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Depleted Uranium

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NUCLEAR REGULATORY COMMISSION

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PUBLIC WORKSHOP 1 ON UNIQUE WASTE STREAMS - DEPLETED URANIUM

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WEDNESDAY

SEPTEMBER 2, 2009

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BETHESDA, MARYLAND

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The Public Workshop convened at the Hyatt Regency Bethesda, One Bethesda Metro Center, 7400 Wisconsin Avenue, at 8:30 a.m., Chip Cameron, Facilitator, presiding.

PANELISTS:

CHIP CAMERON, Facilitator

CHRISTINE GELLES, US Department of Energy

GREG KOMP, US Army Safety Office

RICHARD A. HAYNES, SC Department of Health and Environmental Control

MARK YEAGER, SC Department of Health and Environmental Control

ARJUN MAKHIJANI, Institute for Energy and Environmental Research

PANELISTS: (CONT.)
DIANE D'ARRIGO, Nuclear Information and Resource Service
THOMAS E. MAGETTE, Energy Solutions
WILLIAM DORNSIFE, Waste Control Specialists
FELIX M. KILLAR, Nuclear Energy Institute
MICHAEL T. RYAN, NRC Advisory Committee on Reactor Safeguards
STEPHEN WEBB, Sandia National Laboratories
PETER C. BURNS, University of Notre Dame
GREGORY SUBER, US Nuclear Regulatory Commission
DAVID ESH, US Nuclear Regulatory Commission
JAMES KENNEDY, US Nuclear Regulatory Commission

ALSO PRESENT:
LARRY CAMPER, US Nuclear Regulatory Commission
EDWARD REGNIER, US Department of Energy
JANET SCHLUETER, Nuclear Energy Institute
ANDREW CARRERA, US Nuclear Regulatory Commission
GARY COMFORT, US Nuclear Regulatory Commission
JOHN GREEVES, Talisman Associates
S.Y. CHEN, Argonne National Laboratories
KAREN PINKSTON, US Nuclear Regulatory Commission

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

8:34 a.m.

FACILITATOR CAMERON: On the record. Good morning, everyone. My name is Chip Cameron and I work for the Executive Director for Operations at the Nuclear Regulatory Commission, the NRC. And it's going to be my pleasure to serve as your facilitator over the next two days.

This meeting is about the NRC rulemaking that is kicking off now to establish site-specific criteria for the disposal of depleted uranium and other unique waste streams and I'd just like to spend a couple of minutes on the some meeting process items before we go to introductions around the table. Then I'll do an agenda check with you and then we'll get into the substantive part of the meeting.

In terms of the format for the meeting, we're using a roundtable, so-called roundtable setting in contrast to the town hall meeting type of format. And the objective of the roundtable format is to promote a dialogue on the issues again in contrast to the town hall meeting where there's usually just a one-way communication between one person and the agency.

We have representatives of the effected

and concerned interests around the table and there will be other people joining us at the table who are a little bit late. But we not only want to hear what your perspectives are on these issues, but we want to get your reaction to what other people's perspectives are on the issues. So, in other words, we want to try to have a discussion on the issue and it's a modest attempt to try to develop a richer, a different sort of data for the NRC to kick off the development of the regulatory basis for this rulemaking.

In terms of ground rules, very simple. The first one is you all have a name tent in front of you. If you want to make a comment, questions, whatever, if you could just turn this up and then I'll know that you want to say something and you won't have to worry about jumping into the conversation or continuously raising your hand and I'll ignore -- Thank you for that. Thank you.

(Laughter.)

I was worried that you wouldn't know how to do that. But now I know. Now I know. Thanks, Bill.

But we'll use that. We won't rigidly adhere to it. But if we could do that, that would be helpful. And I would ask that only one person speak

at a time. We are taking a transcript of the meeting. Charles is our stenographer here and if only one person is speaking at a time not only can we give them our full attention, but Charles will know who to list for that speech so to speak on the transcript.

And I would just urge everybody to be constructive. You may have some critical comments for the NRC, but just try to be constructive about it and let's do some introductions around the table and let's start over here with Larry Camper and if you could not only introduce yourself but just give us a couple sentences on what your expectations are for this particular meeting or for the NRC rulemaking.

Larry.

MR. CAMPER: (Inaudible.)

(Off the record comments.)

Good to go. Thank you very much.

Good morning. Larry Camper, Director of the Division of Waste Management and Environmental Protection. My staff had the lead in developing the SECY that discussed unique waste streams and included the depleted uranium and the development of the technical analysis.

In terms of expectations, we are here to listen. We very much appreciate the time of the

panelists. We know that you're all very busy. We have interesting stakeholders here. We have experts here.

As part of the rulemaking process, we want to listen. We want to factor all the things we hear over the next couple of days in the rulemaking that we'll be working on over the next couple of years and I thank you for taking part.

MR. KENNEDY: My name is Jim Kennedy. I'm a Senior Project Manager in the Low Level Waste Branch of NRC. I work for Gregory Suber and Patty Bubar and Larry and my expectations I guess are just to understand all the different points of view. This rulemaking is extremely complex and I know there are lots of different points of view out there about how to manage risk and all the different parameters and so forth. And I think my personal goal is to just understand what those are.

MR. ESH: I am David Esh. I'm a Senior Systems Performance Analyst in the Performance Assessment Branch at NRC. You'll hear a lot from me today on the technical analysis we did and some of the key inputs or key issues with respect to the rulemaking process going forward.

And my expectations are that I get a lot

of input from all the stakeholders on their views of the policy and/or technical subjects so that when we move into our rulemaking process we can hit the target pretty good the first time through so that when you see it in the public comment process you're at least moderately pleased if not -- You're not totally unhappy with it. We realize we won't be able to make everyone happy. But we strive to be objective and fair and, if we get all your views, then that will help us do that.

MR. SUBER: My name is Gregory Sube.r. I am the Chief of the Low Level Waste Branch and my expectation for today is just to have a very candid, but courteous, exchange of ideas between all the various stakeholders here so that we could do the best job that we can and as David says that we could make most of the reasonable requests and things happy. All right.

MR. MAGETTE: My name is Tom Magette. I'm with Energy Solutions and what I would hope to see come out of this meeting is some distinction between what most appropriately belongs in the rule as opposed to what belongs in the guidance that will accompany the rule.

MR. DORNSIFE: I am Bill Dornsife,

Executive VP for Licencing for Waste Control Specialists. My expectations are that we can come to some conclusions that we can develop an efficient, timely process for solving this issue and solving it in a way that provides a cost effective and safe solution.

MS. GELLES: Good morning. I'm Christine Gelles. I'm the Director of the Office of Disposal Operations at the Department of Energy's Environmental Management Program and, while my office is not the only office within the Department that has a stake in this issue, I'm happy to represent us and thank you for having us here at the table.

Our interests in this workshop today are twofold, both as a generator of unique waste streams including depleted uranium streams that may ultimately be disposed of at facilities that are subject to this limited rulemaking but also because we have decades of experience doing site-specific performance assessments at our own DOE facilities and we're happy to offer that experience as it is needed in this dialogue.

Thank you.

MR. HAYNES: I am Richard Haynes, South Carolina DHEC. I'm the Director of the Division of Waste Management. We have the Barnwell facility, rad

waste facility and part of the SRS facility for the RCRA component.

From our standpoint, I guess we're looking to make sure we have a clear path forward on the site-specific performance assessment and the guidance documents and how that will be implemented.

MR. YEAGER: I am Mark Yeager. I'm with the South Carolina Department of Health and Environmental Control. I work for Richard. I'm the Senior Inspector in the program and we regulate the Barnwell facility. I'm here to provide any comments and perspectives from the folks that deal with the public, face-to-face, so to speak, stakeholders and also take away from the meeting ideas and concepts that I can share with fellow members of the E5 Committee on CRCPD and also other states that might be affected by this in the future.

FACILITATOR CAMERON: Great. Thanks. Thanks for that perspective, Mark.

Felix.

MR. KILLAR: I am Felix Killar. I'm with the Nuclear Energy Institute. My takeaway for this meeting is similar to Bill's and Tom's in that we're interested in what ends up in the rulemaking versus what ends up in the guidance.

One of the things in particular I'm interested in seeing is what is the definition of a unique waste stream. Because when you look at a waste facility, you're looking at the waste going in there. So you're not looking at the waste streams. You're looking at the specific waste. And if you say that depleted uranium is unique waste, what else are you identifying as a unique waste? So I hope to get better clarification on that.

MR. KOMP: I am Greg Komp. I'm the Director of Army Radiation Safety. I'm here representing DoD. I'm also Chair of the DoD Advisory Committee on Low Level Radiation Waste.

I guess my perspective here or interest here is to fully understand the NRC perspectives, both in the terms as mentioned earlier with what's going in the rulemaking, also within the guidance and also to make sure or provide the understanding of what the DoD waste stream is in terms of DU.

MR. BURNS: My name is Peter Burns. I'm Professor of Civil Engineering and Geologic Sciences as well as Chemistry and Biochemistry at the University of Notre Dame. I'm also the Director of the Energy Frontier Research Center on Actinide Materials. My expertise are in actinide chemistry and

geochemistry and mineralogy.

I've done a lot of research related to mobility of uranium in the environment. So I have no stake in this other than providing an expert view on factors that will impact uranium mobility in the environment. But, of course, being a professor, I hope to learn a great deal here that I can carry back to my students, both the process as well as the science and engineering that's associated with it.

MR. RYAN: My name is Mike Ryan. I'm a member of the Advisory Committee on Reactor Safeguards and formerly I was the Chair of the Advisory Committee on Nuclear Waste at the NRC which is now a subcommittee of the ACRS.

What I hope to learn today particularly from the staff is their approach to performance assessment. I think since the last rule was written in the late '70s and finished in the early '80s performance assessment has dramatically improved. You know, a TRS-80 was the best computer we had back in those earlier days and now we can really risk inform I think with a site-specific eye how to assess the dose consequences or other risks that you might want to assess and I think the staff is well-positioned and prepared to begin thinking in a site-specific way.

You know, it's interesting to think about the question that was raised by our colleague from Energy Solutions of what will be in the rule and what will be in guidance and the third leg of that I would add is what would be a license-specific condition rather than a generic requirement.

So there's a real opportunity here I think to risk inform for site-specific cases how to deal with uranium and even perhaps other radionuclides that will be showing up in low-level waste. I'll be curious to hear how the staff plans to think that challenge through.

Thank you.

MR. WEBB: Yes. My name is Stephen Webb from Sandia National Labs. My expertise is gas transport in porous media. Also I've worked on WIPP and also Yucca Mountain by doing the PA work. So I have what I think is an overall technical perspective.

FACILITATOR CAMERON: Okay. Thank you all and, in terms of the agenda, I just want to do an agenda check with you to make sure that everybody is on board about what's going to be covered, when and what we're going to be trying to do and we're going to start with some context for you, three presentations by the NRC to give you some background on what the NRC

is doing to aid in not only our discussions around the table over the next two days but also for any written comments that you may want to submit to expand on anything that you've heard here at this particular meeting.

The first is going to be a welcome and overview by Larry Camper and then we're going to hear from Andrew Carrera of the NRC staff who's going to give you some background on the rulemaking process and finally we're going to hear from Dave Esh who's going to talk about some of the issues that were looked at in the technical analysis that the NRC did.

Now after all three of these presentations, we're going to open it up for clarifying questions from all of you on the panel and for any topics, any problem-solving, any discussion, we'll save that until we get to the discussion issues which the first of which is the 11:00 a.m. Significant Quantities of Depleted Uranium issue. And although the focus of the discussion is at the table here, we will be going out to those of you in the audience periodically to see if you have any comments on the issues that were being discussed around the table.

So you can see from the agenda that there's a number of discussion issues, significant

quantities, period of performance, exposure scenarios and source term and then tomorrow modeling, both of geochemistry and radon, the issue of unique waste streams, Felix already referred to that, a discussion of Agreement State compatibility -- in other words, what will the NRC Agreement States be required to do under an NRC rulemaking on this issue -- and then the long-term rulemaking that the NRC is going to do after the conclusion of this and other considerations such as what happens in the interim between now and when the NRC develops a rule and the Agreement States implement the rule.

So we have a full set of issues and I would thank Tom for raising the rule versus guidance. We want to hear not only your comments on these specific issues but your view on whether a particular item should be addressed in the rulemaking text itself or whether it should be developed more in the regulatory guidance that the NRC is using. And for each of these discussion items we're going to have the NRC staff do a short tee-up for you to sort of give you a prospective on that particular issue.

Any questions on the agenda at this point? Yes, Bill.

MR. DORNSIFE: Are we going to expect our

esteemed colleagues to show up or are they boycotting?

FACILITATOR CAMERON: There's been no indication that they were not going to be here. So I anticipate that they will be. I know that Diane D'Arrigo is attending another NRC meeting this morning. So she'll be here and hopefully Arjun will show up. Bob Alvarez, representing the Yakamas, may be here. They're interested, but I haven't had any confirmation from them over the next two weeks. So hopefully they will show up.

Thanks, Bill. Anybody else on any meeting process issues agenda?

(No verbal response.)

Okay. There was a -- I guess I'll just close with something that I read in the *New York Times* on Sunday. They were talking about the town hall meetings on health care that we're all familiar with what's been going at those town hall meetings.

Oh good. Before I do that, Arjun is here and we'll give him time to get settled and then we'll have Arjun introduce himself to us and, Arjun, I've been asking everybody to not only introduce themselves but also give a couple of sentences on what their expectations are for the meeting. And as I mentioned at the beginning of my overview for the meeting, the

idea here is dialogue, discussion among all of you and we'll be trying to follow discussion threads on that. So I may not take the cards in the order they're turned up.

The *New York Times* article was talking about the town hall meetings and they reached the conclusion that dialogue is dead during the Internet Age. But I thought they had an interesting quote which is "If you're looking for thoughtful dialogue you might as well hold your next meeting on the stern of a Somali pirate ship." So I'm hoping that we can do better than that. That's our standard so to speak.

(Laughter.)

But, Arjun, could you just introduce yourself to your colleagues around the table?

MR. MAKHIJANI: You know, Chip, I have a lot of respect for you and I hope that you haven't dropped the bar down there because you always hold a good public meeting. And I really appreciate that and you're one of the reasons I'm here.

I'm Arjun Makhijani. I'm President of the Institute for Energy and Environmental Research. I've done expert work for interveners on depleted uranium in the two uranium enrichment license applications and I've been a proponent of the idea that depleted

uranium is akin to Greater-Than-Class-C waste and I have been a critic of some of some very bad scientific work that's been done.

My expectation of this is at a minimum this just can't be a listening session. If I tell you that the waste site in Utah has at its foundational technical document a number that said they're going to dispose of more depleted uranium than the weight of the earth and that is an unacceptable basis for having licensed a low-level waste site and the NRC isn't exercising its jurisdiction and responsibilities properly as I have said in formal testimony, I expect that it won't just be heard. But you'll do something about it. Verify it. If I'm wrong, let me know. I'll publish a correction.

But if I'm right, the minimum technical standard. There should be a minimum technical standard that public agencies follow. And if you hold hearings to invite people who are familiar with the technical and regulatory aspects of the matters that we're considering, as I told you when you invited me, that I expect that you'll do something about it and that you as the convener of the meeting will report back to us on the list of items and I'll certainly give you my list that we expect a response from the

NRC that's substantive, not just punting. So this is my expectation of this meeting. Otherwise I shall consider it a failure. I've said this before and received no satisfaction. Normally, it's just heard and that's the end.

This is not about you. You know, I deeply respect you. You always hold a truly open meeting and, you know, I always feel comfortable saying things like this and you still invite me again. So I think that we should be able to work together so the minimum scientific standard is met. We may disagree on the policy, but what has been happening on depleted uranium is unacceptable technically and it hasn't registered at the NRC and I've devoted two days of time to come here with the real hope that I'll be able to make it stick.

Thank you.

FACILITATOR CAMERON: All right. Thank you. Thank you very much, Arjun, for those important comments and positive suggestions also.

So let's get started with Larry Camper's presentation. Again, these are context presentations and we'll go for questions to you after they're done and, at least, as far as Larry's and Andrew's presentations, if you could just let them get through

that presentation and then we'll go for questions. Dave Esh's presentation because of its length, we did break it into three parts so that we can go for -- You won't have to sit there until the end of it and wait to ask questions.

It's my pleasure to introduce Larry Camper.

MR. CAMPER: Thank you, Chip. Good morning, everybody, and thanks for being here. And again let me thank all the panelists especially for the effort that you're going to devote to this rulemaking at issue over the next couple of days.

We greatly respect your views. We invited each of you for different reasons in terms of technical expertise or diversity of views and that's the value of this type of workshop. So we do look forward to the input that you will provide us.

I'm going to do something in my presentation I don't normally like to do and I'm going to read some prepared remarks that my staff has prepared for me. I don't normally like to do that. I've always liked to say I don't give the same presentation twice when I do them back to back.

But in this particular instance, the issue that we're dealing with is indeed very complex and,

yes, it is controversial. And there's a lot of context that I want to make sure that we share with you and we share the exact same information in the State of Utah where we'll be meeting in a couple of weeks.

So I ask you indulgence. As I read my remarks, I'll try to be as animated as I can be. But, nonetheless, I'll be reading prepared remarks and it's important that we do that for consistency, for context and there's a great deal of information to share with you and let you have some understanding of the staff's thinking and some of the issues that went into the rulemaking that we're going to be working on.

First of all, this is the first of two public meetings that we're going to hold on this particular topic to solicit input on the proposed rulemaking for unique waste streams and, yes, Felix, we do hope to spend a lot of time talking about unique waste streams. We, too, are seeking a definition for that.

We are here today because we want to gather information on key technical issues associated with the disposal of significant quantities of unique waste streams and, in particular, DU or depleted uranium. We want to focus on DU for a good portion of

the workshop, but we also want to think about other potential waste streams that could be considered unique and could be included in this proposed rulemaking which will be broader than just depleted uranium. We do look forward to a collaborative discussion. We look forward to your input and we welcome all the ideas that you will share with us.

In terms of background, we have developed the term unique waste stream for significant quantities of DU because it is different than typical low-level waste. Foremost, it is a new waste stream in the sense that there were no commercial entities generating significant quantities of it when NRC's regulations of Part 61 were developed. DOE was the only entity operating enrichment facilities in the United States at that time. As a result, only small quantities of DU were considered in the environmental documents associated with the regulation.

DU is also unique because if it behaves differently than typical low-level waste. The hazards from most commercial LLW decreases over time in contrast to DU where not only does the hazard increase. It persists for a much longer time frame due to the ingrowth of long-lived daughter products. However, the impacts from disposal of significant

quantities of DU can be migrated, for example, by increasing burial depth or through the use of a robust radon barrier whose performance can be demonstrated over a long time frame.

Continuing on background. Currently Section 61.55(a)(6) determines any radionuclide not on the classification tables to be Class A waste by default. The statement was an attempt at the time the regulation was promulgated to capture any waste streams that had not been included in the final Part 61. It was envisioned that these other waste streams would not be of significant quantity or concentration to warrant a limit being specified in the table.

Approximately six metric tons of DU were assumed to be Class A in the draft Environmental Impact Statement. A draft concentration limit of 0.05 microcuries per cubic centimeter was determined. This draft concentration limit was not adopted in the final Environmental Impact Statement based on the Part 61 FEIS conclusion that "the types of uranium bearing waste typically being disposed of by NRC licensees do not present a sufficient hazard to warrant limitation on the concentration of this naturally-occurring material."

However, the specific activity of depleted

uranium is 0.5 microcuries per cubic centimeter and now the landscape for waste stream generation is changing. So clearly NRC is entering new territory not envisioned when Part 61 was initially developed.

In terms of the current situation, commercial facilities generating large quantities of DU and the Department of Energy is planning to dispose of these large quantities of DU at sites regulated by NRC agreement states. Commercial facilities have the option of transferring their DU to the Department of Energy under Section 31.13 of the 1996 USEC Privatization Act or they can pursue commercial de-conversion disposal options.

There are no licensed commercial de-conversion facilities built at the present time. NRC would license such plants. LES is expected to start limited operations in the spring of 2010. GE-Hitachi has filed an environmental report and license application that are currently under NRC review for the Global Laser Enrichment Facility to be located in Wilmington, North Carolina. AREVA has filed a license application including environmental report for the Eagle Rock Enrichment Facility in Bonneville County, Idaho that has been accepted for NRC review.

DOE has approximately 700,000 metric tons

of DUF_6 which it has been storing onsite for decades at its Paducah and Portsmouth Gaseous Diffusion plants. It is currently building de-conversion facilities at these sites to convert the DUF_6 to DU-308 for disposal at a commercial disposal site. So the cylinders that you see in this picture will be de-converted into an oxide powder. This is the current situation at Portsmouth and Paducah.

DOE has said they will need to begin disposal shipments for the DUF_6 facilities in mid 2010. More than one million metric tons of DU will need to be disposed of.

Commission direction to the staff. The Commission realized the uranium enrichment landscape was drastically changing. So when during the hearings for the LES facilities, Interveners filed contentions regarding the impacts from DU disposal. The Commission directed staff to evaluate these impacts separate from the hearing process. The Commission stressed in their order to the NRC staff to consider the quantities of DU at issue and noted that these large quantities were outside the bounds of the evaluation conducted in the Part 61 rulemaking in the early 1980s.

In the final analysis, the staff's

response to the Commission direction was yes. The staff did recommend Section (a)(6) be modified through rulemaking to specify a requirement for site-specific analysis for significant quantities of DU and the technical requirements for such an analysis. The Commission accepted this recommendation in their Staff Requirements Memorandum and further directed the staff in a future budget request to propose the necessary resources for a comprehensive revision to risk inform the 10 CFR 61 waste classification framework.

Staff prepared a Commission paper in response to the directions in the SRM that I just cited. In answering the Commission direction, we completed a Commission paper that presented a range of regulatory options that were informed by technical analysis.

You're going to hear a lot of detail today and tomorrow about the technical analysis during Dr. Esh's talk since he was the lead for the analysis. I will just describe it briefly as a screening model we used to evaluate the radiological risk and uncertainties associated with the near-surface disposal of large quantities of DU at a generic low-level waste disposal site that had a broad range of site condition. So we looked at a range of

characteristics of disposal sites rather than looking at disposal at a particular disposal site.

We identified four options in that particular Commission paper. The first option we evaluated was that staff would issue a generic communication, for example, a regulatory information summary which is like a guidance document that would clarify that for disposal of large quantities of DU compliance with the existing performance objectives need to be demonstrated and that classification under 61.55(a)(6) should not be relied upon for this purpose.

The second option was to conduct a rulemaking to require the disposal facility licensee to perform a site-specific analysis demonstrating that the unique waste stream including large quantities of DU can be disposed of at the site in conformance with the performance objectives set forth in Subpart (c) of Part 61.

The third option was to develop a generic waste classification, A, B, C or Greater-Than-Class-C for DU and an associated concentration limit to be added to the waste classification tables. Staff would begin with existing technical analysis which was consistent with Part 61 methodology but updated to

include recent advances in modeling and performance assessment techniques.

The last option was to evaluate the entire basis for the waste classification framework and update it for all radionuclides, not just for DU. The staff recommended and the Commission agreed to pursue a rulemaking to specify site-specific analysis be performed prior to disposal of significant quantities of DU and to specify the technical requirements for such an analysis.

The Commission chose to combine two of the options that I just cited into a thorough approach to address both immediate changes needed to NRC regulations and to address issues with the overall existing waste classification scheme as well. The Commission agreed with the staff's recommendation to conduct a rulemaking to require site-specific performance assessment prior to the disposal of significant quantities of DU, to identify the technical parameters that were needed to be evaluated and to develop guidance that would provide the agreement state regulators, their licensees and applicants with the necessary information to conduct site-specific analyses.

The Commission further directed the staff

in a future budget request to propose the necessary resources for a comprehensive revision to risk inform the Part 61 Waste Classification framework. The staff assumed this direction goes beyond merely budgeting for this rulemaking but in fact to pursue the development of the rulemaking which we will commence in FY '11.

In terms of the initial rulemaking, the rulemaking that we're here today and tomorrow to discuss, the rulemaking will require the disposal facility licensee to perform a site-specific analysis demonstrating that the unique waste stream including significant quantities of DU can be disposed of at the site in conformance with the performance objectives of Part 61. The analysis would be reviewed and approved by the agreement state since the likely disposal facilities are, in fact, located in agreement states.

The rulemaking is designed to be comprehensive in that it addresses unique waste streams, including significant quantities of DU and others to be defined. We will define unique waste streams and significant quantities in the rule language. And these are topics, of course, that we want to cover with you in some detail. This option creates a legally-binding requirement to do a site-

specific analysis. Specifying the technical parameters for the site-specific analysis in the rule language will provide uniformity in the technical approach used by the agreement states and their disposal facility licensees and allow more alignment across the various disposal sites that might be accepting depleted uranium or unique waste streams. The NRC will also publish regulatory guidance on implementation to help ensure more uniformity and to assist with the implementation of the rule.

We're going to talk a lot about performance assessment. So I wanted to make a few comments about the role of the performance assessment. The backbone of the site-specific analysis the initial rulemaking will require is a performance assessment. The performance assessment is meant to be a living tool for both the site and the regulator to be able to assess future compliance of the disposal of the facility with the performance objectives in 10 CFR 61.41 through 10 CFR 61.44 or the agreement state equivalent.

During the licensing of the disposal site, assumptions must be made based on expected waste volumes in streams of the possible final inventory of a site or a specified disposal unit within that site.

As operations occur, these assumptions should be updated on a periodic basis with actual waste volumes and any revised information of future waste that is expected to be received.

The results of the performance assessment can then be used to evaluate whether reasonable assurance still remains and that the disposal unit or site will remain in compliance with the performance objectives. If the result of the performance assessment is that compliance is uncertain or unlikely, additional data collection and modeling may be performed, the facility could be modified or future waste volumes or specific radionuclide quantities or concentrations could, in fact, be reduced. The decision on what actions to take should involve both the site operator and the appropriate regulator.

So who will be doing these site-specific analyses and what are the current disposal pathways for significant quantities of DU? This slide has a lot of information on it. I apologize for that, but it's designed to show the locations of the three operating disposal sites and the one that has been proposed. These, of course, are located in South Carolina, Utah, Washington State with the one coming online presuming near term in Texas.

On the right is a table that identifies the facilities, the waste that is authorized to accept and the compact restrictions that apply to that particular facility. I mentioned Texas is developing a new site, but it's restricted at the current time to waste from the States of Texas and Vermont. A particular note is that the Clive, Utah site accepts Class A waste from most of the United States, but the Barnwell site which accepts the majority of the Class B and C waste in the U.S. is closed to out-of-compact generators impacting 36 states. These are the most likely disposal paths for commercial DU waste.

For the moment, I would note that three of the sites are in arid environments and that one is in a humid environment and this is an issue of consideration during our technical analysis which Dr. Esh will discuss in more detail during his presentation.

The second part of this effort is a long-term rulemaking. This is the one that I referred to earlier when the Commission directed the staff to budget for a future rulemaking to risk inform. So the second part of this rulemaking effort is what we are calling the longer-term rulemaking. Specifically, the Commission directed the staff to propose necessary

resources for a comprehensive revision to risk inform the 10 CFR 61 Waste Classification framework using updated assumptions and referencing the latest international committee on radiation protection, ICRP, methodologies.

This revision would likely involve different, updated methodologies and assumptions than the original Part 61 methodology for key variables such as disposal configurations, performance periods, institutional control periods, waste forms, site conditions, exposure pathways and receptor scenarios. This effort would address all radionuclides, not just depleted uranium, but in fact we were specifically directed to address depleted uranium by the Commission.

We have another category called "Other Considerations." Thus far, I have covered the history of how we got here and the purpose for why we are here over the next couple of days.

But we recognize there are other concerns on our minds and we have reserved some time on the agenda tomorrow to discuss them. The few issues shown on this slide are just some of the notable issues that we've been thinking about, but there may be others. We know that there are important issues and we want to

hear your concerns.

For example, previously disposed volumes of DU should be addressed through the site's performance assessment as we have discussed. The PA is a living tool designed to ensure compliance with the performance objectives.

The second topic is something we've been discussing quite a bit amongst ourselves and with the agreement states and we will talk about more tomorrow. If a site wishes to dispose of significant amounts of depleted uranium before the initial rulemaking is completed, it would be prudent for the site operator and state regulator to review the existing PA, performance assessment, supporting this site and determine whether the issues that were raised in the technical analysis supporting the Commission decision to initiate this rulemaking and the issues that will be discussed here in this workshop are adequately addressed. If not, it would be prudent for the performance assessment to be revised to adequately address these issues on a site specific basis before disposal of significant quantities of concentrated depleted uranium takes place.

Finally, when we reexamined the waste classification framework, we will need to think about

any consequence for depleted uranium that has been previously disposed of under the initial rulemaking which is the subject of this workshop.

In terms of our agenda, first we're going to start off with technical aspects of site-specific analyses for DU and then we will broaden the topic to think about other unique waste streams that this rulemaking could apply to. We will then discuss how the agreement states would implement the NRC change and regulations of what NRC recommends states do in the interim before both NRC's rulemaking is final and before the agreement states have adopted these changes and their regulations. Next, we will discuss the long-term rulemaking and what potential changes could be made to the classification of depleted uranium and other radionuclides. And then finally we will conclude with some time to discuss any questions that may come up during the course of the discussions and to address the other considerations that I specifically pointed out a moment ago.

With that, I'll stop my context remarks. Again, I beg your indulgence for reading all of that, but it is important that everyone hear the same thing both here and in Utah, that everyone have a level playing field in terms of information that the staff

has had on its mind to facilitate your discussions and, with that, I'll take questions of a clarifying nature.

Yes sir?

MR. BURNS: You mentioned the activity of depleted uranium as 0.5 millicuries per cubic centimeter. I'd like you to clarify whether that is fresh or new depleted uranium or is that depleted uranium in secular equilibrium with the starter products?

MR. CAMPER: Dave, do you want to specify?

MR. ESH: I believe that's fresh or relatively fresh.

FACILITATOR CAMERON: Does that answer your question?

MR. BURNS: That answers my question, but in general one should be aware that once depleted uranium is in secular equilibrium with the starter products you could figure roughly 15 or something times as radioactive as that figure.

FACILITATOR CAMERON: Okay. Thank you. So we may have more discussion on that point.

Let's go to Arjun and then we'll go to Bill.

MR. MAKHIJANI: Yes. A couple of just

clarifying questions. Will you be doing an environmental impact statement as part of this rulemaking process?

MR. CAMPER: Yes, you do. You do an environmental assessment as part of all rulemaking.

MR. MAKHIJANI: You'll be doing an assessment, not an impact statement.

MR. CAMPER: It depends. Well, certainly we'll do an assessment. There's a process associated with rulemaking whereby you do an environmental evaluation. As you step through that, you reach conclusions as to whether or not it's an assessment or an environmental impact statement depending upon the outcome following the process.

MR. MAKHIJANI: Well, I would just recommend that the implications of this are so huge that you do a proper environmental impact statement assessing the options.

Part of what's leading you to an environmental assessment is the Commission has pre-judged the outcome of this process by saying you're going to consider just a revision of the (a)(6) part of the rule rather than consider that versus a revision of the tables in Part (a), 61.55(a). And I think it has done so based on an admittedly

unvalidated model and I just want to know how did the Commission decide that results based on an admittedly unvalidated model should be used as the basis for proceeding in this matter. I don't understand that.

MR. CAMPER: On your first point, there is an environmental assessment required for any rulemaking. You step through a process where you determine whether it's environmental assessment or an EIS. Typically, rulemaking would carry with them an EIS, but it's a process you step through to reach that conclusion. So we will be doing that as we will with any rulemaking.

With regards to the Commission's decision, I mean I describe and Dr. Esh will talk a lot more in detail about the analysis. So I'm going to wait and let him explain to you a lot more information about our technical analysis. But as I said in my remarks, we viewed it as a screening model. We did evaluate several periods of time in that analysis and we felt it was an adequate analysis to make a proposal to the Commission.

Now here's what's important. This rulemaking and whatever analytical methodology supports how we perceive this rulemaking will, in fact, be a matter of public record and scrutiny and

will undergo a validation process. This is a rulemaking to proceed with the Commission direction and the analysis is not over. The screening technical analysis that we did was a starting point to make a recommendation to the Commission.

FACILITATOR CAMERON: And just a process note at this point, I'm keeping track of some of these issues in the parking lot which just means it's an issue for us to come back and discuss later or it may be an action item, for example, Arjun's suggestion about there should be a specific response from the NRC to all the substantive and process suggestions made at this meeting.

The idea about the need for an EIS is probably going to resonate through a number of the discussions, but we'll make sure that we come back and address that specifically under "Other Considerations." So I will be trying to keep track of these issues so that we don't lose them.

MR. MAKHIJANI: Could I put two in your parking lot and then I just won't make a follow-up comment? One is I believe a proper rulemaking should consider both a revision of the tables and not just a revision of 61.55(a)(6) and the rulemaking should -- And the EIS should consider a full range of options in

how this should be done.

And secondarily, I do not think that any objective analysis of the matter would regard what was done in October of 2008 as a screening analysis which is supposed to be conservative. This thing has very nonconservative assumptions in it and cannot possibly fit the definition of a screening analysis. So I would like to see the definition of a screening analysis and why you think that this fits the definition of a screening analysis. Put that in your parking lot and I'll let it go.

MR. CAMPER: As I said, certainly during Dr. Esh's discussion, he's going to be giving you a great deal of detail about the approach the staff used and the technical analysis. I'm certain he'll try to address some of the concerns you're raising with regards to the nature of that technical analysis.

I mean in the final analysis as I said in my remarks the staff did recommend a rulemaking to modify the (a)(6) provision by adding a (a)(9) that would require the site-specific performance assessment. The Commission chose pretty much as you're actually suggesting to take it a step further and to also direct the staff to proceed with a rulemaking that would risk inform the entire waste

classification scheme in Part 61.

So I think the Commission in doing that addressed the immediate issue in terms of the pending disposal of depleted uranium and ensuring that there was an adequate mechanism in place to protect public health and safety. And I would add by the way it's an increase in regulatory presence over the disposal of depleted uranium as compared to the status quo and at the same time directed the staff to take a broader look at risk-inform Part 61.

So the Commission looked at the current situation and the future situation. I think that was a comprehensive decision.

MR. MAKHIJANI: This two-step process is ill-advised at best because you're not going to unbury the depleted uranium waste if the risk-informed analysis of ten years down the line shows you that you did the wrong thing. So you're actually prejudging the risk-informed outcome because there's going to be a lot of pressure to say whatever was done with DU is okay on the broader level.

I think if you're going to do it right we should just do it right to start with and not assign one million tons of waste of a waste stream to one category of short-term analysis just because you

issued a license to a corporate without properly considering the issues in advance.

MR. CAMPER: I respect that view and we hear you. At the moment, we have direction from the Commission to proceed with the particular type of rulemaking and our primary objective in this forum is to try to get as much input as we can on the various technical parameters that we'll be discussing over the next couple of days.

But all these types of concerns will be reflected in the minutes of this proceeding and the staff I'm sure will be communicating further with the Commission about what we heard here.

MR. MAKHIJANI: What's the point if the decision has already been made? What's the point of taking the comments? What's the point?

FACILITATOR CAMERON: Okay. If I could just make a process point here is that we do have a slot on the agenda to talk about the long-term rulemaking and certainly it's a legitimate question for all of you to discuss about whether the initial rulemaking should include other types of alternatives and, as Larry said, the Commission will be told about that.

But we will be going to discuss these

issues specifically and the point of the questions is not only to get answers for you but also to identify issues that we need to discuss in further detail.

The issue of nonconservative nature of the screening model, there's going to be an opportunity to ask Dave questions about that. But then when we get to the individual discussion points if there are specific examples, Arjun, of what you believe are nonconservative aspects, then we will be looking for those to be raised and discussed.

Let's go to Bill and then we'll go to Richard. Bill.

MR. DORNSIFE: I have a clarification comment and then an historical perspective comment. First of all, on your map of the disposal sites, I think it's important to note that WCS also is authorized to have a federal disposal facility that will meet the same Part 61 requirements. So it's not just commercial waste that's to be considered under this issue.

MR. CAMPER: Okay.

MR. DORNSIFE: And secondly, from a historical standpoint, I'd like to note that NRC has approved alternate classification standards in compatible state regulations. To be specific,

Pennsylvania's regulation have 100 nanocuries per gram for both uranium-238 and thorium-232 and the reason for the uranium-238 was exactly because of this long-lived issue. Texas has 100 nanocuries per gram for radium-226. So NRC has allowed agreement states to be more conservative on this issue.

FACILITATOR CAMERON: Okay, and that is a -- Larry, I don't know if you want to make a comment there. I was just going to point out that when we get to the agreement state compatibility issues that that's a great issue of discussion at that point.

MR. CAMPER: No, only that Bill's correct, I mean, in both his comments. On the slide itself, we need to make some adjustment to the slide to reflect that authorization. We can do that. But, no, your comments are correct. There have been different approaches used in different states with NRC recognition and approval. That's correct.

FACILITATOR CAMERON: Okay. Thank you.

Richard and, everybody, please use the -- make sure your mike is on and use the mike.

MR. HAYNES: Thank you.

Larry, I just want to clarify. I think in one of your comments you said that the NRC like for the previously disposed DU to be reevaluated in a --

MR. CAMPER: Richard, I can't hear you. I'm sorry. Can you speak up?

MR. HAYNES: Okay. I'm sorry. I think you had indicated in your presentation that the NRC wanted the previously disposed DU to be reevaluated in an updated PA and if that's the case, what time period are you all looking for for that performance assessment?

MR. CAMPER: Yes, what I said, Richard, was that we did a technical analysis in which we evaluated a number of parameters. There have been performance assessments done out there in several of the states that are operating these facilities. Certain of these states are expected to receive depleted uranium near term before this rulemaking will be finalized.

What we're saying is it would be prudent to examine, reexamine, those existing PAs and make sure that they minimally address the technical parameters that we did in our assessment and take a look and make sure that it is an appropriate PA for the materials that we received at that particular site.

In terms of how, we're not specifying a time frame in which a state would have to do that.

Obviously, it would be driven by which state is going to receive the waste when. I suspect, for example, in Utah -- In fact, I know in the State of Utah based upon discussions with state regulators that they are reexamining the performance assessment that's been done. They've had some dialogue with the site operator out there. My impression is that both the state and the operator are eager to ensure that there's an appropriate performance assessment in place.

I think the simple answer to your question is two part. One, we do think it would be prudent and we've had some discussions. We've had two telephone discussions with the agreement state regulators that operate low-level waste sites and all the regulators are in agreement that a performance assessment needs to be done. An appropriate performance assessment needs to be done and that the performance assessment should be reexamined in light of current information and current things that have taken place.

So I think there's an agreement upon that and with regards to the timing I know that the State of Utah is looking with their licensee, their operator, right now at that performance assessment. So I think each state will be driven by the time frame

in which it expects to receive depleted uranium, large quantities of depleted uranium.

FACILITATOR CAMERON: And, Richard, please raise any concerns you have with that again when we get to the appropriate parts of the agenda.

Just let me see if there's any -- quickly go to the audience to see if there's any questions for Larry before we go to the next presentation. Anybody? And please introduce yourself.

MR. REGNIER: Edward Regnier, Department of Energy.

I thought I understood you to say that the previously disposed DU would be reevaluated. Was my understanding there correct?

MR. CAMPER: What I said was is that -- Let me see if I can find the slide here.

(Off the record comments.)

FACILITATOR CAMERON: And, Larry, you may want to clarify, I think, the nature of the question.

(Off the record comments.)

MR. CAMPER: Yes. What I said was -- Chip, do you have a clarification?

FACILITATOR CAMERON: I just wanted to make sure you're very specific about what you mean by evaluate what has been previously buried because it

could have a number of different connotations and, for example, that when there is a request to dispose of additional DU at the site, would the site-specific performance assessment also have to consider what has already been buried?

MR. CAMPER: The simple answer of that is yes. Of course.

FACILITATOR CAMERON: Okay. Is that what you meant, Ed?

MR. CAMPER: What I'm saying in this slide is that a couple of issues that have come up is during the course of conducting this initial rulemaking the question that has arisen in the minds of some is we already have some previously disposed depleted uranium and you're going to have in certain cases for example potentially the Clive, Utah site substantial amounts of additional depleted uranium to be shipped there.

What we're saying in this slide and what I'm saying in my remarks is given that -- I mean, we don't have a requirement. Well, we don't have this new requirement in the regulations yet that would require this site-specific performance assessment to be performed and, as we discussed in the SECY, this would be an item of compatibility assigned B which means it has to be done that way.

Now Duncan White will talk more about compatibility and the subtleties of compatibility in more detail tomorrow I think it is. Right, Duncan? But what we're saying here is that if DU has already been disposed of and more DU is going to be disposed of, it would be prudent to make sure that your performance assessment is current. That performance assessment necessarily has to consider depleted uranium that's been disposed of there, how much additional depleted uranium is coming there and all the various site characteristics would drive the amount of material that can go there. And we're saying during the course of this rulemaking one should do that in those states that operate LLW facilities.

What we're also saying that under the long-term rulemaking the question comes up if you reclassify -- Let's say you reclassify depleted uranium or let's say the waste classification system that exists today doesn't continue to exist once that rulemaking is final. I don't know. We have no preordained views on that. But if we're going to risk inform the waste classification system, we need to look at it with an open mind.

So what happens to DU that gets disposed of during the course of this initial rulemaking up to

the time that you have a new waste classification scheme in place? That's what the last box is getting at. And typically what happens is rules that contain statements that indicate that this particular rulemaking is not retroactive or it provides certain provisions or activities that may have taken place in which a new set of conditions exist because of the new rule. Is that clear? Does that help?

FACILITATOR CAMERON: Okay. Does that answer it?

MR. CAMPER: Okay. Good. Thank you.

FACILITATOR CAMERON: Okay. Thank you.

MR. MAKHIJANI: It's not clear. You're saying the second rulemaking won't be retroactive.

MR. CAMPER: I'm sorry. I can't hear your question. Repeat it.

MR. MAKHIJANI: The second rulemaking won't apply to initially disposed of waste.

MR. CAMPER: I'm -- What is your question?

MR. MAKHIJANI: The second rulemaking won't apply to initially disposed of waste.

MR. CAMPER: No, I'm saying that during the initial rulemaking DU has already been disposed of. DU will be disposed of. This rulemaking will take about two years.

MR. MAKHIJANI: Yes.

MR. CAMPER: In theory. There will be depleted uranium disposed of between now and the time this rulemaking is final that requires a site-specific performance assessment. Okay. And what we're saying in this slide and what I was saying in my remarks is you need to reexamine your performance assessment and make sure that we feel at least minimally addresses the technical parameters that we identified in our technical assessment. Okay. And so we're saying you need to do that now during this initial rulemaking.

We're saying that depleted uranium is disposed of during this initial rulemaking. If the waste classification for depleted uranium is changed, the long-term rulemaking will need to address that in particular.

FACILITATOR CAMERON: Okay, and this is going to be a huge parking lot. I already can see that.

(Off the record comments.)

But we will -- I'm going to put this issue in the parking lot because we will be coming back to address this when we get to those specific discussion items.

Janet, did you have anything you wanted to

add?

MS. SCHLUETER: I guess there is still a subtlety.

FACILITATOR CAMERON: And if you would just introduce yourself.

MS. SCHLUETER: Okay. Janet Schlueter at NEI.

There's still a subtlety because your statements imply that at sites that there's previously disposed of DU that are not expecting to receive more DU you would not revisit those PAs. That's the subtlety, a site expecting more versus a site not expecting more.

MR. CAMPER: Again, Janet, what we've said is we clearly in my remarks we were emphasizing the sites that either have or will most likely receive depleted uranium, in particular, Utah for example. But what we've said to the state regulators -- and we've talked to the State of Washington, we've talked to the State of South Carolina, we've talked to the State of Texas and to Utah -- our advice has been as a Federal regulator, on one hand, we believe it's important to point out the prudent value in looking at your performance assessment to make sure that it passes muster technically, that it's up to date and

that it considers all the site characteristics specific to that particular site.

But given that we don't have a requirement in the regulations yet to require this particular site-specific performance assessment as defined in the recommendations to the Commission, the most we can do, the most effective thing we can do, to say at the time that it's prudent to do that. All of the states that are operating low-level waste facilities agree with that. They all agree with the value of making sure that the PA is up to date and my understanding is that they're all doing that to varying degrees.

FACILITATOR CAMERON: Okay. Thank you very much, Larry, and we will revisit. I'll keep track of these issues. I think they're going to come up in the normal course of discussion. If they don't, then we'll specifically revisit them. Some of these are going to be considered in the Other Considerations part on the agenda and that's Patty Bubar is going to tee that up for us tomorrow.

So thank you very much, Larry. Let's go to Andrew Carrera is going to tell us about the NRC rulemaking process and answer any questions for you.

Andrew.

MR. CARRERA: Chip, I cannot see the

ladies and gentlemen of the meeting. May I do my presentation at the table?

FACILITATOR CAMERON: Absolutely.

(Off the record comments.)

MR. CARRERA: Good morning. Before I begin, English is my third language. So I must ask for your pardon if I mispronounce a few words. So I'm not going to be as eloquent as Chip. I have to ask Larry Camper if I may do my presentation in Vietnamese or Dutch, but he wouldn't allow it. It would have been so much easier to understand.

Anyway, my name is Andrew Carrera and I work in the Office of Federal and State Materials and Environmental Management Program, Division of Intergovernmental Liaison and Rulemaking. And before I begin, I would like to thank the Division of Waste Management and Environmental Protection for inviting me to give a brief presentation on the NRC rulemaking process. Next slide please.

So the question is what is rulemaking. Rulemaking is a process used by government agencies such as the NRC to develop regulations and NRC regulations apply primarily to applicants and licensees who are involved in the transportation of nuclear materials or the use of nuclear materials in

medical, industrial or academic setting or operating facilities such as power plants, research reactors, uranium mills, fuel fabrication and for today's purpose waste repository sites. Next slide please.

So where does the NRC get its authority to do rulemaking? The NRC rulemaking authority stems from the Atomic Energy Act of 1954, as amended. It established the Atomic Energy Commission which is now the NRC. It also delegated the rulemaking authority to the Commission.

The Commission, however, is bounded by the Administrative Procedure Act of 1946, also known as the APA and the APA established procedures that regulatory agencies such as the NRC must follow to implement the regulatory program. Among other things, it sets requirements for publication of proposed rules and final rules on the *Federal Register* for public review and comment. Next slide please.

Rulemaking Stakeholders. There are a significant number of people in organizations who are directly and indirectly involved in the rulemaking process. On the screen behind me, you see a wide variety of rulemaking stakeholders ranging from the Federal and non Federal Government organizations listed in blue, the general public and industry in

pink, as well as different offices within the NRC listed in green. And the roles of the stakeholders may include requesting a rule to be developed, for example, through the petition-for-rulemaking process or gathering and assembling information to support the rulemaking and drafting rule text in supporting documents or providing comments after the rule is drafted. Next slide please.

Let us now talk about the rulemaking process. Before the rulemaking process begins, a regulatory basis which is sometimes referred to as a technical basis should be developed. The preparation or development of a regulatory basis is not part of the rulemaking process; however, it's a very important preliminary step to the rulemaking process.

The regulatory basis contains a justification for the rule and serves as a solid foundation of effective regulation and the purpose of today and tomorrow's sessions is to a major extent to gather information in support of development of a regulatory basis. So we are here to participate in a drafting in the regulatory basis.

Once the regulatory basis is completed, a proposed rule is developed and published for public review and comment. After public comments are

collected from the proposed rule publication, the comments are analyzed. Substantive comments are considered in the final rule and, after the final rule is published, the rule is implemented. I will now discuss the steps of the regulatory basis, proposed rule and final rule in greater detail. Next slide please.

Regulatory Basis. For our purposes, the first step is to develop a regulatory basis for the unique waste stream rulemaking and the development of a sound regulatory basis has become very important in supporting and making the NRC rulemaking process more efficient. The regulatory basis provides the foundation of effective regulation and it is the rationale for the rulemaking action.

It should be supported to the extent practical with sound scientific principles, legal or policy information. The regulatory basis should answer the questions of who, when, what, why and where, not necessarily in that order.

Now it should at minimum explain why the current regulation or policy is insufficient or needs to be changed. It should provide scientific policy or legal information that supports the decision to undertake the rulemaking. It should also discuss the

stakeholder's point of view to the extent known. And as I stated earlier, the major purpose of today and tomorrow's workshop is to gather information from stakeholders like yourself to support the development of a regulatory basis for the unique waste stream rulemaking. Next slide please.

Proposed Rule. Once we have a robust regulatory basis and it has been accepted by the rulemaking branch, a working group is assembled. The working group consists of the NRC staff with technical, legal and administrative backgrounds from various organizations within the NRC. In addition, if the rule is to be implemented by the agreement states like the unique waste stream rule is expected to be, the NRC will add agreement state representatives to the work group.

The working group uses the regulatory basis to draft the proposed rule text and other supporting documents which may include an analysis of the environmental impacts from the proposed action as well as a regulatory analysis to evaluate the cost and benefits of the proposed action.

The proposed rule package is then sent to the Commission for review. In this particular case, the draft rule text will be sent to the agreement

states for their review before it goes to the Commission. And if the Commission approves the proposed rule, it is sent for publication in the *Federal Register* for public comments. Normally, the public comment period is 75 days. Next slide please.

The Final Rule. After the comment period on the proposed rule ends, the NRC begins the preparation of the final rule package. The final rule is a logical outgrowth of the proposed rule and with consideration of substantive comments received from the proposed rule publication.

There should not be huge disconnects, revisions or changes from the proposed rule. Documents supporting proposed rules are also updated to reflect the final rule text. Agreement states' participation is similar to the propose rule stage and once the final rule package is drafted it is sent to the Commission for review.

After the Commission approves the final rule, it is published in the *Federal Register*. The *Federal Register* notice includes the rule text and responses to all substantive public comments received. And the final rule will be implemented on a schedule as posted in the *Federal Register* notice. Next slide please.

So how long does it take to finalize a rule? The complete rulemaking process may take several years. The rulemaking starts with acceptance of a regulatory basis and the regulatory basis itself can take anywhere from months to years to prepare and it's dependant on the complexity and the depth of the issue as well as the availability of the information.

We are currently scheduled to complete the development of the regulatory basis for the unique waste stream rulemaking by September of 2010. And once the regulatory basis is completed, the proposed rule is to be drafted. It usually takes about one year to complete the proposed rule and submit it to the Commission for review.

However, this time frame varies from rule to rule as well. For the unique waste stream rulemaking, we would hope to submit the proposed rule to the Commission by September of 2011. And once the rule goes to the Commission, it may take anywhere from weeks to months or more for the Commission to take action and approve it to be published in the *Federal Register* for public review and comments.

And after the public comment period ends, the final rule is to be drafted with consideration to the substantive comments received from the proposed

rule. It usually takes about a year to prepare and publish the final rule. But again it may vary based on the complexity of the comments received. For the unique waste stream rule, we would expect to provide the final rule to the Commission for review by September 2012.

And with the beginning of the implementation phase, the NRC rulemaking process ends. The agreement states, however, typically take up to three years to finalize the equivalent rules. Therefore, under the current schedule, we may see the implementation of a unique waste stream rule by the agreement states in late 2015. Next slide please.

And I summarized my presentation about the NRC rulemaking process. I thank you for your time. I thank Mr. Gary Comfort for working the slides and I will be happy to answer any rulemaking question that you may have. Thank you.

FACILITATOR CAMERON: Thank you, Andrew. That was an excellent overview of the rulemaking process.

Does anybody around the table have a question about the rulemaking process either generally or specifically in regard to this particular rule? Felix.

MR. KILLAR: Andrew, I'd like to ask you about -- The process you lay out is a typical rulemaking process. But the NRC also has availability at two other methods. They have a direct final rule and they also have an expedited rulemaking. Could you talk about the criteria? What determines which one falls in which category?

MR. CARRERA: Well, for this purpose, we just kind of stick with the straight, regular process. But I believe Gary Comfort can come and join the ANPR.

MR. COMFORT: Well, for the questions that you have for the direct final rule, generally those are only done for rules that we basically think are not going to have any significant or that won't have any significant comment. We still put them out as a direct final for comment and, if we receive comments, we would then have to rescind the rule and issue it as a proposed rule instead. So they're basically considered to be noncontroversial rules when we go to a direct final.

For an expedited rulemaking, those are generally things again that we're going to have more knowledge up front and not a lot of controversy and it's basically I expect -- I'm not as certain as to

how the expedited rulemakings are done other than the fact that they are basically said, "Put your priorities onto this one and get it done as quickly as possible." But again, if you run into complicated issues, you know you may overrun too quickly and you certainly don't want to do something that may be as complex as this rule doing it too quickly so that you overrun what the process would normally allow for comment and complete evaluation.

FACILITATOR CAMERON: Okay. Thank you. And just a follow-on to that, if the environmental impact statement as opposed to just an environmental assessment was done on this particular rulemaking, Andrew, would that add to the time?

MR. CARRERA: Add to the time, yes. The time frame would be extended.

FACILITATOR CAMERON: Okay.

MR. CARRERA: Especially if it's an EIS, environmental impact statement.

FACILITATOR CAMERON: Okay. Thank you, Andrew.

Other questions around the table on rulemaking?

(No verbal response.)

Do we have any questions from any of you

in the audience about the rulemaking process?

(No verbal response.)

MR. CARRERA: Chip, may I ask myself a question?

FACILITATOR CAMERON: You can if you want.

MR. CARRERA: I know the answer.

FACILITATOR CAMERON: We might answer it for you.

MR. CARRERA: Thank you very much.

FACILITATOR CAMERON: Thank you. Excellent, Andrew. Thank you.

We didn't want to wade into Dave Esh's presentation before the break and I know we've only -- Well, we've been going an hour and a half. So this is a good time for the break and I would just ask Dave to take note of some of the issues that were raised around the table and you may want to try to also address those or elaborate on those in your presentation.

I have five minutes to 10:00 a.m. Could we come back around 10:12 a.m., but certainly we're going to get started at 10:15 a.m. So take 15 to 20 minutes to do what you need to do. Off the record.

(Whereupon, a short recess was taken.)

FACILITATOR CAMERON: I think that just in

those opening presentations, we have identified some significant issues that will be discussed over the next two days.

And I don't want to minimize the fact that the time that you spend in breaks and lunch talking to your colleagues, that is a very important time, as important as what is going to be going around the table. And that discussion will spark some of those elevator conversations, so to speak. And so that is great.

Dave Esh is going to talk about the technical analysis, I guess is the formal term for it, that was used and try to put that in perspective for you in terms of what is going to be done in this particular rulemaking.

We will break basically two times during the presentation, the third time being at the end to go out for clarifying questions and identifying specific discussion topics that will happen also. And, Dave, are you ready to turn it over to you and --

MR. ESH: Yes, sure.

FACILITATOR CAMERON: Okay. Great.

MR. ESH: All right. Thank you, Chip.

SITE-SPECIFIC PERFORMANCE ASSESSMENT AND NRC DEPLETED URANIUM TECHNICAL ANALYSIS OVERVIEW

MR. ESH: I am Dave Esh with the Nuclear Regulatory Commission. My background, I had five years of experience at Argonne National Lab and now ten years of experience at NRC, primarily in performance assessment, a lot of different types of problems.

I have worked on complex decommissioning sites; our high-level waste project; low-level waste, obviously. And I am going to cover site-specific performance assessment, our depleted uranium technical analysis overview. Some of it may be a little generic, but I wanted to give a full context for everybody in the audience, regardless of their backgrounds.

English is my first language, but you may not be able to tell that unless you speak rural Pennsylvanian.

(Laughter.)

MR. ESH: And I don't use talking points. I like to wing it, which can be good and bad, but I found that I don't think and read very well unless it is something like *Green Eggs and Ham*.

So my overview here, I am going to cover performance assessment generically and low-level waste. That will be part 1 put together. Then we

will have a little bit of a break so people have all of their cards up. Maybe we can answer a few questions in between there.

Then we will go over our analysis of depleted uranium disposal. We will take another little break and then what we thought were the key issues that came out of that.

Now, to put this in context, this analysis was done as part of the SECY paper to try to understand what were the key variables for the problem. But you don't need a complicated analysis to say we need it to do something with 61.55(a)(6). You can calculate those sorts of impacts on a sheet of paper based on the concentrations and quantities involved for depleted uranium.

But this issue is more generic than just depleted uranium. Obviously we are here to talk about depleted uranium, but we have to try to anticipate, which we didn't do very well in the past what may be future waste streams and what needs to be part of the regulatory process to assure that we aren't here again in 20 years when we find out, oh, there were some other waste streams that we didn't think about the last time we did the unique waste stream rulemaking.

So I want you to try to think specifically

for depleted uranium but then also more generically for all of the unique waste streams. And we are here to get your input.

I heard a lot of people go around the table and say, "Well, we want to know what is going to be in guidance versus in the regulation." We would like to hear from you. What should be in guidance versus the regulation? That is why you are here.

We have experts here to give us their input on some of what we think the key issues are. Hopefully we end up with a combination of regulation and guidance that provides all the essential criteria but then provides some flexibility to evaluate these different problems because they can be somewhat different from site to site.

Okay. Part I, performance assessment and low-level waste analyses. What is performance assessment? Well, it is a systematic analysis of what could happen and what is assessed. We assess what can happen, how likely is it, what can result, how is it conducted. We collect data. We develop scientific models.

I am going to get a different pointer real quick.

(Pause.)

MR. ESH: Collect data, develop scientific models, develop computer codes, analyze results. Why use it? We look at the complex systems with it. We want a systematic way to evaluate data. And it's a generally internationally accepted approach. You have its proponents and its detractors, obviously.

In the center here, this performance assessment, it's a learning process. And it involves the collection of data, development of models, running and assessing those models, and developing confidence in the models and the results. But it combines all of these features, and this is the ultimate in job security, a loop that never ends, right?

NRC would require performance assessment to provide the site and design data; describe the barriers that you are using to isolate the waste; evaluate features, events, and processes that affect safety; and provide technical bases for models and inputs; account for variability and uncertainty; and evaluate results from alternative models as needed.

An important point of this is that when we look at a performance assessment, it is an explanation of what you think is happening with your system. And it should have enough detail to it to explain how your model is working, how you think your site is working,

what gives you adverse impacts, what gives you good outcomes. It should be enough in there that it basically explains your system and your site.

So in a more practical example, then, this performance assessment you're taking a real system. You're going to represent it with some mathematical models or abstractions. And you're estimating some future performance. That is the basic process.

Ultimately this estimated future performance you hope is reasonably representative of your real system. In this process and in the low-level waste regulatory process, you do monitoring. And you do other off-line work to help validate and verify these mathematical models.

So our low-level waste framework, moving out of the performance assessment generically and more specifically into low-level waste, one of the cornerstones of this system is stability. You want to put the material at a place where you think it is going to be stable and it is going to remain where you want it to remain. You are trying to isolate the waste from the environment and people. So you put it in a low population area generally.

The sites have federal and state ownership that allow for 100 years of institutional control. So

you are hopefully controlling the site to limit access to the material. Ultimately, though, we evaluate public exposures to people near the site, people that work at the site, and even somebody that may use the site as you didn't intend.

This disposal site shall be capable of being characterized, modeled, analyzed, and monitored. So you can't put it someplace where you don't know what is going to happen. You need to put it someplace where you can at least feel you have some confidence in knowing what is going to happen with that material at that location.

The process involves site selection and characterization, design and assessment, and site control and monitoring. And all of those are linked with each other. There is a very strong coupling between these two boxes and weaker coupling between the other one.

So in the part 61 EIS developmental analyses that were completed in the early '80s, they anticipated commercial low-level waste streams that they did a lot of work to try to say, "What do we think is going to go into one of these facilities?" They developed waste types, isotopic distributions. It was a way to try to assess, what do we think is

going to go into a low-level waste facility?

Obviously based on this quantity of depleted uranium, they didn't anticipate that. We acknowledge that. That is why we are here. Four reference disposal site environments were used, ranging from arid or semi-arid to more humid locations. And they evaluated the impacts to the public through processes like environmental transport, transport through groundwater.

I will show you a couple of slides here, examples of what they did, what was done in the low-level waste analyses.

Part of the process was the development of a waste classification system. That waste classification system, I like to think of it as it has two functions.

One, it makes it easy for a generator or somebody who wants to dispose of waste or a site operator to know, how do I need to handle a particular type of material that may be coming to my facility or how does it need to be packaged and handled and treated to dispose of?

Secondly, the waste classification system provides some limit on the type of material that was believed to be suitable for near-surface disposal. So

you can either do that -- in this case, NRC did the waste classification system. So they hard-wired what they thought was appropriate for near-surface disposal.

You could also take an approach, like DOE does for a lot of their facilities. They do a site-specific evaluation of what is suitable at a particular disposal facility.

When this was developed, you can read the regulatory basis. They evaluated whether they thought they should go on a site-specific-type process or a generic process. And there were pros and cons to each.

Basically they thought, "Well, we are going to have a lot of disposal sites. We should probably do this generically and just apply it to all."

Well, it turns out that probably wasn't a good assumption either. There aren't a lot of disposal sites now. So that begs the question of whether you should be using a generic approach or whether you should be using a more site-specific approach.

Ultimately the waste classifications that were derived for this waste classification system were

primarily based on inadvertent intruder exposures but not entirely.

So if we dig down into one of the pathways, water pathway receptors, this is a representation of disposal area, broken up into disposal cells. And then the concept was there was a buffer zone around the disposal area and a site boundary. And they evaluated groundwater impacts at a variety of locations, an individual well right next to the facility, a boundary well, population well, and then a population surface water.

This is trying to take releases from the low-level waste and calculate a groundwater impact to a receptor. That is the approach that was used in the early 1980s.

As Dr. Ryan said, things have evolved quite a bit. We have maybe some new tools. But he is probably not aware that our government-issued computers are still TRS-80s.

(Laughter.)

MR. ESH: The low-level waste groundwater analyses here, this is then taking that previous slide and representing it as a mathematical model. This is a representation using analytical or semi-analytical solutions to develop what the groundwater impacts

were.

Of course, today we have numerical models, and we can do all sorts of fancy things. It doesn't mean it is better. I don't know if it is better. But we can certainly do more sophisticated calculations.

Ultimately, though, you need enough information to support your calculations and justify them. So if you have limited information to support your calculations, maybe a complicated model isn't justified, a simple model is sufficient. If you have a lot of information to constrain or support your calculations, then certainly a more complicated calculation would be justified.

And then another key aspect of this low-level waste analyses and one of the reasons why we advocated the approach that we did in the SECY paper to the Commission was this idea of the site-specific behavior.

What I have done is I have taken retardation coefficients -- and our geochemist is trying not to jump out of his chair here now, but in the early 1980s, basically they took retardation coefficients. They assigned them for a variety of different sites. And they assumed different values for those sites. That was put into the low-level

waste analyses to represent site-specific behavior at different sites.

Now, some more modern information here. This is from a Sheppard and Thibault reference, which is a compendium of distribution coefficients and different material types and environments. But basically you can convert the distribution coefficient to a retardation factor so that it is an apples-to-apples comparison.

And if you take the data from this compendium and you calculate a retardation factor, you can see that the ranges that you have in the more modern data are quite a bit more broad than what were used in the analyses in the 1980s. That is not an unanticipated result. If you have a lot of information and there is a variability, you get a broader range of data.

The implication is that a site that has a retardation factor of one for strontium may have unacceptable performance and one that has a retardation of 1,400 may have acceptable performance.

So this variability can greatly impact the calculations at a specific site. So this is just an example from geochemistry. It is a crude example from geochemistry, but I think it emphasizes the point.

The site-specific behavior can have a large impact on the results. So whether you use a site-specific approach or a generic approach, either way the analysis has to be technically sound. But you may be doing yourself a disservice in some cases if you use a generic approach and you have a lot of variability. That is the point of this slide.

So that is the part I. I think we can stop. And then if people have questions, we will do a few questions. Then we will move on to part II, the depleted uranium and the NRC analyses that we did for the SECY paper.

FACILITATOR CAMERON: Okay. Thanks, Dave.

I am just going to hold questions to the table at this point. And at the end of Dave's presentation, we will go out to all of you in the audience. Anybody have a question on the first part of the presentation?

(No response.)

FACILITATOR CAMERON: Okay. Great. Dave, why don't you proceed.

MR. ESH: All right. Part II, depleted uranium and the NRC analyses. I am going to cover some problem contexts so we are all on the same page. I want to talk a little bit about uranium and radon,

uranium geochemistry, scenarios and receptors, and period of performance. These latter things were all important elements of the depleted uranium problem.

As you can envision, if we are trying to develop a rule for unique waste streams, we might be able to do pretty well specifying the technical issues that we need to cover either in regulation or guidance space for depleted uranium. But for other unique waste streams, both that you have to anticipate what those waste streams may be, it may be a little bit more challenging. So your job here today is harder than you probably anticipated.

The nuclear fuel cycle, these are just a couple of pictures to show where depleted uranium comes from. It comes from the fuel cycle process and the enrichment of uranium.

And then in the enrichment process, it is a byproduct of it. These are figures that come from our fuel cycle Web page. And there is a lot more text to go with it.

So any of you that want to get some more familiarity with the fuel cycle and where depleted uranium comes, that is where you can find it.

So the depleted uranium disposal, the problem context, large quantities of uranium were not

evaluated in the EIS for the 10 CFR part 61. But uranium was evaluated. Basically they evaluated about 17 curies of uranium-238 and 3 curies of uranium-235. And that was in roughly one million cubic meters of waste. So that gives you an idea of quantity and concentration that they assessed.

Looking forward, the quantity of depleted uranium that may be generated could be as large or larger than 470,000 curies of ^{238}U just for a comparison point. So it is significantly larger than they anticipated.

When they did the analysis in the '80s and they made the decision, "We don't need to put uranium in the classification tables because we don't have a lot of it. So we don't need to worry about it," well, if you have a lot of it, well, then maybe you need to assess it. You need to ensure that either it's assessed appropriately or it's reflected in the classification tables but in some way that it is reflected in the technical framework that you are trying to evaluate safety against.

So uranium and the environment, well, uranium and surface soils, this is just the United States. It is roughly one to five parts per million in soils, although in farmland, for instance, where

you apply fertilizer, it can be up to, say, 15 parts per million or maybe even 30 parts per million.

Uranium in surface soils results in radon in the atmosphere. Radon is a decay product of the uranium decay chain. Of about .25 picocuries per liter more or less, indoor radon levels are a bit higher than the mean atmospheric calculations because it decays very quickly.

It diffuses into your basement or into your house. And there is less dilution indoors. Basically you can get a higher concentration indoors and outdoors, it is pretty typical. And this is a pretty good rough ratio that you usually see.

But individual houses, for instance, in Pennsylvania, where I live, there were some houses that were 800 picocuries per liter or maybe even a few thousand picocuries per liter.

So there is a lot of variability in the environment of uranium. The radon transport is very much influenced by the environmental conditions and the presence of discrete pathways. So that is why you can get a lot of variability from, say, one house to the next or one area to the next.

As an aside, you should all have your houses checked for radon if you have not. Radon

contributes roughly 70 percent of the average annual dose in the United States, more or less 250 millirem per year.

So then a source comparison here. This is to give some context of how does the depleted uranium compare to other things that we have some idea about or at least had some idea of how they are managed right now.

Well, we have uranium mill tailings that come from the mining of the uranium ore. They roughly have much, much less than one percent uranium oxide in them in the U.S. In other places, it can be significantly higher.

There are some mines in Canada where the ore in the ground is about 70 weight percent uranium oxide. So their tailings are very high in uranium oxide also. And it is a management issue and problem for them.

In the U.S., much, much less than one weight percent uranium oxide, which then the daughters are observed to be roughly 26 to 400 picocuries per gram for a radium-226 and maybe 770 to 600 picocuries per gram thorium-230. That is what they see in uranium mill tailings in the U.S.

By comparison here, depleted uranium, it

has maybe about 40 weight percent uranium oxide as disposed. So that is if you take into account how it is packed into containers, how those containers are put into a disposal facility and the use of space between disposal cells. It will be something like that, on that order.

It starts off relatively free of radium-226, a daughter product that eventually gets you to the radon. It starts off pretty free in radium-226. At about 1,000 years, it is fairly similar to mill tailings. And then at much longer times, it could be significantly more concentrated if you have no loss from the system.

So this is just a theoretical calculation of how much build-up you could get without loss. Of course, if you had loss, that would change the numbers. It would make this lower. And it would shift it earlier in time. So this is just a theoretical decay calculation of what you build up or what you could have over time.

Now, to compare depleted uranium to other low-level waste, this is an activity ratio of depleted uranium to 20 years of a commercial low-level waste stream. It starts off that the depleted uranium has much lower activity on a relative basis because the

commercial low-level waste is generally high and it has short-lived high specific activity material in it. So it is only about 1/30 of the activity.

Over time, then, the low-level waste decays pretty rapidly, most of the short-lived component. It does have a long-lived component to it. We will show that in some figures coming up.

The short-lived activity all comes out, and depleted uranium gets the daughters in-growing. I think we had that comment from Peter Burns I think about the decay products and how much this specific activity can change over time.

But, then, eventually there is a big long-lived component to the depleted uranium. So you get a higher relative value compared to a normal low-level waste stream.

So what did we do in our analyses? Well, we had a screening model developed for SECY-08-0147. And we had the comment about, well, the screening model wasn't conservative. Therefore, it is invalid.

I would agree that the screening model wasn't conservative. The screening model was intended to analyze the problem and look at how key variables may impact the outcome, but it was not to say that the outcome is X.

So it gives you a range of outcomes over a range of key variables. And we think it was sufficient to make the decision of we needed to modify the regulation to handle, basically the regulation that said anything that is not in the table can be considered class A.

You don't need a complicated calculation to say, "Okay. Yes. That doesn't work if you significantly change your source or it may not work if you significantly change your source." You can do that calculation on a sheet of paper. You don't need a complicated model for it.

We actually used this model, though, to help develop what we thought were some of the key issues, specifically for depleted uranium. So that when we get into this step of the rulemaking process, we have both that evaluation, we have the input from the people here, and we can do a much better job at stage one of the rulemaking process so that everybody is on a more firmer footing or at least common ground as what we think some of the key issues were.

For the people here at the table and the people in the audience, though, we do want to know, is our list of issues comprehensive, is there something on the list that shouldn't be there and then this

issue of is it something that is an issue that demands placing in the regulation, as opposed to placing in guidance. Those are things that you need to consider and that we're seeking your input on.

So we developed it to examine key variables. Some of the ones that we looked at or ended up at were period of performance, disposal depth, receptor types and scenarios, and site characteristics.

We did this probabilistically just because we have more modern tools that allow us to use that capability. We thought we should. And the analysis methodology for unique waste streams, though, was consistent with the original part 61 analysis.

So why did we do that? Well, we wanted to do an apples-to-apples comparison. So if we are trying to look at depleted uranium or some other unique waste stream and we are trying to make a judgment about changing the regulation or changing a concentration table or whatever the case may be, we felt we needed to do an apples-to-apples comparison in order to accomplish that. So we used that previous methodology.

There are people who believe that that methodology is dated, that you should do something

more modern, there may be a different methodology. That is a good input to our process, but for this stage of the process, we wanted to be consistent with the old methodology, even though we deviated, we used a probabilistic analysis. We used some updated dosimetry, that sort of thing.

So our analyses, the receptor scenarios, they were consistent with what was done in part 61. You have a resident that lives near the facility but not on the facility. They had a house with a basement. They had a garden. They used the well they could potentially get contaminated water from. And they had all the various pathways associated with this scenario, all the main pathways.

Then in the chronic intruder evaluation, they can potentially -- it was both acute and chronic intruder, but the chronic intruder was more limiting.

They can potentially build their house over the facility, where in this case for depleted uranium, they can get diffusion of radon into their house. You can get diffusion of radon into the environment.

For the person who builds their house next to the disposal facility, you get diffusion of radon into the environment and then transport to the

location where they have their house. Then you also have potentially leaching of uranium from the source into the groundwater and exposure to the people.

So maybe you are encouraged by the crudeness of my figure here that we don't spend a lot of time making fancy drawings. On the right is just a picture conceptually. I don't intend for you to be able to see it.

We have to take these sorts of conceptual frameworks and make it into a mathematical representation. We used the commercial software package GOLDSIM just because we are familiar with it. We can do probabilistic analyses. We can do things much quicker than we probably could if we were writing, say, a FORTRAN program. But we used it to make a mathematical representation of the problem and assess what the impacts were for the various types of receptors.

So this is a picture of a screen snapshot of what that modeling software if you start getting into it looks like. If you purchased a license for GOLDSIM and you opened it up, none of this would be here. It is a blank sheet that you can just make whatever you want on it. It doesn't have to be a low-level waste or radioactive waste model. You can

do any sort of calculation on it.

So we had to build this calculation in here using the basic building blocks that are supplied in GOLDSIM. And it is good for this sort of analyses where you are trying to get first-order type of ideas.

It may be good for site-specific analyses, too, but if you needed to do a detailed groundwater model, say a 3-D groundwater model, GOLDSIM wouldn't be the right tool for that. It doesn't have strong dimensional capabilities in it, but it is good for this sort of analysis or we thought it was good for us.

The major variables, period of performance, disposal depth, receptor scenarios. We did uncertainty analysis. We use a genetic algorithm technique. It seems to work well for these sorts of problems where you get a whole bunch of uncertain inputs and you are trying to sift through them and see which ones are driving the output. It seems to be pretty powerful at being able to really cleanly tell you which ones are driving the output without getting some spurious correlations and those sorts of things.

The key parameters that we found with that analysis, they were related to the water pathways, hydraulic conductivity and gradient of the aquifer.

That greatly influences the dilution that you get in the problem.

Infiltration rate, which affects the release rate and also then the amount of dilution that you get in the groundwater system; and geochemical conditions, which affect both the release rate and the transport rate from the facility. So these are all water-related types of important parameters.

And then down at the bottom here, liquid saturation and properties of the house in this scenario, those are radon-related. So those were the drivers of the radon pathway calculations. We will hopefully talk about those in more detail when we have our specific round table discussions on each of these topics.

So, then, what does the output look like from this sort of process? Well, in this case we developed a table that is a percent of realizations that met our regulatory limits. So what does this mean? I have a whole bunch of numbers on there. I don't know what this means.

Well, okay. A hundred percent of the realizations met the regulatory limits for an arid disposal at 1,000 years for all pathways in these calculations for a resident receptor.

For a chronic intruder at this sort of disposal, very few of the realizations met the regulatory limits. This was applying a 500-millirem dose to the chronic intruder and a 25-millirem-per-year dose limit to the resident.

So in shallow disposals, radon caused problems for the chronic intruder. And it also caused problems at both one meter and three-meter depth. As you got to a deeper depth, then that was enough to knock down your radon.

But. even at longer times, a key variable was, of course, the performance period that you evaluate. These sort of things get more challenging as you go out in longer times. And that is because of the decay and in-growth of the daughter products from the uranium decay chains.

Uranium causes dose impacts, but the daughters are generally much harder to manage. So lead-210 is a difficult one. And eventually in the water pathways, radon is a challenge and an inhalation or an air pathway.

But then, even for a humid site, you get kind of the opposite effect. When you have a lot of moisture in the system, the radon transport can be knocked down sufficiently. But then you start seeing

effects in the groundwater pathway.

It can take a long time for those effects to show up, though. It depends on the geochemistry, the aquifer characteristics, gradient, et cetera.

The groundwater pathways can affect both the resident and the chronic intruder. But you will notice here for area disposal five meter depth, even longer times, about half the site conditions could meet the criteria and about half couldn't.

So this isn't an easy problem. It is not simple and straightforward to do an assessment for one of these problems. And you have competing processes.

The results can be very variable based on the site conditions. So for this problem in particular, it kind of at least nudges you in the direction of maybe you should be doing a site-specific evaluation and not doing something generic. But that is for part of the rulemaking process to decide.

These are not doses. These were percent of realizations that met the regulatory limits. That is because in these analyses, we had to try to represent a lot of different sites and a lot of different site conditions. So we basically made the decision to treat variability or aleatoric uncertainty as real as epistemic uncertainty.

So that basically means that it varied from realization to realization, but it was not variable within the assessment within a realization. And that can have an impact on your results.

In a real disposal system, you should represent that variability that you have at your site. What that means is, then, when you have the site, say, with moisture that is very low in an arid site, then you would be in the range of having trouble meeting the radon performance objective, where if you had a wetter arid site if that makes sense, that would be one that has a higher likelihood of meeting that performance objective.

So if radon is included in the regulatory limits for the dose assessment, then shallow disposal at an arid site can be challenging. For humid sites, the groundwater pathway can exceed the performance objectives. And for this sort of material, generally you would need to consider in more detail the long-term stability of the disposal system.

Typical commercial low-level waste is decaying very rapidly to levels that generally don't pose an undue risk. So something that lasts a lot longer, then you get into this long-term stability issue.

But as part of the NRC's low-level waste regulations, it requires stability. It requires stability of the disposal system. You can't avoid it. But the bottom line is that the site-specific conditions can result in a large variance in the impacts.

So I guess we will stop there and see if anybody has questions at this point.

FACILITATOR CAMERON: Great. Great. Thank you. Thank you, David.

Do we have some questions on what was presented during that frame? Bill?

MR. DORNSIFE: In your screening analysis, did you assume zero erosion, no erosion?

MR. ESH: Yes. We didn't evaluation erosion in the screening analysis because we made the assumption that if this is a low-level waste facility, it needs to meet the 61.56 stability requirements. And it needs to meet the siting characteristics regarding site selection and stability.

So that was one reason. The other reason was we got a broad range of impacts that said potentially acceptable to unacceptable. If we added in the erosion evaluation, we anticipated we would get a similar result, that we would get potentially

acceptable to unacceptable results with the erosion process.

We didn't need to carry it forward at this stage of the process. In the rulemaking process and in the associated guidance, for something that lasts a long time, you have to deal with stability. And the issue is whether you do that in a quantitative, semi-quantitative, or qualitative way depending on the time period that you are looking at.

MR. DORNSIFE: Well, in terms of obviously our future discussions, you know, if you are talking a million years of analysis, I mean, we're talking climate change and everything else. And this is a critical issue.

MR. ESH: Yes, it certainly is a critical issue. I don't dispute that.

FACILITATOR CAMERON: Okay. Thank you, Bill.

Let's go to Peter and then Mike and then Arjun and Felix. Peter?

MR. ESH: Just all put them up.

MR. BURNS: I don't have a question but, rather, a comment. And it is along the same lines as part of what Bill said. I was kind of amused in a way looking at the 1,000, 10,000, 100,000, and a

million-year time frames and the zeroes and the 100s and so on.

I was particularly amused by the climatic divisions, none of which can be relied on, even perhaps at 1,000 but certainly not in 10,000 or 100,000.

As an example, I am a geoscientist. So I have this rare ability to see into the far distant past.

(Laughter.)

MR. BURNS: And I know, for example, that Death Valley was filled with about 1,000 feet of water 10,000 years ago. And that tells you how much the climate can change in the arid regions.

So it is merely a comment. And I am sure we will be back into this topic later in the afternoon because I "Time Period of Performance" in there. And that is all I had to say.

MR. ESH: Yes. We imagine we can cover that in hopefully a lot of detail then. That is a good comment.

FACILITATOR CAMERON: Thank you. Thank you, Peter.

Michael?

MR. RYAN: Dave, thanks for getting us

started on some of the technical details. We appreciate that approach. I appreciate the approach you have taken in getting us started on the technical detail discussion.

A couple of points. We now talk about 600 millirem per year for medical exposure. The ICRP reports updated us on that. So it is a much bigger number and a lower percentage of radon. I don't know if that makes you happy or sad, but it is a lower proportion of the total.

I guess my second comment is the table that we just went through that you just had another comment on, it would be interesting to get some insight as to what the uncertainties really do to that table.

Does it just really make it -- I mean, this is a calculational result. I understand the use you are putting to it, but we have got to I think remind folks that that doesn't have any analysis of uncertainty. And, in fact, it could be all one answer: real short and real long. You know, there could be really two bins of results there.

So maybe you are going to talk about this later on. And if you are, that is fine, even tomorrow. How do you deal with uncertainty in these

long-range predictions? And how do we make sense of that, both in terms of where you are ending up with a new regulation or guidance or whatever it might be?

And then how should folks deal with that from a technical perspective, either as an applicant or a site regulator, to say, you know, with confidence that they don't understand the behavior of these materials in the future?

That is sort of one area. The second one is in the longer haul, I am guessing for this you assume just waste in dirt. At some point there is waste packaging and other things you can do to waste to further sequester it in the environment, at least for some reasonable period of time. Maybe that is 1,000 years and maybe even 10,000 if you are in the right setting with the right material.

MR. ESH: Yes.

MR. RYAN: Are you going to talk a little bit about those kind of things that might influence the outcome of your analysis?

MR. ESH: Yes. Your second point first. Yes, a good comment. We didn't solely just look at depleted uranium in dirt, though. We looked at variability in the form. So maybe different forms could be disposed of, different oxide forms, or if you

stabilize the material with grout, for instance, how that may impact both emanation of radon and the geochemistry for transport.

So we looked at some variability in the engineered things you could think about doing but not a lot.

MR. RYAN: Okay.

MR. ESH: We didn't really need it for this stage of the process. But yes, if you are dealing with a challenging problem, hopefully you would look to your engineers for part of that solution.

But then the second or your first comment, I would say that performance assessment does not make your decision for you. The decision-makers have to make that decision. The performance assessment should communicate the uncertainty. But then the decision-makers have to make the decision.

So it is a good comment. I think you have to clearly work in these problems to address the uncertainty. Peter's comment about the variability or the silliness of assuming the climate condition for an extended period of time, yes, that is part of the process.

I think you need to consider the

variability in your climatic conditions, particularly if they can drive your results, both in terms of variability, site-specific variability and long-term variability. You don't get to avoid it just because it is hard.

MR. RYAN: I think you hit the nail on the head, but I would request that when the documentation of guidance comes along in this process, which is years in the making, that some of those insights that you have gained by developing the background for any change in rulemaking and the tools and techniques and the transparency of all of those calculations would be something that you help to convey to folks who are going to have to be making applications.

So it is not just the answer that counts, which you have said clearly. It is how did you get to the answer and how could that vary based on a wide range of issues.

And if you could convey through the GOLDSIM tool or anything else that gets developed to use, I think that would be a really big step forward in what the agency could do for the users and the licensees or applicants.

MR. ESH: Yes. If we use calculations in the rulemaking, they will be fully documented,

available for stakeholder review, hopefully explained in sufficient detail that somebody could replicate them, understand them, verify them, whatever is needed.

MR. RYAN: Right.

MR. ESH: But in this rulemaking process also, where we are trying to decide on what needs to be done for a rule change and what needs to be developed in a guidance document, a lot of that might not be calculation, right? That is technical information that may come from people like Peter and Stephen --

MR. RYAN: Sure.

MR. ESH: -- that end up in a guidance document. That has nothing to do with the calculation. So we have examples of that in a variety of our regulatory processes, where we have technical documents that provide, say, review criteria and procedures, that sort of thing, that aren't relying on a calculation. You know, there's technical information that you need to develop something in a licensing process.

MR. RYAN: Thanks.

FACILITATOR CAMERON: And, Dave, before we go to Arjun, let me just ask you a process question.

I think it is pretty clear where Peter's comment will be discussion, "Period of Performance." In terms of Mike's comments about uncertainty and waste packaging and things like that, what agenda topics are most appropriate for the discussion of those two items?

MR. ESH: Well, we have source term issues, I think, where we could cover the engineering or the source term part.

FACILITATOR CAMERON: Okay.

MR. ESH: The uncertainty really overlays all of it. So people need to be thinking in uncertainty mode when we are discussing each of the topics.

And there is not just one way to handle that. You know, we do probabilistic analyses. We also do deterministic analyses. If you can do conservative deterministic analyses that you can support, that may be very much sufficient for a licensing process, just as well as a probabilistic one is.

So we don't demand or dictate a certain approach. We allow people the flexibility to generally do it a couple of different ways as long as it is technically supported.

FACILITATOR CAMERON: Great. Arjun, let's

go to you.

MR. MAKHIJANI: Yes. I have lots of questions, but I will just, you know, put forth a few of them with some comments. And maybe I can go after Bill goes the second time or second round.

If you agree with Dr. Burns' comment that your analysis, you agree with Dr. Burns' comment that your analysis, is not valid in the conditions of climate change?

MR. ESH: I agree that the climate variation can impact the results, but it wouldn't necessarily change the conclusion that you need to make a change to the regulation to address unique waste streams.

MR. MAKHIJANI: But the condition that I am talking about is if you go from arid to wet, then under all circumstances, your dose limits would be exceeded. And so the kind of rule change that we would be considering would be much more drastic than what we are actually discussing.

MR. ESH: I understand your comment. I don't think it is as simple as that. If you have variability and conditions, either on a local basis spatially and temporally, or on a broader scale spatially or temporally, I could anticipate that you

could get results that span those outcomes.

It is not predetermined that you would end up with unacceptable outcomes under all of those conditions. I don't think the problem works that way necessarily.

MR. MAKHIJANI: Well, if you didn't look at it. And you just described the silliness of assuming -- that was your word -- the silliness of assuming a constant climate. And what I gather from that is the Commission's taking this SECY paper in which their technical staff has described one of their key assumptions as silly and made a pretty momentous decision based on that when in your own analysis, humid conditions were shown to be unacceptable.

MR. ESH: Well, okay.

MR. MAKHIJANI: That is just a comment.

MR. ESH: But, as I said, you don't need an analysis to make the decision that we have made in this step of the process.

MR. MAKHIJANI: No. It is not --

MR. ESH: So what is the relevance of that?

MR. MAKHIJANI: The relevance is that the technical basis that was presented to the Commission for it to make its decision did not -- that one of the

key assumptions was described by you as silly. Maybe the Commission should know that, and they might want to revisit it.

My second question is very straightforward and factual. You calculated only TEDE. You did not follow the subpart C requirement of calculating dose to the most exposed organ, which in the case of lead-210 and drinking water would be the bone surface. And your dose results from drinking water in that case would have been about 30 times bigger.

Why did you not follow the subpart C requirements in doing your dose assessments and preparing that table?

MR. ESH: Primarily because in more recent evaluations; in particular, for waste incidental to reprocessing, we have had direction from the Commission to use more modern methods, instead of those old methods. So we followed that direction.

MR. MAKHIJANI: Is there something more modern than -- it is not a question of modern or not modern. I mean, we do have organs. That hasn't changed in modernity. I mean, human beings have organs.

MR. ESH: But in terms of whether you specify the dose criteria in terms of TEDE or in organ

doses, the more recent direction that we had in lieu of calculating the organ doses and other projects, we have calculated the TEDE.

MR. MAKHIJANI: But you are only proposing to modify subpart C?

MR. ESH: Not at this time, no.

MR. MAKHIJANI: Yes. So this rulemaking, we are only proposing to modify 61.55(a)(6). It is not proposing to modify subpart C. Yet, you chose not to follow subpart C in your technical calculations, even though the dose under subpart C properly calculated from drinking water would have been 32 times bigger to be precise under the most modern guidance published by the EPA, FGR-13.

MR. ESH: That is a good comment.

FACILITATOR CAMERON: Okay.

MR. MAKHIJANI: Well, I'll leave it --

FACILITATOR CAMERON: I don't want to get into --

MR. MAKHIJANI: I'll leave it there.

FACILITATOR CAMERON: I want to save these issues for discussion. Michael, do you have a quick clarification on this for us?

MR. RYAN: Just a point of information.

FACILITATOR CAMERON: Yes?

MR. RYAN: Just a point of information. There is a rulemaking initiative -- and I don't know at what stage it is -- where Don Cool and folks are, in fact, gathering information about the more modern methods of dosimetry. And they are beginning evaluation process to look at that formally within the agency.

I was aware of it because of a briefing you gave to the ACRS. So I just want to point out there is an activity at least underway to look at the more updated ICRP dose methods and so forth.

FACILITATOR CAMERON: Thank you.

MR. MAKHIJANI: I just want to put something up on your parking lot there that the Commission should clarify whether we are going to follow subpart C or revise it and whether the calculational modeling done in this process will follow subpart C or not because so far they have not.

FACILITATOR CAMERON: Okay. We are going to put that in the parking lot. And we will find a place to discuss it.

MR. ESH: I don't remember in the direction in the SECY paper for the long-term rulemaking whether they said to use the more modern dosimetry methods. I think they told us that in

addition to -- they are pointed in that direction. I mean --

MR. MAKHIJANI: It is not a question of more modern or not.

MR. ESH: It says it in the direction of where we are going to go forward. So I don't see how we avoid that.

MR. MAKHIJANI: Does that mean you are going to revise subpart C? It is a very simple matter. If we are here to talk about revision of 61.55(a)(6), let's talk about that and follow subpart C.

If we are here to revise subpart C, then that ought to be put on the table properly. But it hasn't.

MR. ESH: We are here to talk about that first step and the second step. The second step, the direction from them is that we are proceeding in that direction.

MR. MAKHIJANI: But that hasn't been put on the table anywhere explicitly that we are proceeding in the direction of revising subpart C. This is a complete surprise.

MR. ESH: You can read the SECY paper where they give us direction with respect to this

topic.

MR. MAKHIJANI: Well --

FACILITATOR CAMERON: Okay. Arjun, I think you are putting it on the table.

MR. MAKHIJANI: Yes.

FACILITATOR CAMERON: Okay? So it is in the parking lot. And there may be a simple way to clarify this in terms of maybe modern isn't the exact way to characterize it. But evidently it does need to be put into some context to see if there is a huge conflict in terms of revising subpart C.

So we will go there. I would just note a couple of other things, that you gave a very clear explanation of what the intent, the objective of the screening model and purposes of the technical analysis was.

And I think that everyone, as you pointed out -- and this is Arjun's point, too, that in going forward, rather than looking at the technical analysis, in going forward, then the screening models, everything has to be a lot more rigorous.

The point about the Commission's decision to do site-specific and then long-term classification, I think Arjun's point will be noted in the material information that is provided to the decision about

whether they had particular pieces of information on which to make their decision and further discussion. I just wanted to try to put this in context.

Felix?

MR. KILLAR: Yes. I just had a couple of questions about how you went about developing your model. Did you have any consultation with EPA in the way that they developed their performance assessment models for hazardous waste sites?

MR. ESH: No.

MR. KILLAR: Will you have some discussions with them along those lines?

MR. ESH: I anticipate that if we need to do calculations in the looking-forward rulemaking, the rulemaking process, step one or step two, but we are hoping to get input from any group that would positively influence that process, so yes, EPA, your institution, licensees, whomever.

MR. KILLAR: I think if you look at subpart C, subpart D hazardous waste sites, they have similar issues that we have right now. And from a policy across the board, we need to make sure that all of them are protected to the appropriate level of safety for the protection of the public.

When you start getting to the question

that we just talked about, the 10,000 years and what is under water and what is not under water, the hazardous waste site that is adjacent to the low-level waste sites could be flooded just as well as the low-level waste site if that is the assumption you are going to make.

So we need to as a policy across the board look at that. I don't know if the NRC should be dictating those directions. It is something to take into consideration as you go forward.

MR. ESH: It is a good comment. NRC has a different approach to waste disposal than EPA does in the chemical regime, different regulatory frameworks. And yes, they have different implications for how you assess them or how you evaluate them.

FACILITATOR CAMERON: Thanks, Felix.

Let's go to Bill and then see if Arjun has one more. And then let's go to the third part.

MR. DORNSIFE: Well, I would just note on your comment, Felix, that there is no performance assessment required for hazardous waste sites. It is a standard-based regulation. So you don't do a performance assessment for a hazardous waste site.

On the issue of uncertainty, I could easily argue that there is 100 percent probability

that the uncertainty goes to 100 percent with 1,000 or 10,000 or 20,000 years for certain sites when the next Ice Age occurs.

MR. ESH: Yes. I agree that the uncertainty can be large at particular locations, particular sites. And remember --

MR. DORNSIFE: But it is 100 percent probability. So how do you deal with that?

MR. ESH: Well, basically I think if you are trying to dispose of long-lived material, you have to strike a balance between the decision that you're trying to make today and what you are trying to accomplish with that decision.

So if in the event that the disposal site experiences an Ice Age, is the risk from the radioactive material of the greatest concern when that Ice Age is occurring at that location?

I mean, I think you have to balance in some sort of practical way in a quantitative, semi-quantitative, and qualitative manner these associated impacts. I can't give you the answer here.

MR. DORNSIFE: The risk is probably after the glacier melts and where it deposits. I mean, is there any performance assessment model that can even begin to look at that issue?

MR. ESH: Yes. I understand.

MR. DORNSIFE: I am just pointing it out. I think we will get into more, but I am just pointing out that the very steep slope when you look at performance assessments for shallow end disposal facilities beyond what is currently required.

MR. ESH: Yes. And I think what I tried to emphasize up front and I will re-emphasize here, the low-level waste regulations and framework anticipated certain types of materials and characteristics. And that framework was to ensure safe disposal of that material.

So we collectively, NRC and all of you at the table, have to look at when you are stressing that framework more than was anticipated. And if you are stressing it more, do you need to make a different decision? That is part of this process.

FACILITATOR CAMERON: Okay. And that's part of the crux of the regulatory conundrum here is how you deal with these. What is the best way to deal with this?

Arjun, did you have one more question before we go on?

MR. MAKHIJANI: Yes. If you applied your method of analysis and disposed of spent fuel at 20

meters, would anybody get any large doses of radiation from spent fuel disposal?

MR. ESH: I can't fully speculate on that, but I would anticipate probably.

MR. MAKHIJANI: Sorry?

MR. ESH: I would anticipate they would.

MR. MAKHIJANI: Really? Even if they didn't drill wells directly into the waste. Your wells don't go directly into the waste.

MR. ESH: They do.

MR. MAKHIJANI: No, they don't.

MR. ESH: Yes, they do.

MR. MAKHIJANI: From the figure that I saw, you have a resident intruder on site.

MR. ESH: The resident --

MR. MAKHIJANI: But the well is not in the waste.

MR. ESH: Either they place the house over the facility --

MR. MAKHIJANI: Right.

MR. ESH: -- or they drilled the well if the waste was deep, but the well goes through the material.

FACILITATOR CAMERON: That's an intruder.

MR. ESH: That is the intruder.

FACILITATOR CAMERON: Okay, which is different than what Arjun is talking about. I think that the point that Arjun is trying to make is if you buried the waste, if you put a condition in that would require the waste to be buried at 20 meters, is that a much safer thing to do than having it at 3 meters? Is that what you are trying to imply?

MR. MAKHIJANI: Well, you never get any exposure from anything. You have no erosion. You have no migration. You have no nothing. And everything is very stable. You have no climate change. And so we have apparently found the solution to spent fuel disposal for one million years.

MR. ESH: I think that is a broad mischaracterization because if you place spent fuel in this model, you would have leeching from the spent fuel, transport for the aquifer. You would have a potential intruder drilling for the spent fuel.

I don't want to speculate, but my guess is the doses from either of those pathways would greatly exceed the regulatory criteria.

MR. MAKHIJANI: Another quick question. Your analysis doesn't apply to the Clive, Utah site, does it, which has above-ground disposal?

MR. ESH: We did not do an above-ground

disposal analysis. And we did not attempt to evaluate a specific site.

FACILITATOR CAMERON: Okay. Let's move on to the third part.

MR. ESH: And to address the issue about the silliness, poor choice of words on my part. And I understand Peter's comment, but as I thought about it more, it is very likely that you have locations that are going to have an amount of variation in their conditions that aren't going to be as extreme as the example that you cited.

So take like the location near Clive, where you had Lake Bonneville. And that was under a lake and now not under a lake. And you would say, in the future could it be under a lake?

You can have broad processes like that, but you also have locations and conditions that are much more stable and semi-arid for long periods of time or certainly the geologic material is stable for long periods of time.

So I don't think it is fair to characterize it as, well, because you represented these conditions as epistemic uncertainty, then the whole thing is invalid.

I think the representing it as epistemic

uncertainty tells you the importance of the site-specific variation. And that is what we went forward with in this process.

We believe the site-specific variation is important. Whether it is short-term and local conditions and processes or longer-term and more global, the assessment process has to capture that.

FACILITATOR CAMERON: Okay. And just as a sort of a watch word, the NRC staff it has been said many times, including by Dave, is here to listen, to comment, and to provide information on what we did and to ask questions about proposals that are made about how would this work. They're not here to defend any future rulemaking decision because that has not been made yet.

So this is basically to provide you with background. And I think, as David suggests, the term "silly" is probably not good regulatory language. So we won't use that anymore.

(Laughter.)

MR. ESH: Maybe I should have used "talking points." Right?

MR. MAKHIJANI: Fair enough. Fair enough.

FACILITATOR CAMERON: Okay. Go ahead, Dave.

MR. ESH: Okay. So the depleted uranium rate on this -- we're in now, let's see, what we think are some of the key issues for depleted uranium disposal.

Now, remember, these are some of the things that we think are key issues that we would like to address in the regulation or guidance. But you are here to give input on this. Are there issues we missed? Are there issues that are on this list that aren't issues?

That is part of why you are here, so that when we get into the regulatory process and we do that draft 0 of the rulemaking, we have hit the target the best we could for a draft 0. This is your opportunity. Don't blow it. Okay?

Radon. Radon is a decay product from uranium. It is ubiquitous in the environment. It is transported via diffusion and advection in gas or liquid. And the rate of the radon transport is strongly affected by moisture contents in the system. So diffusivity and tortuosity are very non-linear functions of saturation.

They have all sorts of relationships so you can try to represent this characteristic or this empirical functional relationship. Lots of them are

different power laws. So they change very quickly as you change the moisture content in the system. That is why you can get results where a humid site, you don't have much of an impact and an arid site, you can have a lot of impact.

You can anticipate if you are doing the work like Stephen Webb does and you have a soil column, that you have variability in the moisture content, it changes over time. That is going to give you a much more complicated calculation of what the radon diffusion rate is and, therefore, the radon flux rate from that system may be.

The complexities for this evaluation can include the presence of discrete features, processes like barometric pumping that basically pulls the radon out of the ground and emanation. So when it is released, how much of it actually gets into the gas phase and can be transported?

The low-level waste EIS did not include radon, but it was primarily because they didn't anticipate the large quantity of uranium that would produce the radon. There isn't much about it in the regulatory document supporting the EIS. There is one guidance document that basically implies that you should include radon if it is present, but that is

only a lower-level NUREG guidance document.

So that is a first issue. The radon transport or presence of radon, one of the key issues that came out of the analysis. Second key issue is uranium geochemistry. So they observed uranium concentrations. And transport rates can vary very widely depending on the site-specific conditions.

The uranium is relatively mobile under humid and oxidizing conditions, but it can be immobile under reducing conditions. It depends a lot on the geochemistry, of course. And the uranium is available for transport under arid conditions, but the availability of water can result in long transport times.

I think Karen has a slide in her kickoff presentation for uranium geochemistry or just calculate some uranium transport times with some simple assumptions and show the broad range of results that you can get.

So scenarios and receptors. Basically we have an approach that was used in the part 61 EIS where institutional controls are required for up to 100 years. You have site ownership by state and federal entities. And it is anticipated that that will occur for a long period of time, but in the event

that those controls break down, part 61 framework has an unanticipated public exposure. So an intruder, that is evaluated on the disposal facility.

And they do things that we would expect people to do today: build a house, drill a well to get water, common activities like that. This regulatory process is based on reasonable assurance, where you are trying to do something that you think reasonably bounds the uncertainty and potential scenarios and receptors, but it is not the absolute worst case.

Normal public exposures are evaluated near but not on the disposal facility. And their limiting scenarios usually involve the residential or agricultural practices, but you have to evaluate the suitability of various scenarios and receptors at a particular site.

So the one that we had the most fun on, depleted uranium period of performance, basically our low-level waste regulations do not provide a period of performance. It is silent on the matter.

We do have a guidance document, NUREG-1573, which recommends 10,000 years. And it does talk about longer-lived materials and considerations for longer-lived materials or large

quantities of longer-lived materials; in particular, uranium.

Outside of Yucca Mountain, which does have a 1 million-year period of performance, a period of performance longer than 10,000 years has not been applied in the U.S. This includes WIPP, which has long-lived waste in it.

Uranium mill tailings, which is long-lived material, has a 1,000-year goal. And some of our decommissioning sites have some long-lived material. And we apply 1,000 years there, too.

There is not an international consensus on this topic. There is a recent report out, a 2009 NEA report, which I have a copy of there at my seat that people can see if they want to, that talks about period of performance. It talks about the balancing act you are trying to achieve.

It is basically ethical considerations. How much do you think you need to protect future generations, balancing that with how much you think you need to give them the flexibility to make future decisions for themselves?

It is not an easy problem. And there are very diverse views on the topic. So we do expect to have a very animated debate on this topic.

Scenarios and receptors. I think that is a duplicate, isn't it? I went the wrong way. Sorry. Depleted uranium NRC analyses. Basically the SECY provides a basic description of the assessment and assumptions.

We felt that we were going above and beyond what was required for this step in the process. We didn't need to do an assessment like we did, but we wanted to be better informed as to what we thought the key issues were so that when we got in this stage of the process, we would hopefully do a better job at hitting the target.

The analysis is not intended to replace site-specific evaluations. Those are intended to be done at disposal facilities based on their conditions, their models, their data, all those sorts of things.

All future calculations supporting proposed regulations will be fully documented, will be provided for stakeholder review and comment. If we have to rely on calculations, you will get the full details. You will be able to comment on them, review them, give any sort of input you want.

That is what will be needed. If that is needed in future rulemaking process, you will have full opportunity to do that. The basic conclusion

that we needed to do a rule change to address unique waste streams was pretty straightforward.

I think that is it. And we can have some more questions.

FACILITATOR CAMERON: Okay. And we are running a little bit late. And I don't want to get you too late for lunch. All of these topics in the last segment that Dave talked about are going to be addressed in specific discussion topics.

So let's try to hold this to just clarifying questions at this point. And then I want to check in with the audience. And then we will move on to the first discussion area, which is significant quantities.

So are there questions on the last part of Dave's presentation? Okay. Peter?

MR. BURNS: I am trying to rethink my observations that I was going to make and turn them into questions in real time here because I realize that observations are no longer allowed at this moment.

FACILITATOR CAMERON: At this moment. But, you know, we have had lots of observations. Time has been well-spent because we are popping questions up for the discussion.

So don't go to any great calisthenics on this. Just make your observations.

MR. BURNS: Well, no. I am going with a question.

FACILITATOR CAMERON: Okay.

MR. BURNS: I've got it straightened out in my mind. So we have U308 powder or U308 something or other that is probably the form of depleted uranium we are going to dispose of.

So I was wondering what the relevance, really, of reducing conditions is in your slide on depleted uranium, uranium geochemistry, and the implication that uranium is fairly immobile under reducing conditions.

I certainly agree with that statement, but when you place vast quantities of oxidized uranium, which U308 is, I can't imagine a geologic environment that is going to be reducing enough to really overwhelm that and reduce the uranium.

MR. ESH: Yes. It's a good comment. You may have to engineer it or attempt to engineer reducing conditions and/or it would depend on the unique disposal, of course.

This has to cover potentially small to enormous quantities. So if you had a small quantity

in a disposal environment, you may be able to have some reducing conditions that you would be able to have that effect from.

And I agree with the comment a very large quantity, it would be a challenge for the natural system to provide that reducing environment.

FACILITATOR CAMERON: And this question that Peter asked, the idea of reducing conditions, will that appropriately be addressed in the geochemistry topic?

MR. ESH: Oh, yes. Yes.

FACILITATOR CAMERON: Okay. So we will get that.

MR. ESH: You will have an hour on each of these topics and some other things to talk about each of these. So hopefully everybody feels like they have enough time to have their voice heard and get their input out there.

We are also going to be really reliant on the written information that you submit if you can to us in this process. So we will do the best we can minding the transcript and trying to use that information, but if we get something sent to us, that will be much easier for us to work with.

FACILITATOR CAMERON: Well, I would just

note possibly that just as reliant because the idea here is not -- we are hearing lots of individual comments now. But the idea of the discussion is for other people around the table to respond to Peter's concern about reducing conditions. But, of course, you will be able to amplify with written comments.

MR. ESH: That is my point. If they can provide the context and the detail in those written ones that they might feel like they can't right now in some circumstances.

FACILITATOR CAMERON: Great. Mike?

MR. RYAN: This is a follow-on question to Professor Burns' question. It always strikes me with uranium that we very quickly get into the discussion of the natural environment's ability to serve as a barrier.

So you have talked a little bit about that. That is obviously going to be a point of discussion and analysis, I would assume, in what folks will be advised to do or required to do.

The second is a concept. Can you engineer the site to give you some of those desirable characteristics, like reducing conditions or other things? To me that is important to be explicit about because, at least from other low-level waste

regulations and requirements now, we have been in the mode of not doing that. Other than geotechnical engineering, we really haven't tried to do chemical engineering or other kinds of engineering to force the site to behave the way we want.

So if that is going to be a shift for these longer time frames, I think it would be good to be pretty explicit about the fact that's kind of a change in thinking that some engineering that would also stand up and have to hold and meet the requirements of long-term reducing, as opposed to short-term or whatever it might be, be explicit, that would be I think a real valuable thing for site operators of potential applicants to understand exactly what the dimensions of that site engineering could be for these longer-term wastes, like uranium.

FACILITATOR CAMERON: Great. Thank you. And that will be part of the discussion.

Does anybody in the audience have a question on this? Let's go to John. Please introduce yourself, John.

MR. GREEVES: John Greeves with Talisman International. It's a quick comment. Dave, the staff, you did a good job of identifying key parameters and key variables.

A lot of the speakers started with, what is in the rule, what is in guidance? And either today by the time you get to Utah, if you can kind of express where you are leaning to because the written comments will vary depending on what the answer to that question is.

From my perspective, the period of performance is one of them. It has got to find a home in the rule. The rest of them are typically guidance topics. If that is not where you are going, tell us so that we will at some point in time know where the staff is.

How much of this is in rule? How much of this is in guidance? It is kind of a parking-lot topic unless you want to address it real quickly.

FACILITATOR CAMERON: I think we know the rule versus guidance issue is important. And the staff is going to get comment on that. That is going to be reflected in the transcript. I am not sure the staff is going to be ready to put anything down in terms of what direction they are going to be going on those issues. It is a good comment: rule versus guidance.

MR. ESH: Yes. I think those are broad, difficult decisions. And I can give you my opinion,

but it's not going to be worth anything.

FACILITATOR CAMERON: Okay. Dave, that was a real tour de force of presenting the overview on this. So thank you very much.

Do we have another last question?

MR. MAKHIJANI: Yes, quick.

FACILITATOR CAMERON: Arjun, go ahead.

MR. MAKHIJANI: Under the modeling assumptions of putting these containers and covering them with soil, you would normally have oxidizing conditions, right? I mean, I just want to be clear.

MR. ESH: Yes.

MR. MAKHIJANI: Did you assume any chemical changes in the uranium when you did the modeling in terms of exposure scenarios?

MR. ESH: You mean when it potentially comes from the disposal environment to the accessible environment?

MR. MAKHIJANI: Yes.

MR. ESH: Yes. No.

MR. MAKHIJANI: Okay.

FACILITATOR CAMERON: Okay.

MR. ESH: Remember, though, it was a probabilistic analysis. So basically if you are using a probabilistic, say, dose conversion factor or other

thing, that is partly incorporating variation in the environment in that parameter.

MR. MAKHIJANI: I just wanted to be clear about what was done.

FACILITATOR CAMERON: Okay. Thank you, Arjun. Thank you, Dave.

And, Dave, you can relax now and tee up the first discussion question if that is relaxation. Okay.

MR. ESH: I don't get to sit down?

FACILITATOR CAMERON: All right. The first discussion issue is going to be what are significant quantities, depleted uranium. And Dave is going to explain, is going to tee up why that is an important question.

And then we are going to go out to you for discussion and see what your colleagues think of your perspectives on these particular issues.

David?

MR. ESH: Yes. Thank you.

ISSUE 1: SIGNIFICANT QUANTITIES OF DEPLETED URANIUM

ISSUE 1.1: DEFINITION OF SIGNIFICANT QUANTITIES

INTRODUCTION

MR. ESH: The definition of significant quantities of depleted uranium, this is where you have

to start doing your work here. We are going to give you a little bit of framework, but then it is pretty open for you to give your perspectives on how you think one would go about defining what a significant quantity is.

So a little bit of background and talk about how one would determine a significance level and maybe some methods to determine significance. So in lieu of saying what's significant, that could also be defined maybe by what is insignificant. There are a few measures of maybe what somebody could look at and say is insignificant.

In the development of 10 CFR part 61, the NRC considered that these quantities were essentially insignificant. Seventeen curies of ^{238}U, 3 curies of ^{235}U, if you convert those, that would be roughly 30 parts per million uranium distributed homogeneously over a waste disposal system or roughly 90 drums, 55-gallon size, if you concentrated it.

So this quantity back in the early '80s they thought of as generally insignificant. The quantities were limited. But based on this, they said no need for waste classification limits for uranium based on these limited quantities. That gives you at least one point in space to do a comparison to.

What I would note here is that risk is obviously a function of the quantity and concentration. So it is a product of both of those.

So what would be some methods to determine significance? Well, we could look at historical values, like I just showed on the previous slide. Maybe you could talk about significance with respect to local background.

Obviously in the first presentation, I showed you that uranium is ubiquitous in the environment and what concentrations it is present at and what sort of impact that gives to people from normal, natural sources. So that gives you another point of reference.

And then whatever is done to define what the significance is, there are a few ways that that could be done. It could be defined in the regulation based on a calculation or based on where it is coming from. Those are potential approaches and then maybe other methods.

It could be defined more generically and give people the opportunity to calculate how they would determine whether an amount is significant or not. But this gets to the question that a lot of people had of, is this something that needs to be in

the regulation? Does it need to be in the guidance? What approach would you use to try to do this?

FACILITATOR CAMERON: Great.

MR. ESH: So we are looking at public feedback on developing the criteria for significant quantities, how we would do that, what are our factors to consider, what alternative approaches do people have.

FACILITATOR CAMERON: Good. And, Dave, could you join us at the table for the discussion? And thank you for that tee-up.

Who wants to start off on this idea of significant quantities. Let's go to Christine first. And then we will go to Bill.

MS. GELLES: Okay. Thank you.

ROUND TABLE DISCUSSION

MS. GELLES: I am going to begin with a follow-on question. And it is echoing one of the opening comments during our introductions. And that was, are we going to also have a dialogue on defining what is a unique waste stream as well as what is a significant quantity? Is that going to be a separate discussion item?

FACILITATOR CAMERON: Yes. I think it is a separate discussion item on the second day.

MS. GELLES: On the second day.

FACILITATOR CAMERON: Tomorrow.

MS. GELLES: Okay. Thank you.

And now my comment from the Department of Energy. While we are very experienced, as I alluded to in the introductions, in doing site-specific performance assessments and we are comfortable with the idea of unique waste streams being disposed of in near-surface disposal facilities, but if we are moving towards a site-specific focus, we are wondering whether or not it really is necessary to define what is a significant quantity given that the site-specific conditions that are evaluated will, in fact, be defining what is the limiting quantity that can be accepted.

So we are wondering whether there is really real merit in defining it. And, to that end, obviously we would have more significant concerns with it actually being in a rule, rather than being in guidance.

FACILITATOR CAMERON: Okay. Let's follow that thread. Do we need to define what is a significant quantity, either in the regs or in guidance? Tom, you have something on that, right? Why don't you go ahead?

MR. MAGETTE: I would basically agree with what I think I heard Christine say. I think if you are going to do a site-specific performance assessment, then you are going to get to the question of quantity.

If you want to have as a requirement the disposing of uranium, depleted uranium, in some quantity that requires a site-specific performance assessment, then require a site-specific performance assessment and don't spend a whole lot of time arguing about tons or drums or concentrations.

I mean, the numbers you just threw up there, David, as I could calculate quickly, your 90 drums is 60-ish tons by our calculation. It is a lot more than the one to ten that the SECY references as being non-significant.

So I think we could spend an awful lot of time talking about that and not really get very far. So I don't think you need to specify a threshold, a quantitative threshold.

And as to rule versus guidance, I think if you are going to require a site-specific performance assessment, if you are going to have a 61.55(a)(9), then yes, it is going to be in the rule. This belongs in the rule absent a threshold.

FACILITATOR CAMERON: Okay. Continuing on with the question of do we need this in light of a requirement to do a site-specific performance assessment, Bill, did you have a comment on that? Why don't you go ahead? And then we will come over to this side of the table.

MR. DORNSIFE: Yes. I think there are a couple of issues here. There's an issue of is there a concentration where you can establish that anything below that concentration is acceptable in shallow burial.

And so that is exactly what -- when NRC came out with their decision to do rulemaking, we had analyzed for 10,000 cubic meters of pure DU. And it met our performance assessment out to 100,000 years.

We had to then negotiate with the state and came up with a ten-nanocurie per gram concentration later. Anything below ten nanocuries per gram is a diffuse DU waste stream, and we could dispose of it.

I would also like to mention that the examples that were put up here, I think a better example is recognizing that DU is a subset of source material, there is an exempt level for source material, which is 500 parts per million.

There are also categories of pure depleted uranium that are exempt, like DU counterweights. We have disposed of probably approaching 10,000 tons of depleted uranium in our RCRA cell as exempt material. So that issue needs to be considered also. What are the current NRC exemptions?

I think you could argue that non-depleted source material is worse than depleted source material because you have a higher concentration of ^{234}U in source material. So it reaches equilibrium sooner.

FACILITATOR CAMERON: So ne question for you. The last point about the implications for exempt materials, exemptions that have been established in the regulations, is that independent of the answer to the question about whether the NRC needs to define a significant quantity?

MR. DORNSIFE: Well, they certainly can't define a significant quantity that would allow more exempt materials to be disposed of than the significant quantity as unregulated material.

FACILITATOR CAMERON: Okay. I wanted to get that tie-in.

MR. DORNSIFE: Yes.

FACILITATOR CAMERON: All right. Let's go to Peter. And then we will go to Mike and then Felix.

MR. BURNS: I find myself in agreement with Christine in her comment that there probably doesn't need to be a specific quantified cutoff here because I find myself thinking of some of the world's famous ore deposits of uranium, like Cigar Lake in Saskatchewan that has ore that is over 50 weight percent uranium. And it has been there for two billion years, hasn't gone anywhere, fortunately. Otherwise we couldn't utilize it and so on.

There are many examples of this. There are geologic environments that will contain vast quantities of uranium. But I can also come up with environments where I wouldn't want to put four kilograms of uranium.

So, independent of the geologic and engineered constraints, it seems pretty difficult to set a quantitative limit. But, rather, the limits should be related to the dose that appears through time from whatever is put in that particular environment.

FACILITATOR CAMERON: Okay. Thank you. That puts it in context.

Michael? Bill Dornsife?

MR. DORNSIFE: I think that's important, the diffuse issue.

FACILITATOR CAMERON: Okay.

MR. DORNSIFE: Is there a concentration limit where it doesn't matter.

FACILITATOR CAMERON: Sorry. Okay.

MR. RYAN: I would agree with what most folks are saying, that I would not try and get at that quantity of insignificant because it is very difficult from a number of points of view. Concentration, on the one hand, in Bill's example might be a metric of interest, but when you look at a disposed quantity, it is really the total quantity of uranium disposed I whatever matrix it might be in that drives performance assessment.

So is it concentration-based? Is it quantity-based? You run into all of these difficulties because both of those units have grams of uranium or grams per cubic meter of uranium have meanings in various contexts and no meaning in other contexts. So it is tough from that standpoint.

I think that if you require a site-specific performance assessment, I can understand why that would want to be in the rule. But I would sure vote for a detailed guidance document, a NUREG-level document that gives you if you do these analyses and these calculations and these assessments,

you are on the right track to meeting the regulatory assessment requirements.

Now, if the assessment comes out good or bad, that's the decision process. But I would sure like to see all of the things that you have talked about laid out clearly of how an applicant or somebody who was trying to make an assessment goes about meeting those obligations that might be in the rule but very explicitly laid out in a guidance document as to how they can get there.

With regard to a lot of the issues that you have covered already today we will cover in the rest of the day and all day tomorrow. So just be thinking ahead. If I am not going to have things about unimportant quantities or de minimis concentrations, all the words we have used over the years, it would be good to say, how do you assess what it is you have?

And can you get to an assessment under certain circumstances that is a very easy answer to say, under these conditions, the way you have assessed it, it is okay? And if it doesn't pass that criteria, you have to do a more detailed assessment to decide whether it is okay or not.

In other words, a staged approach of

assessment, as opposed to trying to specify a de minimis amount, now might be a way to incorporate a low end of interest or concern relative to a high interest.

So you kind of incorporate the question of, do you need an insignificant quantity defined as a unit? I would say no. But can you build it into the performance assessment part, a method to assess whether something is significant or not at various levels of concern because of the dose criteria or whatever you apply might be a way to incorporate the two ideas into the one assessment.

FACILITATOR CAMERON: Okay. And I want to ask people. I want to go to Felix and Arjun. But I want to get some response from others around the table in terms of Mike's suggestion that you don't need to put this in the rule, but it would be useful to address I think some of the issues, the issue that Peter brought up, about it's context to assess that and to have something in the guidance on that. I want to get a reaction from all of you to Mike.

First of all, let's see what Felix and Arjun had. And then we are going to go to Bill.

MR. KILLAR: Yes, I guess I am on the "me, too" wagon in that the significance is sort of like

beauty is in the eyes of the beholder. If you have a site that has a lot of other active isotopes, the impact of that depleted uranium coming into that site may have significance. But if you have a site that has a lot of very I would say non-active or lower-significant isotopes, you could bring in a lot more of that depleted uranium and not have a significant impact on the overall performance assessment.

So trying to define a specific term as significant is highly site-specific. So I think that you are doing a disservice by coming up with a significant quantity or level or what have you.

But certainly I think it would be appropriate of how you take that activity from that uranium, depleted uranium, in consideration with the other materials that you plan to dispose of in that site and your total performance assessment and do your total TEDE for that site.

FACILITATOR CAMERON: So that is another context item. Consider the context.

Arjun?

MR. MAKHIJANI: Yes. I mean, I do think the comments that have been made, I think they are very good points. But in order to connect it to one

other point that was made earlier, shallow land disposal means oxidizing environment.

If you are going to require engineered reducing environments, that implies some kind of limit on what you can -- can you put 100,000 tons of depleted uranium in a site and require reducing environments?

We do know under the existing rules that we have come here because significant quantities, large quantities, are defined as what comes out of enrichment plants. And that is the main application that is going to be made.

You know, if we can't define those as large quantities and retain some idea of what large quantities are, then by implication what insignificant quantities might be, it would be a problem, I think, in general, I think, unless we are going to abandon the idea of requiring a reducing environment to take the chemical changes, climate changes into account.

FACILITATOR CAMERON: Okay. Thank you, Arjun. That's again this idea, another idea, on context.

Peter, did you want to say something on that? And then we are going to go to Bill and Tom.

MR. BURNS: Maybe some of my earlier

comments gave the impression that I would strongly encourage a reducing environment for storage of depleted uranium or maybe other people made the comments that led to that conclusion.

The bottom line is that that is not what I intended to imply. It is a very different situation if you have a reducing environment versus an oxidizing environment. But let's say we go with an oxidizing environment. There are very readily achievable chemical engineering treatments that you can use, not necessarily treatments but engineered barriers that you could use to greatly impact the use of uranium out of the site.

What jumps to mind immediately is phosphate amendments of some sort, uranyl phosphate, uranium-6 plus phosphate, not reduced uranium. It is highly insoluble. And it is currently being tested at the Hanford site to a mobilized uranium that is already in the vadose zone and traveling with the groundwater. And, to the best of my knowledge, it is working rather well.

It doesn't even need to be expensive. I mean, one can grind up a bunch of old fish bones and put that in a barrier system, right, and achieve probably chemically almost as good as reducing

conditions.

FACILITATOR CAMERON: Okay. Thank you. Thank you for that clarification.

Bill and Tom, some reactions perhaps to Mike Ryan's suggestion? Bill?

MR. DORNSIFE: Yes. Well, first of all, a very easy way of making a reducing environment is to put the waste in a concrete canister because, even after the concrete canister fails, NRC's NUREG reports have shown that you still have that concrete environment around the waste that creates that reducing environment. So a lot of the waste is currently being disposed of in a reducing environment because of the use of concrete canisters.

On Mike's, I just want to come back to this diffuse issue. The reason I feel so strongly about it is that my concern is if there is not in regulations a lower concentration that specifically says this is a never/no mind, we will get to a rule. And then we will have potentially agreement states saying, "Moratorium on all DU disposal until you all do the site-specific analysis." And that could take quite a while.

And so that we really want to prevent necessary cleanup from facilities that have depleted

uranium while we are looking at this longer-term performance assessment.

FACILITATOR CAMERON: Bill, are you suggesting that it is sort of going the other direction? In other words, you don't need to define significant quantities --

MR. DORNSIFE: You define a concentration that doesn't matter.

FACILITATOR CAMERON: Okay. All right. Let me ask if there are any more reactions. Let me go to Tom and see about a reaction to Mike. And then let's have some discussion about the suggestion that Bill is making that there is a concentration limit where below that, it doesn't matter. This is some familiar territory.

MR. DORNSIFE: Very.

FACILITATOR CAMERON: Four-letter, three-letter, four-letter word, I guess.

Anyway, Tom? And then let's hear from Christine. Tom?

MR. DORNSIFE: When I say it doesn't matter, I don't mean exempt. I mean, you know, a place where we know that the performance assessments already done for low-level are good enough for this concentration. It is not an exempt level.

FACILITATOR CAMERON: Okay.

MR. DORNSIFE: You don't need to do any additional analysis. You don't really have to do any additional analysis to demonstrate that the current site in its current configuration can adequately isolate that material.

FACILITATOR CAMERON: Okay. Tom, do you want to talk to Mike's point? And can we get a reaction from you if you have one to Bill's suggestion?

MR. MAGETTE: I think those two are inextricably related because, I mean, obviously if you are going to talk about a regulation that doesn't have a threshold, which is where I started and I still think that is okay, then I am not sure what you put in guidance. I'm not sure where you need to guide anybody to.

I mean, you could certainly have an interesting discussion. It might go to some of the things that Bill is talking about. But if the regulation says there is no minimum, then there is nothing, there is no guidance to how to interpret zero.

So I don't know what the guidance would say. Now, if, in fact, you want to look at a de

minimis level --

MR. DORNSIFE: No. It is not de minimis. Don't use that word.

MR. MAGETTE: Strike that.

FACILITATOR CAMERON: And don't use that three-letter acronym. Go ahead.

MR. DORNSIFE: No, no. Don't use that one either.

MR. MAGETTE: What are you going to call it, Bill?

MR. DORNSIFE: We'll call it that your existing performance assessment and what you are licensed for is adequate to deal with this concentration. I mean, your license for disposal of source material, you obviously had to do a demonstration. You can dispose of that amount of source material. This is no different.

FACILITATOR CAMERON: Okay. Let's test this idea out, then. Tom is saying if you don't need anything in the rule for significant, what are you going to say about it? Why is there any need to say anything about it in the guidance? I want to give Mike an opportunity to respond to that.

Mike, maybe there is some connection with what you were suggesting to what Bill was saying. I

don't know. Why don't you go? And then we will go to Christine.

MR. RYAN: It's a good dialogue. And I appreciate these thoughts. What I am trying to get across is that if you have a de minimis or some low-level concentration that you say is below this, you don't need to worry about any additional requirements for uranium.

I don't really have a problem with that idea. It will be a real low limit, I am guessing because you have got to assess that. And that has got to be based on probably the most dose-significant case that you look at across a range of cases is where the staff would be on it. So I have no problem with that.

My other part of my comment is that okay. Now I have got, let's say, a material for which an analysis is required. And whether it is for any material, it is required or if it is above some limit, as, Bill, you and Tom have suggested, I am finding a way.

What I am asking for in the second part of the comment is that the guidance be real explicit with what I have to analyze, what parameters I have to evaluate, how I have to do it, how I have to do uncertainty analysis so that I will know when I am

done.

FACILITATOR CAMERON: Okay. That's --

MR. RYAN: That is my big question in any performance assessment, is please tell me when I will be done.

FACILITATOR CAMERON: So your point is an over-arching point --

MR. RYAN: Right.

FACILITATOR CAMERON: -- that covers the whole performance assessment.

MR. RYAN: But they are not completely separate from one another because if I have to go down to lower ALARA concentrations, my performance assessment may get more and more complicated because I now have to include things that are at that level that may exist in nature as part of the dose.

FACILITATOR CAMERON: Okay. So you see some value in what Bill is saying?

MR. RYAN: Oh, absolutely, yes. I am not saying I am absolutely against some concentration limit, but the other caution I would offer is that concentration doesn't determine the risk in disposed waste. It is quantity. If I have a high concentration and I only have three milligrams of it, it is certainly not nearly as important as having

300,000 tons of the same.

And, likewise, if I have a concentration that is very low, like below average surface soil, I don't care about it at all. But I may have lots of curies of uranium.

So concentration doesn't determine disposal risk. It is a convenient metric we use for transportation requirements and surface health physics and all of that. But I think we ought to be very careful and try and clarify when concentration is a metric and for what purpose and what drives doses that are calculated from a performance assessment, which is total quantity and not concentration.

FACILITATOR CAMERON: Okay. Thank you, Mike.

We will go to Christine and then Arjun and then Felix. Christine?

MS. GELLES: Thank you. I think there are a lot of really valuable ideas and thoughts that have been put on the table already. It is certainly a complicated question.

Mike, I am responding first to your first representation of I guess a reaction to what was perhaps this initial discussion on the issue. Now I have a question about the second way you just

described it.

It really boils down for the Department of Energy based on our experience to a balancing act. I mean, I heard first that you were suggesting that we have as detailed a guidance document as possible so the owner/operator knows what is expected of them. But then I heard very explicit guidance in your second description.

What we would certainly support is a guidance document that recognizes and implements a graded approach that certainly is against site-specific, has a site-specific, focus and certainly requires an iterative analysis so that as you get new information, as you receive additional quantities over the time of your operation, as you understand that there are new hazards or risks that need to be analyzed, you incorporate that into your site-specific PA and you keep that as a robust defensible document or representation of your system but not be so prescriptive that you hinder the flexibility that is needed by the operator to respond to changing circumstances or new information or new waste streams that, all of a sudden, are unique because we didn't know enough about them to analyze them the last time we ran our PA. I mean, in our two

decades, three decades of experience, we have generated a lot of new additional waste streams that require constant analysis.

So it is finding that balance between detailed guidance and prescriptive guidance so that you are not tying the hands of the owner/operator.

MR. RYAN: And I think the NRC might be slightly differently than the DOE in that licenses and license conditions drive the agreement state or NRC world. And perhaps the system at NRC is a little bit different. You are really relying on an updated performance assessment to sort of be your license.

So for a licensee, once I have got a license, I follow the license conditions. It is that simple. But when I find that I need to take different materials that might challenge the license conditions, there is a new constituent or a different concentration or whatever it might be. Then I have got to go back to the regulator and say, you know, let me try and convince you this is within what we can do. And it should be added to the things we are allowed to take less than our license.

So I accept your comment, but I don't think it's incongruous with what I am suggesting. I think it agrees with what I am suggesting. And all I

am asking is that guidance tell you or me when we want to assess something that is outside of our current working envelope, that we get pretty clear direction as to what I need to assess in order to come to them with a case to say, "Is this okay?" or "I think it is okay based on my analysis according to your guidance. And how about let's sit down and make sure I have done it right and I can convince you where I am."

FACILITATOR CAMERON: But there doesn't necessarily seem to be any inherent conflict between the type of thing that ideas that Christine was suggesting.

MR. RYAN: I think we are in agreement. I don't think there is any difference whatsoever.

FACILITATOR CAMERON: Okay. Great. That is terrific.

Arjun?

MR. MAKHIJANI: Well, if Bill isn't talking about BRC or de minimis, then you are really talking about a revision of table 1, I think table 1 or table 2. I can't remember, one of the tables.

And because you are asking for a concentration limit that you can dispose of with your existing license, I am okay with putting revision of table 1 in the table. I said that in the beginning,

that I thought that we should be doing more here than just looking at revision of (a)(6).

Then I would simply suggest that we revert to the draft EIS from 1980 or '81. And there is a quantity defined there, 17 curies, and a limit, .05 microcuries per cc, if I remember right, and that we just accept that. And that would give us a quantity as well as a concentration.

FACILITATOR CAMERON: Bill?

MR. DORNSIFE: As a kind of a compromise on this concentration issue, I think NRC can easily come up with a number and justify that concentration number.

I mean, the way we did it in Texas, ten nanocuries per gram is the class A limit for transuranics. And that allows you a factor of ten to play around with in terms of what it really is. Okay?

And right now we are disposing of everything in concrete canisters. The way we treat A versus B and C is no different, what we are currently authorized at waste control.

But, anyway, I mean, I think NRC can easily come up with a number: ten nanocuries per gram. You know, give that a ride. And then have that limit in there so people don't start questioning what

has already been disposed of because you take any DOE waste stream out there. They cannot prove there is not some depleted uranium in that waste stream.

So are you going to risk preventing any disposal in any cleanup because you don't have some number that is okay? But then eventually when you do your site-specific analysis, you have got to include that, whatever you have disposed of as part of that analysis, to make sure it is acceptable.

MR. RYAN: If I may react to that, Chip? I understand your need for a least common denominator. I appreciate the practical aspects that you are raising there, Bill.

Maybe the compromise is, okay, if there is some number below which I am fine, I can dispose material, so be it. And that is kind of the least common denominator for any site, any sort of geohydrology or geochemistry or whatever it might be. Then how do I show that my limit for my site under my circumstances is probably more like ten times that, your number?

All I'm asking is that the guidance that is given allow me to address that or give me the flexibility to define a different baseline below which I can just dispose without any further constraint.

So let's don't make it one number. And that was my point I didn't articulate so well maybe at the beginning, but if we have got an absolute floor, so be it. And then if we have got some other way that I can set a different floor based on my site-specifics and waste specifics and all the rest, that should be part of the process to --

MR. DORNSIFE: I mean, when you are doing your site-specific analysis, are you really setting a different floor? You're setting no floor, I thought. That was the intent, that you can --

MR. RYAN: No, no.

MR. DORNSIFE: -- take your DU if you do your site-specific --

MR. RYAN: I didn't communicate well if that is what you took away from my comment. That is not what I am saying at all.

MR. DORNSIFE: But isn't that the premise?

FACILITATOR CAMERON: Are you guys on the same wavelength here or I sense there is still a difference?

MR. RYAN: I thought we were okay up until Bill's last comment.

(Laughter.)

MR. RYAN: I actually agreed with him.

And now he is saying he doesn't agree with me.

MR. DORNSIFE: No. No, no, no. I mean, this concentration limit, when you do your site-specific analysis, which my understanding is is intended to allow you to dispose of pure DU --

MR. RYAN: I didn't say anything about pure DU. I just said a limit. So I am not trying to imply anything about pure DU or any other kind of DU.

MR. DORNSIFE: Well, I mean, when you do your site-specific analysis, I mean, are you proposing that maybe there is a concentration-based limit that comes out of that?

MR. RYAN: I think you sure could do that if you want or you could do a quantity limit.

MR. DORNSIFE: Why would you want to? You just said, you know, it is a total quantity that makes the difference.

MR. RYAN: I am trying to recognize, Bill, if there is a wide range of disposal opportunities for DU. There are chunks of metal DU that might be over-packed in a concrete canister of some kind. And there is diffuse DU that is intermittent with some soil matrix or some other solid material matrix. And one size of shoe doesn't fit all of those cases.

So, I think, you know, if there is some

exemption-level concentration, which is --

FACILITATOR CAMERON: Lowest common denominator.

MR. RYAN: -- the lowest common denominator for all of it, great. I am thrilled with that. All I am asking is if I want to increment that up because of some other concentration, quantity, physical or chemical formed circumstance, that the guidance give me advice on how to do that. That is not a lot. But it did change from your concentration that you want.

FACILITATOR CAMERON: So, if I understand, what you are saying is that there is a default lowest common denominator, but that when you do the performance assessment for the site, you may find out that there is something about the site that would cause you to not accept that, not want to follow that default.

MR. RYAN: Not quite. What I am trying to say is that default value might be -- you know, there is nothing wrong with having the opportunity to change the default value on a site-by-site basis.

FACILITATOR CAMERON: Okay. Tom?

MR. RYAN: Because one site may have a default that is completely different than another one.

FACILITATOR CAMERON: Let's go to Tom, and then let's hear from Dave Esh. And then I want to come back to Bill in terms of what Mike just said and see whether that totally kicks the pins out from what you were suggesting. Tom?

MR. MAGETTE: My fear with this whole concept and this notion is that it would be difficult to establish a floor, whatever we are going to call it. I think this discussion illustrates that that is, in fact, the case. I think if you were going to have to do a performance assessment at the sites that are accepting depleted uranium, then, really, I don't see how you need a floor.

I mean, Bill's issue about the uranium coming in and a lot of it being diffuse is entirely correct. I mean, the shippers' manifest, the rate that they are shipping into the market is a default at some level anyway. So, in essence, we get it virtually constantly.

I am still not convinced that it necessarily makes sense to try to establish a floor. We have heard comments about rule versus guidance. I don't know that there is a place on the agenda to discuss that, in particular, but I still think as for the rule, simpler is better.

You require a site-specific performance assessment for taking uranium or depleted uranium. Then you don't have to do much more. I think you are going to have to establish a period of performance in the rule. And I think you are going to have to establish a dose standard in the rule. And that may also include revisiting or revising subpart C.

I don't think that that should be off the table. It is not just 61.55(a)(9) that I would be talking about, but I think that is pretty simple. That is not very many words or sentences that goes in a rule. It is very, very short and succinct.

Then I agree I think with the outcome of the discussion that Mike and Christine had about guidance. We have guidance documents that I think both go into detail and allow flexibility in NUREG-1573 and NUREG-1854. This is not new. So I think those objectives are possible to achieve simultaneously. And I think the NRC could do that.

As for concentration versus overall mass, I mean, certainly yes, you could have a lot. But if you have a lot in a very large site, you can still have a tolerable concentration.

So here again, you back into the complexity of trying to establish a floor. So I don't

see that there is necessarily a lot of fruit to be born there because I don't think anybody is going to be saved, so to speak, from doing a performance assessment by the virtue of the existence of that floor.

FACILITATOR CAMERON: So you could spend a lot of time trying to figure out what this should be. And it may not gain you that much --

MR. MAGETTE: Precisely.

FACILITATOR CAMERON: -- in the long run. Okay. Let's hear from David, and then one last comment from Bill. And I want to check in with the audience. And then we will go to lunch.

MR. ESH: I was going to add that I appreciate Tom's last comment about keeping it simple. We like to keep things simple. It seems like the discussion here might be an opportunity to consider whether you need a couple option approach, you know, option A. NRC specifies concentration. You can either use that as your lower level or not.

If you don't want to use that as your lower limit, use B, which is you do a site-specific determination of what your lower limit is or if you are doing a site-specific performance assessment, then forget A and B. You just do your site-specific

performance assessment.

I mean, I think we want to be flexible. We want to ensure that all of the requirements are there, that we achieve the safety goals that we are trying to achieve. But we also want flexibility, too. That is a comment for you to consider, whether you can do an approach where you have a couple of options of which way to proceed. And, of course, you could do that in regulation or guidance.

FACILITATOR CAMERON: Thanks, David.

Bill, last comment before we go to the audience?

MR. DORNSIFE: Yes. I think, first of all, as I said, my reasoning for the floor limit or floor concentration was that when a rule is published and if it doesn't have that, the states are liable to say, "Cease and desist all DU disposal until you do your site-specific performance assessment."

FACILITATOR CAMERON: So that is your concern, is that --

MR. DORNSIFE: Yes.

FACILITATOR CAMERON: I think that is very explicitly stated.

MR. DORNSIFE: And I am wary. Okay? I am wary of any ability for a specific site other than a

maximum quantity, a limit on the total quantity that they can have, of any site-specific, meaning state-specific, concentration limit.

That is why I would like to see one standard because you get then into the situation that different regulators have different standards in terms of evaluating data. And then you come up with a non-uniform, non-competitive environment.

FACILITATOR CAMERON: Well, let's go to one of those scary state regulators.

(Laughter.)

FACILITATOR CAMERON: Mark, do you want to say something?

MR. YEAGER: That was the perfect segue, Bill.

Option C, one of the things we faced at South Carolina was the continued extension of Barnwell's life. And it transcends regulation because you have the public perception that "When is this going to end? When is the material going to end?" And we can talk the technical part, but there is that part where the public, the stakeholder, says, "Yes. You are telling me this is safe, but you keep putting it in the ground."

So option C for me would be -- and, Mike,

I appreciate your comment on this -- to make the performance assessment simpler. Would it not be a possibility to have a facility source term limit up front and then base your performance assessment on the company that makes the proposal based on what form, metal, diffuse, what type of waste form are we going to be disposing of.

You can make a pretty good guess on what your customers are going to be needing. And then you could, you know, make your performance assessment conform to those different types of waste form.

And then if it does change down the road based on the regulatory framework, you could ask for an amendment to your license, for example, that could be put out to the public at that point and say, listen, we did the initial assessment for this facility source term. We said we wouldn't increase it. Conditions have changed. We're doing a revised performance assessment. Is this acceptable?

Because you have to have that buy-off because eventually you are going to lose credibility. And you just have a bunch of angry people showing up at public meetings that you can't satisfy.

MR. RYAN: Mark, thanks for your comments. I appreciate what you have said, and I will try and

respond. I think if you look at a facility that has a decades-long life span -- and in my own experience, the waste streams change over time. The waste forms change. The waste packaging changes. The concentration of radionuclides per package changes. And all those things are variable.

So a couple of ideas. One is you have got to somehow envision how your approach to performance assessment can change with all of that. So the idea that you would have updates or periodic reassessments or reassessments of other waste being added I think is a reasonable thing to think about. I can't think of a site that doesn't have a sort of a living performance assessment capability to address that.

The second part of transparent communication of all of that to the public is a challenge for everybody that does this kind of work. And I think that certainly takes a lot of work to get folks to understand that.

My own experience is the closer you are to a site, the better people understand that because they are nearly and may have relatives who work there and those kinds of things. And the further away you get, you get less understanding.

I think having a system that is clear and

transparent and how you got from A to B and you can lay that out helps you to do a better job of that. So I admire your goals and appreciate both of those things, but the fact of the matter is sites and site licenses are going to evolve and change because conditions change.

Just from nuclear power waste management, ion exchange resident in solidified concrete were the waste streams of interest for a long time and now are producing very low-volume solid mass waste that came out of reverse osmosis processing. And solidified concrete is almost a thing of the past for water waste streams. So how do you deal with evolving technologies and evolving issues in waste management? You have just got to have your basic structure of your system such that you can deal with those changes.

And they are changes not because something failed. They are changes because something better is coming along.

FACILITATOR CAMERON: Okay. Do you want to say anything quickly on that?

MR. YEAGER: Yes. It is a good point that Mike brings up. And that might come up within the unique waste stream discussion later about how low-level waste has evolved from volume to lower

volumes with higher concentrations.

And that is something that I don't think was factored in when part 61 was originally drafted. I think when it was originally drafted, people did approach it from the standpoint of large quantities with activities spread out over a large volume.

But then as facilities charged by volume, guys said, "Well, let's try to reduce that volume to save costs." So, as a result, you have a higher concentration, higher source term, higher ramifications.

MR. RYAN: I always think about five things, Mark, when I think about those new issues. One is the chemical, physical, and radiological content of the waste; the waste package; the disposal technology used to put it below grade; the cover technology, which you use simply to shed water so it doesn't get wet because if it doesn't get wet, nothing is going anywhere; and then the geohydrologic setting in which all of that sits.

FACILITATOR CAMERON: Okay.

MR. RYAN: Now, for a lot of things, only three of those change. So that is the system I always think about when I address those emerging issues.

FACILITATOR CAMERON: This has been a

great discussion. And I think it gave the NRC some really strong things to think about in terms of what you are hearing from people around the table on whether you need to establish that.

We have a couple of minutes. We actually have hours since we are already a half-hour behind. We have a couple of minutes. Does anybody in the audience want to ask anything? Okay. And we are going to welcome Diane D'Arrigo back when we get back after lunch. She will be at the table.

Yes, Gary?

PUBLIC COMMENTS

MR. COMFORT: I am Gary Comfort. I am with NRC in the Rulemaking Branch.

One of the questions that I have because I heard a little bit of discussion on the variety of -- you know, I have gone from depleted uranium, that the rule is based on that we are getting a large supply of depleted uranium that wasn't originally evaluated, mostly coming from enrichment facilities.

Then I heard some expansion of doing performance assessments for DU in general and then maybe even uranium as part of the source term and stuff.

The question I have is, because we are

doing this as a two-phased rulemaking, would one of the concepts also be to limit this first part to just DU from a specific source, meaning if you are getting disposals from the enrichment facilities, and that would get rid of some of these issues also potentially of how do you deal with the most diffuse waste streams and things like that because this rulemaking is not focusing well and you are continuing to use that as well as then in the future rulemaking, you look at the big change to the waste classifications and all. Do you then address them and all that? And you keep a much more focused rulemaking.

You know, is that what people are potentially looking at or considering or were they looking at a much broader all of DU being assessed in these waste streams?

FACILITATOR CAMERON: And that is a good question. And let's save that and either first thing after lunch see what people think about that before we go to the next discussion topic. But we will get to it.

It is around 12:30. Originally you had an hour and a half, I think, for lunch. So maybe let's come back in an hour and 15 minutes. That still gives you time to figure this neighborhood out. Okay?

So a quarter to 2:00. 1:45 we will start.

(Whereupon, a luncheon recess was taken at 12:29 p.m.)

FACILITATOR CAMERON: Okay. Welcome back from lunch, everybody. There is a couple of administrative details.

I would like to welcome Diane D'Arrigo, who is here from the Nuclear Information and Resource service. And, Diane, do you want to just introduce yourself in any more detail than that? Go ahead.

MS. D'ARRIGO: I think that explains it.

FACILITATOR CAMERON: Okay. All right. Thank you.

There are some little cards out on the table, if you parked in a hotel, that will give you a reduction in parking rates. So if you want to park here tomorrow, then I would get one for tomorrow also. And it's probably the same rate as the County Hotel, which is down the street, or it may be cheaper.

Also, so that Charles can get everything that you are saying, hit the button on your mic before you start to talk, because he has been missing some of the -- just the first couple of words, and so we just made some stuff up.

(Laughter.)

And also, I think you are doing really

well on the Somali pirate ship standard. We have had some good discussion. And we are going to address this issue that got brought up right before we broke, before we go to the next agenda item, because it did address some -- or may be a way to address some of the issues we were talking about, and Gary Comfort from the NRC's rulemaking staff raised it.

Should the rule only -- in other words, this site-specific criteria rule -- only address the disposal of DU from a particular category of sources? Is that correct, Gary? Okay. And I just put in parens I guess one of the issues there is: what do you do with the other DU if the rule only does this?

So I wanted to get a few minutes of discussion that, and then we will go to the next agenda item. Christine, did you want to talk to that point?

MS. GELLES: I would, thank you. I think the example we cited was DU from enrichment facilities, and the Department of Energy would have to oppose such a restrictive focus on this, because if there are questions about the disposal of our DU waste streams I would say that not all of our existing DU waste streams that require disposal would fall under that category. So I think we would have to have some

discussion about exactly what would be the waste streams that we would be limiting.

FACILITATOR CAMERON: Okay. Thanks, Christine.

MS. GELLES: In terms of both form and quantity.

FACILITATOR CAMERON: All right. And Tom?

MR. MAGETTE: I would say that you probably could limit this rule, accommodating Christine's comment, you still probably could limit it more than just having it totally wide open. But that definitely assumes that there is a follow-on rule, this notion of risk-informing Part 61. I mean, what I have heard so far is that, you know, from -- the SRM said put it in the budget.

Larry told us it's in the budget for '11. As long as it stays there, you know it's going to happen. I mean, budgets change in Washington occasionally. And so I would not like to think that you deferred something that then became indefinitely deferred.

FACILITATOR CAMERON: So you think it might be -- it might turn out to be an indefinite deferral.

MR. MAGETTE: I think you could mitigate

that risk administratively, but you would have to take some steps to do that, to make sure that there was in fact a follow-on rulemaking before you did anything more limited.

FACILITATOR CAMERON: Okay. Do we have any thoughts on what Christine offered to us about the Department of Energy issues, or from the NRC staff, any thoughts on that? Peter?

MR. BURNS: I have a question for Christine. If the -- where do you get depleted uranium except from enrichment?

MS. GELLES: Well, and again I didn't want to assume that I knew exactly what was being offered as the illustrative example. But we have historical -- we have volumes of DU that resulted from our reprocessing activities at Savannah River three decades ago. If the reference to enrichment facilities meant, you know, the modern day enrichment facilities, and maybe even the deconversion product from our soon-to-be-operational conversion facilities, then I think we would potentially orphaning our historical DU volume.

So it really just boils down to defining what we mean by the stream that is going to be addressed by a limited rule.

MR. BURNS: So you are referring to weapons-related production of depleted uranium from --

MS. GELLES: Yes.

MR. BURNS: Okay.

FACILITATOR CAMERON: And, Bill?

MR. DORNSIFE: I have a general question about the rulemaking. Could the outcome of the rulemaking be a rule isn't necessary, and some other option?

FACILITATOR CAMERON: In other words, such as?

MR. DORNSIFE: Well, you know, we make it all Class C for a such as.

FACILITATOR CAMERON: Which would probably require a rulemaking, if you wanted to make it all Class C. Let's get to the --

MR. DORNSIFE: No, right. Well, I mean, yes. Yes.

FACILITATOR CAMERON: I mean, you are taking it from Class A to Class C.

MR. DORNSIFE: Well, let's -- I mean, maybe that's a bad example. I mean --

FACILITATOR CAMERON: Okay.

MR. DORNSIFE: -- could the result of the rulemaking be we don't need a rule, everything is okay

the way it is?

FACILITATOR CAMERON: Now that would -- that would require the staff to definitely go back to the Commission. But how would the staff get to that point, Larry? Do you want to talk to that?

MR. CAMPER: That last one is a good question, Chip. I mean, at this point, the Commission directed the staff to do something outside of the adjudicatory process. The staff undertook that assignment. We conducted an analysis, which I discussed in my presentation. We provided four options in the SECY. We made a recommendation, i.e. option number 2, to require a site-specific performance assessment and to identify the technical parameters and to create the guidance to accompany it.

The Commission, at the moment, has chosen to accept the staff's recommendation, but also direct us to proceed to budget for at least -- and we assume that means proceed with the rulemaking to risk-inform Part 61. So we have an assignment on the table.

If in the course of these deliberations -- and now that -- the purpose we are here now is to do gathering of principally technical information on the several technical subjects we have identified on the agenda to aid in that rulemaking.

I mean, at some point along the line, if we were to -- if the staff would hear compelling arguments that suggest, based on sound reasons, that you don't need a rulemaking, then the staff can always go back to the Commission and communicate further, you know, go further than we have already in discussions.

However, the Commission would then have to decide that it wanted to do something different, whatever that something is. But thus far I have not heard anything in the discussions this morning that get to the point where you don't need a rulemaking. I have heard some very interesting comments made, not the least of which was Christine's regarding, you know, this notion of significant quantities.

But I guess the simple answer is, yes, you can arrive at that place where the staff would go back to the Commission and communicate, but you really have to identify some compelling reasons that that is where you were, have some discussion about it, so the staff would have something to work with that would make a compelling case to the Commission to change direction.

FACILITATOR CAMERON: Okay. Let's -- on this issue, let's take the -- and Christine has already pointed out some practical issues that would be presented, the orphan-DUs issue. Let's take the

cards that are up now on this.

When we get to tomorrow afternoon, the long-term rulemaking, the other considerations, after we have had discussion about a number of points, let's revisit this rulemaking issue. But that is -- it's not to mean to say to take your card down, Bill, but we have -- let's go down, Greg, Arjun, Diane, Felix. We'll go down the list. Greg?

MR. KOMP: Yes, I just wanted to really second Christine's point. There are more forms of DU than just the enrichment facility, and we would also have a hard time of disposing of source if we were just limited to that, because we have a variety -- everything from, you know, plating that we use in tests all the way through, you know, contaminated materials and also some other variety of materials.

FACILITATOR CAMERON: That's -- the question is, then, what do you do about the rest? And if there was some suggestion that you don't even need the rule, that you could effectively do something by doing X, that is sort of Bill's point, although he filled in the X with don't do anything. Okay.

Arjun?

MR. MAKHIJANI: I just want to follow up on Bill's point. Is it possible that the outcome

could be this is all greater-than-Class-C waste and can't be disposed of in shallow land burial? Because one of my concerns is that shallow land burial seems to be a pre-judged outcome of the current rulemaking process. I would love to be disabused, but at least a clarification would help.

FACILITATOR CAMERON: Some thoughts on that, Larry? I don't think you are necessarily pre-judging anything, but is there some assumption about that?

MR. CAMPER: In the course of this analysis, and in the course of the interface with the Commission, the class of this waste was not changed. One of the recommendations that was provided to the Commission, option number 3, was to examine the class of this waste, using the methodology, perhaps modernized somewhat, that was used in 1979, 1980, when Part 61 classification scheme was developed.

The Commission did not choose that option. I mean, any modification of class of the waste would have to undergo an analysis appropriately designed, and then it would have to be subjected to appropriate stakeholder review, rulemaking, and the like.

So, again, the assignment that the staff has at the moment is to proceed to conduct a

rulemaking that would require a site-specific analysis, and then to proceed to budget for risk-informing Part 61. So that is a remarkably different potential outcome as compared to where we are at the moment.

FACILITATOR CAMERON: But going along on Arjun's track, we have heard this morning about, well, maybe you need to bury it six meters instead of three meters. Mike Ryan was talking about the waste form and things like that. Would things like that -- and, David, I should ask you also, are we going to get to -- is one of the discussion topics going to focus on those types of things that might be done? Not making it greater than Class C, but how do you ensure that the radon, etcetera, etcetera, is not going to harm anybody? Dave, do you want to talk to that?

MR. ESH: Yes, I think I understand this discussion and the -- what we are trying to get at. The elements that we hope to cover in the issue discussions that will follow are the issues that will need to be evaluated to assess what would need to be specified in the regulation and in the guidance to ensure safe disposal of depleted uranium.

If, in the event we got to the point where we said, "You can't do this," in the course of that

rulemaking process, then obviously that would be a different outcome or direction than where we are now. But certainly that is what we would do. I mean, we will do the technical basis and the appropriate technical basis. And if it came out different than where we may expect now, or where we are right now, then we would reflect that in the outcome. So --

FACILITATOR CAMERON: Okay.

MR. MAKHIJANI: Can I just ask for a clarification?

FACILITATOR CAMERON: Go ahead. Go ahead.

MR. MAKHIJANI: So right now you are only going to consider shallow land burial. Leaving aside the classification issue, I stand corrected. Within (a)(6) of course you are creating a Class A1 and a Class A2 basically.

But within the context of this analysis is an outcome that only deep burial would be a suitable, safe disposal method. Is that -- are you going to look at that even?

MR. ESH: I think I understand what you are asking.

MR. MAKHIJANI: Yes.

MR. ESH: And if the technical evaluation would not support near-surface disposal, which in our

regulations is defined as the upper 30 meters, then obviously that wouldn't be done under low-level waste regulation any more. It would have to be moved into some other regulatory program.

MR. MAKHIJANI: That is not correct, because depleted uranium would remain low-level waste, but it wouldn't be Class A.

MR. ESH: The low-level waste only applies to -- low-level waste only applies to disposal in the upper 30 meters.

MR. MAKHIJANI: No. GTCC is low-level waste, but cannot be disposed of in the upper thirty meters. It's in the rule. I have the rule in front of me.

FACILITATOR CAMERON: Okay. We can clarify this issue. I think the important point is is that, what is the NRC going to consider in this rulemaking? And Arjun, others, may make suggestions that, look, you can't assume this can't be done with shallow land burial, or it needs to be of, you know, maybe not -- if it needs to be 29 meters or something like that.

As I understand it, the NRC is going to be listening to all suggestions like that, and is going to consider that in developing the technical basis for

the rule. So I don't want to -- this is an important discussion for everybody here. I don't want to get us way off track, so I would like to finish up this topic, so that we could move on to the agenda item.

Larry, can you shed some light on any of this for us?

MR. CAMPER: Well, the -- I mean, a couple of points. I mean, we are listening to everything we hear here, obviously. And we will review the transcripts and the like. But, again, the assignment at the moment is to gather technical information on a Commission decision to proceed, to require site-specific performance assessment.

Now, on this question of the suitability of depleted uranium for disposal near surface, that means up to 30 meters, that was the driving question that the staff asked itself when we undertook the analysis. That was the driving question. Is this material suitable for near-surface disposal?

And the reason that was the driving question to staff -- one of the first order of principles that we followed is because there were serious contentions filed in the course of the LES hearings that said it was not suitable for near-surface disposal.

And if we had determined as a staff that it was not suitable for near-surface disposal, then my view was we would have had to have gone back to the Commission and further communicated with the Commission regarding the direction it had given us, because the direction, which I had on my slides earlier today, did not direct the staff to determine what class of waste this was.

It did not determine to -- it did not ask us to reclassify it. It asked us to consider whether those quantities warranted modifying those two parts cited. And had the material not been suitable for near-surface disposal, as witnessed by our analysis, my view is we would have had to have gone back to the Commission and communicated. Our analysis determined that it was suitable for near-surface disposal, albeit under certain conditions, for example, burying it deeper or taking other mitigative measures to reduce the amount of radon in the nation, things of that nature.

So we did explore that very question at the essence of our technical analysis.

MR. MAKHIJANI: Are you saying that your analysis was definitive enough to have advised the Commission that near-surface disposal is suitable when

subsequent to your presentation the person who is responsible for that technical analysis said that they didn't take climate into account?

And excusing the informality of the language, that it was silly to exclude climate change, that erosion was not considered, and a lot of things that are very essential in the real world are not considered. There wasn't a screening analysis --

MR. CAMPER: I think --

MR. MAKHIJANI: So --

MR. CAMPER: I think we are going to --

MR. MAKHIJANI: Wait a minute. You two have said very different things about the objectives of that paper. Dr. Esh said that the objective of that paper was simply to advise the Commission of whether a new rulemaking was necessary, so essentially the details of the analysis, which was done with a non-validated model which the NRC has refused to provide to us, were not important.

What you are saying is the details of the analysis are all important, because they were the basis on which the NRC decided that the next investigation was to be done under Class A for shallow land burial.

MR. CAMPER: I think --

MR. MAKHIJANI: And that our analysis, which I did in the LES case, that shallow land burial was not suitable was in effect wrong.

MR. CAMPER: I didn't say your analysis was wrong. I said --

MR. MAKHIJANI: That is the effect of what you are saying.

MR. CAMPER: First of all -- first of all, we are going to spend a lot of time debating something that is not the purpose of why we are here today. Okay? Now, we can do that, or we can focus on other -- let me finish. Let me finish.

MR. MAKHIJANI: Okay.

MR. CAMPER: Let me finish.

FACILITATOR CAMERON: Larry, finish up, and then --

MR. CAMPER: Okay.

FACILITATOR CAMERON: -- let me say something.

MR. CAMPER: We can spend a lot of time debating this issue, or we can spend our time focusing on the reason we are here, is to gather technical information. I suggest we do that.

Dr. Esh answered your question I thought very thoroughly a while ago as to the purpose of the

technical analysis and how we used it in communicating with the Commission. I think he gave you a thorough and reasonable and accurate answer. Okay? You may not agree with it. That's your prerogative. But he gave you a reasonable answer.

And what I'm saying now is we have drifted into a discussion as to the suitability of this material for near-surface disposal, and all I am saying to you is is that was one of the fundamental questions we had to ask ourselves when we undertook the design of the technical analysis, because if the answer had led us to the conclusion that it was not, we believe we would have been in a different position, given the Commission direction to us at the time, and would want to communicate with the Commission further. That's all I'm saying.

MR. MAKHIJANI: Well, what you are saying is that it was appropriate for you to do calculations with a non-validated model you won't provide the public, and that you concluded that shallow land burial was appropriate. The Commission made their decision on that basis, that we are going to pursue a rulemaking on that basis.

But your model expert has said that essentially -- my words -- that essential factors,

like climate change and erosion, were omitted. The one site that is under practical consideration for DU disposal, which consists of above-ground pyramids, which are vulnerable to erosion unless you build them, would not be vulnerable for one million years, would not be covered by the present analysis, and that is not germane to the technical questions that were here today. I --

FACILITATOR CAMERON: Okay.

MR. MAKHIJANI: I came with the explicit idea that these kinds of technical questions would be on the table. Otherwise, if we are going to say shallow land burial is suitable, and it is already decided, what is the point of my being here when I have spent a lot of years and a lot of time and a lot of money concluding otherwise?

FACILITATOR CAMERON: Okay.

MR. CAMPER: I'm going to let Dr. Esh speak to the technical analysis, since he was the lead individual in the technical analysis. He's far closer to it than I am, and he is better suited to answer those particular questions.

FACILITATOR CAMERON: I've got to do an intervention here, okay, so to speak so that we can get on with the discussion of points. Certainly --

and, Dave, if you have something to say after this, say it. But I want to get to Diane and others, and I want to get to the next agenda item.

Certainly, Arjun's logic on this may be correct, and people around this table can tell the staff that they should not be -- they should be doing something else than pursuing a rulemaking that is based on the assumption that shallow land burial is correct.

Those issues need to be brought before the Commission, like everything else that is being said here. The Commission has to know that people who came to the table disagree with the assumptions, and the reasons why. For example, the technical analysis did not look at this, that, and the other thing. I mean, it is a very important issue.

Arjun, all I can say to you is to make the point, which you are making, and then we get to the specific discussion issues like period of performance, etcetera, etcetera. If there is something relevant there from this aspect, bring it in, but also perhaps suspend disbelief, in a sense, and tell them what you believe on those things.

Before we go to Diane, because she may have a similar point, Dave, do you have -- do you want

to give a short explanation to -- on this point? You were very clear before, but the issue on the table is, did you have enough information to assume that shallow land burial would be the way this is going to be done?

MR. ESH: Yes. I think we attempted to describe clearly the assumptions that were made in that assessment and the basis for that assessment. We acknowledged that, for instance, in our treatment of climatic variation we took the approach of representing it as epistemic uncertainty, which means in a particular realization those conditions are invariant in that assessment, which, as Dr. Burns stated, may be somewhat reasonable for shorter periods of time. But as you go to longer periods of time, that may not be reasonable.

But what I want to emphasize is, when you take that approach of representing that variability as epistemic uncertainty, there is a pretty strong likelihood, based on our experience, that you may be overemphasizing the extremes of the outcomes, which means you can say that you may get results that are very unfavorable when in fact, when you put that variability into your simulation and you incorporate it on a site-specific basis, the outcomes aren't nearly that extreme.

So it was an approach to simplify a part of the calculation. It does not make it invalid from the standpoint of our outcome was you need to do a site-specific analysis, and that site-specific analysis needs to support the decision that you are making. Period. And if that site-specific analysis is dependent on some parameters that are uncertain or variable, they need to be factored into that site-specific analysis.

So with regard to climate change, what the -- with regard to erosion, I would say near-surface disposal is in the upper 30 meters. We may have disposal facilities now that are looking at disposals at one meter, two meters, or three meters' depth. Thirty meters is quite a bit different from a long-term stability standpoint than three meters or one meter.

And there are lots of locations in the United States, based on isotopic dating and those sorts of things, where I am sure you can demonstrate -- and maybe Dr. Burns could talk to -- you can demonstrate that there are portions of our country that have been stable for long periods of time. Not every location is highly dynamic. Some certainly are, but the decision and the assessment that you are

making needs to evaluate that.

FACILITATOR CAMERON: Okay. So, and we'll get to period of performance. But could -- if the site-specific performance analysis showed that the waste should be buried at 31 meters, is that also -- is that also a possibility?

MR. ESH: Anything is a possibility. I mean, sure.

FACILITATOR CAMERON: Okay. Well, let's go to Diane, and then Felix, and then we'll hear a final word from Bill, and then we'll go on. Diane?

MS. D'ARRIGO: My question might be moot. Earlier on you were having a discussion about something that Christine said this morning, and I wasn't here, so I was asking if there could be a summation of what that was. But if we're done with that topic, we don't have to go back to it. But if it's something that is going to keep coming up, I would like to know what it was.

FACILITATOR CAMERON: Okay. Thanks, Diane. Do you mean this morning, or do you mean just -- not what she said right at the beginning of this session?

MS. D'ARRIGO: I don't know what you all were talking about. You were saying Christine

mentioned something, and everybody was saying, "Yes, and I support what she said," or "I have this question." I want to know what you all were talking about.

FACILITATOR CAMERON: Okay. Okay. Christine?

MS. GELLES: I think Larry was referring to my comment when we began the discussion on significant quantities.

MR. CAMPER: That's correct.

MS. GELLES: And what I simply had stated, Diane, is that if the focus is on site-specific performance assessment, it is the Department of Energy's position that perhaps it is not prudent to define what is a significant quantity, because in fact the site-specific performance assessment, if it's done properly, is going to establishing the limiting quantity of any isotope or radionuclide that you would want to put in that facility, in that specific site, given the conditions there.

So I offered that perhaps we were focusing on the wrong element --

FACILITATOR CAMERON: Okay.

MS. GELLES: -- in defining.

FACILITATOR CAMERON: Thank you.

Felix, and then Bill, and then we are going to tee up period of performance.

MR. KILLAR: Actually, I am going back to the question that initially was asked after lunch, and that was: should we focus strictly on depleted uranium as coming from enrichment facilities? And basically my perspective is very consistent with what Christine said, is that you have a lot of sources of depleted uranium. Enrichment is only one of them. And so you shouldn't necessarily lead us to one particular source.

And it actually gets into -- part of the discussion I am concerned about is identifying unique sources of material for unique waste streams and stuff, because to me the waste stream is a waste stream, not the source of the waste stream. That if you have cobalt-60 coming from a hospital versus cobalt-60 coming from an irradiator versus cobalt-60 coming from a reactor, it's cobalt-60.

So you are looking at the particular isotope, particular materials involved, and the waste form. You are not looking at the origin of the material. And so I think trying to get into a discussion that is focused on the enrichment facility versus a deconversion facility versus a facility that

makes munitions for the military, you know, those are different perspectives than looking at the waste itself, at the waste stream itself, the depleted uranium.

FACILITATOR CAMERON: Okay. Thanks, Felix.

And, Bill, the last comment on this. And we will find an opportunity to revisit it again, because it's important. Bill?

MR. DORNSIFE: Yes. I think obviously the dilemma we have here with shallow land burial is you have to first of all assume timeframes that are well outside what you currently have to do from a performance assessment standpoint to even get a risk. And then, secondly, you have to do a silly performance assessment to determine whether or not it is real.

And, you know, this is not -- another way to look at it could be there are other waste streams under the current scheme of shallow land burial that we -- at some point we only look for certain things. Like for example, you know, for the long term under the current guidance we look for mobile radionuclides. That could impact the need for site limits. Okay?

We ignore all of the other stuff that is

there in terms of erosion, you name it, which could indeed present the same kind of problems we are talking about from the long-term standpoint.

So, you know, somehow we have got to I think deal with this issue that the risk doesn't occur for a very, very long time period. And what is likely to happen to civilization, and what does that mean? Does it matter that 50,000 years from now there is a problem?

FACILITATOR CAMERON: Okay. Good segue to period of performance.

(Laughter.)

Do you want to tee that up?

MR. ESH: Well, this one is easy. I know we will all be in agreement on period of performance.

(Laughter.)

I am going to give you a little background for our low-level waste regulations and associated NUREG, some other waste programs, maybe some key considerations, and talk about various approaches to period of performance.

As I mentioned in my earlier presentation, there really isn't a consensus on how this should be done internationally. The NEA has done some good recent work doing a fairly comprehensive evaluation of

the problem. It's an NEA 2009 report on time scales. You can Google it. There is a Google book result that you can see some pages of it, or you can order it from NEA. I happen to have a copy if anybody wants to see the reference but not take it from me.

But this is a challenging part of this problem. A little bit of background here. In development of Part 61, it was initially considered a 10,000-year performance period, but the regulation itself does not provide a value. The site and the waste characteristics can obviously influence the timing of the projected doses.

So if we look at a 10,000-year slice on the picture of the activity ratio here, this is commercial low-level waste inventory normalized to one, the decay characteristics look like basically. It starts off at its highest point. It drops off very rapidly, in hundreds of year timeframes. And then at much longer times you would have a little bit of a tail come in from the long-lived in-growth.

Both of these calculations are assuming no loss from the source. And, obviously, you will have loss from the source. You could have very different losses from the sources, depending on your site conditions.

Depleted uranium is essentially flat for a long period of time, and then eventually you have the daughters come in, because it is so long-lived. So these -- the behavior of these two different types of material are quite a bit different, and you have to ask yourself in your regulatory process and in your technical evaluations whether I have appropriately accounted for these differences.

I guess I forgot my animations.

NUREG-1573, which is our performance -- our guidance document by our performance assessment working group, it considered a 10,000-year period of performance sufficient with some exceptions. The exceptions are noted here, or the exceptions are noted at the bottom.

It was sufficient to capture the risk from the short-lived radionuclides and to assess the risk from the more mobile long-lived radionuclides. That is just what Bill Dornsife spoke to.

And it was felt that it would potentially bound the potential peak doses at longer times, based on the characteristics of the typical commercial low-level waste stream.

The exceptions that were noted in that document were the in-growth of daughters from large

inventories of uranium, and also peak doses at humid sites from large inventories of long-lived transuranics. So, and noted there were exceptions to the selection of that period of performance.

Within the U.S. we have some other points of reference for period of performance. In the Yucca Mountain-specific regulations, 10 CFR Part 63, it goes out to a million years. It uses a different radiation limit for the first 10,000 years compared to the longer times. For WIPP, 10 CFR 61, it specifies 10,000 years, and then the general regulations for high-level waste disposal, which would apply to any site outside of Yucca Mountain currently, still maintains a 10,000-year period of performance.

For near-surface disposal, for some other types of materials, decommissioning sites, contaminated sites, it has a 1,000-year period of performance, and then for mill tailings it has a 1,000-year goal. Now, as I have said many times, there is no international consensus.

So what would be some considerations that I hope we can talk about? Hazard and longevity of the waste. What is your analysis framework that you are putting it into? A consideration of socioeconomic uncertainties, which we don't really talk about too

much, but I think Bill alluded to a few moments ago. And then, uncertainty in extending models; we have talked some about that.

So this is a horsetail plot of PA calculation, and what I want to illustrate with this are two different things. First, some people that maintain that performance assessments aren't credible are -- partly maintain that because they look at this period of time, and maybe when you first start getting the horsetail curves and say, "Look at this broad range of results you can get," and then the uncertainty is reduced. But we know the opposite is true, that the uncertainty grows in time.

Well, this sort of performance on this chart is solely due to the fact that in this early times, from the few hundreds of years to the ten thousands of years on this result, you are seeing the uncertainty in both the magnitude and the timing of when that result occurs. Whereas, when you get to the longer times, the timing isn't as uncertain. It is just the magnitude that you are achieving. So one reflects two components of uncertainty, and one reflects just one. That can kind of give you this misleading impression.

Then, the other point is in our regulatory

processes people argue, "Well, what society is going to be doing long times into the future." Now, this is an enormous time scale, and we basically have something that we are assuming today and extrapolating that forward. Well, that is done partly to avoid unnecessary speculation. It is a regulatory construct. You are trying to do the best you can today with the decision you are making for society.

And the receptors and the societal uncertainties that are really selected by your receptors and scenarios are done in some manner to try to mitigate, or at least account for, these potential societal uncertainties.

If we go forward now, some perspective. Now, what I have done is I have taken some things of various ages from the past and projected them onto this projection forward, so you can get -- get you thinking about the time scales and how big they are.

So the first thing is the NRC -- and this is a picture of my twin brother and myself. And we were not Siamese twins; it just looks that way on the picture.

(Laughter.)

About 40 years more or less. It's a log scale, so you don't really know how old I am.

(Laughter.)

So then if we look at some things that are more like 100 years old --

(Laughter.)

-- the State of Utah is about 106 years old or so, and this guy here, he is around 100 years old.

(Laughter.)

The United States, okay, that is more or less 250 years. See, if we are projecting this forward, as Bill was talking about there, you don't even see an impact on this calculation. Just understand this is to convey a point, and it's not specific to depleted uranium. You don't even see an impact beyond the age of the United States.

Here is the Great Wall of China, at least a part of it, that is on the order of a couple thousand years old, and a mastodon. I had a lot of trouble finding anything that was accurately dated beyond 10,000 years that I could put on the figure as a point of reference. A lot of the prehistoric or ancient animals and plants, there are very broad ranges for their ages, you can't even put a context to it.

So this is just put up there to

communicate this issue at time scales and the enormity of them, and that it needs to be thought about in maybe a different way. Myself, being an engineer and a scientist, sure, I like to go off and calculate something. But you always have to step back and say, "What does it mean? And does it make any sense?"

So what are some approaches to period of performance. Well, of course, we could specify in the regulation a period of performance. That would be one method. Another method would be NRC could specify the factors to consider, and somebody develops that on a site- or condition-specific basis.

But either way, whether we specify the period of performance or we allow some approach to specify the performance of -- the period of performance, we want to discuss during this meeting, what are the factors that need to be considered for either approach? And is there some other way that we haven't thought of that maybe we could go about this?

FACILITATOR CAMERON: Okay.

MR. ESH: That's it.

FACILITATOR CAMERON: Thank you. Thank you very much. Thank you, Dave.

Let's start with Mike, Mike Ryan. Mike, what are your thoughts or questions on this? Let's

turn on --

MR. RYAN: Oh, thanks. Sorry. Sorry, Charles.

You know, I think the period of performance has to be in the context of -- and, David, you have done a nice job laying out the context of, you know, what -- what are we looking at a disposal site for, over what period of time?

We haven't touched on it yet, but at year 100 a very important event occurs, at year 100 plus zero days with a probability of one. And that is that an intruder occurs and digs into the waste and grows food and ground-up irradiated hardware and stuff like that, and conducts his whole life through the highest activity waste that happens to be in a low-level waste site.

Well, for a place like Barnwell, I calculated once the probability of randomly hitting the Class C waste is 10^{-5} or so. So, you know, we have got a couple of artifacts along the timeline that we assume for the purpose of conservatively estimating impact what occurs and doesn't occur. We don't have that construct yet for some longer timeframe, like 10,000 years. But we assume there is some use of the resource, typically water, that carries radioactivity

from the disposal site to a receptor, and we go through a dose calculation.

So when we think about alternate timeframes for a period of performance, are we going to attach some -- the same kinds of constructs? Like use of the water would be the one you would think about for really long timeframes, or something else, or, you know, what do you want to do there?

I'm not suggesting anything. In fact, I am suggesting that it is something to think about, and I don't really have a good suite of ideas of things that would be relevant at that time. But it is such a long time period for the very reason that you showed in your last graphic, David, that it -- that deserves some additional thought.

I personally think, for example, at the 100-year point that it is a very conservative thought to say that, you know, any low-level waste site will be intruded to with a probability of one at day zero past 100 years. You know, if you get it to 300 years, and cesium and strontium are gone, you get a whole different profile of what that intruder might get for a dose.

So, you know, within reasonable bounds of certainty or uncertainty, even for the current

constructs -- and I am not criticizing or complaining about them at this point. I am simply saying you need to think about what is the endpoint of interest that you will be interested in evaluating against. And, you know, it may be a transport kind of a question, or it may be just an inventory question, you know, and the potential for mobility.

So that is something to think about in this arena. Thank you.

FACILITATOR CAMERON: Okay. Thanks, Mike.

Peter, do you have any thoughts on this from your perspective?

MR. BURNS: Well, I found myself thinking about Yucca Mountain, which is apparently no longer a viable site for disposal of high-level nuclear waste. And the court decision in D.C. however many years ago it was, that the 10,000-year regulatory timeframe was not appropriate because it did not capture peak dose, predicted dose, which I think is something in the order of 100- to 200,000 years, and I was thinking, gosh, if that scenario developed with the depleted uranium storage situation, peak dose is way out there, further than it would be for spent nuclear fuel, because it is -- it has got such long-term radioactivity, peak doses in the millions, and you

would be toast. You could never put it anywhere.

So I guess maybe that's not a terribly useful comment, but if -- you know, there has to be a regulatory timeframe that makes sense in a societal framework, rather than ending up at a peak dose scenario.

MR. RYAN: And, Peter, if I may, maybe that is a good reason you have just given why perhaps an endpoint of dose might not be the most meaningful or useful concept for those super-long timeframes. So that is -- I think we are on the same page you are suggesting. Think carefully about what time you are talking about as well as the construct for what impact you are trying to assess.

FACILITATOR CAMERON: And how about that issue that Peter raised about peak dose versus other factors that you might consider to deal with the risk so to speak? Anybody? Richard?

MR. HAYNES: Thanks. I guess from our standpoint -- my standpoint as a regulator, my concern is is that your uncertainty is so great at -- when you get out to 10,000 years that, you know, the number or the calculated number is almost irrelevant at that point, because if you are looking at your own graph there, you are showing that there is almost four --

there is five or six orders of magnitude that that value of exposure could be at over that -- at that 10,000-year mark. So is the number you actually calculate meaningful at that point?

FACILITATOR CAMERON: So, Richard, with that, are you saying that the uncertainty is so great after 10,000 years that it doesn't make any sense to go beyond that?

MR. HAYNES: I would back it up. I would say I don't know that it makes much sense to get out beyond 1,000 years, because even at 1,000 you still have quite a bit of uncertainty. But at 10,000 it is like throwing a dart at a dartboard at that point.

FACILITATOR CAMERON: Okay. Peter raised his flag on that one. Let's get a direct response, and then we will go over to Tom.

MR. BURNS: Well, the response I wanted to make was when -- and this is sort of philosophical in a way, I suppose. But if you rely upon the performance assessment, at some point -- at some point you start to be -- your decisionmaking process starts to be driven by events that are not necessarily what is actually going to happen. And you start responding to those in order to make your model or your scenario work better.

And what I'm trying to say, I don't think that made any sense, so -- I had a fair bit of experience with the Yucca Mountain program. I was not part of the program, but I was funded for nine years to do research. And when the decision was made to go from 10,000 years to a million years, neptunium-237 became very important overnight. It didn't make any difference at all in 10,000 years. But at 100- to 200,000 years, neptunium-237 was a major dose contributor.

And so all of a sudden we are all scurrying around trying to figure out what is going to happen with the neptunium. But if you had a different knowledge of how the colloids would behave in that environment, which we might have, say, in 10 years, it might well be plutonium that is the most important, and then you are scurrying all around trying to correct your repository design, and so on, for plutonium.

And you get into this cycle where the probabilistic performance assessment starts to drive the engineering, or something like that, and it gets -- it is a no-win situation when you get to that point. I'm not sure I'm being clear, but maybe someone else can expand on it.

FACILITATOR CAMERON: I think people realize what you are saying. It is a question of what you do backing off from that, perhaps for some of you at any rate. But let's go to Tom and Arjun, Felix, and then back over to Bill. Tom?

MR. MAGETTE: I am certainly inclined to agree with Richard's point as well as Mike and Peter's about uncertainty. I haven't heard a whole lot about specifics thrown out, so at least for a point of discussion I would suggest that there is certainly some regulatory precedents which could inform us.

And I think David had them all up there, actually. 10 CFR 60, 40 CFR 191, 10 CFR 63, all talk about 10,000 years. 63 also has, as he mentioned, a different standard out further in time. But there clearly is an established precedence that it may be worthwhile to do some sort of specific deterministic modeling out to that time period, acknowledging that there is a lot of uncertainty associated with that.

But I think that that is probably as reasonable a line as any to start with. There is also the concept of peak dose, which in this case, if you are talking about the in-growth of daughter products from depleted uranium, gives you a number much further out in time.

NUREG-1573 speaks to that and says that you should consider a time to peak dose. You may not model out to it. You aren't really able to model out that far in any sort of rational way, but you can take into consideration what that may mean. And so some sort of combination of those two ideas, a compliance number and another number at peak dose, which you take into consideration, but it is not a compliance number in a regulation, I think would make as much sense as anything I can think of.

FACILITATOR CAMERON: Okay. Thanks, Tom.

And as all of you speak to these points, let's keep in mind Tom's suggestion, so that we can get reactions to that.

Arjun, what do you have on this?

MR. MAKHIJANI: Yes, two points. You know, of course, those of us who do science and models all recognize that when you get out to 10,000 years and one million years, anybody who knows history knows that this is a very difficult thing. But we all draw different lessons from it.

The lesson that we have drawn at my institute, and many of us who don't -- you know, are two-fold. One is that society should do its utmost to not create problems for which we can't foresee the

solutions, and burden future generations with pollution and pollutants when we get the benefits and we pass on the costs to them.

The idea that our generation should pass on costs to future generations is unacceptable to us. The other thing, from a practical point of view, as to what you do if you are stuck with a situation -- we've got 60,000 tons of spent fuel, and we all recognize we have to do something with it. Not a good situation.

How we respond in the face of this uncertainty is to say that we protect future generations in the same way that we protect our own generation, at least no less. And if our models are not good enough, we should try to make them better. We cannot clear up our crystal balls more, but it just doesn't mean that we can throw them in the trash.

So we need to keep the same dosimetric rules and the same risk protection rules. We can't say, "Oh, you know, day after tomorrow we are going to have a cure for cancer." And day after tomorrow we may all be more vulnerable to a new set of diseases that radiation may cause. We don't know that.

The other point is regulatory. If we are going to limit the period of performance, I think in

my opinion -- I have been playing a lawyer on TV for some time, so I'll do it here -- a new notice of rulemaking has to be issued that Subpart C is going to be modified.

You cannot hide a modification of Subpart C by saying we are going to modify 61.55(a)(6). Subpart C is explicitly devoted to performance. It contains dose limits. It contains -- and does not contain a period of performance. That is what would need to be changed.

And if that's the direction in which we are going to proceed -- and you may want to do that, and I recognize the issues -- a new notice of rulemaking and a new document needs to be put on the table, perhaps along the lines that Dr. Esh has outlined in his presentation. These are the situations, these are the precedents, this is the reason we ought and out not to limit, and we are going to do this.

But I think that in this particular discussion, for the same reason that you said, maybe deep burial is out of limits, I would say period of performance is out of the limits, and dose -- to say that we are going to do modern methods of dose calculation, also off limit unless you put Subpart C

on the table.

FACILITATOR CAMERON: Okay. And I want to get reactions from the NRC staff and all of you to what Arjun has just said. I do want to go to Felix and Bill before we do that. And, Tom, this is up for another -- are you --

MR. MAGETTE: I am responding.

FACILITATOR CAMERON: Okay, good. Good. Let's go to Felix and Bill and Tom on these issues, including thinking about what Arjun is saying, and then let's go to Larry and Dave on these issues. Felix?

MR. KILLAR: Yes. The points I wanted to make on coming up with a performance time is that it actually goes along the lines of all that has been said so far, is that when you go beyond the 1,0000 years you are out into never neverland. Ten thousand years, you have no idea what is going to happen in 10,000 years, from a socioeconomic issue, from a climate change issue, what have you. So using something like 10,000 years is ridiculous.

But if you have to come up with a number, I would like to see a uniform number across all of the government agencies, and so I would like to see the NRC get more interactive with the EPA in

establishing something that has some credibility across the board for all types of hazardous waste sites.

As pointed out this morning, for the subtitle C and D sites, the EPA does not have a time period on those sites. If you look at the life of those toxicity, those materials, you know, 10,000 years is nothing.

So, you know, when we start talking about these things, we need to talk about them across the board of all hazardous materials, because, really, when you talk about radioactive materials, it is just another hazardous material. And you have to look at protection of the public from all hazardous materials, and that level of protection should be uniform across the board.

FACILITATOR CAMERON: Okay. Thank you. Thank you, Felix.

Bill?

MR. DORNSIFE: Well, this is facetious to begin with. Maybe from the standpoint of intruder protection we can assume after 10,000 years the intruder lives in a tent, and, therefore, radon isn't a problem.

FACILITATOR CAMERON: Okay.

MR. DORNSIFE: Getting to something serious --

FACILITATOR CAMERON: That is a starter.

(Laughter.)

MR. DORNSIFE: It's as good an assumption as we know we do now.

My biggest concern about this timeframe is the implementation of it. And what I mean by that is unless it is very, very prescriptive, and agreement states have to carry it out to the letter, it is going to be implemented differently. For example, for our license evaluation we had to literally do a performance assessment, a real performance assessment, including the effects of erosion, site stability, you name it, out to 50,000 years.

And if we have to do a million-year analysis, God knows what our regulator is going to suggest. We had to look at climate change as part of our -- as part of our performance assessment work for shallow land burial. We had to assume twice the rainfall falls in west Texas.

So, you know, we are already out there, and I think, you know, we did analyze for 10,000 cubic meters of depleted uranium in our original license, pure depleted uranium, and it was okay out to 50,000

years. But, you know, when you start going beyond that, I mean, it was tough to even do that, particularly from an erosion standpoint, even though we have evidence that our site is not eroding, it is accumulating. Okay?

It is -- but, you know, it is extremely difficult, depending upon how the state determines that you implement that performance assessment. And that is going to lead, again, to mischief I think in terms of different sites dealing with the issue differently and not having uniformity.

From the standpoint of the societal issue, I mean, another way of looking at the societal issue, you are taking something that is naturally occurring and you are redistributing it. Okay? And, you know, if you assume linear no threshold, you get the same risk, unless you can demonstrate that you are giving a dose that is going to be a fatal dose. That is the way we deal with radiation risk.

FACILITATOR CAMERON: And, Tom?

MR. MAGETTE: Just one point regarding the uncertainty. Mike mentioned one point, you know, regarding if you do assume a resident farmer scenario, Barnwell, the odds of actually having, rather than a probability of one, what a more reasonable probability

might be.

There are other aspects of conservatism built into this, which we can talk about more or less, but a performance assessment is not the only factor by which we actually ensure the safety of a site for the disposal of low-level radioactive waste. We have siting criteria, site selection criteria. We have site licensing. We have packaging requirements, site closure requirements.

This is part of a tier, and it is well down in the tier, and each of those layers includes conservatism. So there is an awful lot of margin that is built into here that I think addresses a lot of the uncertainty. So I would just like to get that on the table to, if not demystify, at least put into some sort of context this notion that we are overwhelmed by uncertainty and, gee, who knows what might happen?

The other thing I would like to say is we don't have a proposed rule on the table. I think a proposed rule can come out and modify 61.55(a) to add nine. They could modify Subpart C, or could modify whatever else the NRC determines is an appropriate way to implement the guidance that is in the existing SRM without starting over, unless I'm missing something. So I'm a nuclear engineer playing lawyer now.

There is no -- there is nothing in the Administrative Procedures Act or the Atomic Energy Act that would prevent a proposed rule from coming out to implement the kinds of things that we are talking about today without starting over.

FACILITATOR CAMERON: Okay. Thank you for that, because emphasize there is no proposed rule on the table now. So certainly the type of thing that Arjun or others are expressing could be in that proposed rule.

Do you want to hear from these two before you guys talk? Because -- let's go to Peter and Mike, and then let's hear what the NRC has to say. Peter?

MR. BURNS: I found Bill's last statement to be very provocative and interesting, so I just wanted to follow up with a comment, because I don't think I agree that this is a situation of mining something from nature and redistributing it.

The reason I don't agree is because the geologic conditions over a period -- a very long period of time led to the formation of the uranium deposits from previously-dispersed uranium, so they actually concentrate uranium and create a uranium deposit, which we then disturb greatly, change to chemical form totally, of the uranium, and we are

talking about putting it in a near-surface environment where we know it is not stable.

So I don't think there is any relationship between the uranium or deposit in nature, and what we are talking about doing in terms of disposal. We can learn, no doubt, from nature. We can learn from the natural analogues what will work for a long time and what won't. Well, it's harder to learn what won't, because it is gone. But we can certainly learn what did work and apply that, but it is a very different situation.

FACILITATOR CAMERON: Thank you.

Michael?

MR. RYAN: I just pulled up 10 CFR 61, and I want to read this part, 61.58, that I think helps with the discussion from 20 minutes or so ago. "The Commission may, upon request, through its own initiative authorize other provisions for the classification and characteristics of waste on a specific basis, if after evaluation of the specific characteristics of the waste, disposal site, and method of disposal, it finds reasonable assurance of compliance with the performance objectives of Subpart C."

So, I mean, there are a lot of provisions

in 61 that have those kind of features where alternatives are allowed and in fact recognized as being a good possibility. So, and they are in several places. I would just suggest that, Chip, it is probably useful for everybody to refresh on where those alternative requirements are actually spelled out for either the Commission to take or licensees to submit or those kind of things, because a lot of the things that we have talked about in a rigid way in our conversations today actually have flexibility built into the language of the reg.

So all of that is in there, and I think we have covered a lot of that territory. And there is no need to go through the other ones that are like that, but that is one that would seem to be on point.

FACILITATOR CAMERON: Thank you, Mike, for putting that out there. 61.58.

MR. RYAN: Yes, exactly.

FACILITATOR CAMERON: Alternative approaches.

Okay. Larry, you and Dave have heard --

MR. CAMPER: Yes.

FACILITATOR CAMERON: -- this conversation? What is your reaction?

MR. CAMPER: Well, I want to make a couple

of comments, and then I want to ask you a couple of specific questions. You know, Arjun twice has raised this issue of Subpart C, and this morning you have cited the fact that an organ dose is required there. And, of course, Dr. Esh indicated why the analysis using TEDE was done, and not organ. But you have made that point twice.

And what -- and as Tom says, there is no rule on the table, we are in fact-finding. But your point is a very interesting point, and what we will do is take a good, long look at that as we analyze all of this information we are gathering and try to specifically determine, if we proceed with this rulemaking as we are currently directed to do, is there a need to make some sort of corollary adjustment to Subpart C?

Or could it be dealt with under an overall risk-informing and waste classification scheme? We will specifically address that question and try to provide an explanation of where we end up on that, because you have made a very interesting point.

I think all of you have done a very good job of expressing the problem that you get into when you start to consider a period of performance. This is a very, very complicated subject. It is not a

subject upon which reasonable people will always agree upon a timeline. They just won't, for a myriad of reasons. But what I would try to do is ask you to answer a couple of specific questions, so that you can be of great assistance to the staff as we proceed ahead and analyze what we have heard here today, or what we might discuss in Utah as well.

The first question I would ask you is, this notion of specification in a rule versus guidance. I mean, for example, you could have a rule that has some language that, in essence, said, "Conduct an appropriate period of performance." I mean, that might not be the exact words, but that's the idea.

Or you could have -- and then, if you did that, get into a rather elaborate discussion and guidance of all of these various issues we have discussed today -- you know, 1,000 years, 10,000 years, a million years, all of these various parameters that have been talked about, so that the licensee and the state implementer, then, are left to try to figure out what is an appropriate period of performance that they want to use in their particular state under their particular scenario.

So, or, by contrast, you could specify a

PoP. Dave, in his slide, showed you several examples. A period of performance is specified at 1,000 years in the license termination rule in Subpart E of Part 20. Part 60 has a specified period. Part 63 has a specified period of performance. You could specify a period of performance which would contribute to uniformity in all states, and then of course provide some explanation and guidance as to why you chose that particular period of time.

So I am looking for -- we are looking for some definitive feedback from the panel, specify a PoP or don't specify a PoP in terms of the number. That would be very helpful.

And the second thing is, in the SECY that the staff did, the technical analysis, in the section entitled "Conclusions and Recommendations," the staff said the following. "Considering the technical aspects of the problem, the period -- the performance assessment, staff recommends a period" -- excuse me -- "a performance period of 10,000 years for the analysis of DU disposal. However, analyses should be performed to peak impact. And if those impacts are significantly larger than the impacts realized within 10,000 years, then the longer term impact should be included in the site environmental evaluation."

And my question to the panel is: given all that you have heard here today, would that be a reasonable approach, given that there appears to be no perfect solution to this question? Is that a reasonable approach?

So I would very much appreciate some feedback on those two particular questions. Thank you.

MR. MAKHIJANI: Can you state again the last part?

MR. CAMPER: Yes. What we said -- sure will, Arjun. What we said, what the staff said in the conclusions and recommendations section, in the second paragraph, it said, "Considering the technical aspects of the problem, the performance assessment staff recommends a performance period of 10,000 years for the analysis of DU disposal. However, analyses should be performed to peak impact. And if those impacts are significantly larger than the impacts realized within 10,000 years, then the longer term impacts should be included in the site environmental evaluation."

And that is consistent with NUREG-1573, by the way, which is our performance assessment guidance document.

FACILITATOR CAMERON: Okay. Let's hear

from David, and then let's get some opinions on the two questions Larry asked. And I want to check in with the audience on any of this. And I think we probably have mined it enough, as much as we can.

But let's hear from David, and then let's go to Diane. David?

MR. ESH: The first thing I was going to say was reiterate Larry's comment about, should we provide a number and justification for a number? Or, like the current approach, be silent on a number and let it up to the agreement states and licensees about how they implement that? So that is just reiterating his question.

And then, the other thing I wanted to say was that in -- if you look at that NEA report, it basically gives a good overview of what people do all over the world that also deal with this problem. So it gives you a good context of what other people think about this problem. It's a difficult balancing of some ethical considerations, some that Dr. Makhijani talked about. Then, there are other ethical considerations that kind of go in the other direction that people talk about or consider.

So, but one of the main -- if I had to condense it and generalize it, which is always a

danger, but I will do anyway, it basically takes the approach of acknowledging that these uncertainties are larger with time due to our ability to understand the physical processes that some -- like larger global scales that may happen, and to account for the socioeconomic uncertainties.

And it does that in a manner where a lot of groups or agencies specify a compliance performance period where they expect a quantitative evaluation, some longer period where they expect a semi-quantitative evaluation. And then, if they do need to look at very long periods of time, then expect a qualitative evaluation. It is a generalization, but I just wanted to get people's views on that, whether they think that is a reasonable approach or not.

FACILITATOR CAMERON: Okay. And that ties to Larry's second --

MR. ESH: I think so, yes.

FACILITATOR CAMERON: -- question. Okay.

Diane?

MS. D'ARRIGO: Just conceptually, I know it's not practical when you have such long-lasting waste, but that the performance period should be for as long as the material is hazardous. And if you can't protect, then we have to really question whether

you are going to continue generating waste that you can't protect people from for that period. So the performance period should be the same as the hazard of the longest lasting radionuclides.

FACILITATOR CAMERON: Okay. And in this case, radon daughters, a million years, million years plus. And just so that Felix doesn't have to say it, I think probably might want to repeat his comment from earlier about some uniform approach to this. Chemicals perhaps don't have -- go on for -- beyond that. I am just calling people's attention to that.

And I think Diane gave you an answer to the two questions that you posed, that it's not going to be acceptable from her point of view to have some sort of a qualitative -- a compliance period that is less than the peak dose, and have some qualitative analysis in the environmental impact statement.

Other opinions on that? Peter, and then we'll go to Mike. Or on any -- any of this.

MR. BURNS: I said before that, although it is not a certainty, probably the peak impact is many years in the future, much greater than 10,000 potentially, perhaps even greater than a million. And I don't think there is any way that we can have a regulatory framework where you can demonstrate, say at

1.5 million years, that you are not going to have a serious problem with this depleted uranium.

So it is -- I argue towards a more realistic timeframe of something like 10,000 years with more qualitative assessment beyond that. But, I mean, you don't want the scenario where waste is buried in a place that is certainly going to be eroded, that we know is going to be eroded in 11,000 years. That wouldn't make any sense. All right?

But if you are going to go to in excess of a million years, you have to go to deep hard-rock burial. Well, maybe you will put it back in the uranium mines you took it out of, but at least those holes are already there. Maybe you could use Yucca Mountain actually, seeing as it is no longer viable for spent fuel. But you would have to go to that kind of scenario is the only way you could ever get into that sort of performance.

FACILITATOR CAMERON: And I know you gave Christine some ideas on that one for Department of Energy. And anything on Larry's first question? Should it -- should whatever the time period is, the compliance time period, should it be specified in a rule, or should people be given flexibility in terms of that? Mike?

MR. RYAN: I have been thinking a lot about the timeframe and how do I show I am meeting whatever the requirement is at the timeframe. And, you know, I can be comfortable with 10,000 years with some regulations that I understand of how I am going to demonstrate that.

So I think part of that question is it is hard for me to separate what is the period of compliance without knowing what my requirements or obligations are going to be at that timeframe, or to demonstrate now for that timeframe. So I am having a little bit of trouble saying, "Yes, 10,000 is the right number." I don't think I can give you that answer today without understanding what 10,000 means in terms of demonstration of performance.

So with whatever number you pick, whether it's 1,000, 10,000, or some other number, or maybe even two numbers with two different things to demonstrate, it would sure be helpful to match those up in a way where the expectation of demonstrating the conformance with whatever the requirement is at a given time is matched up in a reasonable, doable, interpretable passes-the-laugh test kind of way.

So I don't think you can separate the dancer from the dance on that. So I would, you know,

and, again, I mean, I appreciate and accept all of the conversations we have had about different time horizons. But until I know what I am going to have to demonstrate at a given time -- I mean, I know what I can demonstrate at 100 years. We are pretty good.

And, David, I am getting back to your curve. You know, we can -- I can tell you for 200 years pretty much if it is going to happen. I would even be comfortable putting in institutional controls that say an intruder is not going to get there for 200 years. But that's just me.

So, you know, but when we get out there longer it is -- until I know what I am going to be required to demonstrate, it's hard to say I like the idea of that timeframe. So I would offer that we really need to put both of those thoughts together in some way to say, "Well, you know, this is what we think is a good demonstration at 1,000, 10,000, 100,000, a million, and so forth."

FACILITATOR CAMERON: Okay. Thanks. Thanks, Mike.

MR. RYAN: Thank you.

FACILITATOR CAMERON: Let's go to Tom and Bill and Christine, and then let's finish up with Arjun, and see if anybody in the audience wants to

chime in on this, and then we will go to the next issue. Tom?

MR. MAGETTE: I would generally agree with Peter's statement as modified by Mike, which condones Larry's proposal as modified by David.

(Laughter.)

And by that I mean the notion of a compliance period which is possibly on the order of 10,000 years, but with a more qualitative assessment going out further. I think the language in the conclusion of the SECY is close to that, although I think the way David described it embellishes that a little bit more, which clarifies a reasonable flexibility there.

So I think that combination is also what Mike was getting at, and I agree that you do have to link this with what it is that you are going to have to demonstrate. And so if I could rest assured that what I am going to say tomorrow morning is going to be accepted, then I might be more comfortable saying, "Yes, I'm good with that now."

But the bottom line is I do think you have to link those two things. I do think that this is one of the few things that belongs in the rule. The rule needs to be simple, but the rule needs to say what the

period of performance is.

And the flexibility that Mike described I accept, the notion that a licensee can justify this, have a hard time with understanding which licensee is going to have a different period of performance for depleted uranium from any other licensee. So I don't just see any rational path that says a licensee can justify a different period of performance for an individual isotope, or, in this case, waste form that may have several isotopes as part of the daughter products.

So I don't think that is okay, unless that is some words that just flowed down from the unique waste stream dialogue. If you are talking about depleted uranium, no, I don't think a licensee can individually justify that.

FACILITATOR CAMERON: Okay. And there -- I think you are talking about some of the dangers of some licensees having the flexibility to do other things because of the whole competitive nature of the business.

Bill, what do you think about all of this, and also about any reaction to what Tom said?

MR. DORNSIFE: Well, first of all, I think on this period of performance issues, I don't think

anybody at the table disagrees that a realistic performance assessment for a million years for a shallow land disposal facility is meaningful. Okay? So we can kill that as -- in terms of an issue.

I could live with a 10,000-year or some nearer term, 50,000-year period of performance. And looking at, you know, the bounding conditions beyond that, but I guess the concern based on my own experience would be the radon issue. And particularly how erosion at the site relates to that radon issue.

So this waste stream creates a very unique situation in terms of long-term performance because of that radon issue and the erosion concern.

I was kind of intrigued about David's suggestion regarding, you know, a multi-phase, if you will, performance assessment that looks, you know, at the end qualitative. I would like to hear more about that. And I guess I am totally opposed to the state, you know, just -- the state having general, you know, guidance that would lead to chaos in terms of implementation.

So from that standpoint, I agree with Tom that you have to have some sort of a uniform standard, because of the competitive nature of the business.

FACILITATOR CAMERON: Okay. Thank you,

Bill.

Christine?

MS. GELLES: Thank you. I'll be honest and admit that during the course of the last four comments I kept debating, putting my tent down, but now I feel like I want to respond a little bit to everybody. But it began with just wanting to reinforce something that Michael said that I think, while I appreciate Larry's request and need, it would be so great if we could give you definitive feedback on what the number should be, you know, what the time period should be.

It is -- these questions are too complicated, and the factors and the issues are too interdependent. So I wanted to second what Mike had said. I also am supportive of some of the thoughts that Tom expressed as well and the need to retain some flexibility.

So, and then the question of uniformity came up, or the issue of uniformity or concern of uniformity came up during one of the comments in between the two gentlemen, and I think we just have to keep in mind some points that Bill raised earlier today, that if you come up with a different regulatory period of performance, or performance period for a

specific waste stream or unique waste streams or DU, we need to ask ourselves, you know, is that consistent with the regulatory requirements that exist for other waste streams under other regulations? And if not, why not? And then, what about those exempt quantities that might pose the same hazards?

And I also want to recognize some of the comments that Felix made that, I mean, perhaps the EPA needs to be part of a dialogue here as well, because perhaps there are hazards associated with the DU stream that are being missed and not captured in some of our dose questions and calculations.

FACILITATOR CAMERON: Okay. Thank you.

I want to finish with Arjun, and go back to some of the things that he was talking about earlier. So, Richard, why don't you go ahead, and then we will go to Arjun.

MR. HAYNES: Mine is just short, just to answer NRC's question of which -- I think from our perspective we would prefer them specifying a period of performance in the regulation itself, and the reason being is that from our perspective if we -- you leave it up to the state or the -- and the licensee to work that out, you are still going to end up at a default value through the public participation period

process of -- that is just something else you can be appealed upon.

So having something in regulation that specifically says, "You shall use this period" would make our life easier from that standpoint.

FACILITATOR CAMERON: Okay. Thank you, Richard.

Arjun, let's go to you, and then we will go to the audience. And, you know, earlier you talked about not passing the uncertainty on to generations and protecting them like we would want to be protected. And you also raised the point that Subpart C should be on the table of setting the period of performance.

I think we know that Subpart C could be on the table in this proposed rule, and I guess I would just look for whatever you have to say, plus your reaction to what people have been saying about -- saying around the table.

Sorry, Charles.

MR. MAKHIJANI: Well, I definitely gather that Subpart C is on the table as part of this rule, because we are discussing period of performance and method of dose calculation. So I will just reserve the right to consult with our lawyers on that, and see

what they have to say.

As a non-lawyer, I will simply say that I think you need to go back to the drawing board and tell the public what is on the table and present the basis for that rather than hiding a change of regulations under modern dose calculations. I still have bones, and that hasn't changed.

So the point in regard to the specific passage, actually, I will go to the favorite people of the nuclear industry and also my favorite people, since I am married to one of them, the French. The French high-level waste rule is very interesting, and we have studied the French repository, you know, research program and have a 250-page report on our website in French if you want to go look at it.

And this is from memory. Their rule recognizes this problem of long-term uncertainty in a different way than what you proposed in your paper, and I would recommend that you consider it. I think it is a better -- it is certainly a better method than what is proposed in your paper. It doesn't abandon the dose limits for the long term, but it abandons the idea that you can have a precision performance assessment in the long term.

So they say for the first 10,000 years

where we can have more confidence in our model, we try to select parameters that -- you know, and distribution for parameters that we can have some confidence in. And that is I think what we have been saying is that we can possibly do that, at least for some sites, maybe climate exceptions, and so on. And they looked into all of that.

For the one -- 10,000 years, what they said is -- and this is from memory, so you will have to excuse if there is an error in this. I will supply the information to you in writing. Is that they will choose conservative parameters, so that they actually get a conservative result, preserving the dose limit. So that they don't actually have to choose best estimates and distributions, but they can take the worst case that we can imagine for the various parameters and do the calculations that way.

I think that would be compatible with what I said earlier. There is -- certainly, you don't have to take my word for it. There is -- you know, the most-referred-to nuclear establishment on planet Earth adopted this as a rule for their high-level waste. So you can maybe start at that point rather than what you have.

FACILITATOR CAMERON: Okay. Thank you.

Thank you, Arjun.

Anybody out in the audience want to offer anything on period of performance, including whether -- whatever it is, whether it should be set in the rule or guidance? John? And just introduce yourself again for us, please.

MR. GREEVES: John Greeves. I would like to thank the people that are on the panel. I thought this has been quite useful. Individually, I think the period of performance needs to be in the rule. It is what we have been struggling with for a long time.

It needs to be in the rule, and, individually, I am comfortable with what the staff has used in 1573 and 1854. They have been using 10,000 years in their analysis recently, and, looking qualitatively out beyond that, I think that is a default place to begin with, and let people comment on both sides of that. So I congratulate the panel.

FACILITATOR CAMERON: Great. Thank you, John.

Anybody else that wants to add on this?

(No response.)

Okay. Can we go --

MR. DORNSIFE: Can I make one quick one?

FACILITATOR CAMERON: Go ahead, Bill.

MR. DORNSIFE: Following up on Arjun's discussion, you know, a way of looking at it, I mean, we assume that future generations aren't going to know anything. I mean, probably the more likely assumption, if we still have a form of government, there will be records, and we will know.

So maybe a way to deal with this long-term issue is to identify in this performance assessment what parameters are important to preserve, if indeed there is institutional control.

FACILITATOR CAMERON: So when you say "what parameters to preserve" --

MR. DORNSIFE: Like, for example, erosion is a problem.

FACILITATOR CAMERON: Yes.

MR. DORNSIFE: You know, in terms of the radon, so you'd better make sure, if you are around, you maintain appropriate cover.

FACILITATOR CAMERON: So you maintain -- what was that? Corporate --

MR. DORNSIFE: Appropriate cover.

FACILITATOR CAMERON: Appropriate cover. Okay.

MR. DORNSIFE: But, you know, I mean, it's a way you identify those parameters that are part of

the performance assessment. That makes a difference in terms of the long-term risk, and you say these are the things you need to focus on society if you are still around. And if you're not around, do we really care?

(Laughter.)

FACILITATOR CAMERON: Okay. Thank you. Thank you, Bill. Thank you, all.

And can we tee up the next issue? Is it -- David, are you doing this next one?

MR. ESH: Unfortunately.

FACILITATOR CAMERON: Which is exposure scenarios. Okay. Here we go.

MR. ESH: All right. Exposure scenarios for the site-specific analysis. We talked about this a little bit.

FACILITATOR CAMERON: I see some -- wait a minute. Hold on, hold on. Do we need a break?

PARTICIPANT: Yes.

PARTICIPANT: Yes.

FACILITATOR CAMERON: Okay. Sorry, David. I saw some consternation across the way, so let's take a break and come back at 25 to 3:00, approximately 15 minutes.

Thank you.

(Whereupon, the proceedings in the foregoing matter went off the record at 3:22 p.m. and went back on the record at 3:38 p.m.)

FACILITATOR CAMERON: Okay, everybody if you could come back to the table, we'll get started with the next to last topic which is Exposure Scenarios. And Dave is going to tee that up. And then we're going to give Dave a break and the last topic, the Source Term Issues is going to be teed up by Dr. Pinkston right here.

MR. ESH: Okay, exposure scenarios for the site specific analysis; we talked about this some in the previous discussion and earlier this morning. It's pretty much tied to some of the other components. It's hard to segment a lot of these issues and deal with them individually but we'll do the best we can.

So a little bit of overview with background on what we do right now for 10 CFR Part 61, what may be some key considerations and then what would site specific exposure scenarios consider. So a little bit of background here. The development of 10 CFR Part 61, the NUREG-0782 and NUREG-0945, took the approach of evaluating residential, agriculture or other activities near a disposable area and then as I've discussed previously, this morning, evaluated

inadvertent intrusion on the disposal area.

On the right-hand side of this figure here, which is -- you probably can't see too much but I'll describe to you what it is, why I put it here. Basically, it has a number of different scenarios in the first column, what were called biota access locations in the next column, and then the media type with which people were exposed -- contacted the material through exposed to soil or air and then what the uptake pathways were and these were condensed into Pathway Dose Conversion Factor, a PDCF.

So basically, the scenarios at the high level here, this residential or agricultural or other activities near the site and then somebody inadvertently using the site was the regulatory framework for receptors and scenarios that were used in the development of 10 CFR Part 61. What does this look like?

Well, we looked at something like this earlier. Actually, this figure is a lot nicer. Karen made this one, so but we have a site boundary. We have people living near the site which have a potential dose from water usage that they maybe grow some plants and get their garden and vegetables from. Potential dose from ingestion of the vegetables. And

this can be a resident farmer or a residents out there. A resident farmer, then they raise animals, too, cows and chickens generally.

If they are just a resident, then they have a garden, but they don't have animals. Either one can use potentially contaminated water, though. For the chronic intruder, it's over top of the waste disposal area. The assumption is that people come use the site in the future, as Dr. Ryan said. It's evaluated, can be evaluated at year 100, day zero. The difference being that when they're above the disposal area, especially in the case of depleted uranium, they can get diffusion of radon directly into their house.

They also can, if the depleted uranium was disposed shallowly, dig some of it up inadvertently, it's spread on the surface, it contaminates the soil, contaminates the plants and people are exposed to the contamination directly that way. If the depleted uranium was buried more deeply, then we evaluate a potential well being drilled through the material and the material being -- the drill cuttings being exhumed and spread on the surface in the environment in the vicinity of the house, which then contaminates the soil and the plants.

In either case, you can have groundwater contamination and groundwater flow to wells. So that's a little bit of background on the exposure scenarios, both what was used for 10 CFR Part 61 development and what we used in the analysis for the SECY paper.

So what are some considerations? Well, we can always, of course, use the historical approach, what was done in the past. We can continue to use something similar to that, which is an offsite resident, onsite intruder evaluate acute and chronic effects. What's important to consider, I think, is the relationship of the receptor scenarios to the characteristics of the waste. That being -- as Dr. Ryan pointed out, maybe it's a fairly low likelihood that in 100 years somebody comes right when the institutional control period ends and builds a house on your site or does some other activities, but as time goes on, it becomes probably more and more likely that you lose the institutional knowledge and something inadvertent may occur.

So if your waste has a long-live characteristic to it, then that probably needs to be acknowledged in your receptor scenarios and/or regulatory framework. In some programs, like for

mill tailings, the include radon but it's done through a flux limit, so specify a flux limit at the cover above the materials that you have to meet and that's the regulatory criteria for radon. Otherwise radon isn't included and say a dose assessment for somebody living on a mill tailing facility in the future.

Radon is ubiquitous in the environment and gives us a large percentage of our background radiation. So should the regulatory limits that you apply for radon be the same as you apply for everything else, should it be a small percentage of the background radiation dose, these are questions that you should probably -- would need to consider in this problem.

But then we can have regulatory defined scenarios or site specific. We do this in our decommissioning program where people are able to define site specific receptor scenarios and in some cases justify use of, say, an industrial scenario. That generally applies or we like to see it applied for periods of time that are more recent to when we're making the decision. That being that if you have industrial use of a facility right now, and you have short-lived contamination that you're trying to decommission the site for, then it's probably

reasonable to evaluate an industrial scenario to develop your cleanup goals, in particular because that short-lived radioactivity is going to decay very rapidly and you have the higher confidence that, yes, an industrial scenario is appropriate.

But so there is the ability to do some site specific consideration of receptor scenarios or it can be defined in regulation either in rule or in guidance. So that's it.

FACILITATOR CAMERON: Thank you, David. Who wants to start us off on exposure scenarios? Is there a basic point that we should hear on this to get us started? Let's go to Tom.

MR. MAGETTE: I would suggest that one basic point to consider would be in response to David's last point or his last question that I think exposure scenarios belong in guidance. I don't think they belong in the rule. I do think they also should be site specific which, I think, can be addressed in guidance. So I think both of those are important points. To the extent that anything goes in a rule, I do think that there is a component of the rule related to intruders that should be looked at and it would be a Subpart C thing, I think, that a 500 millirem standard for intruders should be put into the rule

that's consistent with current practice but it's not in the regulations anywhere.

So those three points are what I would suggest as a good starting off point.

FACILITATOR CAMERON: So if there was anything more stated in the rules then the performance assessment should include exposure scenarios. If there was anything more than that, then you would also recommend putting the 500 millirem limit for intruders into the rule also. But the best thing would be to just have this in guidance. And when you say it should be site specific, how would that work? Could you just explain to me because I'm not sure I understand it about how the exposure scenarios for site specific would be in the guidance.

MR. MAGETTE: Well, I think it's reasonable that there are some exposure scenarios that simply wouldn't apply at some sites.

FACILITATOR CAMERON: Okay.

MR. MAGETTE: For example, at our site groundwater ingestion is not a reasonable scenario because the groundwater is more saline than ocean water. So consumption of groundwater is not a reasonable exposure scenario for Clive. For example, I mean, there would be many others but that's just --

that's the context for my comment.

FACILITATOR CAMERON: Okay, great. Great, thank you, Tom. And thank you for addressing the issue we should always be considering for any of this is rule versus guidance. Mike, do you want to --

DR. RYAN: Yeah, I just have one additional point and I appreciate what Tom said. I have one additional point. And that's to the extent you're comfortable and it can be practically done, a little bit more realism in the scenarios. The farmer, you know, intruder is one that catches my attention as being unreasonable. You know, exhuming waste, growing food in ground up hardware and stuff, it just doesn't pass the laugh test for me.

So I think that reasonable human activity can be superimposed on some part of the materials, but other parts, no. For example, chunks of DU metal in a welded container are not going to end up in the food, really.

MR. ESH: So you mean, consider more directly the recognizability of the material based on when you expect the scenario to appear.

DR. RYAN: Yeah, and if it is, you know, metal chunks, then an external exposure scenario seems pretty reasonable to me, but an ingestion one, you

have to reach a little bit, unless there's some process that, you know, takes the material to some other chemical state. You know, so just the realism and the construction of the individual scenarios that are appropriate to whatever your range of scenarios are, I think, would be helpful and better risk informed as opposed to the old way of thinking 30 years ago, "Well, if we use these bounding assumptions, it will be conservative". Well, you know, that's silly at some point, so that's in addition, I think, to what Thomas made is a very good point, so thanks.

FACILITATOR CAMERON: Thanks, Michael. Anybody else, anybody want to talk about the more risk-informed suggestion that Mike brought up as well as anything else, but I would just ask people to respond to what they think about that. Bill, and then we're go over to Arjun.

MR. DORNSIFE: I think in terms of the radon issue, I think we ought to strive for uniformity among standards and certainly the mill tailings emanation rate is the appropriate standard if that's indeed what needs to be in the regulation, 20 picocuries per square meter per second or whatever it is.

FACILITATOR CAMERON: So, Bill, again. You know I get to demonstrate my ignorance on this in case anybody else is as ignorant as I am which is probably not true, but when you say -- when you're talking about mill tailings in the context of scenarios, how does that -- what are you saying?

MR. DORNSIFE: Well, I'm talking, one of the issues was radon and the needed regulatory limits for radon release. That was one of the issues that was raised. And I'm suggesting that the mill tailing standard be the appropriate standard for radon. However, whatever we're looking for as this compliance period.

MR. ESH: I understand the comment, Chip.

FACILITATOR CAMERON: Okay, great. Thanks, Bill. Arjun?

MR. MAKHIJANI: This discussion is now really centered in Subpart C because we've now talked about putting an intruder dose limit of 500 millirem there which is now not specified. It just says, "We shall protect the intruder". It's a paraphrase. Now we have a radon -- effectively a radon dose limit from what Bill has said and this is a rulemaking -- this is a discussion. It's no longer recognizable as a depleted uranium discussion but rather you know, the

second part of what we were told in the morning we would be doing is after this kind of emergency specific thing so LES can dispose off its waste two years from now or whenever, or the DOE, that we would have a broader risk discussion about risk-informed.

But I think we are fully into this risk-informed discussion already. And for one, I just want to say I didn't come fully prepared to discuss this. My preparation would have been a little bit different if I had come to discuss the second phase of this. I just want to put that caveat in there. I will make some written comments but I think if we're going to do a risk-informed discussion, a more -- then we ought to abandon the DU-specific discussion and do the risk-informed discussion in this meeting.

Otherwise, I think we ought to limit our discussion to what we're going to do about depleted uranium within the existing rule. And the existing rule says some very specific things. Lots of licenses have been granted based on the existing rule. We're talking about operating under existing licenses with creating a Class A1 and Class A2 basically under 61.55(A)(6). We'll have (A)(6) Roman Numeral II and Roman Numeral I basically, and I don't recognize the -- I don't recognize this discussion as being centered

in where the Commission said it should go.

I mean, I'm okay with having a broader discussion but I think it's a different discussion.

FACILITATOR CAMERON: Okay, thanks, Arjun.

MR. MAKHIJANI: Oh, I had a question about the scenario, which is, from your published paper, Dr. Esh, I didn't see the well in the depleted uranium itself. I saw the well on the side, which was the origin of my question in the morning and maybe some clarification.

MR. ESH: I believe the text describes that the well can go through the materials even though it's not showing.

MR. MAKHIJANI: Can go even, okay.

MR. ESH: Even though it's not shown in the figure.

MR. MAKHIJANI: Yeah, I just got this, this morning, so I haven't had a chance to read it.

MR. ESH: Oh, okay, all right.

FACILITATOR CAMERON: Okay. Thank you. Does anybody have any reactions to what Arjun just said? Any of the NRC staff or anybody else? Christine.

MS. GELLES: Thank you, Chip. Just to reinforce some of the comments already made, we do

support more realism in the exposure scenarios and I also concur with the idea of site specific exposure scenarios. That is akin to how the Department of Energy conducts our analysis today and we certainly do recognize that unique circumstances of the Clive Facility, for example. So, thank you.

FACILITATOR CAMERON: Great, okay. Thanks, Christine for affirming some of that. Yeah, Arjun, go ahead.

MR. MAKHIJANI: Can I say something about the site-specific scenarios? I think it's not appropriate to leave too much discretion to the sites. So while I would acknowledge, of course, we're not going to be drinking salty water, there's no reason why such common sense guidance can't be put into national guidance and say you know -- I don't know of any scenario and any model that has assumed people are going to be drinking salty water because you'd die if you drink salty water.

And the -- I think I believe that the general pattern of these scenarios should be specified in the NRC guidance. And there's a reason for this. I mean, if we take the Clive site, we showed that under the erosion scenario, if you actually bury the waste, not build pyramids on the site the way they do

now or whatever. That it would be uncovered and that doses, dose limits would be greatly exceeded on the order of 10,000 years. I can give you the exact results of calculations. They're in my computer. So you don't need to go out to a million years.

And that dose limits would be exceeded in a few hours with a hunter going on site and just standing there waiting for their prey. And these scenarios were also excluded as unreasonable the people -- there would essentially not be intruders on site. Now, excluding intruders on site in Clive means perpetual institutional control. That might be reasonable for the kind of waste they have there now. I'm not making a comment on that. But I know it is unreasonable for the kind of waste that we're talking about now and I would very strongly recommend that scenarios not be -- that there be very specific guidance about what sorts of scenarios have to be considered. And I don't think anybody's talking about unreasonable ideas like drinking salty water.

FACILITATOR CAMERON: Okay, thanks, Arjun. It's -- I'm not sure that -- I think everybody would agree with the idea of having very specific scenarios. I guess I'm testing this out. We heard people talking about more realism in scenarios. And Arjun,

are you saying that that makes sense or are you giving us a cautionary note on that?

MR. MAKHIJANI: Well, I've always appreciated the kind of guidance that has come from the DOE and in its own work as national guidance and from the NRC and the EPA about the kinds of scenarios in which how we proceed to calculate doses or exposures so as to protect the public. I mean, you take Subpart A to the Clean Air Act and there's a way to do that, that applies to all facilities. It is a scenario that says, you know, a resident closest to the site boundary.

You don't -- Los Alamos doesn't have a discretion to say, you know, "We have an airport over there so we're not going to calculate". They don't have that discretion. And I think -- and I think because you don't know whether that airport is going to be there tomorrow and whether that land is going to be sold off, and it makes sense to create a set of conservative scenarios. I think the federal approach generally has been good although you know, sought to be abandoned from time-to-time in terms of resident farmer and so on being too restrictive as the Yucca Mountain Panel of the National Research Council tried to do.

But I think, overall the federal approach has been good. I'm saying something nice, so take it from me.

FACILITATOR CAMERON: Yeah, I realize that. (Laughter)

(Off the record comment)

FACILITATOR CAMERON: Great. Are we just tired or is -- we're going to have a short discussion on exposure scenarios, I guess. We got it, okay, good. All right.

(Off the record comment)

FACILITATOR CAMERON: I'm sure you can spur that on for us. Anybody in the audience? Ah, great. And just introduce yourself.

MR. CHEN: S.Y. Chen, Aargon National Lab. I just wanted to mention the DU, the uniqueness of the DU that have not been discussed here. As much as we want to think about DU as a waste here, it is in fact, is a source material. Especially with the large quantity disposed of, at some point it's entirely likely that the not too distant future our next generation will feel the heat of having to find energy sources. The big quantity of depleted uranium is a likely source for future power.

It's just that we don't use it today. So

I would say this scenario here probably would be advisable to consider that somebody would excavate the site for the reuse of this source, if you consider the waste is not going to be considered the waste in the future generations, that's my point.

FACILITATOR CAMERON: Great. Thank you. Any comment from anybody around the table on this? Let's go to Peter.

MR. BURNS: I certainly agree with that comment and to give it a bit of context, I've seen credible estimates that the depleted uranium on hand in a breeder reactor design and with recycling could meet the energy needs of the world for 400 years. So perhaps, we should stop calling it waste and start calling it a national treasure and problem solved. We're preserving the national treasure.

FACILITATOR CAMERON: Okay, thank you. Thank you, Peter. Now, indeed, I guess that there's -- the option is that some of this may not be declared as waste, is that correct, because of that very possibility? Felix, I think on this issue?

MR. KILLAR: It's related in that one of the things that we haven't touched and I think it's appropriate to mention is similar to the point that he just brought up, is that when you start looking at the

depleted uranium out there, or have you, you have to remember it's heavy metal and the characteristics of a heavy metal for toxicity it's out there very similar to lead and gold and what have you.

So, you know, we talk about radioactivity, radiation, exposure, but if somebody wants to dig th is up and start eating it, they've got some real problems because as a heavy metal the radioactivity is minimal compared to that.

FACILITATOR CAMERON: Okay, that's a warning, guess, huh? Okay, thank you. John, any comments on exposure scenarios? John Greeves.

MR. GREEVES: The only comment is this belongs in guidance, not in rule. I think I heard that around the table but if there's somebody who thinks these scenarios belong in a rule, I think you'd better start talking about that and let people understand it. But as far -- what I'm hearing is it's in guidance space, which I think is where it belongs, and that's what the staff has been doing all along.

But I'm a little -- I lack confidence that it couldn't creep into the rule. That's all. So the limit is 500 millirem for the intruder needs to be in the rule. The point -- your period of performance needs to be in the rule. The rest of this is in

guidance space. If it's different, let's talk about it. I'm just trying to generate some clarity on what's in the rules.

FACILITATOR CAMERON: I think that we heard commentary on put this in the guidance. I think that's what we heard and Arjun didn't -- also said that he thought that federal guidance has been pretty well done. So we can do that and do you want to say something?

MRR. DORNSIFE: Just a comment on this resource issue; I think, you know, you could make the argument that other types -- other low level waste categories could be a resource like irradiated hardware. You know, there's some pretty valuable metals there. So I think that gets you down a really slippery slope in terms of how you calculate if somebody was in there two years or 200 years to recover depleted uranium, how are they going to get disposed of depends on how they get it out of there and what's there. You know, where it's been disposed of?

If it's down in the bottom of the cell, you're going to get a lot of exposure. So I think that kind of a scenario creates more problems than it's worth because it's not unique to DU.

FACILITATOR CAMERON: Okay. Any final comments? Diane? Okay. All right, oh, sorry, Pete, go ahead.

MR. BURNS: This is not entirely serious, but I wanted to respond to Bill by saying that if we have the existing technology in our society in 300 years to run breeder reactors and reprocess the fuel, as we do today, they'll be able to handle the risk associated with excavation and we won't need to -- we don't need to worry about that aspect of exposure at all. If they choose to dig it up to use, that's -- they deal with that risk.

(Off the record comment.)

MR. BURNS: We ignore it, I think, because if they choose to dig it up to use it, that's their risk that they're accepting.

MR. DORNSIFE: Well, then why consider it.

FACILITATOR CAMERON: Okay, I think that some of this is -- Arjun?

MR. MAKHIJANI: I think this is actually a little more serious thing than we're giving it due because there is a school of thought that says we're going to have breeder reactors and from a physics point of view, there's no question that depleted uranium potentially converted into plutonium could

supply a lot of energy. I mean, from an economic and proliferation and a lot of other points of view, whether we can handle all the liquid sodium is a different -- you know, it's a been there, done that for me. But it's not that for everybody else.

And from the issues of concern at this meeting, I think we do have to grapple with the question that somebody may want to go in there 50 years from now and dig it all up and how -- should that be part of why the NRC has to consider because the DOE still has not officially classified depleted uranium as a waste so far as I'm aware. It still a source material in your rules, right? And we're treating it as a waste in licensing proceedings from a conservative point of view to make licensees responsible for the waste financial assurances should it be disposed of. Right, I mean that's my understanding of how all of this is proceeding.

And so, I think the scenario question is actually a little bit more serious than we've just been discussing it and perhaps you ought to build it in to what you do.

FACILITATOR CAMERON: Thank you, Arjun. Tom?

MR. MAGETTE: Christine is here and she can

certainly speak for the Department of Energy but I won't let that stop me from telling you what I think she might say.

MS. GELLES: Thank you.

MR. MAGETTE: The DOE called it a national treasure for decades and they only recently started looking at it as a waste. They just published an EA that said it might be a resource and it might be a waste. There's plenty of latitude in the Department of Energy to make an intelligent decision regarding whether or not there's going to be a need for blanket material in the existing stockpile of DU. So I don't think that's a decision that we need to contemplate any further than we've already over-contemplated it.

And as for the scenario that we would consider that someone might excavate it and we should somehow protect against that, I would agree with Peter, which is if we're going to get to the point where we have a sufficiently advanced technology and a sufficiently well-defined need for this material, I don't think that that's something that will be that big of a problem, although I certainly agree with Bill, it probably will be on the bottom of the cell.

There probably will dose associated with excavating it but that is something I would see that

there's perfectly reasonable justification for assuming that the people going after it will not only know but be able to manage. So I don't think that we should do a performance assessment that in any way considers that as a scenario to evaluate.

MALE PARTICIPANT: Well, it's no longer an inadvertent intruder.

MR. MAGETTE: It's an advertent intruder.

FACILITATOR CAMERON: Christine.

MS. GELLES: And I'll be brief because I know you want us to move along. I would -- I would just say that I think we do need to retain a distinction between suggesting that we model a scenario of excavation because somebody wants to recover the power source associated with DU if it is ultimately disposed from questions of you know, realistically some of the stockpile that is being considered as part of the disposal problem were here to inform the solution of, may never actually be disposed.

Our project in Portsmouth and Paducah will convert the -- our DUF_6 tailings to a potentially reusable form but we're also considering potential disposal requirements that need to be met at the same time. So we are prepared to dispose of it if it

cannot be reused but we're talking about facilities that will be generating this product for you know, two to three decades. So it's quite possible we will dispose of some and ultimately reuse others.

So that doesn't, of course, address the entire inventory of DU waste forms that we've been talking about today, so I just wanted to be responsive to Tom's, you know, reference to our projects. He is right and Arjun is right, we have not declared all DOE DU to be a waste form. To the extent that we have decided it has no useful mission, then we do, in fact, declare it as waste and manage it as such. And that's what we've done in the past and that's what we'll continue to do in the future. Thanks.

FACILITATOR CAMERON: Thank you, Christine. We're going to go to our last topic, and Karen, are you ready to tee that up? This is Karen Pinkston of the NRC staff who is going to tee up the issue 1.4 Source Term issue for a site specific analysis.

MS. PINKSTON: Okay, so as Chip said, I'm going to be talking about source term issues for a site specific analysis. The modeling of the source term estimates that amount radio-nuclides released from the waste into the environment over time. And the amount of radio-nuclides release from the waste is

a function of both the total inventory of the radio-nuclides present in this disposed waste as well as the chemical and physical form of the material.

And the chemical and physical form of the material can strongly influence the solubility and leachability which then effects the release rate of radio-nuclides into the environment from the waste. And performance assessments are living analyses that evaluate the potential dose from the whole disposal system. So performances estimates should be updated as new information is known about the system such as when additional inventory of radio-nuclides are added to this disposal system.

So uranium can be present in a variety of chemical forms. As we will discuss in more detail tomorrow morning, the chemical form of the uranium can greatly effect the release and environmental transport of it. The depleted uranium generated during the enrichment process is commonly stored as uranium hexafluoride. Uranium hexafluoride is unstable in the presence of water and reacts with water to form hydrofluoric acid. Hydrofluoric acid is highly corrosive and would likely cause damage to and instability in a disposal facility and it could possibly cause safety issues.

So for this reason in the NRC screening analysis, it was assumed that the uranium hexafluoride was going to be deconverted to a more stable uranium oxide prior to disposal. So in addition to the chemical form of uranium effecting the release from the source, it can also be effected by the use of stabilizing materials in the disposal.

For example, grouting the waste may result in a slower release of radio-nuclides. So there are several important factors to consider when modeling the source term in the performance assessment. The first factor is the physical configuration of the disposal facility such as the size and shape of the disposal cell and engineered features such as is the waste present in a vault or is it in a particular container?

The second feature is the inventory or the amount of each of the radio-nuclides present. As discussed on the last slide, the chemical form of uranium can also effect the release. The -- whether or not stabilizing materials are used and the possible effect of these materials on the release should also be considered. And finally, if stabilizing materials are used, the long-term performance of these materials needs to be considered in the performance assessment.

The stabilizing materials may degrade over time and as they degrade, they may not be as able to prevent as much release.

So NRC is seeking public feedback on specifying criteria for the source term or developing guidance for the review of source term issues including the inventory of depleted uranium included in the modeling, the physical and chemical forms used in disposal, the use of stabilizing materials and factors to consider when modeling the source term in the performance assessment.

FACILITATOR CAMERON: Okay, thank you, Karen. Would you join us at the table?

MS. PINKSTON: Sure.

FACILITATOR CAMERON: And we did hear one remark earlier this morning from Mike Ryan about engineering and waste package and we noted that there would be room for discussion of that during this particular segment of the agenda and let's go to Bill Dornsife, please, lead us off.

MR. DORNSIFE: Well, certainly the site specific performance assessment should include any engineering or any affects from the engineering that is included as part of the disposal methodology. And I guess the question I would ask, does NRC think that

there's enough information currently in the literature that would allow, for example, assuming something is disposed of in a concrete canister, and I know there was a NUREG put out many, many years ago that talked about changes in K_D because of that disposal that waste form, now if you will, and even after that container loses its stability because of the concrete still retains its chemical capabilities.

I mean, if indeed, that was in part of the performance assessment, is there enough guidance out there to allow one to use to include that?

FACILITATOR CAMERON: Karen, do you have any -- do you want to offer anything on that or David or Larry? Karen, do you want to go first or --

MS. PINKSTON: So I guess the question was, you're asking is there enough -- do we think there's enough information in the literature to support depending on the chemical properties of the grout lasting long periods of time into the future?

MR. DORNSIFE: And what are the K_D effects at all of the -- and what are the K_D effects regarding all of the daughters.

MS. PINKSTON: Right. So there's certainly a fair amount of research on you know, time equals zero, what is the effect, the chemical effect on K_D on

the different radio-nuclides? There's also been -- we've been supporting our contractors in doing some research of our incidental waste work related to what do we expect a long-term behavior of cementitious materials to be. So that's some information that's out there.

MR. DORNSIFE: Larry, do you recall that report that had talked about the K_D's and -- no? It's pretty old but --

MR. CAMPER: When I'm 100 years old, give me a break. I mean, I think if you're asking the staff is there an ample amount of information out there about this particular topic, I think the answer is yes. I think the staff thinks that there is. I mean, Dave can speak for himself or Karen but I think the answer to that is, yes. And so we would proceed reviewing that type of information. I mean, I think the question here before us today, is there something that you -- is there something we've left out in a discussion of the source term here or is there something that we didn't address adequately in the technical analysis that the staff did in support of the SECY? But the simple answer to your question is, yes.

FACILITATOR CAMERON: Okay, Bill.

MR. DORNSIFE: Now you have me confused. I mean, my specific question was that if, you know, you ought to -- my specific comment was you need to be able to include engineered barriers or whatever you have as part of the disposal system in your site specific analysis. That ought to be allowed. Now the next question is, is there -- does NRC think there is sufficient technical information out there to support how that engineered barrier, if you will, would perform and what credit could be taken for, for the long term.

FACILITATOR CAMERON: And let's make sure we address the first part of Bill's comment/question is that engineered barriers should be considered in assessing source term if Karen, Dave can address that. And also, is there enough information to do that is the second part of the question.

MR. ESH: Well, the first part, are you allowed to use engineered barriers? I think, yes, you're allowed to use engineered barriers. You need to provide the technical basis for their performance to use an engineered barrier. The second part of your question, is the existing information sufficient to justify the performance of say the chemical effects of cementitious materials? As Karen said, there's a

decent amount of literature out there. It's much more for specific radio-nuclides.

A lot of the research if focused on fission products, strontium and cesium, but there's also some data out there on uranium or plutonium or some other isotopes. But the answer to your question of is it sufficient to justify the use of it, it depends. It depends how much credit you're trying to take for that process or phenomena. So if you came in and said, "Well, my grout is going to retain my material indefinitely", which implies some very large K_D value, you'd have to show the research and/or the literature that supports the use of that amount of credit.

So I can't say -- for the second part of your question, I can't give you a firm answer. Yes, there is information out there. Yes, it could influence the results in some cases but it's somewhat disparate when it goes from radio-nuclide to radio-nuclide or the amount of credit that you're going to try to --

MR. DORNSIFE: Well, there is, in fact, an NRC NUREG that says that, in the contractor's opinion, that you can take credit for the long-term chemical characteristics of a concrete matrix.

MR. ESH: Yes, yeah, and I'm not saying anything different than that.

MR. DORNSIFE: Okay.

MR. ESH: I'm saying that this is a relative -- it's a relative question, though. So if you said, well, that means for my humid site, I'm going to try to take a million years of chemical credit for the cement, that might be a stretch. An arid site, then you say I'm trying to take 1,000 years of credit for this chemical performance, that might not be so much of a stretch because it greatly relates to the flow of water through the material and the depletion of the alkalinity in the cement and when you move from high PH to lower PH, et cetera.

That process of evolving the material and when you go from one state to another, I think, is -- should be considered in the evaluation. That would tell you how much credit you can reasonably take for it.

MR. DORNSIFE: Okay.

FACILITATOR CAMERON: Okay, thanks, Dave. Karen, did you want to add anything?

MS. PINKSTON: No, Dave pretty much captured what I was going to say.

FACILITATOR CAMERON: Okay, thank you.

Mike?

DR. RYAN: Just to follow on on the --

FACILITATOR CAMERON: This is the mike.

DR. RYAN: I'm sorry. Just to follow along, David, on your line of reasoning, this is an example where you know, really being explicit in the presentation, in the guidance of what does pass the laugh test and what may not would be real helpful. You know, again, for dry sites, for relatively intermediate periods of time, we'll probably find that cement and that's one example and there's probably a half a dozen or more key things to think about with the long-term sequestration question. You know, even things like, you know, if I'm in a natural analogue where uranium has been held for a really long time, could I create that chemical or physical environment and get to 100,000 years?

You know, you might. So I just -- again, I'm saying go forward and do more good along the lines you're talking about but I don't think you can give too many good examples of what you can take credit for or me as a applicant can take credit for and what the range of credit might be. That's very, very helpful information and, you know, you certainly and your team have studied, you know, these questions a lot more

probably than most applicants have and to the extent you can gather that together and say, "Here's a body of knowledge you can draw on", is really very positive through you in the guidance.

MR. ESH: I think that is a good comment. I appreciate it. The struggle that we have sometimes is if we put that information in guidance, for instance, then a licensee will just want to do exactly what's in the guidance and they forget about doing their own thinking. We want them to do their own thinking, provide their own justification, provide their own basis, give them enough to hopefully send them in the right direction with that process, but allow them to do the good work themselves and come up with a basis for it, because that way they're going to be able to explain their product to their other stakeholders, et cetera.

DR. RYAN: And that's a fair expectation for an applicant. I couldn't agree with you more, but you know, maybe there's a middle ground where you could have workshops with potential applicants or sited facilities or, you know, other interested parties and actually talk about this in more detail in kind of a seminar sort of forum to say, "Here's where we think the literature is", and have other experts

who actually have, you know, expertise in the broad spectrum in this literature come in and talk to stakeholders and interested parties. That might be another way to try and get the message out, not just try and jam it all into one guidance document but have the guidance document and then have sessions to explain it more fully, you know, to folks.

So there's lots of ways to get the information out. It's not just in a book or a NUREG. But you know, there might be other ways to try and communicate what your intent is as well as what the technical content is. But I applaud your effort to move in that direction.

FACILITATOR CAMERON: Tom or Bill, are you afraid of your creativity being stifled by the NRC?

MR. MAGETTE: No.

(Laughter)

MR. DORNSIFE: No, but what I'm afraid of is how it gets implemented by the state and that -- you know, that begs the question, you know, can the NRC, through rulemaking require from a compatibility standpoint a state to use guidance, so there is uniformity in terms of implementation?

MR. MAGETTE: But we've had that comment several times but we have an agenda item for that. So

maybe we can address that all at once. Because I have some thoughts on that, too, but I've been kind if holding back. That's hard to believe.

FACILITATOR CAMERON: That said, we'll put that one in the parking lot for tomorrow.

MR. CAMPER: I mean, we'll talk about that tomorrow at great length but guidance is not a sign of level of compatibility. Typically, what happens is when the states and the Federal Government, the NRC work together on a particular rule, a level of compatibility is assigned and then the state and NRC working groups works together to develop a guidance, but the guidance is never assigned a level of compatibility.

FACILITATOR CAMERON: And we'll talk more about that tomorrow. The answer might be the same, but we'll save that. We'll save that. Okay, Peter and then Christine. You want to say something, Peter and then we'll go to Arjun and Diane or Diane and Arjun. Peter?

MR. BURNS: So I'm a director of this newly funded Department of Energy Center and it's mostly actinide materials, a big part of it a actinide waste forms.

MS. D'ARRIGO: Can you start over again? I

didn't hear the beginning of what you were saying.

MR. BURNS: I'm sorry.

MS. D'ARRIGO: You're a director of a --

MR. BURNS: I'm the director of an energy frontiers research center on actinide materials that was just funded in August. That's the only such center on actinides in the country. So I have some pretty strong views, I think, so I want to preface my comment by that, with that on what a waste form is and what the role of a waste form is in disposal and so on.

So the first point I wanted to make was that I hear -- throughout the conversation I didn't make any comment about it earlier, but people are using the term "waste" and "waste form" entirely interchangeably in this discussion. Depleted uranium is definitely not a waste form, it's a waste. And the debate might center around what would the appropriate waste form be for depleted uranium, but of course, depleted uranium itself is the waste.

Now, when it comes to putting it in a disposal setting, there are really three things, I guess that you're considering in your model and you should be; the waste form performance, the engineered barriers that you may or may not have in such a model

-- in such a system that would be modeled, and then ultimately the geology once you've gotten past your engineered barriers.

It happens to be a very strong view of mine that there's nothing much more important than the waste for geology match. If you get that right, life is very, very good in terms of your performance assessment. Now, I know that that's not your -- that's not NRC's role to necessarily seek that match, but the point I wanted to make is that the companies and so on that wish to construct these disposal facilities need to be encouraged in my view to think very hard about the compatibility of the waste form with the geology and with the engineered barriers, and I think I heard somebody mention, I wrote it down, a certain durability requirement for the waste form and I think that is in the realm of potentially in the NRC rulemaking or rule, is that there's a certain -- in my view, there should be a certain minimum standard for waste form performance under whatever environment one wishes to put it in and that, of course, is -- it varies considerably depending on the depth of burial, the groundwater regime, the -- whether it's oxidizing, et cetera.

But there's certainly not a one size fits

all scenario and uranium hexafluoride is absolutely not an acceptable waste form, I would think in any scenario. It's a waste but not a waste form. So if one is going to go into converting, and that's the first time I heard the word but it's probably common, deconverting the uranium hexafluoride in to some other form, why not just go right straight to a reasonably economical waste form that's going to have a very high durability in the waste environment you intend to put it in? So this could be encouraged by the rulemaking, I would think.

FACILITATOR CAMERON: And we're going to go to Christine and then Diane and Arjun, but it might e useful to hear some comment on Peter's suggestion about this durable -- why not go to this durable waste form in terms of a requirement perhaps? Christine?

MS. GELLES: Yeah, my comments actually may be somewhat responsive to Peter's comments. I just wanted to respond to the request that Karen put forward, which was requesting some public input on use of stabilizing materials in physical and chemical forms and I know you are well aware of it, but for the record I just wanted to state that the Department of Energy has been looking into questions of waste form as it pertains to the potential disposal of our DU

streams that would produced the U308 waste form specifically is what we selected to be produced by our conversion facilities or deconversion facilities, we've called them both at Portsmouth and Paducah and there are published reports.

Those reports are referenced in the draft supplement analysis which Tom eluded to before which we're in the process of finalizing that we'll ultimately make the disposal decision on that specific waste stream. And again, that's just one stream of the potential inventory of DU waste forms or waste streams that we will have.

In response to Peter's question, I think it's --first off, I want to say the Department of Energy completely concurs that there is a very important relationship between waste form and the geology of the facility that it's going to be placed in and we recognize that interdependence and that is one of the things that factored into our selection of the U308 form for the DUF_6 tailings that is the subject of this draft supplement analysis.

But I also want to be responsive and say that we have not, repeat, that we have not determined that all DU that the Department of Energy owns is, in fact, a waste and for that reason, we selected a form

that still proves for its potential reuse but at the same time is an acceptable waste form in the event that we do ultimately dispose of it in your surface disposal facility. So, yes, we did consider grout but that would certainly complicate any potential reuse options and so we -- it was a factor that led to our selection of the U308 form. Thanks.

FACILITATOR CAMERON: Thank you. Thank you, Christine. Diane?

MS. D'ARRIGO: I think I'm going to wait.

FACILITATOR CAMERON: Okay. Arjun?

MR. MAKHIJANI: Just to respond to this waste form question; I really agree with Dr. Burns that if you're going to deconvert maybe U308 which has been the general assumption, that would be the best idea. We argued this thing at some length in the LES case because UO_2 would be more compatible with -- than going to more durable waste form like zircons and so on; whereas U308 is not. And we were overruled out of hand because -- there wasn't any good reason, because it was simply assumed that U308 would be the final disposal form without really more serious investigation at least in that proceeding.

There had been some investigation before. The other thing is, just on the presentation that you

made, I would add one factor that you didn't put up which is the waste concentration. This came up earlier. I think the waste concentration will effect the geometry of disposal. The geometry of disposal, you know, if you have a very high waste concentration, the volume required would be lower. If the specific activity of the waste total as disposed is lower, you're going to require a larger volume, a larger infiltration, you know, present a different face to the environment.

And so I think it's very important to take that into account. The specific example in this case, you know, which I brought up in my introductory, so when I introduced myself, was it's very important to check on what the concentration, allowable concentration results are because in the 1990 technical analysis done for the Clive, Utah site, there were a number of results for allowable concentration that were wrong. That allowable concentration, as I mentioned exceeded the weight of the earth, in program exceeded the weight of the earth in one case and that wasn't the only case. It wasn't a typo.

And so I think while the factors that you mentioned are fundamental, paying attention to

concentration is very important and I'd like to put on the record that I think the underlying document, the license that Clive, Utah site which the NRC staff said in the LES proceeding was scientifically sound. It's at least partially not scientifically sound and it should be fixed. I don't think that we should allow sites that have defective underlying technical documents to proceed to do analysis themselves for their sites without fixing the documents that exist currently.

FACILITATOR CAMERON: Okay, Charles, you captured all of that? All right. Does NRC staff have any questions for Arjun about his concentration remark? Is that understood? Okay, thank you. Felix, and then we'll go to Tom.

MR. KILLAR: Yeah, I just want to put a plug in for DOE. I think Christine has been very I guess humble or bashful or what have you but I think that the work that they did on the supplementary analysis for the location of disposal depleted uranium oxide conversion products from generated from DOE's inventory depleted uranium hexafluoride, DOE EIS-0359-SA1 and DOE EIS-0360-SA1 really lays out what the issue is that we were talking about here.

They looked at different forms. They

looked at whether it's grouted or ungrouted. They looked at arid sites versus humid sites, what have you. And I think if you look through there, you'll see that it really lays out a pretty good reason for why you want to use U308. I don't recall if it specifically in here, I know that there are some other analysis that there was a minimal benefit to go to uranium metal and the cost wasn't justified. I don't recall if that was in the EIS or not. One of the things that they demonstrated in here is that even if you have field site that's in an arid site, after 1,000 it still meets the performance criteria.

So I think there's a lot of good information here. I think the -- for bringing it up because I think some of the NRC may want to look at that work and talk to DOE to get some more details on it.

FACILITATOR CAMERON: Okay, and he repeated that title and number of the document from memory. That's very good. Tom?

MR. MAGETTE: I have a question for you, Karen, about what you're asking for here in part, but before I ask that, let me just say, since we are keeping a record, I will say for the record that we absolutely do not agree with the notion that the

licensing basis for Clive is in any way incorrect or unscientific.

My question is, it's not clear to me just from the reading of the slide and also it's not clear to me from reading the Q&A that you all published in the Federal Register, if you're asking for feedback on criteria of physical and chemical forms used, in other words, are you talking about disposal criteria or are you asking for a feedback on taking credit for those criteria in the performance assessment?

MS. PINKSTON: Yeah, I think the way it was written in the Federal Register notice was that we were interested in feedback both on criteria for whether or not it would be appropriate to specify the forms and/or ad mixtures used and also how you would go about taking credit for them in the performance assessment and what factors to consider in the modeling.

MR. MAGETTE: Because I would agree with the latter. I think it would be appropriate in this context and we would definitely be interested in seeing criteria in your published guidance at the risk of stifling our creativity, I think, as Chip put it, but I don't think it would necessarily be appropriate in this context to have that same guidance in some way

limit disposal criteria, notwithstanding the discussion that's been going on about disposal forms. I'm not taking exception to that or suggesting that we want to roll a bunch of DUF_6 cylinders into the site, because obviously, we don't. But that's a different question, I think.

MR. ESH: I think that was part of the -- part of the subject of the comment. If you look at the low level waste regulations, there are waste characteristics that are in there that are prohibited for instance. So you could, in theory, specify characteristics for a unique waste stream that you would say, "I don't care what you do, you can't put this type of material in".

MS. PINKSTON: And also with considering the criteria for what types of forms and this goes back to the guidance versus rule issue, it maybe would be -- would it be appropriate to put in guidance, for example, that UF_6 would make a terrible waste form, don't ever use it, you know, that type of -- or, you know, to alert people to -- these are the pros and cons, these are possible forms of uranium, so that when someone is doing the review they're aware of what to look out for?

MR. MAGETTE: I guess I would say in the

context of the performance assessment, you would get -- you might get a different answer depending on how you addressed that question. In other words, you -- it might be logical for you to say you're not going to be able to take credit -- you're going to have a more difficult time with your performance assessment if you use certain waste forms than if you use other waste forms. But I do think going beyond that, you're going to certainly complicate this rulemaking if you start making it about waste forms.

FACILITATOR CAMERON: Thank you. Thank you, Tom. And Peter?

MR. BURNS: I don't think I'd favor the rulemaking specifying, "Here's your list of possible waste forms. Choose one of these pre-approved things", but rather a certain minimum durability standard for the waste form that is intended to be disposed in that particular environment seems appropriate. And it's -- U308 might well fit the bill in many different environments. I don't think uranium hexafluoride would probably in any environment, but here are potentially a variety of other materials.

Uranium metal is probably not one of them that would also fit in an oxidizing environment. I don't think this was done, for example, in the Yucca

Mountain program so far as NRC regulations were concerned. I don't think there was any NRC requirement that there be a certain durability of the waste form. But it seems to make -- it makes sense to me at least that it's -- I'll tell you if your waste form holds up there's absolutely no other problem in the world, I mean, unless somebody blows it up. Right.

But if your waste form is stable, you're golden. So that should seem to be where a fair bit of emphasis is placed in securing, you know, minimizing the contamination exposure.

MR. DORNSIFE: You're using durability and stabilities synonymously or are you using durability to mean something else?

MR. BURNS: I would use durability to capture -- would include stability in --

MR. DORNSIFE: What else because once you get beyond stability, you're talking about something that's beyond Part 61, other than the minimum requirements. All that's required is stability.

MR. BURNS: I don't carry a burden of knowing anything about what's in 61 other than 6 and 1, so I can't comment on that, but what I mean is how the waste form performs in the particular environment

you wish to place it in. That's what I mean by durability or we can say stability. I assume that this doesn't -- this is not relevant to the relatively, perhaps, low probability event of an intrusion but is relevant to the much higher probability event of water leaching, an event that -- a probability that's presumably 100 percent if you go out far enough in time. So I think I'm more thinking of solubility, the waste forms in the geofluids that will be present.

MR. DORNSIFE: Well, in practice, okay, in the current disposal facilities, that durability, if you will, is handled in many cases by disposal in a container, you know, typically a reinforced concrete container. It doesn't necessarily involve doing something with the waste form.

MR. BURNS: Right, right. The -- and that's -- well, I mean, that's the -- part of the engineered barrier which is fine and I wouldn't suggest that you rely wholly on a waste form. You certainly have to have an engineered barrier and put it in an appropriate environment as well. But well, it depends on what our regulatory time frame is. If we get to the point where after -- so NRC comes up with 10,000 years in the rulemaking and it goes to

court and the next thing you know you're dealing with 500,000 years or something, then you can't rely on your engineered barrier any more and but your waste form is still the source.

MR. DORNSIFE: Well, maybe. That's hard to prove, too.

MR. BURNS: Well, I mean, you probably want me to stop.

FACILITATOR CAMERON: No, that's okay, go ahead.

MR. BURNS: It's -- well, the waste form is the source term of the radioactivity that's going to be released. We can agree on that.

MR. DORNSIFE: Well, including leachability. It's hard to prove that over a long time.

FACILITATOR CAMERON: Tom, Bill, and I know Tom cautioned about don't make the rule about the waste form. When you hear Peter's comment about there should be some minimum durability standard and assuming that he's talking about the concept of stability. Any comments on that?

MR. DORNSIFE: As long as it's something that's already required by Part 61, I have no problem with it.

FACILITATOR CAMERON: Tom?

MR. DORNSIFE: I mean, if it we're going -- if we're going to a waste characteristic that currently isn't covered by Part 61, then I have a problem with it.

MR. MAGETTE: I'm not sure I heard Peter say anything that's inherently inconsistent with existing requirements in Part 61 as he knows them not to be. So I think his comments are very well taken but they're not novel, I guess would be part of my -- and I agree with a lot that's been said about the importance of the waste form and I don't want my comments to be misconstrued as suggesting that those are in any way unimportant, but remember, here again, we've been focused on a performance assessment and that's only one piece of the puzzle.

We have waste acceptance criteria, license conditions and a lot of other factors that address these things. So this is not somehow unique to the discussion of a performance assessment. But I don't really have any problem with any of the comments that Peter has made. I think they're all very valid.

FACILITATOR CAMERON: Okay, thank you. Audience, anything to add on the idea of source term generally or specifically about waste form? Anybody

want to add anything on that? Okay, and Diane, go ahead.

MS. D'ARRIGO: I'm just not quite sure where on the agenda to insert this thought which is you know, having tracked the low level radioactive waste siting issues over the decades and you know, it's pretty clear that the reason for public concern about new low level radioactive 10 CFR 61 sites is that the length of the radioactive hazard is longer than the time that the waste will be either institutionally controlled or projected to be isolated.

And so by putting in something -- putting depleted uranium in which you know, is so very, very long-lasting it exacerbates that concern and obviously, the form of it is important, the potential for synergistic effects with this waste and the other wastes that are already in the A, B, C categories are something that needs to be looked at and if it's going to go to mixed waste facilities, then that also would require some evaluation.

I think that it's better to attempt to isolate this material than to use it as a -- you know, as it is being used in some cases for armaments and other uses, so that it disperses in the air and in the

environment because that's the worst way to be exposed to it. So the goal of isolating it is a good one. And I believe that the effects, the health effects that are in 10 CFR 61, they are limiting based on fatal cancers. There seems to be open concern, discussion, uncertainty about what the health effects are of depleted uranium, non-fatal health effects on thyroid, on immunity, and on other teranogenic, carcinogenic effects that may not result in fatal cancer. So that's another piece of concern.

These are just some of the general issues with a long-lasting material like depleted uranium and as I'm raising them, I'm not really clear at which point it's appropriate to do that, but I think it's important that that be taken into consideration.

FACILITATOR CAMERON: Okay, thank you, Diane, and I think that this is an appropriate time to raise those and as I understand just shorthand, two issues the synergistic effects and also the full range of health effects and I guess I would ask Dave for starters, how does this fit into the site specific performance criteria rulemaking? Do you have anything to respond to Diane's concerns?

MR. ESH: Yeah, I think synergistic effects need to be considered compatibility of waste with

other waste, compatibility of waste with the system, compatibility of the system with the waste. Those all need to be considered. I believe in NRC, the waste characteristics part of the regulation. It already mentions an idea like that. It says something to the effect of not disposing the chelating agents, maybe. I think chelating agents are referenced but it's getting at that idea. So I agree with that.

As to the health effects, I'm not an expert on the health effects but it's a good comment. We'll take it under consideration.

FACILITATOR CAMERON: Anybody else want to -- and so the compatibility with other waste forms, these types of synergistic effects is something that would be considered in doing the performance assessment?

MR. ESH: Sorry, say that again?

FACILITATOR CAMERON: Is that -- would that be something that would be considered in doing the performance assessment and Karen is nodding affirmatively on that one.

MR. ESH: In terms of the synergistic effects of the -- yes, yeah.

FACILITATOR CAMERON: All right. Okay, well, thank you all for your attention and your

discussion today and we did finish on time and tomorrow we're going to start at 8:30 and we're going to go into some other things that Karen is going to tee up for us on modeling. We're going to talk about unique waste streams generally. We've already heard some on that. Agreement state compatibility, the long-term rulemaking which has been a subject of discussion today and then other considerations.

So, with that, if no one has anything else, we'll adjourn. Thank you. Thank you, all.

(Whereupon, at 4:54 p.m. the above-entitled matter recessed, to reconvene at 8:30 a.m. September 3, 2009.)