetry and addition of colloidal release and transport models
- Repository layout (emplacement panels)
  - Affects spatial distribution of net infiltration among repository subareas and layer thicknesses in transport pathways
  - No major effects expected

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Anticipated Effects of Updates (continued)

- Updated dosimetry
  - Np-237 dose conversion factors lower
  - I-129 and Tc-99 dose conversion factors higher
- Igneous activity, including redistribution
  - Variable wind field results, on average, less deposition at reasonably maximally exposed individual location
  - Time-dependent changes for new model

Anticipated Effects of Updates (continued)

- Drift degradation (nominal scenario)
  - Flexibility to assess time dependent drift degradation
  - Without seismicity, simulated rubble loads generally are not sufficient to cause mechanical breaching of waste packages
  - Failed drip shields allow water contact with waste packages for potential localized corrosion failure mode
  - Failed drip shields and waste packages are modeled to allow partial protection from seepage

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Anticipated Effects of Updates (continued)

- Drift degradation (seismic scenario)
  - Seismic activity increases rock load on failed drip shield
  - Number of mechanical failures depends on simulation time (i.e., longer simulation times allow more time for low-probability, large-magnitude seismic events to occur)
  - Average number of waste packages contributing to release increases with time

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Anticipated Effects of Updates (continued)

- Generalized corrosion
  - Generalized corrosion failures are reduced
  - Temperature increases generalized corrosion rate during thermal period, but not enough to cause failures
- Localized (crevice) corrosion
  - Localized corrosion requires seepage water contact and cannot occur if drip shields do not fail before end of elevated-temperature period
  - Average number of waste packages affected by localized corrosion is small
  - Localized corrosion damage mainly occurs on waste package welded areas

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Anticipated Effects of Updates (continued)

- Glass waste form
  - Glass inventory is small compared to the spent fuel; however, the volume occupied by the glass is significant
  - No significant effect is anticipated
- Cladding
  - Exploratory partial cladding credit model added

Anticipated Effects of Updates (continued)

- Colloid model – irreversible colloids with Th, Pu, Am, Cm isotopes; increases effective solubility; permanent filtration factor for transport; and reversible colloid sorption
- Reversible colloids anticipated to have minimal effect
- Irreversible colloids dose contribution from Pu-239, Th-230 and Am-243 is anticipated

General TPA 5.1 approach

- Available data used to construct approaches
- Simulate a range of potential performance outcomes of the potential repository and allow for computational efficiency where warranted
- Flexibility built into code to assist review capability

General TPA 5.1 approach (continued)

- TPA conducts probabilistic dose calculations for specified time periods, accounting for:
  - Essential features of the engineered and natural barriers
  - Chemical and physical processes affecting degradation and release to the biosphere
  - Uncertainties and spatial variability of system attributes, model parameters, and future states (scenario classes)
  - Biosphere characteristics

- Scenario classes include:
  - A nominal scenario including climate changes
  - A disruptive scenario involving seismic events
  - A disruptive scenario involving faulting
  - A disruptive scenario involving igneous activity

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User Guide for TPA Version 5.1

- Chapters 1-4: Introduction; overview of conceptual models; installation and execution; and architecture
- Chapters 5-17: Module descriptions
- Chapters 18 and 19: Input and output

TPA User Guide Module Descriptions

- Conceptual model
- Model support and assumptions
- Implementation of conceptual model in TPA 5.1
- Input parameters in *tpa.inp*
- Auxiliary input data and external process models
- Intermediate outputs and information passed to other modules
- Techniques for understanding module performance
- References

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Part 2
Areas Addressed in TPA Version 5.1: A Few Examples

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Areas to be Discussed

- Mechanical damage to engineered components from **drift degradation and seismicity**
- **Flow modification processes** in the near-field
- Recent data and modeling regarding **near-field environment and corrosion processes**
- **Colloidal releases** of actinides and impacts on transport of radionuclides attached to colloids through the geosphere
- Alternative igneous consequences abstraction accounts for wind-field variations and **redistribution processes**

Topics Addressed For Each Area

- Flexibility in TPA Version 5.1
- Conceptual model
- Integration
- General approach and data support
- Software validation

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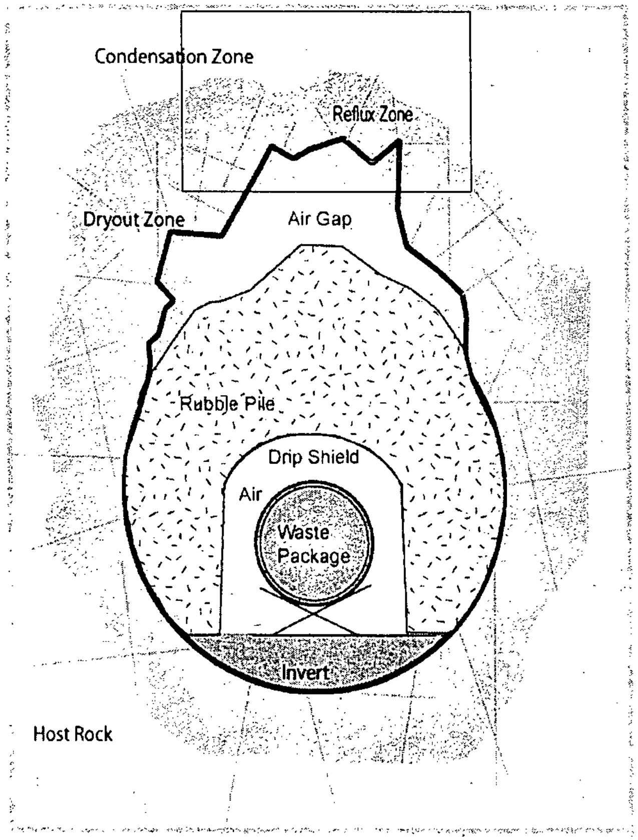
Drift Degradation: Overview



(After Leslie and Grossman, 2007)

- TPA 5.1 can estimate the effects of accumulated rubble due to excavation-, thermally- and seismically-induced stresses on the lifetime of the engineered components and near-field thermo-hydrology

$$P_v = \frac{H_{rubble} g \rho_{rock}}{BF}$$

Equation 6-10

(Leslie and Grossman, 2007)

- TPA 5.1 compares the expected capacity of engineered components, affected by temperature, creep, or general corrosion, to the demands from rubble loads resulting from induced stresses to determine engineered component lifetimes

- Accumulated rubble also impacts thermo-hydrological estimates for the near-field environment

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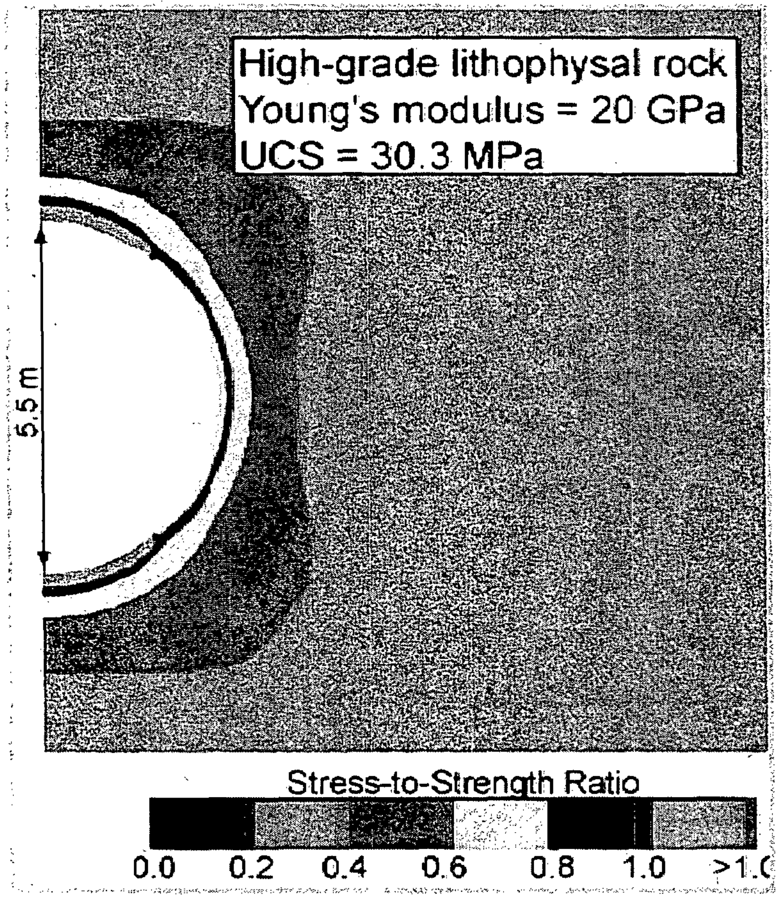
Drift Degradation: General Approach and Data Support



(Ofoegbu et al., 2006)

- Drift degradation abstraction inferred from results of thermal-mechanical analyses (Ofoegbu et al., 2006)
- Mechanical interactions based on structural performance analyses utilizing finite element modeling (Ibarra et al., 2007a,b)
- A process-level study using a two-dimensional, dual-continuum, drift-scale model supports the thermal abstraction implemented into TPA for degraded drifts (Manepally et al., 2004)

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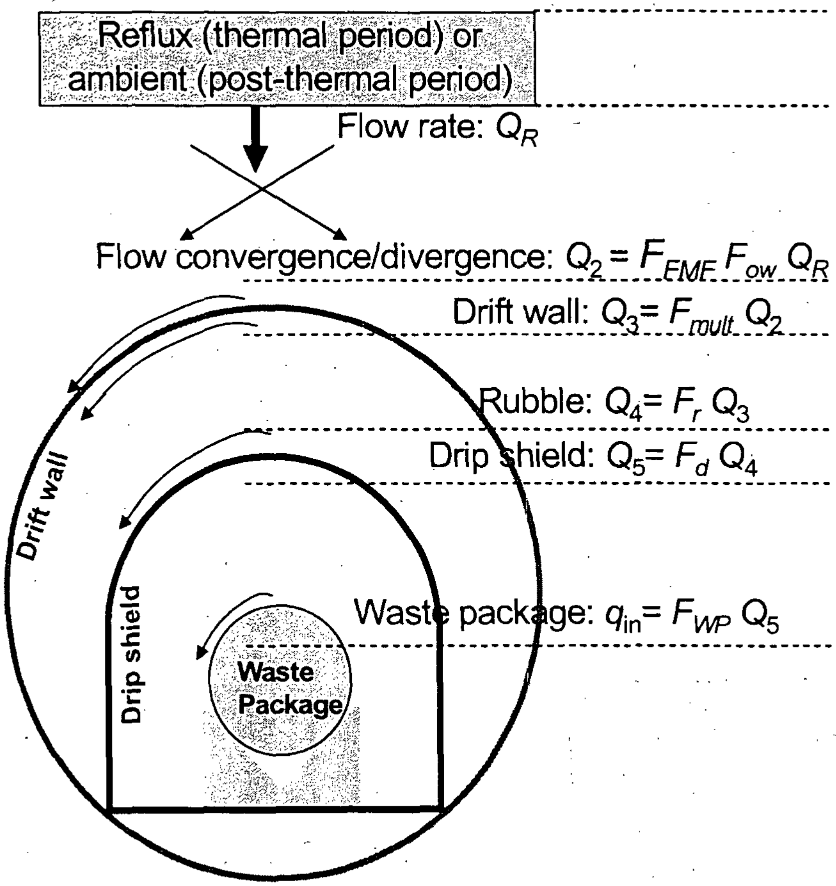
Near-Field Flow Processes: Overview

- Flexible approach to address potential flow diverting and converging processes for thermally perturbed percolation and ambient flow conditions
- Time dependent reduction rates at multiple locations
- Integrated with drift degradation choices

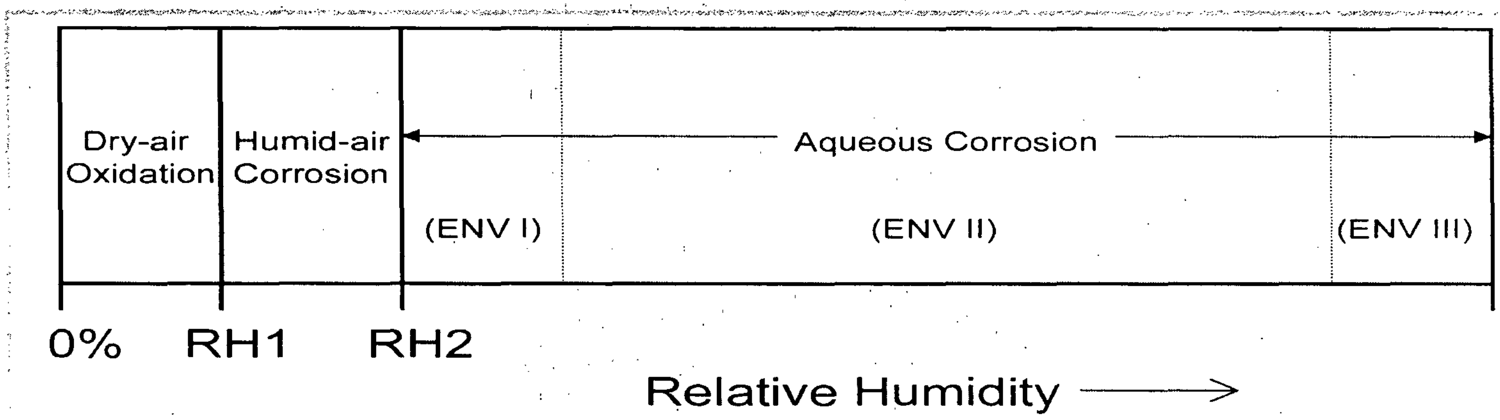
General Approach and Data Support



(Leslie and Grossman, 2007)

- The flow factors F_{FMF}, F_{ow}, F_{mult}, F_r, F_d, and F_{WP} are used to modify flow rates to simulate the effect of components of the engineered barrier system (e.g., drift wall, drip shield, waste package)
- Figure illustrates flow factors, each of which is used to compute flow rates at particular locations inside the drift

Chemistry and Corrosion: Overview



(Leslie and Grossman, 2007)

- Waste package corrosion abstraction estimates time-dependent waste package thickness as a function of near-field environment
- Aqueous general corrosion uses an Arrhenius relationship to estimate corrosion rates as a function of waste package temperature
- Aqueous localized corrosion is activated when water of an appropriate chemical composition contacts the waste package surface
- The chemical composition of water on the waste package is dependent upon the relative humidity, temperature, presence of the drip shield, dust and seepage water compositions

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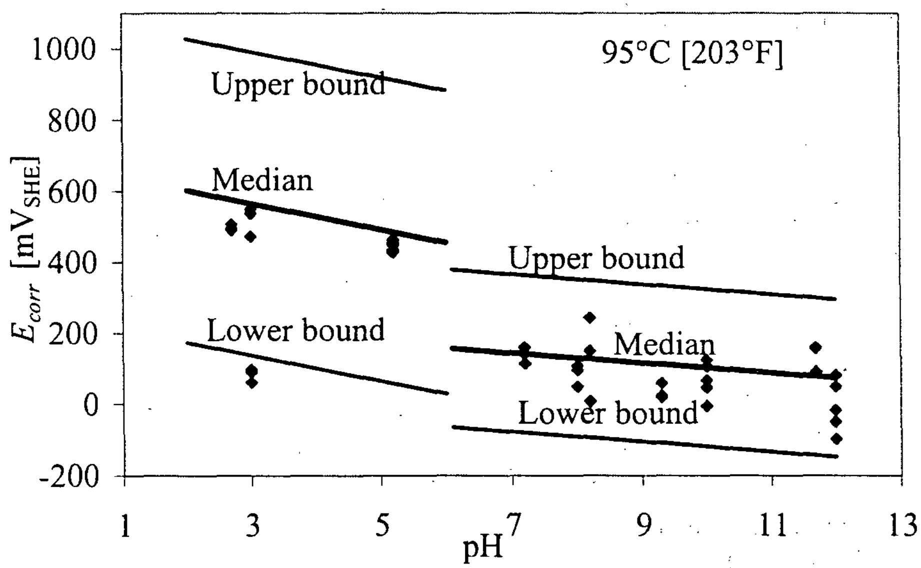
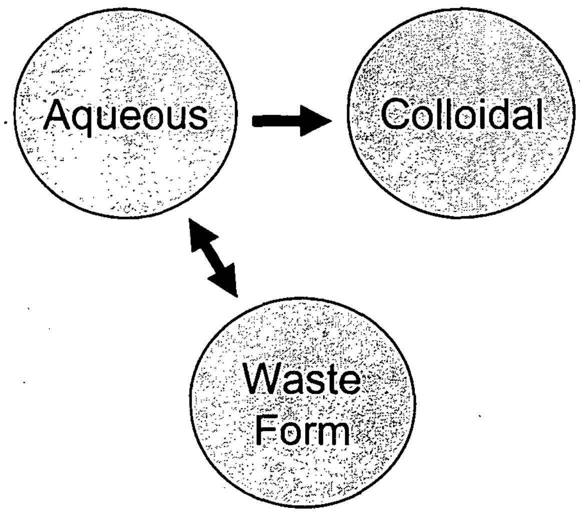
Chemistry and Corrosion: General Approach and Data Support



(Dunn et al., 2005)

- Transition relative humidity to aqueous corrosion supported by recent studies suggesting nitrate brines deliquesce at low humidity (Rard et al., 2006) and could induce general corrosion at elevated temperatures during a limited time window (Yang, 2006)
- Semi-empirical corrosion potential model is consistent with measurements (Dunn et al., 2005)
- Chemical compositions based on:
  - Observations of corrosion inhibitors in dust from Yucca Mountain for Env I (Dunn et al., 2005, Browning et al., 2004)
  - Simulated evaporation of pore waters for Env II (Dunn et al., 2005)
  - Dilute pore water for Env III (Yang et al., 2003, 1998, 1996)

Colloidal Release and Transport: Overview



- TPA 5.1 can estimate the release of actinides (i.e., Am, Cm, Pu, Th) irreversibly attached to colloids (J-species) subject to competition and sorptive capacity

$$C_{J_i} = S_X \frac{Y_i \mathrm{Min}(C_i, C_{S,i})}{\sum_i Y_i \mathrm{Min}(C_i, C_{S,i})}$$

Equation 10-20

(Leslie and Grossman, 2007)

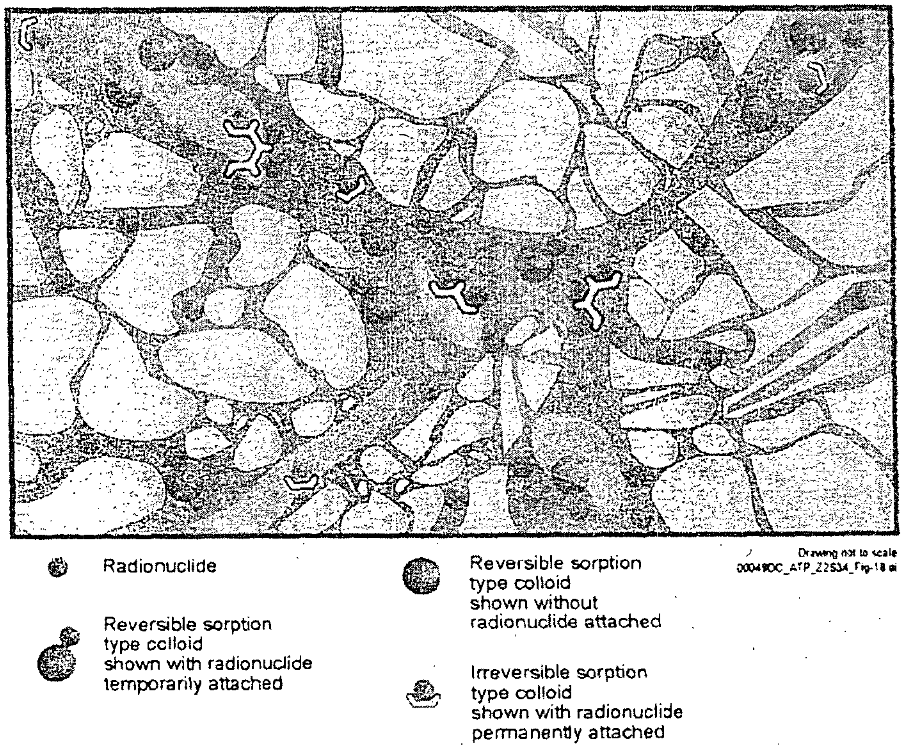
- TPA 5.1 also can estimate the impact of reversible attachment to colloids on the transport of dissolved radionuclides through the unsaturated and saturated zone below the repository

$$R_D^{eff} = R_D \frac{1 + K_0 (R_C / R_D)}{1 + K_0}$$

Equation 11-11

(Leslie and Grossman, 2007)

Colloid Release and Transport: General Approach and Data Support



(DOE Preliminary Site Suitability Evaluation, 2001, Figure 3-60)

- Abstraction for colloidal release on corrosion products based on:
  - Data for sorption efficiency of corrosion products (Lu et al., 2000, 1998)
  - Relative abundance of colloidal particles (Pickett, 2007)
- While equilibrium sorption is assumed in the transport abstractions, kinetic models were developed (e.g., Painter et al., 2002; Cvetkovic et al., 2004) to guide parameter selection

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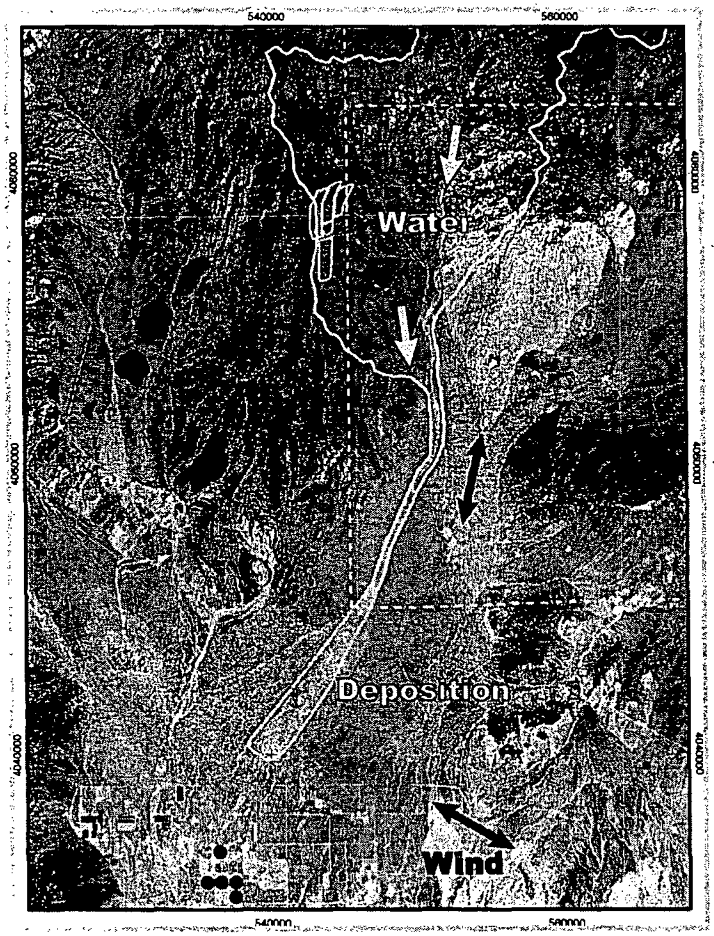
Igneous Redistribution: Overview



(Leslie and Grossman, 2007)

- TPA 5.1 estimates potential volcanic eruption consequences accounting for:
  - (i) wind-field variations along the height of the eruption column
  - (ii) first-order fluvial and eolian redistribution of tephra

$$D_{inh,j}(t) = BI_j \eta_{HLW,j}(t) H_{RMEI}(t) A$$ Equation 15-1

(Leslie and Grossman, 2007)

- TPA 5.1 uses the results of the TEPHRA code to account for wind-field variation effects on tephra distribution

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Igneous Redistribution: General Approach and Data Support

- Airborne concentrations above initial deposit exponentially decrease with time to a long-term constant value
- Fluvial remobilization based on observations of sediments at Fortymile Wash and analog sites (Hill and Connor, 2000; Hooper, 2005; Middleton, 1997; Segerstrom, 1950)
- Additional ongoing studies at Sunset Crater
- Mass loading of fluvial remobilized component is assumed to be constant
- Flexibility to estimate airborne concentrations for inhalation pathway from different levels of surface-disturbing activities

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Summary of TPA approaches

- TPA provides a **flexible** framework to **independently** review pre-licensing activities and a license application for the proposed repository at Yucca Mountain
- TPA calculates a range of potential performance outcomes of the potential repository to represent potential repository behavior and allow for some **computational efficiency**
- The approaches are based on **data,** when available

Part 3
Next Steps for Staff

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Next Steps for Staff

- TPA activities for this fiscal year
- Analyses to assist prelicensing activities
- Apply enhanced staff performance assessment review capability to prepare to review DOE's license application performance assessment

Future Near-Term TPA Activities

- Minimal, focused on code maintenance
- Potential to make many sampled parameters in *tpa.inp* constant
- Finalize and implement seismic scenario probability analysis

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Additional Prelicensing Analyses

- Potential limited, focused, analyses to update portions of the Risk Insights Baseline Report
  - Million year calculations
  - Colloids
  - Drift degradation
  - Igneous activity, primarily redistribution

Preparing to Review License Application

- Examining the Supplemental Environmental Impact Statement model
- Reviewing DOE Total System Performance Assessment-License Application (TSPA-LA) related documents
- Enhancing capabilities to conduct an efficient, risk-informed and performance-based license review

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Summary

- TPA 5.1 is a review tool
- Modifications to TPA increased flexibility for conducting review
- Development of TPA 5.1 led to increased staff readiness to review DOE's performance assessment
- Focus is now on preparing to review DOE's license application

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Preventing Legacy Sites ACNW&M Presentation October 17, 2007 FSME Staff

Mark Delligatti
Thomas Fredrichs
James Shepherd
Kevin O'Sullivan

- Opening Remarks
- ACNW&M letters regarding Financial Assurance
- Issues that Affected the Proposed Rule Technical Basis
- Status and Schedule for Guidance Documents
- Status and Schedule for the Proposed Rule

Tom Fredrichs

ACNW&M letters regarding Financial Assurance

- Financial Requirements (8/13/2007 letter)
- Financial Incentives (12/27/2006 letter)

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Tom Fredrichs

Issues that Affected the Proposed Rule Technical Basis

- Need for more detailed cost reporting
- Need for tighter NRC control of financial instruments
- Discussion with EPA on the use of trusts to meet financial assurance requirements

Tom Fredrichs

Status and schedule for Financial Assurance Guidance Document

- Guidance currently in review by staff
- Guidance to be released with proposed rule

Jim Shepherd

Issues that Affected the Proposed Rule Technical Basis

- Deleted "Action Limits" mandating prompt remediation
- Specified a broad framework of contaminant release prevention and detection
- Included Agreement State participation

Jim Shepherd

Status and schedule for Subsurface Monitoring Guidance Document

- Guidance currently in review by staff
- Guidance to be released with proposed rule
- Considering a workshop to receive public comments during 75-day comment period

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Kevin O'Sullivan

Status and Schedule of Proposed Rule

- Two deferrals (05/2006 and 01/2007) allowed completion of technical basis on 2/28/2007
- Proposed rule to Commission 10/03/2007
- 75-day comment period following publication

Kevin O'Sullivan

Summary – Proposed Rule and Guidance to Prevent Future Legacy Sites

- Proposed rule is risk-informed
- Proposed rule is performance-based
- Proposed rule and guidance documents will benefit from public review