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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON NUCLEAR WASTE (ACNW)

166ST MEETING

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WEDNESDAY,

DECEMBER 14, 2005

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ROCKVILLE, MARYLAND

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The Advisory Committee met at 8:30 a.m. in Room T-2B3 of the Nuclear Regulatory Commission, Two White Flint North, 11545 Rockville Pike, Rockville, Maryland, 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

ACNW STAFF PRESENT:

NEIL M. COLEMAN

JOHN FLACK

LATIF HAMDAN

RICHARD K. MAJOR

ALSO PRESENT:

BOB ABU-EID

LARRY CAMPER

JAMES DAVIS

TOM ESSIG

MARGARET FEDERLINE

BILL OTT

BILL REAMER

JACK STROSNIDER

BILL VON TILL

I-N-D-E-X

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

8:39 a.m.

CHAIRMAN RYAN: On the record. This is the second day of the 166th Meeting of the Advisory Committee on Nuclear Waste. My name is Michael Ryan, Chairman of the ACNW. The other members of the Committee present are Vice Chair Allen Croff, Ruth Weiner, James Clarke and William Hinze.

During today's meeting, the Committee will be briefed by the NMSS Office and Division Directors on recent activities of interest within their respective programs. We'll hear presentations by and hold discussions with representatives of the United States Geological Survey and the Office of Nuclear Regulatory Research regarding demonstrations of the generalized composite approach to modeling of reactor transport phenomenon and we will discuss Committee letters and reports.

Richard Savio is the Designated Federal Official for today's session. This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. We have received no written comments or requests for time to make oral statements from members of the public regarding today's sessions. Should anyone wish to address the

Committee please make your wishes known to one of the Committee's 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's also requested that if you have cell phones or pagers kindly turn them off during the meeting. Thank you very much.

I might also add that as a scheduling item based on prediction of incoming weather the Committee worked late last night. We did review our Commission slides and as a result, we will not meet tomorrow. There will be no continuation of the meeting for a third day. We hope to conclude business this afternoon in time for folks to make their travel provisions for today and more importantly, so that if it is icy in the morning, the Staff can make a good decision on whether or not to come in based on road conditions and icing and so forth. So our business will conclude this afternoon.

With that, I think we're waiting for a couple of our first participants. Bill Reamer is here and perhaps some others and I think we're just a few minutes ahead of schedule. So why don't we suspend the record until our other speakers come and then

we'll resume the record when our other guests arrive on the scheduled hour of 8:45 a.m. Thank you. Off the record.

(Whereupon, the foregoing matter went off the record at 8:38 a.m. and went back on the record at 8:40 a.m.)

CHAIRMAN RYAN: On the record. We can resume the record please. Gentlemen, good morning. This is a briefing to the Committee from the U.S. Nuclear Regulatory Commission's -- I'm sorry. I'm reading the wrong agenda. Other than that, thank you, Bill.

MR. CAMPER: Let us know what we're supposed to talk about.

CHAIRMAN RYAN: Yes, exactly. My mistake. There we are. Sorry. This is our Combined NMSS Office and Division Directors Briefing. The cold winter and the late night working on letters has me a little goofy. It's my pleasure to introduce Jack Strosnider in a minute and he'll lead off the discussion with his colleagues, Bill Reamer and Larry Camper.

I would like to recognize on behalf of the Committee Jack and the other gentlemen that we really appreciate the collaborative effort that your staff

and our staff have put in to framing an effective calendar for the ACNW. We just had our planning and procedures meeting and in short order, we now have a calendar that looks very full of lots of very important and timely activities over the next year.

Things change and things shift. But I think we have our arms around that and it is truly an effective way for us to conduct our work and I think to minimize our impact on your staff because we can now coordinate things in a better way, the prime example of which I again appreciate the opportunity to sit with you at your Commission briefing with certainly our D&D effort where we participated, all five of us, at your public stakeholder workshops which prepared us in a timely way to be ready to offer comment and hopefully constructive comment input to the Commission and in discussion with you. This kind of approach we find to be just fabulous. We really appreciate your work and the work of all the staff to get it done.

I particularly want to thank Sam Jones who's our coordinator with you and he does a very good job of coordinating. We really appreciate his work. With that, I'll turn it over to you. Thank you very much.

MR. STROSNIDER: Thank you, Mike. Appreciate those comments. Actually I wanted to talk about that myself a little bit as an introduction here and specifically I wanted to talk about the value of our interactions.

Within the Office of Nuclear Material Safety and Safeguards, we have a commitment to continually look for ways to improve our programs, to make sure that we're focused on the right topics so that we're ensuring safety and protection of the environment, to look for ways to make our programs more efficient, effective and to make sure that we have the level of openness that we should have in our programs. A key part of that commitment to the continuous improvement, if you will, is getting input from a spectrum of independent stakeholders and of course, the Committee plays a key role there.

We get a lot of good input which really helps us in terms of, as I said, making sure that we have the best programs that we can have. I think there are several examples that I just wanted to highlight briefly in some of our recent interaction:

The preparation in the Decommissioning workshop by the Committee. This sort of workshop is exactly what I'm talking about where we're looking for

stakeholder input on how our program is working, where can we find areas for improvement and we appreciated the Committee's participation in that;

The hosting of the WIR workshop in the summer, the workshop on Waste Incidental Reprocessing and that facilitated scoping of the staff's standard review plan that we'll be using in those reviews;

The trip to Savannah which I think was a very successful trip in the summer to tour the high-level waste tanks. Wish I could have been there. Unfortunately, I missed it but the feedback I got was that that was a very useful visit;

Hosting the West Valley Performance Assessment workshop in the fall which was another good activity in another key place where we get input from the Committee and other stakeholders; and

The close coordination that we've been having and will continue to have, I believe, on the white paper on low-level waste which I think will provided a really good platform for moving forward with engaging other stakeholders and assessing the program to see what areas for improvement might exist there.

There are a number of related to high-level waste. We appreciated the comments on the

licensee application review plan. This planning is extremely important for us in making sure that our reviews are effective and that we do it efficiently, we hit all the right topics, and again the expertise here and the independent look at it and the comments is very helpful to us. The same thing with comments on the preclosure review plan.

Finally, I would just mention the comments, the review, we got from the Center, the CNWRA program which is very helpful to us. So those are all things that we had great input from the Committee on. It's really helpful to us and again in this spirit of continually looking for ways to improve our programs, we appreciate that input.

So we have, recognizing that and trying to put better planning into this process to help both of us. We've done a comprehensive review of our programs. We've put together an update of the 12-months calendar and there's a substantial increase in the number of interactions identified. We're looking in the next 12 months now as the calendar stands to have 35 different subjects that we'll be bringing to the Committee. That's a large increase over what we've had before. I want to warn you a little bit on that too. But I think by maintaining this calendar

and doing this sort of planning hopefully we can help each other to manage the activities that we're identifying and again get the sort of input we're looking for.

To help do that, it is a rolling-12 month calendar. So we'll be looking at updating that monthly. We plan to continue and we're scheduling now the quarterly meetings with NMSS management, what we call our Executive Team, the Leadership Team, with the ACNW Executive Directors and we'll be scheduling weekly meetings I think in our staffs. So we'll have a regularly scheduled meeting and they've been interacting as needed to support these activities.

The bottomline is we appreciate the support, the input, the independent perspective that you've provided us on these programs that I've mentioned and we look forward to getting that same sort of input as we move forward through the next 12 months and beyond. But there will be a lot on the calendar, a lot of work. So we'll have to make sure we continue to communicate and plan that as effectively as we can. I appreciate that. Unless there are any questions or comments on that, who is going to go first?

MR. REAMER: I think I was.

MR. STROSNIDER: I'll turn it over to Bill Reamer.

CHAIRMAN RYAN: Thanks very much. I appreciate the opening comments.

MR. REAMER: Thank you, Jack. We know there's a license application delay which will obviously expand the period of preapplication activities and will mean a continued interaction with the Committee and we look forward to that. I know you have questions about the specifics of that and hopefully we'll be able to respond to your questions today on what we see in the near term in the preapplication area.

I do want to say at the outset that there's always uncertainty but there's particular uncertainty with respect to the climate we're in on the Yucca Mountain program. We don't have a license application date from the Department. We really don't even have a date as to when they expect to be able to come forward with a specific schedule. The Department's concern is that they have objectives with respect to the quality and the technical content of the program and they want to focus on that. They are concerned that dates will become a distraction. So that's where they are.

Also there is uncertainty with respect to resources and budget and there's always a budget that's in the process of being made and there are budgets that are in the process right now of being put together that will impact the level of resources that the Department has for the program and that we have for the program. That clearly creates uncertainty with respect to how much we'll be able to do and the interaction we have with the Committee.

If I could start by summarizing where we think things are on the program generally, we know that DOE has announced a plan to move towards a simpler, cleaner approach to handling fuel. This will involve use of the container that's known as the transport aging and disposal container or the TAD container. A container that is not yet designed will need to be designed and will also potentially involve significant changes to the surface facility because it would envision a change in the nature of the handling activities that would happen at the surface facility, at the repository.

Spent fuel would be sent to the site in the TAD canister by both truck and rail. It would potentially require less handling at the repository, certainly a cutback on what some viewed as repetitive

handling. Conceptually it would involve a cutback on repetitive handling at the repository. Some assembly handling obviously would still be required where the fuel was not suitable to be handled entirely in a TAD canister. And we know that that will conceptually involve changes to the facility design as I've mentioned.

The Department is in the process of what they have called their Critical Decision Level 1 process or the CD 1 which is the way in which they will make the decision with respect to these changes. They've told us that they are serious about moving forward on the projects, serious about moving on the license application, serious about moving forward on the CD-1 process which they've given us to indicate could be in a position for decisions to be made in the spring 2006 time frame.

As I've said, the Department told us they are not in position to be able to estimate a license application date. They're also not in a position to be able at this point to estimate a licensing support network certification date. That latter date would potentially be a precursor to a license application because our regulations require that the Department certifies the document six months prior to the license

application and the Department has said that the LSN certification date depends upon a couple of things: (1) the resolution of a adjudicatory matter pending before the Commission with respect to an earlier draft license application and whether it would be part of the system and become public and (2) also finalization of the CD-1 process that I talked about which is key to the Department getting its hands around the schedule issue.

We also know that the Department is replacing, they've told us they're replacing, the moisture infiltration model which is a link to the USGS email issue and will require in addition to replacing the model technical analysis work to support it. We're also informed by the Department that a technical report and an extent of condition report will be forthcoming with respect to the USGS email issue. But we don't have those reports and we don't have a specific date about when we will get them. But we expect that once we get them and complete our review, there will be interactions with the Department and actually the Committee will be interested in being informed about the technical report and the extent of condition report.

The Department has told us that they are

completing their modeling and technical analyses needed to support a compliance with a revised EPA standard which would carry compliance out beyond 10,000 years to the period of geologic stability or one million years. We know that the EPA has received comments on their proposed regulation. The comment period has closed. The ball is EPA's court to evaluate those comments to prepare a final rule in response to comments and to publish that such that it can become an effective regulation.

To my knowledge, there's not a formal schedule that EPA ha issued. I've heard in public settings that has talked about potentially the summer of next year. But I wouldn't say that's an official date. I think there is no official EPA date. So, in general, that's the status of things. Of course, we have our own proposed regulation out as well and comments we've received on that and would intend to finalize that once EPA has finalized their regulation.

In this context, we as a staff want to continue to implement our prelicensing program, continue to identify potential technical issues that are licensing issues, maintain the staff capability to perform the license application review in accordance with the project plan when the application is

submitted and look at our program as basically made up of our regulatory aspects, meaning the rule and guidance and I'll give you a little detail on this, our activities on issue resolution, our activities with respect to maintaining our own capability and also the LSM.

First, looking at the regulatory program and enhancements, I'm talking here about Part 63, our regulation, and the EPA proposed Part 197. Those two rules as I've said will need to be completed in the next year.

We also are looking to bring our own total system performance assessment code or TPA code up to a code that can analyze and handle a one million year compliance period consistent with a revised Part 63.

We are working in completing potential changes to our guidance document of the Yucca Mountain Review Plan that would be consistent with the revised compliance period. We'll issue those through a process that involves public comment, those changes to guidance, and we'll call them Interim Staff Guidance and we'll look to interact with the Committee on those.

We'll need to be developing a regulatory framework to handle the TAD canister and the proposal

when the Department develops its path forward on how it intends to interact with us with respect to the TAD canister design and its approval for purposes of storage and transportation.

Also we will be looking for the Department as well as our own indication of how the TAD canister approach will impact our own regulatory program and review plans and also to the extent that the rail corridor environmental impact statement process continues to move forward as the Department works out its own plans for `06, that will be part of our `06 activities as well.

With respect to issue resolution, let me just go through the numbers again which the Committee has hear that they haven't really changed, the 293 technical issue agreements. We have completed our review with respect to 258 of those. An addition 29, we have completed our review on and indicated to the Department that we believe there's a need for additional information and when the Department is ready to interact. If they want to interact on those 29 agreements, we will be ready to do so. There are eight agreements that remain on hold because they are potentially impacted by the USGS email issue.

We're also going to look at the need to

update our risk insights baseline in light of the changes to the Department's program and the one million year compliance period change as well. That's part of our plans for the forthcoming preapplication period.

We have also the potential need to update the integrated issue resolution status report where we report on the technical basis for our issue resolution. So that potentially is something that we'll be developing in the preapplication timeframe.

Let me just comment on one area here and that is a potential Department decision to move to a coal repository and at this point, our understanding is that while that is potentially under evaluation by the Department, it's not part of the changes that they are now proposing. Changes that they are now proposing relate more to what I think they would call clean, the clean and simpler, the changes to the repository design and the handling that would involve a clean and simpler process. They're not at this point proposing any changes that would move them toward a coal repository, but that potentially may be something that they look at. So we'll have a need to be ready to interact with them in the event that they do dedicate resources and activities in the area of

looking at a coal repository.

In the preclosure area, the Committee is aware that we have developed our prelicensing, preclosure issue report and we have identified issues to the Department and have interactions with them in the area of seismic and aircraft hazards and have offered to have future interactions on preclosure issues including the PCSA. So the Department has indicated that they're interested in that but we don't have specific dates yet which those interactions would occur. We are continuing our activities to understand the Department's model, the PSPA and any potential changes that they're making and any impact that would have on issue resolution that might cause us to go back and look at key technical issues.

In parallel, we're spending time and effort to update and revamp the TPA code, TPA 5.1, to help us to represent and independently evaluate the significance of the changes that the Department has proposed and may propose in the future. As I mentioned, we'll be updating our risk insights baseline, at least, informally looking at the need to update based on the TPA code and the changes that we understand are forthcoming from the Department. We want to also continue to gain experience and use the

PCSA tool and to look for opportunities to apply it to evaluate specific issues and to provide the focus for us in the preclosure area that the TPA has provided for us in the post-closure area. We will also as part of our independent activities maintain our presence at the sight through our onsite representatives.

In the quality area, the path forward really is linked very heavily to the Department's own processing of the USGS email issue which I've already touched on. We will also continue our monitoring of the DOE QA audit activities. Recently they conducted an audit of the high-level waste-related activities at Savannah River and we do want to continue to do our observations. It helps us maintain a knowledge of the QA program and how it's being applied and does provide opportunities for us to suggest issues and improvements.

We proposed at the recent management meeting as well that we have a separate meeting with the Department with regard to their corrective action program, in other words, the efficacy of their process to identify issues, to resolve those issues and to resolve them in a way that keeps them resolved, doesn't lead to repetition in terms of issues. So we don't have a specific date from the Department but

they have indicated they would be willing to have an interaction with regard to their corrective action program and also as I mentioned a potential technical meeting with them on the USGS email issue in the near future once they've issued their technical reports and extent of condition reports.

Also part of our preapplication activities will continue to be our public communication/public outreach to be available to the effected units of the local government to provide information to them and the State of Nevada and to perform our role to present ourselves, to present what our role is and to be ready to provide information in response to their questions. Also our preapplication activities will continue to maintain the licensing support network at least in the near term and also any related preapplication presiding officer activities.

So that's the general overview of what's forthcoming in the preapplication period. At the appropriate time, I know you have questions and I'll try to do my best to respond.

CHAIRMAN RYAN: And it's up to you if you want. Maybe we should take a few questions for Bill now and we'll shift gears to other topics in a minute. Bill, that's an excellent summary of your activities.

We appreciate hearing it. Just as an opening comment, I think we've been in much the same mode of thinking of prelicensing now that it's clear the LA's been deferred a bit. So we've been getting back in touch with DOE and with the Staff of course, both, and we're adding to our rolling calendar, of course, your contributions as well as we've heard from DOE and things they're willing to come and talk about in some order that probably fits their work plan. John, you may have an additional comment there.

DR. LARKINS: I was going to say I was looking at the list from Bill. Also we had a list of topics from DOE that they were willing to come in and talk about it and sometime I think we need to sit down and coordinate these so that similar topics get discussed on a similar schedule if possible. A lot of these are overlapping.

MR. REAMER: We'd be happy to do that.

MR. FLACK: But there are some differences that probably we should reconcile and your list of topics is quite extensive. We'll have to figure out how to work some of these out.

MR. REAMER: Sure. If there's time in your current meeting or if we need to arrange a telephone call or video conference.

CHAIRMAN RYAN: Yes. I think following the rolling calendar process that would be a great place to start and begin that coordination because some of the things we have are preliminary by topic and we really haven't gotten to the details of calendar. There's a few things that we'll work on but we're on much the same page of getting back into a prelicensing mode where we're trying to look at technical issues of risk-significant items and issues as well.

We're aligned on the goal. We just have a lot of moving parts to get meshed in to have it be effective for everybody. That's a positive thing. And just for your information, we've turned our attention a little bit to the technical issues related to the revised Yucca Mountain standard and really not so much what the EPA is doing although we're mindful of what their process is but how the NRC would implement what the EPA puts forth. So we're trying to understand some of the issues of the technical and the technical area from the 10,000 to the million year time frame and we'll be offering letters of comment on that. Of course, your staff is participating in that.

MR. REAMER: Yes.

CHAIRMAN RYAN: So I think in general I

see that we're focused on the same shifts and goals and we look forward to continued coordination. Any other comments or observations for Bill or questions? Let me start with Jim.

MEMBER CLARKE: Thank you for the update on where the license application is. It was very helpful. As I understand, the DOE is focused now on changes that would address the cleaner, simpler fuel handling approach and the decision of whether or not they would move to a coal repository is the future. Is there any indication when that will be made?

MR. REAMER: I don't have any information on that in terms of timing. But I think the way you characterized it is exactly our understanding.

MEMBER CLARKE: Thank you.

CHAIRMAN RYAN: Ruth.

MEMBER WEINER: First of all, I wanted to thank all of you for the support that NMSS has given the Committee when we make our annual visits down to the Center for Nuclear Waste Regulatory Analyses. It's been extremely helpful and my question is in the light of the delay in the license application do you foresee any major changes in that program that would impact our oversight of it or just generally, do you see any major changes?

MR. REAMER: I think I would want to first go back to my very opening statement which is that we are in an environment of great uncertainty, uncertainty that's related both to the DOE plans with respect to the license application and the design and also uncertainty with respect to how this program will be funded in the future. But at this point, I think we see the Center's role being fundamentally the same, the place in which we develop our own independent understanding including that understanding that related to a revised EPA standard, an understanding that relates to potential impacts of changes as DOE makes to its program. The key for the NRC to be able to do the review is to have its own understanding of how things work and that's what the Center has historically been able to support us on and at least in my view though, that fundamental role will continue to be there.

MEMBER WEINER: I'm just concerned that our oversight is a help to you and assists you in developing the staff capability. If there are any disconnects there, just tell us.

MR. REAMER: Peer review is a basic part of the process and I don't know whether it's fair to call the Committee's role with respect to oversight of

the Center as peer review. That may be the wrong characterization of it but I think it has some of the same benefits. So we look to the Committee to continue that role. I know the Committee has broader responsibilities with respect to assessing the NRC's research capability and we know there's an umbrella there that part of some aspect of the Center may fit under. But the role that the Committee has played historically on issues with respect to the Center, I think, is good.

MR. STROSNIDER: I'd just like to make an observation on this, too, that I think everyone here is aware of this but I think some people react when they hear about a delay in an application that while there's nothing to do which certainly isn't the case at all. In fact, talking about changes in design and that sort of thing just actually creates more work and it might be going in some directions.

It's been some twists and turns in the road, but there certainly will continue to be, I believe, a high level of activity and understanding where the Department is headed in trying to position ourselves for when an application does come that we're prepared for it. I see the same role in terms of making sure that we have the right sort of program

headed in the right direction.

CHAIRMAN RYAN: And in fact just yesterday we had a briefing from Tim McCartin on the first steps of updating the TPA code with respect to the six year horizon and so forth. I'm sure that dialogue on that and other topics related will continue. So I agree there's a lot more work than there might be. Bill, I think you characterized our role well. It's peer review in part but it is the other issues. I think you captured it very well. Allen?

VICE CHAIRMAN CROFF: No questions.

CHAIRMAN RYAN: Okay. Professor Hinze.

MEMBER HINZE: Briefly, Bill, the replacing the moisture infiltration model as a result of the current work that the DOE is doing, is that a reanalysis of existing data or does that include the acquisition of new data either in the field or the laboratory and, if so, are you and your staff monitoring this and how are you interacting with it?

MR. REAMER: The answer is we are monitoring, actively monitoring, and I think the story has not entirely told. So I really can't answer that first question to the extent to which its reanalysis of existing data versus potentially the need to provide additional data.

MEMBER HINZE: Do you envision the new model of this new data impacting the TSPA of the NRC?

MR. REAMER: I think what will be important for us is to understand the impacts of it. So really we'll need to do the analysis first. So I would guardedly say potentially yes.

MEMBER HINZE: Yes. Regarding the TAD, what kind of details do you have on the TAD at this point and when are you going to get additional details? Do you know and is the size going to be the same as the presently planned waste canisters in the repository? Can you give a little broader feel of what's going to happen?

MR. REAMER: My knowledge is that the Department has really begun the process with us to begin to describe the TAD and that the TAD is not at this point designed. So answers to the questions you are raising really depend upon the Department making more progress in developing its own plans to obtain the design and interact with the industry and the vendors along the way.

MEMBER HINZE: So we have a waiting process again. Thank you.

CHAIRMAN RYAN: Let me turn it back to you and Larry.

MR. CAMPER: Good morning. Let me echo first, Dr. Ryan and other members of the Committee, some of Jack's points and sentiments that I've heard expressed this morning from the Committee. Over the last several months since I assumed the directorship of this division this January, I have personally enjoyed very much interactions with the Committee and the Committee members.

I thought that our visit to the Savannah River site looking at the waste incidental reprocessing determinations were extremely useful and fruitful. From my vantage point hearing the questions of the Committee directly to the DOE staff and the contractors was a great utility as we work our way through the determinations.

Our work together on the decommissioning workshop, having you there, participating in that was extremely useful. The input that you have given us in terms of the issues that we're dealing with on the D&D front has been very useful. I've also very much enjoyed the interactions that we've had with Dr. Larkins and other members of the Committees in terms of addressing how we might interact better together and more effectively and efficiently. So it's been very fruitful. It's a pleasure to be here with you

today to continue that type of interaction.

You wanted to hear about several things. There were five of them in total. So I'll try to cover the waterfront and it's interesting on the first one in terms of emerging issues and the management of low-level radioactive waste with a five year horizon in mind. That's a challenge. It's a very interesting environment.

On one hand if I look at Part 61 and how long it's been around and if I look at where we are in terms of new site coming into existence or not coming into existence, if I look at how industry has dealt with managing the low-level waste problem, on one hand you ask yourself what do we need to be prepared for. What is really going to happen? How much of a pent-up need is there for more sites being developed and what have you?

On the other hand, you look at Part 61 and while it's worked very well, you ask yourself is it as risk informed as it could be, some of the challenges that Dr. Ryan and the Committee raises in your paper. So we try to look at all this and say in all these various things, what are the ones we really need to be looking at and yesterday Scott Flanders gave you a good overview in terms of our observations on your

paper, shared with you some of the things that we're trying to deal with. So I think I'll use Scott's talk yesterday as a point to go from.

If we look out there at external factors first, what's going on that we try to keep our eyes on? Obviously first and foremost is this question of Barnwell closure in `08 and what does that mean? Specifically what does that mean in terms of the need to do something to update our guidance on long-term storage of low-level waste.

We owe the Commission a paper in the first quarter of next year. We have to go back. This grew out of the interest some time ago in long-term isolated storage, a short isolated storage and the need to do further guidance development, we will go back with a SECY in the first quarter of next year and make a recommendation to the Commission on that.

Our view as a staff is we look at the guidance that's out there today on low-level storage. There's a lot of it. In some cases, it's very old. The last activities really occurred in the early `90s in an organized fashion and there probably is a need to do something in current terms. We must proceed under the assumption that Barnwell will close and therefore there will be a need for additional

guidance. So that's one thing that's on our plate.

Of course we watch closely and interact with the State of Texas and with WCS regarding its license application for the WCS site in Andrews, Texas. We in fact are meeting later this morning with the Department of Energy. They have received a letter from WCS regarding DOE's interest or level of interest or lack of interest or what have you in ownership of the federal component of that site. The DOE wants to get some of perspectives on that.

GAO as you know is examining programs in other countries to see if there are approaches that we might adopt to improve management of low-level waste. Obviously we'll keep a very close eye on that particular study. In particular, they are looking at centralized storage of low-level waste, financial assurance and tracking of the generation of the waste. Of course, there is the National Academy of Science study on low activity waste. We're looking very closely at that.

Continuing potential Congressional interest and actions at least after the GAO report is produced next year. So we'll be looking to see. We all understand some of Senator Domenici's comments in the past about the question of low-level waste. So

we'll have to see what the GAO report generates in terms of interest in Congress. We don't know what that will be but we will obviously monitor it very closely.

DOE will continue to make progress on the GTCC fund. They expect to issue their notice of intent in early 2006 regarding their environmental impact statement. We have a responsibility to license such a facility if one does come to be. If DOE proposes other than a geological disposal facility, NRC will have to develop a licensing criteria to address that licensing process. Security concerns are regarding sealed sources. GTCC in particular may be a catalyst for action on this front.

I noticed that you also had an interest in hearing about our role on the GTCC EIS. Now the slide indicates this being a cooperating agency. Actually we are a commenting agency. The staff prepared a SECY at the request of the Commission and provided some options of pros and cons as to whether or not we ought to be commenting agency or a cooperating agency.

The staff suggested that we be a cooperating agency. This was in keeping with the type of role that we have for the West Valley site. In the final analysis, we thought that that was a more

efficient and effective way to interface with DOE as a cooperating agency. It could help us down the line in terms of whether or not we have to develop our own supporting environmental impact statement.

But in the final analysis, the Commission saw it differently than the staff. They were driven primarily by their concern that at some point we would have to step out of our cooperating agency role on the EIS and function as a regulator licensing the action and they wanted to make sure we kept an arm's length from that process. So the staff has made DOE aware that we would work as a commenting agency and we look forward to doing that as the EIS process proceeds.

There continues to be a lot of interest in alternate disposal under the 20.2002 process by industry disposal of low activity waste in RICRA hazardous waste facilities or even solid waste landfills. Category 2 landfills, in some cases, is attractive and can be safe and we expect that this will expand.

Historically as you know if you go back and look at 20.2002 disposals or even going back to 20.304, those were onsite disposals but that with the advent of the license termination rule in `97 ceased. No one is disposing onsite anymore because ultimately

they have to consider that waste in their dose determination to determine if the site meets the standard in the rule. So the requests since '97 and certainly in current terms are for offsite disposal typically in RICRA facilities or even landfills as was the case with Big Rock Point.

So organizations continue to look for better ways to manage their low activity waste or their low-level waste in general and we expect this will continue into the future. It will be very interesting from our standpoint to see how the Committee proceeds with the white paper and then in turns how the Commission reacts to that.

Dr. Ryan and I and other members of the ACNW staff have talked a lot about how that could play out and I think what's very important as I look at all of the low-level waste issues is it is interesting because as Scott pointed out yesterday and John Greves, my predecessor point out, the low-level waste program is a very low budget program, about three FTE. So whatever we do on the low-level waste front we must look at in a strategic sense. The staff has certain activities going on, the 20.2002 process, interfacing with the Committee on your white paper, monitoring the kinds of activities that I pointed out that are going

on out there nationally.

But whatever we do, we must do in a strategic sense. The analysis that Scott pointed out yesterday for example you can readily see how you can use a lot of resources just to do the analysis depending on how extensive it was, how it took and so forth. So it's very important that we look at all this in that context.

In terms of internal issues that impact the low-level waste front, we continue to provide technical assistance to the states at their request. We conduct IMPEP reviews of states that have low-level waste facilities.

There's a lot of international work. For example, I participate as a member of the Waste Safety Advisory Committee with the IAEA and the IAEA, for example, amongst the things that that Committee is looking at is waste classification. So we must monitor those international activities and participate actively.

We, of course, are preparing for interactions with DOE on the GTCC front and we're having discussions with DOE about the licensing, what to do depending on about how their EIS comes out and which approach they decide to use for licensing. We

are having some pre discussions with them so they will understand the kinds of information that we would expect to receive from them to license such a facility.

We, of course, respond to the National Academy of Science when asked on low-level waste issues and we confer with GAO. We provide support to other NRC offices dealing with inspections and licensing. The LES case is an example that for fuel cycle folks. We provide assistance to external stakeholders such as CRCPD, the Organization of Agreement States, DOE, EPA and, of course, this Committee and we are involved in the import/export licensing reviews.

The Commission has asked us to provide information to them which we will be doing at the end of the year in terms of how we might make the 20.2002 process more visible particularly to those that are impacted, meaning stakeholders at sites near these facilities where this waste ends up.

We have a lot of interest as does the Committee in the degree to which Part 61 is risk-informed. Part 61 has been around a long time but has worked well. It's not a perfect regulation but it is a very good regulation. It has served the country

well. But like most regulations, it has its flaws and it could be better. So the question is how do we make the process better.

In your white paper, for example, there's a lot of emphasis upon a four-tiered approach. There will be in your commendations we know, but a particular lot of interest in what might be done in the licensing space, in the guidance space, without having to actually get into the rule itself. So we'll continue to monitor that.

There's a lot going on as you can see on the low-level waste side both externally and internally and I would reiterate that whatever we do on this front we have to do within a strategic approach given the limited resources that we have.

On the resource front, we are right now working with an OMB pass back for FY `07 year that portends further reductions for the program. So we'll have to take a look at what that might mean to the low-level waste component of the program, but more to follow as we work our way through that.

Another item that you wanted to hear about is the question of quantities of depleted uranium. The Commission recently directed the staff in order to consider whether the quantities of depleted uranium at

issue in the waste stream from uranium enriched facilities warrants amending Section 61.55(a)(6) of Part 61 Waste Classification Tables of 61.55(a).

Specifically in a memo and order identified as CLI-05-20 related to the Louisiana Energy Services license application, the Commission directed the staff that outside of the adjudicatory process to consider whether the quantities of depleted uranium at issue warrant amending Section 61.55(a)(6) or the Waste Classification Tables in 61.55. The Hearing Board is further considering the disposition of the depleted uranium issue for the LES case because as the Commission noted a formal waste classification finding is not necessary to resolve the disposal impacts contention.

As the Commission noted in its memo and order, NRC considered only specific kinds of depleted uranium waste streams when Part 61 was developed, the types of uranium-bearing waste being typically disposed by NRC licensees at that time not the quantities of material that are envisioned for disposal under the waste being generated by LES. The staff concluded at that time that no separation concentration limit for DU was needed in the classification tables.

Currently we are considering as a staff how to respond to the Commission order. We would like to do it again as part of the overall strategic look at the low-level waste arena that we're conducting between now and probably mid year of `06. There is not a timeline assigned in the sense that there's not a tracking of that order for completion by the Commission. So we do have the opportunity to determine how to best respond in a timely way. We would like to do this as part of our overall strategic assessment.

As Scott pointed out yesterday, Part 61 revisions need to be considered in a broader context. Of all of our work, I have reiterated that this morning and the bottomline with regards to the depleted uranium is that we are going to conduct an analysis as directed by the Commission. We're going to look at the quantity of waste that will be deposed, for example, at the LES site and make some determination as to whether or not there is a need to consider opening up our 61 waste classification as it related to depleted uranium.

On the waste determination front for waste incidental to reprocessing, the work that we're doing with the Department of Energy under the NDAA which is

was passed last year, the Committee has a lot of familiarity with that of course. We provided a road map on the first of December in a memo from myself to Dr. Larkins laying out all of the various steps in the process of looking at the waste determinations and its relationship to Committee activities. You clearly have a very important role in that process.

We are currently developing the standard review plan that we will publish in March of next year. We had a public meeting recently to solicit comments on the scope of that standard review plan. As we continue to develop that, we intend to interact with the Committee and to further get input from you about its construction.

We did work with the Committee in August in a working group on waste incidental to reprocessing which addressed a number of technical issues. We provided some comments to the Committee on its draft letter regarding the standard review plan and we certainly look forward to receiving the letter and taking your recommendations into consideration.

The scoping meeting I mentioned. Latif Hamdan was there. Dr. Croff was there. We participated in that public meeting. The public meeting on November 10th was interesting. We had

attendees there from the Department of Energy, from EPA, from NRDC and from the Savannah River Site Citizens Advisory Board.

The feedback though was of minimal value. In other words, it was a scoping meeting and the question that we were asking everyone was had we identified all the various technical subjects that need to be addressed in the standard review plan and we didn't really hear that we had missed anything. The scope of the document as defined by the staff seemed to be adequate.

There were some discussions about things we should pay attention to. One of the things that I try to do very hard in that scoping meeting was to make it clear that we're not there to debate the history behind the determinations, whether we should or should not be doing them or some of the other issues that have come up on this topic but really are we on the mark with the scope of the standard review plan. And we came away with the feeling that we are.

So we'll continue to develop the SRP and work with the Committee as we proceed to do that. We provided a draft annotated outline on the SRP on the Committee on the 7th of December. We'll continue those interactions.

The salt review itself DOE as you know submitted its first waste determination in February 2005. We transmitted our request for additional information in May of 2005 and the request for information covered a variety of areas including assumptions that were used in the modeling, sensitivity analyses and erosion control. We met with DOE in two open meetings in June and July to discuss the RAI and then DOE submitted its response to the RAI in two parts, one in June and one in July.

Then following the RAI submittal, we met with DOE in two open meetings in July and August to discuss their responses. During those meetings, we requested some additional information in support of certain of their responses. Then finally on September 15th and September 30th, DOE did provide that additional information.

We are currently drafting the technical evaluation report and we have that starting through management concurrence and our objective is to issue that report before the end of this year. We did brief the Commissioners of the findings in the PER on November 15th.

Concentration averaging guidance, this question of DOE being able to make a determination

within its determination as to whether or not the waste of these sites, at the Idaho National Laboratory site, at Savannah River site in the tanks, is greater-than-Class-C or whether it's Class C waste. It's come up in several meetings over the past few months. In those meetings, DOE indicated that it did not have enough guidance from NRC on how to apply concentration averaging to the type of situation being evaluated in the waste determinations.

We met with DOE in July. We provided verbal guidance to DOE at that time which was based upon the 1995 branch technical position of concentration averaging in the encapsulation. In recent waste determination submittals for underground high-level waste tanks at the Savannah River site and the Idaho National Laboratory site, DOE did not specify whether the residual waste within was Class C limits or greater-than-Class-C limits as required by the NDAA. DOE cited the lack of clear NRC guidance on applying concentration averaging as one reason for that omission.

We felt this was a very important issue that they had raised and we felt that it was incumbent upon us to ensure that there was adequate guidance for DOE to make such a determination. What they had done

was to default to the assumption that there was greater-than-Class-C and they would meet the performance objectives accordingly without actually making the call whether there was greater-than-Class-C or Class C waste based upon concentration.

On December 5th, we sent a letter to the Department of Energy and we also released a *Federal Register* notice that provided draft interim guidance on the application of concentration averaging principles to the types of situations typically encountered within the DOE waste determinations. In that letter, we indicated to the Department of Energy that with this guidance they should have an adequate amount of information to make a call as to whether the waste being evaluated in their determinations is in fact greater-than-Class-C waste or not.

CHAIRMAN RYAN: Just a quick point to clarify. That guidance was based on the `95 guidance that already existed.

MR. CAMPER: Yes, it was.

CHAIRMAN RYAN: Okay. I just wanted to make sure.

MR. CAMPER: Based upon and built therefrom and we also coordinated it with the Center and tried to make it so that it would fit, built upon,

the `95 guidance but to cover the types of situations they're evaluating.

In the *Federal Register* notice, we pointed out that this guidance would be part of the standard review plan. We're going to collect comments on the guidance until the 31st of January and we'll address any comments that we get as we look at the comments we receive on the SRP in an integrated fashion. We also, of course, provided that draft interim guidance to the Committee last week.

The Savannah River site tanks 18 and 19 review has commenced. The DOE submitted its draft waste determination for in-place closure of tanks 18 and 19 at the Savannah River site on September 30th. We have already met with DOE on that submission. The purpose of the first meeting was for them to explain some of the approaches that they used in that determination. We agreed in that meeting that both DOE and our staff would identify technical topics that warrant specific discussion and we would move into meetings in January to address those topical issues. That meeting took place on the 30th of November. Our plan is to issue our first RAI on tanks 18 and 19 submission in early March following the meetings that we'll have in January.

Regarding the Idaho tank farm review, DOE did submit its draft waste determination for the closure of the INELL tank farm on September 7th. We met with DOE on October 4th in an open meeting so that the DOE staff could provide an overview of their submittal and we expect to issue an RAI on that submittal in early January.

Regarding Hanford which is not covered under the NDAA, the Nuclear Defense Authorization Act, but we are doing a consultancy work with DOE for the Hanford tank closures as well. They submitted a portion of their performance assessment for single-shelled tanks at Hanford and the remaining portion of the performance assessment as well as a revision of the first portion is expected to be received by our staff early in `06.

The other thing that I would point out on the waste incidental determinations is that we have held a conference call with the executives at the Department of Energy regarding the process that's been doing on during the first determination review. Jack and I are speaking this week with the State of South Carolina on some of the issues or concerns they raised during the review. Their concerns focus primarily upon the amount of time that it takes for the reviews

to be done and we're going to try to talk with them and address some of their concerns. We have all agreed, the DOE, the NRC and the state, to have a lessons learned meeting in January to figure out what we can do to make the process even more efficient and effective and get it done faster and so forth.

On the decommissioning front, we've had a number of activities this year. I would point out again that the Committee's involvement in helping us to develop the guidance on decommissioning as we try to update the process has been of a great utility to us. The workshop I thought was extremely successful. We had a two day workshop back in April. It was sort of a roll-your-sleeves-up-and-tell-us-how-we-can-do-this-better workshop and there was a lot of good input.

We're going to be developing our final guidance as a result of our license determination rule analysis in September of `06 and there's going to be a follow-up to the June `05 Committee working group meeting and your letter on the draft guidance and public comment period on the draft guidance ends at the end of December. We're starting coordination with the Committee staff to set up ACNW meetings to summarize public comments and start draft responses

and obtain feedback from the Committee.

After further follow-up to the June `05 status briefing, we plan to interact with the Committee and keep it aware on the status of and seeking feedback on a number of things including our work on preventing future Legacy sites. The staff will be doing a proposed rulemaking and draft guidance by September of `06 and the idea generally behind this approach is to try to take a look at what has happened out there at the sites when they've had operational failures that resulted in groundwater contamination, subsurface soil contamination, that resulted in an increased cost to decommission these sites and what can be done to prevent that in the future.

Groundwater monitoring, we are preparing a draft guidance on this which will be done by September of `06 as well. We are formatting plans on the draft guidance for integration with the Office of Research and we plan to present the draft guidance to the ACNW and to seek feedback.

With regards to lessons learned which has been getting a lot of attention, the Commission has a lot of interest in it, we've had an initial meeting with EPRI, NEI, OAS to plan our consolidated path forward to collect and memorialize decommissioning

lessons learned and we will continue to update the ACNW on the status of staff activities. We had a meeting with NEI EPRI back about six weeks ago. Those organizations are also very interested in capturing lessons learned.

At some point in the near future particularly on the reactor side, we're going to go into a hiatus in decommissioning. Now we can see the next bough wave of decommissioning on the reactor side out there in 2025, 2030, around that timeframe. What's terribly important is that we capture all the lessons learned that we and industry have gained as we've been decommissioning power reactors and continue to decommission them so that those who follow us can benefit.

West Valley, there's a lot of work going on West Valley. There is a draft of our environmental impact statement being prepared. `06 is a benchmark year for the development of that environmental impact statement. Similarly in `06, we are to receive a decommissioning plan for the site prepared by Department of Energy. I think you're aware that Nyserda in conjunction with the Citizens Task Force at West Valley proposed some legislation which one of the Congressman from New York is working toward

introducing as legislation in Congress. That's going through the preliminary pre-committee work that goes on in Congress on that particular legislation and we'll continue to monitor that very closely.

The legislation as proposed certainly could have some impacts upon our interactions at West Valley because some of the things proposed in that legislation if it ever become legislation would be remarkably different than what is currently contained in the decommissioning policy statement for West Valley. So we'll continue to interact with the Committee regarding the contents of that environmental impact statement and keep you posted on the staff's work there.

I've covered a lot of topics. I've said a lot. So I would invite any questions you might have.

CHAIRMAN RYAN: I guess there's a lot of work to do.

MR. CAMPER: Yes, there is.

CHAIRMAN RYAN: Sounds great. A couple of things just at the top level of the excellent detail you provided to us, Larry. One is I think our focus and I'll start at the low-level waste white paper is that some of the things you touched on throughout your

talk, one is to document the rich history that's out there because soon we'll be handing off that to a next generation of folks that will go what were they thinking and two is to focus on the risk-informed opportunities that we see from a technical standpoint as well as a risk-informed standpoint.

MR. CAMPER: Right.

CHAIRMAN RYAN: We're also very mindful of the fact that with the rich agenda that you have in front of you and probably not unlimited resources to manage it, that they will be a prioritization from your perspective and we're certainly sensitive to that and are not trying to and in fact are explicitly avoiding trying to identify things with any type of priority or urgency.

One thing I think we will clearly point out in our letter as we transmit this to the Commission is that we believe that the current regulations are protective of the public health and protective of worker health and safety. From that standpoint, there's a basis of success in meeting that fundamental requirement. What we see are opportunities that are along the lines that you've mentioned of making it more perhaps user friendly, more transparent, more easily understandable and

interpretable and things that help applicants and stakeholders understand the process a little bit better and perhaps make it more risk-informed so it's in tune with what we've done in other areas of nuclear regulation. I think that's an important thing for us to hold as our principles of how we're going forward and again interacting with you on the many issues that you identified.

Let me start with Bill Hinze. Any questions for any of the three?

MEMBER HINZE: I'll pass.

CHAIRMAN RYAN: You're okay. Allen.

VICE CHAIRMAN CROFF: I'll try one or two. Larry, when you were talking about greater-than-Class-C if I understood what you said, if DOE were to propose disposing of it not in a geologic repository you would have to develop rules to do that. But that wouldn't be needed if they proposed geologic disposal. Can I infer from that if they go geologic disposal you'd propose to use the existing Part 63 framework? Or what would be used for that?

MR. CAMPER: Possibly. We would have to wait and see. They have several options they can consider and it's really going to depend upon which one they would go with. But either use that or use it

as a good baseline framework from which to make any changes that may be necessary. But now if they proposed something other than that, then we would have to develop a licensing criteria and process.

VICE CHAIRMAN CROFF: So you're saying the existing rules for geologic repositories would be a starting point.

MR. CAMPER: Absolutely.

VICE CHAIRMAN CROFF: Not the end point necessarily.

MR. CAMPER: Correct. That's right.

VICE CHAIRMAN CROFF: Second then, and I'll address this at you. I don't know if it's your area. But the Department of Energy is developing a new generation of advanced reactors and fuel cycles to go along with them and in legislation, I think it was last year, Congress directed the NRC, and this would probably be NRR, to initiate a dialogue between the two concerning how those would be licensed in the future, the reactors. Is there any similar dialogue ongoing concerning the fuel cycles or the waste that might come from these in the future?

MR. CAMPER: I can't comment on that. Jack, do you have anything?

MR. STROSNIDER: I don't know that we have

anybody here.

MR. CAMPER: I have not been directly involved in such dialogue, but we don't have anybody here from fuel cycle I don't think.

MR. VON TILL: I'm representing.

CHAIRMAN RYAN: Could you just use the microphone and tell us who you are please? Thank you.

MR. VON TILL: Bill Von Till. I'm the Chief of the Uranium Processing section representing fuel cycle. I would probably have to get with Bob Pierceson to see if there's been any dialogue from that standpoint. Can I get back with you on that?

CHAIRMAN RYAN: Sure. That would be great. I think it's one of those advanced thinking questions where when we hear about the new generation of reactors, of course, our obligation is to think about the waste and I always think about a reactor as a system that includes the waste on the front end and the whole cycle. So we're just getting our feet wet on those questions. That would be helpful.

MR. VON TILL: Sure.

CHAIRMAN RYAN: Great. Thank you.

MR. CAMPER: We agree and that's one of the reasons every time we get a chance when we're talking about decommissioning if there's going to be

new generations of reactors we should think about decommissioning on the front end.

CHAIRMAN RYAN: Design them like you're going to take them apart.

MR. CAMPER: Sure.

CHAIRMAN RYAN: There are lots of opportunities across that spectrum of issues.

MR. CAMPER: So we owe you an answer on that one, Allen.

VICE CHAIRMAN CROFF: Okay. Thanks.

CHAIRMAN RYAN: Ruth.

MEMBER WEINER: Thank you for a very thorough presentation.

MR. CAMPER: You're quite welcome.

MEMBER WEINER: I have some questions about the whole DU question, depleted uranium question. We have had depleted uranium from natural uranium enrichment. We've had the DU tails around for decades. We use DU in a variety of applications. We store it. We transport it. Is this concern that DU is waste or how to handle it as waste being driven entirely by LES?

MR. CAMPER: Principally, yes. Principally. To answer you, there are two categories of things to think about. If you look at it, what are

the central questions that we'll have to look at, for example, in this analysis? We'll need to determine whether the depleted uranium from the Richmond facilities is low-level waste of greater-than-Class-C category. Is it? The determination of the proper low-level waste class, A, B or C, assuming that it is low-level waste, the issue is is that it wasn't analyzed for the volumes that are envisioned for the LES disposal at the time the Part 61 was created and that's what part of the contention is about. Then there's this question of the Tables 1 and 2 in 61.55. They did not include uranium isotope concentration limits to classify low-level waste containing uranium. We need to look at that.

Now what can you make of the contentions that were filed? There is this question of whether or not it is GTCC in the view of some rather than low-level waste. There's the question of near surface disposal of depleted uranium and noncompliance with performance objectives under 61.40 or .41 or .42. There's a contention regarding DU classification Class A waste using the transuranic concentration in Table 1 and demonstrations and analogies between transuranic radionuclides and DU isotopes. The contention regarding disposal of DU in deep mine cavities. Of

course, the State of Utah, if you use DU as low-level waste as we know. But the point is is that all of those kinds of questions and technical issues need to be looked at in some orderly analysis which wasn't done years ago.

Now Dr. Abu-eid, Bobbie, as we know him is our Senior Level Scientists and Bobbie's going to be the central figure in this analysis. Bobbie, do you want to add anything to the points I made.

DR. ABU-EID: Yes. Good morning. Thanks for these good questions. I'm really enjoying your feedback and we look forward for more. I believe the disposal of DU is a contentious issue and has been there for some time and the reason is because the 10 CFR Part 61.55 indicates that if certain radionuclides are not listed in Table 1 and 2 this means the waste of the class is supposed to be considered as Class A. That's number one and uranium was not listed in Tables 1 and 2. So it is an issue that the staff may consider this based on the current regulation as Class A waste.

Also there was earlier contention even whether it is a low-level waste or GTCC and I believe the Commission decided on that and they recommended or they ordered that this waste to be considered as low-

level waste. So this is the result and the question is whether it is Class A waste or not Class A waste and that is for disposal in a mine cavity that there are some issues regarding the study and the analysis because of the DU issues that were submitted that relied on this analysis. This is another contentious area that it may be not advisable to talk about it now.

So those are the major issues and other issues, chemical issues, solubility of uranium, about the source term and the performance assessment methodology. It is unfortunately that our previous performance assessment methodology was actually more of deterministic in nature, not probabilistic in nature. The scenarios that were used previously they were not also probabilistic in nature, deterministic not probabilistic. So all of those issues I believe the staff needs to deal with when we tackle the issue of the DU disposal.

CHAIRMAN RYAN: Just as an early example if I may, Ruth, I think this is an interesting one because in our own thinking which we'll hopefully finish up the letter in this meeting, that kind of risk-informing scenarios that are the foundation of the concentration tables and the classification tables

might be a great starting place and this might be an interesting case to start with. Sheets of DU metal are probably a little bit different than you would think from enrichment waste or perhaps other chemical forms of waste as Bobbie points out or fuel fabrication waste for that matter. So it's an interesting array of materials. Thank you, Ruth.

MEMBER WEINER: Thank you. I was also interested since we ship a good bit of tails from enrichment all around the world. But you are aware that any NRC decision or classification decision will have some international implications.

MR. CAMPER: Absolutely and the first step is this analysis to determine if there is a need to make any adjustments to Part 61 and you're right. Any changes would have far-reaching implications.

MEMBER WEINER: And I presume you're going to bring this to ACNW in due course.

MR. CAMPER: Oh, we are. The answer to that is yes.

MEMBER WEINER: Thank you.

CHAIRMAN RYAN: Jim.

MEMBER CLARKE: Just a comment. I would like to echo some of the statements that have already been made and tell you that personally it's been a

real pleasure working with you and your staff.

MR. CAMPER: Thank you.

MEMBER CLARKE: We think the early involvement in the decommissioning in West Valley has been very beneficial to our deliberations and we look forward to continued interactions with you.

MR. CAMPER: Thank you. Thank you very much.

CHAIRMAN RYAN: Thanks, Jim. Any other questions or comments? I'm sorry. Yes. Sure, John.

MR. FLACK: John Flack, ACNW staff. I just wanted to follow up a little on Allen's question because we are on the reactor side of things in the wake of the Energy Policy Act of 2005 looking at all the needed expertise over the out years now as we begin to deal with that. The question is on the nonreactor side do you see anything there in the wake of the Energy Policy Act of 2005 that would require an improvement in the infrastructure or expertise or work load above the baseline that you see now.

MR. CAMPER: Yeah. Possibly. We're working through, the agency is working through, this question of what to do about the materials that are impacted under the Act that we heretofore have not had legislative or regulatory authority for. So depending

upon what regulations we develop to address that question, we may have some additional work to do. Yes.

MR. FLACK: It's just not clear at the moment though what specifically.

MR. CAMPER: NARM, NORM. The question of NARM and NORM. There will probably be a need to develop some infrastructure to deal with that.

MR. STROSNIDER: I think part of what's happening in the activities now, the rulemaking, etc., is to define the scope and the definition of scope and that will drive what additional areas we need to get into, resources, etc.

MR. CAMPER: And then as we work our way through that rulemaking obviously the questions we'll be asking ourselves is what is the infrastructure, what does it mean in terms of implementing the guidance, the rule and what is needed to do that. But I think the simplistic answer now is probably yes.

DR. LARKINS: Let me just follow up. Will there be an opportunity for the Committee to hear about what type of regulatory role you might take with NORM and NARM?

MR. STROSNIDER: Yes. We can work that into the calendar. We have a task force that's

working on this and you might be very interested in the activities they have and where that's headed.

CHAIRMAN RYAN: One question that struck me as you were making your earlier comment on it and it's on John's point is it depends on how you define discreet source and include what NORM or NARM. I mean that's a balloon that gets real big or gets smaller based on how those fundamental things happen. We may be able to offer some insights that might be helpful at least on what those boundaries or shapes might look like. So we'd be happy to interact with you on that.

MR. CAMPER: I think just to echo Jack's point. Given that we have a group right now working on the rulemaking to enact the responsibilities under the Energy Act, I think as that group works its way through the process, Dr. Larkins, getting back to your question it would be good for the Committee to hear from the working group.

DR. LARKINS: That would be great.

CHAIRMAN RYAN: Other questions or comments? John?

DR. LARKINS: Yes, just a comment. Following your comment about thinking strategically about what needs to be done in the low-level waste area. I agree with that. I think what we need to do

is to somehow assess what the interests are in the low-level waste arena out there and then decide on a strategy and priority and then provide some options for the Commission in order to decide later of what type of regulatory agenda they might want to establish in that area.

MR. CAMPER: I would whole-heartedly agree with you. In the near term as we develop a strategic assessment to the low-level waste area, one of the important components of that assessment development will be interacting with some stakeholders and we would like to do that early in calendar year `06 to get some input.

Now I know, for example, that NEI EPRI is taking a long look at the current waste classification scheme of 61.55. They've indicated to us for example they would like to do a pilot where they would focus upon one or two or three radionuclides with the objective in mind of ultimately determining if in fact the waste classification scheme should be examined. They might do that depending upon the outcome of their pilot in a proposed rulemaking, a petition for rulemaking.

Now that is a factor that we have to keep in mind. To what extent can we as a staff given

limited resources leverage the work of this committee or the work of NEI EPRI or others as we determine the need for additional guidance in low-level waste storage? So whatever we do on the low-level waste front has to be done in a strategic sense because as Dr. Ryan pointed out, we just don't have a plethora of resources. So it has to be strategic. It has to be well thought through. I has to get stakeholder input. It has to be appropriately prioritized and make sure we're getting the maximum return on investment. Margaret, did you want to add a comment?

MS. FEDERLINE: No, Tom might.

MR. ESSIG: Yes, Tom Essig. I'm Chief of the Materials Safety branch in NMSS. Getting back to the comment earlier, I meant to jump in when we were talking about possible involvement by the Committee in the NARM/NORM rulemaking that we're working on. Unfortunately, that's on such a tight schedule which is driven by the Energy Policy Act that I'm not sure to what extent we can accommodate a cycle through the Advisory Committee and secondly, a lot of the issues that we're facing with regard to accelerator-produced materials are in the medical arena and we have engaged our advisory committee on the medical uses of isotopes already. So we're getting input from them.

MS. FEDERLINE: But we're very sensitive to your needs. So let us look for when we could find an opportunity to go to the waste interface.

CHAIRMAN RYAN: Well, it's not just the waste. It's the material aspects as well and I think there are many other radionuclides that are produced that are not medical and one thing we've done and we might think about this option is on our working group, for example, on health physics questions, the ICRP documents, we had a working group where we very specifically included members of -- for just exactly that reason. It was the solo-lapse (PH).

So there may be opportunities to actually put us both in the same place and I think that joint interaction actually enriches your information base by hearing the different points of view on the same. Cobalt-60 is cobalt-60 independent of who is using it. That might be an opportunity to collaborate with them a little bit more closely. Thanks.

MR. STROSNIDER: Thank you.

CHAIRMAN RYAN: Any other questions or comments? Thank you. Again, we appreciate the briefing and I conclude there is lots of good work to do and not enough time to get it all done and anybody that wants to help is welcome. We're happy to have

the briefing and look forward to our continued good work together. Thank you all very much for coming.

MR. STROSNIDER: Thank you for your time today and everyone have a good holiday season. We look forward to working with you in 2006.

CHAIRMAN RYAN: Same to all of you. With that in mind, I think I would like to just -- Let's see. We're scheduled for a 10:30 a.m. start. Let's take our break 10:00 a.m. to 10:15 a.m. and then we'll come back and get our schedule for letter writing organized at 10:15 a.m. Thank you. We'll take a break for 15 minutes. Off the record.

(Whereupon, the foregoing matter went off the record at 10:01 a.m. and went back on the record at 10:21 a.m.)

CHAIRMAN RYAN: On the record. Thank you very much. I want to turn this portion of the meeting over to Dr. Weiner for a discussion on Generalized Composite Modeling. Ruth.

MEMBER WEINER: Thank you very much. We are going to hear today from Dr. James Davis from USGS who is going to talk about the field work which basically supports the modeling on new views of sorption and desorption and radionuclide mobility and, Bill Ott, do you want to say a few words for openers?

MR. OTT: Okay. You recall in the November meeting we had a very broad program planned in which we were trying to present all of our geochemistry research to you and Jim was a key part of that and couldn't attend. So we shortened the meeting and I filled in for him a little bit and Randy Cygan filled in for a little bit. Jim is not just the PI for the Naturita work for the Commission. He was also the Chair of the Technical Direction Team for the NEA Sorption Project and he was the Chair of the Working Group 3 for the MOU on Research and Development on Multi-Media Environmental Models, both of which we reported to you on at the November meeting. So since we have enough time, if you have questions on those matters as well those are fair game to hit Jim with.

I say that only because I was pitch-hitting for him and I know he's far better at answering those questions than I was. Jim is very distinguished and a highly respected member of the field and is quite sought after for his expertise in this area. He's going to focus on the Naturita work, the field demonstration project that we had that we had put together to demonstrate that we are at a state in the science where we can start applying this work in a regulatory framework and that's the important

thing for us because the regulatory framework up until now has been dependant on extremely simplistic analyses and analyses that you couldn't actually say were conservative or nonconservative. So we're pushing toward more realistic analyses that we can actually have some credibility in the licensing arena. Jim.

DR. DAVIS: Thank you, Bill, for that very complimentary introduction. In talking with Ruth Weiner in preparation for this presentation, we decided that I should summarize some of the previous work. I did speak before the Committee in June of 2004 and at that time, I summarized the Naturita project and the conceptual model that we had developed for sorption and how that was coupled with transport. So I'm not going to really focus on the details of that today but I will summarize some of that previous work and that sets the context to describe our current research. So the bulk of the talk today will actually be about the work that we've been doing now and a little discussion of where the project is headed.

Of course, there are many aspects of performance assessment and the part that we deal with is the modeling of the chemical aspects of radionuclide transport or the geochemical aspects and

so from the context of waste disposal that means thinking about transport of radionuclides via groundwater pathway is the main target of our research. For decommissioning, it also is an important aspect because it's important to understand whether an radionuclide is moving away from a site or whether it is in fact going to be staying present at a site.

In current practice, of course, we all understand that the conceptual model for sorption processes is to use a constant Kd value to describe retardation and we believe our research which is described in detail in NUREG CR-6820 which is the summary of the Naturita site research that we did in the previous sorption project that we demonstrated the utility of a more robust conceptual model to describe sorption. We believe this more robust approach decreases the uncertainty in PA in the geochemical aspect or the retardation aspect of performance assessment calculations and because of that, it increases the scientific credibility of that part of the PA modeling and in some cases in the standpoint of decommissioning, it might be useful for a deduction of cost for licensees.

With that as an introduction, we'll move

onto the next slide and just a demonstration about why we should care about this and this is not a field system but it demonstrates the point that over here we have log Kd values for uranium sorption on a pure mineral phase ferrihydrite across a very wide pH range. But if we look at the pH range that we're most interested in, around 7 to 8 for groundwater systems, you can see that you have two sets of data here, Kd values determined in a system equilibrated with air or Kd values in a system equilibrated with a 1% partial pressure carbon dioxide.

This is a very typical value for groundwater 1% CO_2. And you can see that say at pH 7.5, this decreases the Kd for uranium by several orders of magnitude, three orders of magnitude. So in other words, it's important to understand this interaction in the environment because this means that the uranium be 1,000 times more mobile, 1,000 times less retardation, just with this simplified approach here. This is important because most of the Kd values available in the literature are determined in systems equilibrated with air.

This just shows the reason for it which you probably already know which is the reason that the Kd value goes down so much at these higher pH values

is that it forms uranium carbonate, dissolved uranium carbonate complexes. This is just showing you it equilibrated with air and at higher partial pressures of CO_2 these species move over to even lower pH values. So that's the reason for the decrease in the Kd value and this is important for other actinides too including Neptunium-5.

And an important thing to think about in terms of conceptual models of sorption is that this is derived from the NEA thermodynamic database. The NRC and many other agencies from other countries have invested in the development of this database. It's used in the PA process to determine solubilities that would come out of a waste package and therefore the highest concentrations it might move away from a waste package. But we can also use this database and we do use it in our more robust model for adsorption where we couple together this aqueous speciation data and the thermodynamic data that it is derived from to describe the dependence of Kd values on chemistry.

So here is simple representation of different conceptual models for describing sorption and over here is the common practice of using the constant Kd value and this is strictly valid for systems with constant chemistry in both space and time

and linear adsorption. Nonlinear adsorption can occur but things are made even more nonlinear when you consider the actinides or any radio-elements that undergo big speciation changes as chemistry changes in either space or time in groundwater and for these, we get a more accurate description adsorption and retardation if we use thermodynamic sorption models.

A thermodynamic sorption model is simply what I was describing in the last slide. It's a coupling together of the aqueous speciation data together with some reactions to describe adsorption. This gives us Kd as a function of chemistry.

Now how important the choice of the conceptual model really depends on how much chemistry is going to vary in a PA scenario. If we have a PA scenario where chemistry is constant in space and in time, then we don't need this more robust model. When we need this more robust model is when we think chemistry is going to change in space or time. So this gets into thinking about are we going to have climate change in long-term models for waste disposal that might affect the carbonate chemistry and for decommissioning, we often find that in the field because it's a waste event. If there's a plume, then we have chemical gradients in the system in space in

which case we could need a more robust model to describe sorption.

I was asked to provide a little history of the USGS/NRC interaction and our first project was work on, it's described in this NUREG report. This was a study of a natural material from near Koongarr uranium deposit in Australia. So there was a focus on that natural material. But really the focus of this project was about developing thermodynamic sorption models for single mineral phases that were present in that natural material near the Koongarr deposit and specifically ferrihydrite, quartz and kaolinite where the minerals that were studied.

The idea was -- Now in the previous slide, I talked about thermodynamic sorption models on the right. But in fact there's a range of ways to develop a thermodynamic sorption model and this was one thing that was part of the Naturita project. One is to think about a forward modeling approach which is a more deterministic approach and I call that science here because that really is the approaching this problem of describing sorption on a natural mineral assemblage by breaking it down into its parts and trying to understand how much radionuclide sorption occurs on individual mineral phases and using this

approach one can have the idea of developing a database. How does uranium adsorb on quartz? How does neptunium adsorb on ferrihydrite and so forth and build up a predictive model? The model itself may be site specific in that each site has different amounts of mineral phases but the idea is that we're drawing from a database just like we draw from a thermodynamic database for aqueous speciation.

What we did on the Naturita project though was to demonstrate a different approach which can be thought of as a more practical or engineering approach where instead of trying to develop a predictive model we use the aqueous speciation thermodynamic data and we couple it together with an inverse modeling approach similar to what's used to develop flow models in hydrology where you collect adsorption data for a site-specific material and you study adsorption of the radionuclides of interest for the field conditions that are relevant. So from a PA scenario point of view you want to look at what chemical variables are going to change in time and space for your scenario and you want to know how adsorption is going to vary across that parameter space.

This approach, we call this a semi-mechanistic adsorption model. It is a site-specific

model. We still have to do more work to see whether it has transfer value but we believe this simplifies the complex parameter estimation that's necessary in using a forward modeling approach.

This now talks about the forward modeling approach just demonstrated what I've already said is for particular sediments you want to look at what minerals are present and you want to try to quantify how much, in this case, we were interested in uranium at Naturita. So we would like to know from a database how much uranium is going to adsorb on each of these things and then the total sorption for the sediment is going to be simply a matter of summation. And there are some databases already in the literature for individual mineral phases.

However there are problems and we've demonstrated in the Naturita project. It's not really written up in the NUREG but it's written up in the follow-up article in *GeoChemica* that there are problems. You don't really get a good -- Well, you can get within 1 to 1.5 orders of magnitude across chemical space using this modeling approach and the problems are that these more scientifically-based models have electrical double layers and we have the problems that we don't understand very well in natural

systems of overlapping double layers among mineral phases and difficulty in characterizing the relative surface areas of each of these minerals. You can't use x-ray defraction or some mass-based approach to say there's 65 percent quartz in the sediment. So therefore 65 percent of the uranium is adsorbing on quartz. That doesn't work.

You have to understand the relevant surface area of each of these mineral phases and that's difficult to characterize at present time. So that's the reason this additive approach which is a more deterministic approach doesn't exactly produce what we would like from a practical point of view at this point in time.

As a result, we had this demonstration project to illustrate the utility of the inverse modeling approach and in this project, we also demonstrated through collaboration with NRC staff the incorporation of this into PA calculations and dose assessment was actually done and there's a section in this NUREG report where that is done and demonstrated. So whereas our previous project we'd worked on, this database development for individual mineral phases, here we took a natural system and we used this more engineering approach to describe sorption as a

function of chemistry and we showed I think quite convincing that this approach can be applied.

I'm just going to show a brief summary of that work. These are chemical concentration contour plots for the Naturita site in 1999. Here you see dissolved uranium concentrations in the aquifer that this reach of aquifer here is about 2 kilometers in space and here you see the area of contamination in 1950, where the original contamination, the source, was to the aquifer.

Ph is relatively constant in the aquifer and alkalinity however has a distribution similar to uranium and that's because there was a source of alkalinity as they put either acid-leeched or base-leeched tailings onto the land surface and because of the calcite in the subsurface material, this produced alkalinity in the groundwater and has a distribution somewhat similar to the uranium contamination. If you put together these pH values and these alkalinity values, you get partial pressures of CO_2 of 1 to 10 percent. Remember I referred to earlier about the importance of high partial pressures of CO_2 in increasing the uranium mobility and the calcium it also turns out is an important aspect of it and it's controlled by the solubility of calcite.

So now variable alkalinity is the parameter that drives the need for a better model adsorption than constant Kd at the site. So we collected Naturita sediments, subsurface sediments, and studied the absorption of uranium over relevant groundwater conditions, not over a large chemical space, but just over the range over which the important variables changed. And from that, we calibrated a uranium sorption model, this inverse model, and I'm not going to describe that in detail because I did that in June and it's in this NUREG report that I've been assured that all of you have read in the last week.

The cost for this model was not that great which I think is an important point to make. The cost of the research project was significant but you have to remember we were doing the entire thing, the field characterization, the hydrology, the flow modeling, everything. The development of this sorption model, the cost was not a significant part of the project.

So then after developing a flow model, we used this to simulate uranium transport at the site from the original area of contamination. So this is now going from -- This is a simulation. I'm not sure why the left side of the slide is being cut off for

some reason. But with the simulation, it runs from, this is a 62 year simulation from the beginning of the deposition of tailings on the land surface and up here we have the observed uranium concentrations and down here we have the simulated uranium concentrations and this is not doing any fitting here. We have taken the flow model and we have applied the surface complexation model that we derived in the laboratory. So we are not trying to fit these observations.

Now the one thing that we did have to estimate though is the source term. We did not have accurate source terms. So we made our best estimations of those source terms and that does influence the simulated values. One thing that you can see is we don't simulate the alkalinity perfectly and that would affect our uranium simulations.

But an important thing to notice is over here that we have a distribution of Kd values predicted in the model. This is the distribution of the Kd values after 62 years of transport and so there's a spatial variation in the Kd values. The reason for that is that the spatial variation is chemistry. It's not due as I'll show in a minute to some variation in the sediment properties.

In fact, the model we've developed is

based on a large composite sample of uncontaminated sediment that we did the adsorption experiments with. So we assumed in this model that all the sediments in this aquifer are the same and we get this variation in Kd by about an order of magnitude which is because of the spatial variation in chemistry in the aquifer and this thing changes over time. This is just a picture at 62 years of transport.

So this is important is that some approaches to variation in Kd that I've seen being considered for nuclear waste disposal talk about using a bell curve or a normal distribution of Kd values. But that loses if there are in fact chemical gradients. That's not really an appropriate way to sample that distribution with Monte Carlo (PH) techniques and assume that it's anywhere on this bell curve. This has spatial character and we have lower Kds where we have high alkalinity. At the Yucca Mountain site for example, there is spatial changes in alkalinity as you move down gradient in that aquifer.

So that's a summary of the previous work and now I'm going to move onto talking about the current project and mostly what I'm going to talk about today is that the couple geochemistry and flow modeling approaches that were used at the Naturita

site have been written up in detail in this NUREG report that was published this year and then we are also working on development of field-based Kd validation techniques at the Naturita site in follow-up research and this NUREG, a draft of this, will be produced by February of next year.

I've made a few changes in my presentation. So the next few graphs are going to appear at the end instead of where it is in your handout. What we have in the NUREG 6871 is a documentation in detail of the reactive transport code, RATEQ, which was used for the Naturita modeling and was also used by NRC staff to do the performance assessment calculations that are in that NUREG report.

So the documentation of the NUREG is quite dense. It's all about the parameters and the computer code itself. But the part that's probably more interesting is it has simulation setup in the operational procedures. It has some benchmark test problems and simulation results for a wide variety of transport scenarios. So I think the NUREG will be of interest to those that are in the reactive transport field.

I'm just going to show a few simulations to give you the feel of what it can do. Some of this

material is not in the NUREG. I showed you before simulations for the period from 1930 to 2002 and in those simulations we didn't know the source term. But here we're starting from present day conditions and predicting forward using the flow model and our inverse model for uranium sorption at the site.

So here we know the existing conditions. We at least have that part right and the source has been removed by the Department of Energy during 1996 to 1998. So the source has been removed. As time goes by, we can find out whether our simulations did well or now. We'll all be dead by 100 years from now of course but maybe in 20 years someone will go back and look at this.

The interesting thing here is that you see that the dissolved uranium, the high concentrations, the peak concentrations, move out of the aquifer relatively quickly and that's because of the high alkalinity associated with that peak and you see that the alkalinity also moves out fairly quickly. But what's retained as the alkalinity moves out, there's a tail to the dissolved uranium and that leaves a fair amount of uranium in the aquifer for a long period of time well above the drinking water standard. This would not be predicted by a constant Kd model which I

will show you in a second. Well, it could be predicted but in a way that does not then describe the arrival of the peak concentration.

The important part of the surface complexation model compared to constant Kd which I'll show in a second is that they differ in describing the arrival of the peak and they differ in the fact that there's a long tail that's simulated with our modeling approach.

Here is a plot of the distribution of Kd values in the field. One is based on taking measurements across the field site, the dissolved measurements, and then using our thermodynamic sorption model (TSM) to predict how much should Kd vary and this is a cobble (PH) corrected Kd, how much should Kd vary as this chemistry varies and we get this distribution and then we also have contaminated sediments that remove from the aquifer and we measure actual Kd values for that material using the uranium isotopic exchange and for that we get a variation in Kd.

Here we're looking at a groundwater variation. Here we're looking at both a sediment and groundwater variation. So they produce different distributions but the 50 percent probability is a

value of about 0.26 for the Kd. I'm going to show some simulations of constant Kd using this 0.26 Kd value.

Here you can see the difference in uranium distribution that's produced by the thermodynamic conceptual model for sorption and the constant Kd conceptual model for sorption using this average Kd value. And it does what I was attempting to describe earlier that the thermodynamic sorption model has a tail on the uranium movement out of the aquifer and the reason is that as the alkalinity moves out, sorption becomes stronger and at lower uranium concentrations, sorption becomes stronger and the Kd rises.

Also because of the alkalinity, in fact, this peak uranium concentration moves out faster in the sorption model than it does in the constant Kd model. This just shows that in fact these model produce different results whether we believe this is going to be a more accurate representation than what's actually going to happen. We don't think the cost of getting there was much higher than one we'd get from determining a reasonable distribution of Kd values. So we feel that this representation of sorption and retardation in this way is a better modeling approach

for performance assessment.

I'm going to skip this slide but basically this shows for this particular observation point, I guess I'm not going to skip it because I'm going to talk about it now, that how long it takes to get to the drinking water standard which about 10^{-1} uranium concentration and our model says that at this point because of the tailing it's going to take 100 years to get down to the drinking water standard. You have to have very high Kd values, way above the average, to get that value using a constant Kd and if you had these high Kd values, then you would have a very bad description of the movement of the peak the bulk of the uranium out of the aquifer.

So now I'm going to talk a little bit about some of the independent tests we've done of the model and this is going to get into some of our current research. A little bit of this has been described in the Naturita NUREG report. I'm going to talk about testing the model by putting uncontaminated and/or contaminated sediments in contact with groundwater of variable composition from the Naturita site and we're going to talk about taking contaminated sediments from the subsurface at Naturita, bringing them to the lab and putting them under constant

chemical conditions.

We have done this work by suspending both Naturita sediments and as I'll show you in a minute single mineral phases into wells in the Naturita aquifer which they have variable chemistry as I've shown previously. The orange dots here show which wells we were using. We have put the sediments into the wells for periods.

Initially we used three to 15 months but we found no time dependence whatsoever during this time frame in the measurement of Kd values and now we in fact use one month to equilibrate and we use dialysis bags. Here we were using a very small mesh bag that was able to contain the Naturita sediments. But now we're using fairly small sized mineral phase particles and we're using dialysis bags. So in this case, we're using this large composite of uncontaminated sediments and therefore we had the same sediment put into the wells and the only variable is the groundwater chemistry. So the sediment is the same.

And then we also have another technique where we take contaminated sediments from the field and we measure as I've already mentioned Kd values by using the uranium isotopic exchange. These are the

same wells and now we have both the variation of sediment and the variation of groundwater. So we can compare the relative importance of those two variations in Kd values.

This is a busy slide to look at so let me just walk you through it. First of all, we have Kd plotted on a geometric scale over here. NABS refers to the uncontaminated composite sediment. So here we had the same sediment in all the wells. Over here, we're using the actual sediment from the surface. So first just looking at this part of the graph here, we see that Kd varies.

This shows the Kd variation across the site. It varies by a factor of 22 to 25 from the lowest Kd values up to the highest Kd values and if you look you have the measured Kd value from putting the sediment in the well and we have the model predicted Kd value from our semi-mechanistic sorption model. We were testing the model here and we see we got within a factor of two to three, about 2.5, was the worst in predicting these Kd values. So we're comfortable with that degree of error.

MEMBER HINZE: What's the source of that error?

DR. DAVIS: The model is -- That's a good

question. I'm not sure I can answer it but even in the lab in calibrating the model to the lab data, we don't accurately predict every data point. The model is a simplification. We tried to minimize the number of variables in it. So we have -- I deliberately am not showing the model because I showed it last June. But what we have there is we have about 100 datapoints and in our model, we have four variables where we try to simulate all 100 datapoints.

The model does not simulate every datapoint perfectly. So it represents the accuracy of the model is one approach. You could say even in the lab, but then you have consider maybe there are other processes going on in the field and we want to check whether our model does a good job of describing uranium sorption on the sediments in the field not just in a lab setting. There are bacteria in the field. There's a possibility of precipitation processes. There's aging. These are three to 15 months.

MEMBER HINZE: Is temperature a concern?

DR. DAVIS: I don't believe it is. The temperature is different in the lab than it is in the field and the model is calibrated on lab data. I haven't looked at that but temperature could be a

small part here. I know one thing you notice is that the model is more often under predicting than over predicting. So there is some systematic aspect to the error and maybe temperature is part of that and we haven't looked at that.

MEMBER CLARKE: Can I ask a question just to see if I understand this slide? What is NABS again?

DR. DAVIS: NABS, I'm sorry, that stands for Naturita Aquifer Background Sediment.

MEMBER CLARKE: Okay.

DR. DAVIS: That's our large composite of uncontaminated sediment.

MEMBER CLARKE: So is it fair to conclude that for those samples you're putting contamination on to the sediment.

DR. DAVIS: Yes.

MEMBER CLARKE: For the other samples, you're taking it off.

DR. DAVIS: The other samples, no. What we're doing is for the measured Kd we're going in the lab and we're doing isotopic exchange to determine. We're using that as an estimate of how much absorbed uranium is on the sediment. Whereas here we took the uncontaminated sediment and it didn't have any uranium

on it to begin with and so we let uranium adsorb on it and then we extracted off with carbonate to determine how much uranium adsorbed unto the sample.

MEMBER CLARKE: Okay. I was wondering if these data would enable you to look at adsorption versus desorption but in both cases you were looking at adsorption apparently.

DR. DAVIS: Well, in effect isotopic exchange you could say that you are incorporating desorption into it because to get the isotopic exchange you have to have desorption occur.

MEMBER CLARKE: Yes and where I was going is are you seeing any difference based on the age of the sediments to see contamination time if you will.

DR. DAVIS: Well, the overall effect here is that from three to 15 months here we didn't see any effect and this of course has been in contact for decades. Now the errors are greater over on this side but part of that, let me go on. Over here, we see larger errors than we do on this side and one of the reasons is for these Moppin (PH) 2, 3 and 4 wells we know now which we didn't know when we wrote the NUREG report that uranium reduction is occurring at those locations.

We've measured bacteria populations that

are involved in reduction of uranium. There is ferrous iron present in the wells. So down here which is at the downgrading end of the aquifer, there are sub-oxic reducing conditions and we think that the difference here is due to uranium-4 precipitation. That occurs out in the sediments and not in the well because if you look over here we have the same wells where we put the uncontaminated sediment and we don't see uranium reduction.

We got good agreement for these wells and these conditions when we just suspended uncontaminated sediment in them. But if you dig up the sediments you find that there's more uranium there than you expect from the ground just measuring uranium adsorption. I need to move on.

MEMBER WEINER: Yes. Please.

DR. DAVIS: When do I need to be finished by?

MEMBER WEINER: In order to allow time for questions and because I've been asked to keep on schedule, if you could finish up by about 11:15 a.m., 11:20 a.m.

DR. DAVIS: Okay.

MEMBER WEINER: That would be great.

DR. DAVIS: All right. One interesting

conclusion here is we can draw from looking at the two different types of variation in this work. One is we took that NAB sample, the uncontaminated composite sample and we put it into 17 wells and Kd varied by a factor of 22. Then we took the contaminated sediments and then we --

MEMBER WEINER: Excuse me. That's a variation over the site.

DR. DAVIS: That's a variation over the site. Yes.

MEMBER WEINER: That's an aerial.

DR. DAVIS: Yes. And then we took the subsurface sediments from 14 locations in the aquifer and we put them in one water in the laboratory and measured Kd again by isotopic exchange and we only get a factor of 2.5 variation in Kd.

So what that means is that as far as the variation of Kd across the site, we have spatially variable groundwater chemistry at this site is more important than variable sediment composition in determining the Kd values. And actually, sir, that points out another thing I forget in answering your question is that our model assumes that the sediment is the same throughout the aquifer and when we take sediments from different locations and expose them to

the same water, we do get some variation in Kd value. So the sediments are not the same obviously throughout the aquifer. That's another.

MEMBER CLARKE: Are you disturbing the sediments much when you take the samples? Is this a factor that came into this at all?

DR. DAVIS: I don't think so. We used air drilling. These were just pulled off the auger flight. As they came out, there was no -- We didn't add anything to them as we sampled them. So I don't think so. Well, I will say that -- I don't want to get off on that tangent. I'll be running out of time.

Now here in the current project, it calls for us to test the database for single mineral phases by exposing single mineral phases in these same wells and looking at their experimental Kd values and there are published thermodynamic sorption models for these phases. So we want to see how well those models do at predicting Kd values and we're doing this in the project with kaolinite, quartz, hematite and clinoptilite which is misspelled over here. Clinoptilite is a zeolite mineral that's important in fracture filling mineral assemblage at the Yucca Mountain site. So this now is going back to thinking about the database approach where we might use some of

the existing models to predict Kd values. So this is a way of testing them in the field.

Now here we have the results for kaolinite. This shouldn't say sandbags. This should be dialysis bags and we see that in the lab we have found since this was done that it required four days to reach constant uranium concentrations when we put kaolinite in a dialysis bag in a uranium-bearing solution. And in the field, we only measured two days and 30 days and it's obvious that two days wasn't long enough to reach a steady adsorbed uranium concentration on kaolinite.

Looking at the 30 day data, we have over here model predicted Kd values. The model was published by Tim Payne, et. al., in 2004. It goes back to the Alligator River project when kaolinite was studied as one of the minerals phases in the Koongarr deposit. And what you see is actually a not-very-good agreement between the model-predicted Kd values and the measured Kd values. The model-predicted Kd values are generally in the order of magnitude or 1.5 orders of magnitude too high.

And I think in looking at the result the reason is that Tim Payne only studies uranium adsorption on the kaolinite and systems equilibrated

with air. So he had no real variation of carbonate in the system. Here we're going out and putting that kaolinite into groundwater that has partial pressures of one to ten percent.

I think the model which does has a uranium carbonate complex on the surface, it's just not a well calibrated model because there were not enough experimental data collected as a function of carbonate concentration for uranium adsorption. So that shows a problem I believe with that model. I believe our measured Kd values are actually closer to what should be correct and the model needs more work.

This summarizes our work, where we stand on our work with these other phases. We have finished the analysis of quartz and we found that the field Kds is too small to measure and our model predicts that Kds should be less than 0.1 in all the wells. So in fact we have experimental error here. We have to separate the quartz from the groundwater and there's always a little bit of entrained water. So we're not going to be able to measure very small Kd values by this method.

I'll show in a minute why this happens. Because we did not expect this, we probably would not have put quartz in the field if we were expecting this

low a Kd value. But we didn't at the time. We put it in the field. It's also valuable because it shows that uranium precipitation or some other uranium accumulation process is not occurring. We're able to put quartz powder in these wells and not get much uranium adsorption on them as predicted. So that's good.

Hematite, we have finished the field measures but we don't have a lab model yet to compare these measurements but we do get significant uranium adsorption on the hematite. And the clinoptilite, the field samples were just retrieved last week.

These next two slides are inserted. They are not in your handout. I wanted to describe why the uranium adsorption is not occurring on the quartz because I think this is an interesting result. The reason is that calcium decreases uranium adsorption on quartz. We've measured that and this is our model for adsorption on quartz in the absence of calcium and it's our model. The interesting thing was when we started this work we would have predicted with this model that calcium had no effect on uranium adsorption. So in the interest of time, I'm going to have to go quickly here.

Just to point out that the reason that the

reason that calcium does decrease the uranium adsorption and the reason it didn't adsorb on quartz in the Naturita aquifer is that we now understand that the major aqueous species under these conditions is this species here and this species is not in the NEA database and it's just not been as an accepted value yet.

But the existence of the species has now been proven with EXAFS spectroscopy and if you could go back one slide. If we put that species in the NEA database, here are our predictions of uranium adsorption as a function of calcium. They go right to the data. So this is further proof that that species probably exists and needs to be added to the NEA database.

This is important because this species which are fairly certain exists is the most important aqueous species at the Naturita site at essentially all the Untra (PH) sites and at Yucca Mountain. So this is an important species to be thinking about because it's not yet in the NEA database and it makes uranium more mobile.

The other method of study field base Kd validation we've been doing is our tracer tests at the Naturita site. At one location, we put in a small

scale tracer test study site. This arrow was one meter per scale. So we've been able to study transport over a few meters and we've done two types of tests, push-pull tests and uranium migration tests.

In the push-pull test, what we do is we first pump up groundwater and we change the chemistry in some way and we change the chemistry in some way and we add bromide as a tracer. We pump it back down in the aquifer and then we wait for a period of time and then we pull the groundwater back out and looked at what has happened.

This shows a table of some of the push-pull tests that we've done. For some of these tests, you see here although we're in a contaminated part of the aquifer where the ambient uranium concentration is 4 micro-molar in the groundwater. We've done several tests where we add water with very little uranium. The ambient alkalinity here is about 8 and we've done tests where we've put in less or more alkalinity and we've varied the time before we do the pull part of the test.

Here you see a result where we injected low uranium concentrations but the alkalinity was the same as ambient and here is the bromide coming back in the pull. So this gives you, from this, you get an

estimate of the mixing curve of ambient groundwater with the tracer test groundwater. Over time, you're going towards ambient. At zero time, we just pull up what we injected into the ground.

Now we injected water into the ground with zero uranium. If you use this mixing curve, you can see here that from just mixing this is the dissolved uranium concentration we would expect. But in fact, we see fairly constant uranium concentration and this is an indication. This is 14 hours allowed between push and pull.

So what we see is the adsorbed uranium is able to bring this right back up to the ambient concentration within that 14 hour period. Uranium desorption occurs to bring it back to the ambient concentration. This is consistent with what we expect from sorption to do. It's a fast reaction. We expect it and there's enough adsorbed uranium in the area of the aquifer that we expect it to bounce back up to the ambient concentration and it does.

We do see though that there is a time dependence to it. If you only allow a half hour before you start to pull, you don't get the ambient concentration back. So the results I showed on the previous slide were these for the 14 hours allowed

between push and pull. With only a half hour, you have a lot of desorption that has occurred but not enough to bring it back up to the ambient concentration. Desorption is not instantaneous but it's fast.

Here we show results of varying alkalinity. In this test, we had the ambient alkalinity and the 14 hours of drift that I've already showed you before. Over here, we had higher alkalinity in the 14 hours of drift and you see that if you put higher alkalinity into the water you get much higher uranium concentrations in ambient and again this is because of desorption. Adding alkalinity to the groundwater, it desorbs uranium from the sediments because you have a higher carbonate concentration in the water. This is what we expect from our sorption model.

Here we come to our intention of doing these types of experiments which is to test our sorption model against the results. Here is our predictions of what would happen in the systems compared to the experimental data.

And what we have found is we don't get a perfect description and one of the reasons is that we feel one of the problems is, and I don't want to go

into all of these numbers because I don't have time, what we're doing is pushing water in at about 100 meters per day type velocity and during that time, we push this water in, and during that time, we don't really have local equilibrium.

So this is our problem with modeling is that we assume equilibrium. The fact that we don't get exact results, we think the lack of agreement between these results and the experimental data has to do with the disturbance to equilibrium that occurs during the push part of the tracer test itself and we haven't figured out how to model that yet. Push/pull tests are probably better for modeling desorption kinetics under field conditions than just modeling only the equilibrium, looking only at the equilibrium model.

Just a couple more minutes here. Go forward two slide please. The other type of tests that we've been doing are natural gradient types of tests where we put again amended groundwater into the system with a bromide tracer and then we look at its breakthrough at 1.5 meters down gradient and there are the results I'm going to show. These are done by taking observations for a period of three weeks. It takes about five days for the nonreactive tracer

bromide to travel the 1.5 meters.

This shows results for three tracer tests. The first one where we put in very low radium water and but this also has lower alkalinity than ambient. But what you see here in the blue is the bromide breaking through. It takes about six days to reach its peak concentration and the uranium that's shown in these black squares is dropping down. But it should drop down to zero because this goes up to the full bromide concentration injected and there was no uranium in the injected water. It doesn't drop down to zero and the reason is that uranium is desorbing as it travels that 1.5 meters to get to the observation well.

Down here we have a second type of injection where we put in water with an ambient uranium concentration but very low alkalinity and here we get a dip in uranium concentration also. But unlike this one where we're looking at uranium desorption, here we're looking at uranium adsorption, depleting the water as it passes through here because it have a very low alkalinity. In the third injection, we've increased alkalinity and we see a rise in uranium concentrations as it passes the observation well due to uranium desorption.

Again we're going to look at the ability of our model to predict these change in the field. Basically we use bromide the calibrate the transport framers.

The next series of three slides just shows the agreement between our model and the experimental observations. One thing we're not assimilating for some reason is the arrival of the alkalinity is slightly delayed behind -- I mean the observations show it's slightly delayed behind the model and in the model we have alkalinity. We expect it to be essentially a conservative species. We are going to have to look at the kinetics of calcite precipitation to get this slide retardation into the model and we haven't done that yet.

Because the alkalinity arrives a little late, we see that the uranium also arrives a little late and it should arrive at the same place as the high peak in alkalinity and it does. So there's a small part of this which we don't feel has to do with our adsorption model. It has to do with calcite precipitation and dissolution kinetics.

Here we see the case where we injected low alkalinity and we have uranium adsorption occurring and here we do a pretty good description of the change

in uranium concentration, a drop due to adsorption and even the little peak here at the end which is due to desorption as the high alkalinity water comes back.

This one we don't do as well describing. We're not quite sure why yet. It seems to have something again to do with a strange breakthrough in alkalinity compared to our modeling approach. So this tracer test we've repeated but we don't yet have the results for that.

So finally, just to give you an idea of what else we are working on and where we're going in the remainder of our project. We are well along in this task here. We are developing and are going to demonstrate an inverse sorption model for uranium on using subsurface sediment on the 40-Mile Wash aquifer in Nevada. This is the downgrading from the Yucca Mountain site.

We are also developing and demonstrating inverse sorption models from neptunium-5 adsorption onto Naturita sediments and nickel adsorption onto sediments. In a very different investigation, we are going to be studying what conditions can result in the oxidation of iodide by either manganese oxides or nitrate and we are going to be studying iodide transports trying to find the reactivities of iodide

in an aquifer in Cape Cod.

This is a broad conclusion. It's not just about our current research and results but includes what we've learned from the Naturita site that we think the current reactive transport models could easily accommodate the surface complexation concept and that using the inverse model it's not too expensive to calibrate such a model for a field site. Therefore, at least from a computational point of view and expense point of view, we don't think the constant Kd concept is really required to describe retardation of radionuclides.

We think that this inverse modeling approach can reduce uncertainty. We've also concluded at the Naturita site at least that spatial variability of groundwater chemical conditions is more than the variability of the geochemical properties of the sediments on the colorimeter scale and we've also seen this at the Cape Cod site and other studies and when you talk about variability of sediment properties, of course you have to be sensitive to whether you move from one geologic formation to another. Obviously that's going to be very different. But within aquifers at the colorimeter scale, things actually probably don't produce Kd variations larger than about

a factor to 2 to 3.

Finally as I talked about earlier, predictions based on a range of constant Kd values do not always bracket simulations results that came with this inverse surface complexation modeling approach and random sampling of a Kd distribution may overlook spatial character of that distribution that is important in transport simulations. So thank you very much and I'll take questions.

MEMBER WEINER: Thank you very much for a very illuminating discussion. We have a few minutes for questions. Dr. Hinze.

MEMBER HINZE: Few. He covered a lot of territory for some of us that are not really chemists. Let me ask you a broad question. Climate change. How much should we be concerned about change of Kds with climate change that might be associated with the range from the last glacial maximum to today? See. I got back at you.

DR. DAVIS: Yes, you did. Well, of course, it's going to vary with individual radionuclides and where they are. I wish I could know what partial pressure of carbon dioxide change that you're talking about.

MEMBER HINZE: I'm not sure that we know

that.

DR. DAVIS: Yes. But we might try to put some bounds on it and then I could answer your question. If I could get back to you.

MEMBER HINZE: Yes.

DR. DAVIS: But it's probably going to affect uranium more and neptunium more than anything else of relevance to high-level nuclear waste disposal.

MEMBER HINZE: Dr. Davis, this is really a very important question as we see the revision of Part 63 and 197. Let me just ask one more quick question. And if you could get back to us, that really would be great. You can give some kind of boundary conditions insight. The uncertainties that we hear about in Kds, do I assume from what we've heard here today that this is not an uncertainty in Kds but this is just different chemistry?

DR. DAVIS: Can you elaborate on the uncertainty in Kds that you've heard about?

MEMBER HINZE: Well, like neptunium is a classic which has uncertainties in the Kds as I understand it. Is that just because one has not considered the chemistry, the alkalinity, in these measurements?

DR. DAVIS: I think that some of the work that I've seen by the Department of Energy they are considering the alkalinity. So historically I would say alkalinity has been a big problem in understanding Kd values. I think as I understand what the DOE does now they are considering higher alkalinity values in developing their Kd values. But what I think I object to a little bit in there is that the way they then use the variation. They sample randomly rather than considering spatially where are the high alkalinity values in the aquifer.

MEMBER HINZE: So they handle it probabilistically rather than deterministically.

DR. DAVIS: The alkalinity variation, yes.

MEMBER HINZE: Right. Thank you.

MEMBER WEINER: Allen? Jim?

MEMBER CLARKE: Just a quick one. I agree. That was a very interesting presentation. Thank you for that and I'm essentially interested in your work on sorption versus desorption. One of the things I wanted to mention and I know you're well aware of this is that another process that gives you long tails especially if you have contamination that's existed for some time is diffusion where the material actually penetrates, a low permeability under the rock

matrix or organic matter or whatever it is. And we see in pump-and-treat systems often the concentration going down fairly rapidly and then tailing off and then when you shut off the pumps it rebounds which is another indication that there's a mass transport limited process going on. I wonder if you think that's a factor in some of this or it needs to be addressed at some point.

DR. DAVIS: It is certainly a factor at a lot of field sites and it's been well demonstrated that it's a factor. We have been lucky at this site, the Naturita site and also the Cape Cod site that we've studied a lot that it's not a factor and that may be partly -- Well, it's due to two things, the relative ease with which uranium and zinc desorb and the fact that we don't really have, we're not really studying aquifers where diffusion is an important process from a physical point of view in terms of the physical characteristics of the sediments. But there are a lot of systems where diffusion is important and certainly in the presentations I've seen about Yucca Mountain in the part that's above the groundwater table diffusion is important.

MEMBER CLARKE: Thank you.

MEMBER WEINER: I'm going to ask another

very general question. Knowing how Kd is introduced into performance assessment, how would you introduce this model into a performance assessment calculation, into the TPA, for example?

DR. DAVIS: How would you introduce it?

MEMBER WEINER: What would you do to change the way that Kd are used in performance assessment now? Would you sample at various sites? How would you do it to take into account things like the spatial variability, things like the dependence on other factors? The fact that Kd is clearly not a constant?

DR. DAVIS: I think you have to simplify things. You have to break the physical system down into blocks that have different properties and within a particular block, physical block, you're going to then have to probably assume a particular alkalinity value. So you can through using this type of model use this as a Kd predictor for those blocks which runs as a separate sub-routine. The issue is how many blocks can you handle in a performance assessment before it simply becomes unwieldy and do you have enough data from your field system to populate the parameters? So I don't think is incorporating the sorption model. The difficulty is more about field

characterization than anything else.

MEMBER WEINER: I just have one more. How well does your work apply to the other actinides particularly neptunium, plutonium?

DR. DAVIS: This work is very relevant to neptunium.

MEMBER WEINER: In other words, you could make the same kind, do the same sort of experimental work with neptunium in the laboratory. You could get similar variations dependence on the Kds for neptunium.

DR. DAVIS: Yes.

MEMBER WEINER: Are you contemplating doing that, Bill? Is that under consideration?

MR. OTT: Jim can tell you what's in the project right now. I can't. I'm not the project manager. I look at it in a broader view.

DR. DAVIS: We are doing work with neptunium as I mentioned for the Naturita sediments and also at the Southwest Research Institute the NRC is supporting doing work. Well, they're doing neptunium adsorption measurements on 40-Mile Wash sediments, the same one we are doing uranium. But I'm not sure what modeling approach they're going to use.

MEMBER WEINER: Does anyone on the staff?

Yes. But you'd better be quick because I'm under pain of death.

MR. HAMDAN: Just one quick question.

MEMBER CLARKE: Yes, you are.

MR. HAMDAN: Jim, your first conclusion, use of the concept of the constant Kd concept is no longer required. Because as you mentioned chemistry has a major impact on the adsorption, the question really is constant Kd is -

DR. DAVIS: Is it what?

MR. HAMDAN: To predict what's going to happen especially when you're talking about long time periods.

DR. DAVIS: I'm still not sure I understand the question.

MR. HAMDAN: The question is you talk about whether the Kd concept is required or not required.

DR. DAVIS: Yes.

MR. HAMDAN: The more important question to us is whether a constant Kd is adequate to predict the future especially since over time chemistry is going to change and with the changing chemistry.

DR. DAVIS: Okay. What you can use this modeling approach to do is if we can make estimates

for how much chemistry is going to change over time, that's the critical part. But that's the answer to your question is that if you define how much chemistry or give your best guess of how much chemistry will change or use experts to tell you how much the chemistry will change, then you can make predictions of how much the Kd is going to change over time and then you can decide I'm only with the constant Kd because it's not going to change that much.

MR. HAMDAN: That's fine but the point I'm trying to make is part of your conclusion should be that other question.

DR. DAVIS: Yes.

MR. HAMDAN: As how ultimately we want adequate procedures or concepts or methods to get us where we want to go and that's the question that needs to be addressed. To me, it's not the question whether the constant Kd is required or not. That's for the --

DR. DAVIS: The other way to look at it is that you can isolate which radionuclides we need to focus on and for Yucca Mountain, neptunium is obviously a very important radionuclide. So maybe we need to focus on not using a constant Kd for neptunium as opposed to all the other radionuclides if that's

the most important one.

MEMBER WEINER: Thank you, Jim, and thank you for rushing through and staying within the time scale. I'm going to cut this off now because the Vice Chairman is looking daggers at me saying we have to quit. So thanks very much and I'm sure you'd be happy to answer questions if people come back to you with them.

DR. DAVIS: Yes.

MEMBER WEINER: Thanks again.

VICE CHAIRMAN CROFF: Thank you very much for an interesting presentation. With that, we're going to adjourn into lunch. We're going to be back here at 12:30 p.m.

(Whereupon, at 11:38 a.m., the above-entitled matter recessed to reconvene at 1:00 p.m. the same day.)