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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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SUBCOMMITTEE ON RADIATION PROTECTION

AND NUCLEAR MATERIALS

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WEDNESDAY

AUGUST 17, 2011

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ROCKVILLE, MARYLAND

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The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 1:00 p.m., Michael T. Ryan, Chairman, presiding.

COMMITTEE MEMBERS PRESENT:

MICHAEL T. RYAN, Chairman

J. SAM ARMIJO, Member

DENNIS C. BLEY, Member

DANA A. POWERS, Member

HAROLD B. RAY, Member

NRC STAFF PRESENT:

DEREK WIDMAYER, Designated Federal Official

ANDREW CARRERA, FSME/DILR

JIM DANNA, FSME/DILR

DAVID ESH, FSME/DWMEP

CHRISTOPHER GROSSMAN, FSME/DWMEP

DEBORAH JACKSON, Deputy Director, FSME/DILR

CHRIS MCKENNEY, FSME/DWMEP

GREGORY SUBER, FSME/DWMEP

PRIYA YADAV, FSME/DWMEP

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

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

1:00 p.m.

CHAIRMAN RYAN: The meeting will now come to order please. This is a meeting of the Advisory Committee on Reactor Safeguards Subcommittee on Radiation Protection of Nuclear Materials.

I am Dr. Michael Ryan, Chairman of the Subcommittee. ACRS' members in attendance are Dr. Sam Armijo, Dr. Dana Powers, Dr. Dennis Bley and Mr. Harold Ray. The purpose of this meeting is to continue the Subcommittee's discussion with NRC staff, on proposed rulemaking language to amend 10 CFR 61 to add site-specific analyses for low level waste disposal.

The Subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions as appropriate. The Subcommittee plans on proposing a Letter of Report on this matter for consideration by the full Committee at the July --

MR. WIDMAYER: September.

CHAIRMAN RYAN: -- I mean September, thank you, full Committee meeting. I thought we would be behind schedule already.

MR. WIDMAYER: We tried to do it in July.

CHAIRMAN RYAN: Derek Widmayer is the designated federal official for this meeting. A transcript of the meeting is being kept and will be made available on the web. It is requested that speakers first identify themselves, and speak with sufficient clarity and volume so that they can be readily heard.

We have not received any requests from members of the public to provide comments, however, I understand that there may be folks on the bridge line who wish to listen in on today's proceedings.

Now would folks on the line please introduce yourself, if you're on the bridge line now? Very well, on the bridge line I assume there will be nobody there. Thank you for that. We now proceed to the meeting and I call on Debbie Jackson, Deputy Director of the Division of Intergovernmental Liaison and Rulemaking at FSME to open the proceedings.

MS. JACKSON: Thank you Dr. Ryan, and good afternoon. Good afternoon to the Subcommittee members and meeting attendees. I'm going to provide some opening remarks before the staff begins their presentation.

So I am going to start off on why we're here today. We're here to provide an update on the

Part 61 rulemaking to inform HRS regarding the comments and the staff proposed rule text changes.

The staff has modified its approach to enhance some of the flexibility and to address some of the concerns the Subcommittee had during the last meeting, and also to brief you on the draft guidance documents.

We've had two previous briefings with ACRS, one with the Subcommittee in June of this year, and one with the full Committee in July. And we've had the Commission direction, which is to proceed with the rulemaking to require site-specific performance assessment prior to the disposal of significant quantities of depleted uranium and blended waste.

CHAIRMAN RYAN: And we, just for the record, somewhere again today we'll define what blended waste is, coming in the Commission's direction may have mentioned that.

MS. JACKSON: I believe that, is that --

MR. ESH: We can, yes.

CHAIRMAN RYAN: That would be helpful, I think.

MS. JACKSON: Okay.

CHAIRMAN RYAN: Just so that we are all clear that, you know, what we're talking about today,

if it's evolved or changed or, clear, you know. Thank you.

MS. JACKSON: Okay. So today's topics and the presenters, Andy Carrera will follow me with the draft proposed rule and analysis of the comments received on the preliminary rule language, and he's also going to talk about some of the rule changes to address the flexibility.

And then Priya, Dave, and Chris will follow with a discussion on the guidance for conducting the site-specific analysis of Part 61, and then I'll close with Path Forward. So with that, Andy, we're going to change seats a little.

MR. CARRERA: Thank you Debbie, good afternoon everyone. My name is Andrew Carrera, I'm the project manager for the Part 61 rulemaking. Next slide please.

And the last time that staff briefed the Committee on the Part 61 rulemaking was while the working group was in the process of reviewing the public comments that we received on the proposed rule language, I'm sorry, preliminary proposed rule language for the Part 61 site-specific analysis rulemaking.

And for this rulemaking, this fact follows

Commission's direction in Staff Requirement Memorandum SECY-08-0147 and SRM-SECY-10-0043, which is to specify site-specific analysis requirements for the disposal of large quantities of depleted uranium, and develop a guidance document for such analysis. And also to included blended waste into existing rulemaking for depleted uranium. And Dave, do you want to talk about what's your definition of blended waste, yes?

MR. ESH: Yes, sure. I'll just describe it. The blended waste that you asked about is when you take waste of one classification, say some amount of Class C waste, and you blend it with lower class waste to lower the overall classification of the mixture. So blended waste would be taking a higher class waste, mixing it with a lower class waste to get the combination at the value of the lower class waste.

CHAIRMAN RYAN: Okay. And that's allowed, or the perception now is that it would be allowed over all classes, A, B, C and Greater-than-C.

MR. ESH: A, B, C, a Commission gave explicit direction to not allow it for Greater-than-Class-C.

CHAIRMAN RYAN: Not allow it for Greater-than-Class-C, okay, just so that everybody's clear on what we talked about.

MEMBER ARMIJO: What's the cutoff between Class C and Greater-than-C, you know, specifically what is Greater-than-Class-C and, I know high-level waste, but --

MR. ESH: Yes.

MEMBER ARMIJO: -- is there something in between?

MR. ESH: The Greater-than-Class-C is defined by the weight of the Class C waste concentration values that are provided in 61.55, Tables 1 and 2 in Part 61, so it's concentrations that were derived, where if you're above those concentrations then it's considered Greater-than-Class-C waste.

If it's not determined by language or derivation to be high-level waste, because high-level waste is based on where it came from, basically.

CHAIRMAN RYAN: It's interesting that that's a classification that's based on the potential for, basically, worker exposure during handling, because it does involve both long- and short-lived radionuclides.

MR. ESH: Yes.

CHAIRMAN RYAN: And some Class C waste will become lower than Class C fairly quickly, 50

years for example, it's driven by cobalt. So it's not only risk-driven classification for disposal alone, it does take into account the questions of operational management while they're being handled, and some of which go away quickly after disposal.

And then the risks become those for longer-lived radionuclides, and if it was classified at that time it would be a much lower class of waste.

MR. ESH: Yes, there are two isotopes in practice that drive it a lot, and those are cesium and strontium.

CHAIRMAN RYAN: Right.

MR. ESH: So and Class A waste, the concentrations are derived that they're quite a bit lower than the concentrations of Class C waste. Because Class C waste you basically have 500 years of decay that you can take advantage of.

So you can dispose of much higher concentrations. And the table for long-lived radionuclides, the way it basically works is the Class C waste is, the concentrations that are at the values in the table, Class A waste is at 1/10th of the values in the table for, to determine whether it's Class A or Class C waste for the long-lived isotopes.

CHAIRMAN RYAN: Thank you.

MR. SUBER: Excuse me Dr. Ryan, this is Gregory Suber. I do have just one clarification.

CHAIRMAN RYAN: Yes, sir.

MR. SUBER: What something the doctors said. The SRM said that greater than Class C should remain a federal responsibility. As you know, waste that is Greater-than-Class-C, the Department of Energy is responsible for disposing of that waste, and the Classes A, B and C are NRC or agreement state responsibility. So what the SRM did is issue a mind set that we want Greater-than-Class-C waste to remain a federal responsibility?

CHAIRMAN RYAN: Absolutely. No, that's a great classification, I appreciate that.

MEMBER ARMIJO: So for the purposes of this rule, everything that, let's say the civil nuclear programs deal with, A, B and C, they all can be blended, right? And Greater-than-Class-C is a federal thing, and we don't have to worry about it?

CHAIRMAN RYAN: One important aspect of waste is, it's not waste until you declare it waste. So if you create a package of waste, you can create it in such a way so that it will be classified as A, B or C, based on how you prepare those materials in the commercial sector.

But by definition I think, Dave has pointed out correctly that those things that are clearly large quantities of Greater-than-Class-C waste are in fact a DOE obligation at this point. Thank you.

MEMBER BLEY: I'm sorry, I just, I was mixing other places I know with this. So if you have a process estimate and you've accumulated something in a tank that will end up as waste, it's not waste until you package it and declare it as waste.

CHAIRMAN RYAN: And perhaps even treat it. For example, a liquid waste you may solidify in concrete, and that concreted waste is what you assess for its classification as a waste.

MEMBER BLEY: But before it leaves the process plant it's not waste.

CHAIRMAN RYAN: Correct. It's material on process and --

MEMBER BLEY: Materials.

CHAIRMAN RYAN: -- you know, if you solidify it, obviously that'll have an impact on the ultimate concentration, you know, those kinds of things. Sorry David, but thank you for the clarification. Andrew?

MR. CARRERA: Now, the staff is here again

today to pick up where we left off, and inform the ACRS of stakeholders' comments on the preliminary proposed rule language, and revisions being considered for the proposed rule language. Slide Number 3, please.

Just to recapture the essence of the processes on rulemaking, the Commission directed staff to keep this rulemaking to a limited scope and that is where the Staff's focus remained. And in this limited scope rulemaking, the staff inserted several approaches.

And one of the approach is to specify site-specific analysis requirements for a demonstration of compliance for the performance objectives in Subpart C of 10 CFR Part 61. And these site-specific analysis include performance assessment, intruder assessment, long-term analysis as far as update analysis at facility closure.

And these analysis will enhance the safe disposal of low-level waste and would also identify any additional measures that will be prudent to implement. Next slide, please.

Staff also proposed additional amendment to Part 61 regulations, such as adopting new definitions and concepts as part of the program to

facilitate the implementation of the site-specific analysis requirement.

And during the proposal development process, the staff made the decision to make no explicit reference to depleted uranium or blended waste. The proposed requirement would apply to total waste inventories.

MEMBER ARMIJO: Is there any reason why you wouldn't just make it very clear, where you have issues related to DU or blended waste, you know, it seems like the objective was to bring that into the regulations and you don't, you say you're not going to talk about it in the language?

MR. CARRERA: Well we may have special reference to it, but while the working group was formulating the approach to this rulemaking, we were talking about looking at DU by itself, and then we will see as uranium for, include blended waste in there, and then we proceed to look forward to the future where we're contemplating future waste streams that were not part of the original Part 61 analysis.

And looking at those, we figure it would be more prudent or more efficient if we were to make this rulemaking apply to all waste streams, all waste types.

CHAIRMAN RYAN: And I hear what you're saying, but I guess I would add to Dr. Armijo's comment that if you say something, that this regulation now also applies to DU and blended waste as long as you meet the performance objectives or whatever it is, that's helpful.

And then if you want to deal with how to do that and guidance, fine. But being silent on it leaves the impression that it's not covered.

MEMBER ARMIJO: Or that everything is the same. You see where I'm a little worried is that DU may have special properties, special issues that require different treatment. And if it's just kind of buried in with all the other stuff, then we have to apply the same treatment to all the other stuff when it's not really justified.

CHAIRMAN RYAN: And in fact the Commission directed that that be considered, so why wouldn't you add it to the things that are covered in the regulation? I just think you shouldn't be silent on it because it creates the wrong impression.

MR. ESH: Yes, I think the documentation that will be produced with the draft rule, such as the FRN and the Statement of Considerations will be clear of what the rule applies to. And generally, I think

if we don't explicitly state in say, the regulation, that if you carve out special exceptions or criteria for a certain material, then it's going to apply to all low-level waste regardless of the type, characteristics, or consideration.

CHAIRMAN RYAN: Right. I don't know, I guess I'd just like to see what the regulation covers in the regulation. I know the lawyers will tell you it's how things apply and don't apply, but I think it ought to be explicit.

MR. ESH: The two things that we struggled with, or we discussed when we got to this point was, one, the reason why we're at this juncture today is because when Part 61 was developed they didn't envision disposing of waste streams such as the two that we're talking about here today.

And because they didn't envision them, then the criteria, in particular the Waste Classification Tables weren't designed to deal with the situations that you may establish when disposing of these waste streams.

CHAIRMAN RYAN: So they should be changed to accomplish that.

MR. ESH: Well, that was an option that was presented to the Commission in the SECY paper 08-

147, and the Commission didn't tell us to follow that option. They said to develop requirements for site-specific analysis instead of changing the Waste Classification Tables, because that's more risk-informed.

You can develop then the actual concentrations that a site may take of these types of materials, instead of one number, that you would have to build some conservatisms into and apply to all of the sites. So that's one of the things we thought of is, are we smart enough today to know all the waste streams that are going to be generated in the future?

Well we weren't when we got to this point, so what is there to say that we're that smart now again, and that we're not going to be back in this box again when the fuel cycle changes, and some new stream comes online that wasn't envisioned in the previous two steps.

And the other thing is what I just mentioned, is that if we develop say table values, it starts becoming very difficult to be risk-informed when you do that, because there's a lot of variance from site to site in particular, and conditions to conditions, the risk that may be derived from the material that's disposed of there.

CHAIRMAN RYAN: Well now you're on the right track with me, because a site-specific risk-informed assessment is exactly the right way to go, all radionuclides, forget about what's in the table and what's not.

MR. ESH: Now the question that Dr. Armijo mentioned of whether there are specific requirements that you need for maybe these waste streams that are special and different than other waste streams, that's a different issue.

We didn't necessarily envision, hopefully you'll see by the rule text that we discuss, and the guidance document that there were things that stood out that deserved regulatory requirements, but that's a thing to discuss. Maybe there are something, especially if you have some views that there are special requirements that should be applied to those waste streams.

MEMBER ARMIJO: And only to those waste streams.

MR. ESH: And only to those waste streams.

MEMBER ARMIJO: Yes, that's concern I have that--

MR. ESH: Yes, that's something we should talk about.

MEMBER ARMIJO: -- the DU is a particular problem with long life issues like that.

CHAIRMAN RYAN: Okay, well let's --

MEMBER ARMIJO: We'll get to that.

MR. CARRERA: Slide 5, please. The Stakeholder Involvement, the NRC published Part 61 preliminary proposed rule language in this regulatory basis document, including the period of performance paper that they developed on regulation.gov on May 3rd.

We also held a public meeting on May 18th to present the documents and solicit early public comments on these documents. The public commentary ended on June 18th. The staff also received stakeholders' comments from the previous ACRS meeting of Part 61 as well. Slide number 7, please.

The comment that the staff received came from a diverse group of stakeholders such as public interest group, the industry, and other government organizations, and their view were just as diverse as the organization that they represent.

All comments were fully considered. However, because we are not technically in a proposed rule comment period, the NRC will not provide response to these comments. In all we received 15 comment

letters at the end of the comment period.

The staff reviewed all the comments, including verbal comments provided at the public meetings, and grouped them into nine separate issues. And these issue are listed in the lasted bullet of this slide, and I will briefly touch over each of those issues and some of the flavors that you get from these comments.

CHAIRMAN RYAN: Okay, thank you.

MR. CARRERA: Slide number 8, please. The issue on performance assessment requirement, we received comments in support and against the use of Total Effective Dose Equivalent methodology, or TEDE.

Some thought that it's not an appropriate dose methodology to use, and others thought it was a good idea to be consistent with Part 20 of the regulation which used TEDE dose methodology.

We also see comments related to uncertainty involved in the performance assessment, conducting a performance assessment. Some say the performance assessment result would not be meaningful, taking into consideration of the large uncertainty that you get from the 20,000 years period of performance.

Others suggest that in addition to

evaluating the uncertainties in the assessment, we should also apply a dose limit for the timed period beyond the 20,000 years.

Intruder assessment requirement, some comments support intruder assessment language, while others suggest that the intruder dose scenarios is burdensome. While some agrees with the 500 millirems that the staff proposed as a dose limit for intruder dose assessment. Others believe that we should lower it to 100 millirem, and even lower it to 25 millirem to be consistent with other regulations.

And some take issues with the requirement to demonstrate that intruder barrier must be affective for the duration of the period of compliance.

MEMBER ARMIJO: You know, this intruder assessment issue, the question I think I raised at the last Subcommittee meeting was whether it was even justified. The number of people who might be exposed far into the future is tiny. And their exposure would not be catastrophic.

And yet so much of this rulemaking and regulations are based on the need to protect, or belief that someone has to protect some very small population of intruders far in to the future, who are unable to protect themselves.

And so that I looked for, what's the legal justification and it goes back to this concept of intergenerational equity. So I'd like to ask when, is there an NRC policy statement that uses intergenerational equity as a basis for regulation?

MR. CARRERA: Dave?

MEMBER ARMIJO: Is there such a thing?

MR. ESH: Not that I'm aware of.

MEMBER ARMIJO: So it hasn't been really been decided by some sort of a discussion among the commissioners to decide, yes, we've really got to regulate according to that concept. So we're doing it sort of because we want to do it, it's our preference.

And I just don't see how that's justified at all and particularly for 20,000 years. So at some point we're going to have to get into that, but I'm just looking for some sort of a rational justification of why such an assessment is justified, either by law or by real safety, or just by preference.

MR. ESH: No we have, I mean it is an individual protection standard that's applied in Part 61, it's not a population-based standard. And the intruder performance objective is not something that we're adding here.

It's something in the regulation, we're

just specifying that the intruder dose assessment component of it, which is what was done to derive the classification tables, we'll add it in since the Commission told us not to change the Waste Classification Tables, and that handles the intruder protection for material that's not in the tables.

So I don't necessarily disagree with you about the issue of the intruder protection but this is a limited scope rulemaking, and I think we're comfortable and we feel we're on firm ground with the intent of the Commission to put this requirement for the intruder dose assessment under 61.42 because it is a limited scope rulemaking.

MEMBER ARMIJO: If it's just a simple assessment, I could understand. Just do it just to see what things are like. But if it brings all sorts of other requirements into play, time scales, and these reassessments, and barriers that'll last out into the future, and assessment of the reliability of those barriers, and it goes into all of that sort of stuff, it starts looking more and more like Yucca Mountain, high-level waste.

And I keep reminding myself we're dealing with low-level waste and, you know, we've got to keep that, we can't let the Yucca Mountain approach become

the model for low-level waste.

MR. ESH: Yes, and I would agree with that. I would say that for some of these materials though, you have to look carefully at them, especially over the longer time frames. So there's a big divergence in the characteristics of the material and the hazard that they have at today, when the materials are generated.

So you put depleted uranium next to commercial spent nuclear fuel, there's no comparison. The radiation fields and how you need to handle them, et cetera, they're way different.

But I would say, think of it this way. In the high-level waste repository, if it had gone forward it was going to take about 70,000 metric tons equivalent of uranium. The amount of depleted uranium that has been generated and needs a home for disposal can be ten times that and more.

So it is a lot of uranium and whenever you run those calculations out to long time, I saw an interesting figure from a U.K. report that they had looked at all different types of waste that are generated over there, and did a comparison of disposing of each type of waste in the same facility.

And at longer time, say after 10,000

years, especially out at 100,000 years, the depleted uranium was actually the highest risk. It was higher than their spent nuclear fuel, and their defense high-level waste, and all the other materials.

So the problem is, is how these things change over time and to get thinking about it the right way and in the appropriate context.

CHAIRMAN RYAN: You know, in addition to those comments which I appreciate David, I think we've also got to think about the notion that, you know, as a system of regulation in the U.S. we take other uranium wastes, put them on the top of the ground, cover them up with a little topsoil and grow grass on it. It's called uranium mill tailings. So, there are lots of different strategies.

MEMBER POWERS: Can you explain how depleted, how there's any risks at all? I mean, I live pretty close to Grant, New Mexico, and we have, ostensibly a mountain of undepleted uranium there, have always had so. And there are a lot of very weird people in New Mexico, but I don't think any of it comes from genetic --

(Laughter)

(Simultaneous speaking)

CHAIRMAN RYAN: The point is now, I think

they're making the same point, is that the quality of distribution substrate from uranium and its characteristics in terms of how it's disposed, and the characteristics you assume from intruder and their access, can now really change the basis you estimate.

MEMBER POWERS: Yes.

CHAIRMAN RYAN: So I think it's something that if we're going to follow that path, it has to be done very carefully to really be realistic. But one thing I'm getting to is, very quickly an inadvertent intruder which is what we are protecting, becomes an advertent intruder.

He's not inadvertent for very long. Sooner or later he's going to figure out, this isn't Mother Nature and something's happening here. So, you know, I struggle with how you allow a scenario to run for lifetimes or longer, when sooner or later the inadvertent intruder is advertent and knows what's going on, or at least has recognition, this isn't Mother Nature.

MR. ESH: Yes, and I would say those are good points. It would be helpful if you could point us to other analogous regulatory programs where those philosophies are used, because then we could point back to those from the waste area, okay, here's what's

done in reactors.

They take into account some future intelligence of the people that are, something's happening to them in this scenario and they're reacting this way. I mean some examples or analogues would be helpful.

As to the point of mill tailings and depleted uranium, they're tremendously different in concentration space. Mill tailings in the U.S. are about a tenth of a weight percent uranium or so, whereas the depleted uranium is about 80 weight percent uranium, as it's generated now and packaged and this would --

CHAIRMAN RYAN: But there's hundreds and hundreds of times more tailings than there are uranium.

MR. ESH: Well I don't know. If you put 500,000 metric tons of uranium in a facility and compared that to a mill tailings facility, I think if you look at the total quantities disposed, you're going to end up with hundreds of times more uranium in the low-level waste disposal facility than you have in a mill tailings disposal facility.

CHAIRMAN RYAN: But again, the risk is really related to a concentration-based metric, not

necessarily the total quantity.

MR. ESH: But the risk for something like radon exposure and/or groundwater exposure, if you don't have a solubility limit or you have a high solubility limit, is driven by concentration.

CHAIRMAN RYAN: All fair comments, and I think that points to the case, you know, the point that, I don't think there's one size fits all. So I think that the requirement has to be really focused on whether the site-specific conditions that you must analyze to reach a competent evaluation.

MEMBER BLEY: I'd like to go back to the argument before this one, and maybe you can explain it to me a little better, but the idea that in thousands of years the depleted uranium will be more of a hazard than the current spent fuel doesn't make much sense to me, because if the spent fuel were much lower than it is, like it will be in many years, we wouldn't be treating it the way we do now.

MR. ESH: Yes.

MEMBER BLEY: But is the risk of that, it might be greater than this stuff that has decayed completely down, but it's still probably not very high.

MR. ESH: Yes, so is your question, is the

risk of the spent nuclear fuel lower? Yes, I agree with that, it is lower. The problem is the spent nuclear fuel risk, for the transcriptionist, decreases asymptotically or exponentially, whereas the depleted uranium curve builds in over time, gets higher, because of the ingrowth of lead-210 and radon in particular, or radium-226, lead-210, radon that comes in, in the decay chain.

But the uranium itself, you have enough uranium itself that you have to be smart about how you manage it, because it essentially is a concentrated industrial metal. And I don't care whether it's uranium, lead, mercury, whatever, you have to be smart about how you manage a concentrated substance of some sort.

MEMBER BLEY: Nobody would dispute that I think, but this started from Sam's comment that we don't want to treat this stuff the way we treat spent fuel. When you say, well yes, but in thousands of years uranium waste will be higher, and the fact is we can't see that curve you drew, but the uranium curve doesn't go up as far as the spent fuel curve.

MR. ESH: I'll make an action to send you a reference to the U.K. report where they put all the same materials in it and analyzed it, that's what I

was referencing.

MEMBER BLEY: That would be great.

MR. ESH: We've done our own calculations internally to understand the problem, but I don't have a report I can send you for those. But that's a report that's out there in the public, and you can look at it and see what they did and see the curves for yourself.

MEMBER ARMIJO: Of these hundred, these large, large quantities of depleted uranium, how much of that is DOE, or military, or defense-related waste, not the civil nuclear program waste? Is it, I understood the bulk of it was defense-related.

MR. ESH: Yes, I'm not exactly the right person to answer it but I'll try anyway. There's a large quantity of it now which I believe is considered to be the DOE stockpile, but as you run the enrichment facilities, the commercial enrichment facilities, then they're going to generate material over time.

And as you go out a few decades, I think the quantities are fairly comparable. You'll have about the same amount from the DOE stockpile right now as is going to be generated commercially.

MEMBER ARMIJO: Is the depleted uranium that's come out of the U.S. enrichment for example, is

that considered civil waste not DOE waste?

MR. MCKENNEY: It is owned by the Department of Energy, and as one of their actions is to -- sorry, this is Chris McKenney, Performance Assessment Branch Chief. Then they either try to dispose of it on their own sites, but they also have the option to use commercial disposal and it tends to save the government money.

There it is another commercial nor anything else, it's just DOE waste. And so they have looked at the option of using commercial disposal options for a number of their waste types including depleted uranium. And so that is why the potential became part of the discussion. Of course this whole issue raised because of a commercial developer --

(Simultaneous speaking)

MR. MCKENNEY: -- but the DOE is probably the largest producer of commercial waste disposed per a year now.

MEMBER ARMIJO: Yes, okay. So let's say a new enrichment guide, LES or maybe the GE laser or whatever it is. Those guides would generate DU, pretty small quantities compared to USEC. But they have no option except to go to a commercial disposal site.

MR. MCKENNEY: 1996 Privatization Act makes that a little more complicated in the fact that they have the option also of giving it to DOE. And DOE --

(Simultaneous speaking)

MR. MCKENNEY: -- at cost to LES or whatever has to pay the disposal cost, right.

MEMBER ARMIJO: Sure.

MR. MCKENNEY: DOE can take title to it and then dispose of it through their means, which would mean, also looking to get back at privatization.

MEMBER ARMIJO: This is a long way for me to get around to the fact that DOE has their own system, and regulations, and practices that they've had in place, and I did get three of their comments to the preliminary language which I thought were very good.

And so I was trying to understand which was the elephant, and it looks like the elephant is DOE and the depleted uranium that they've got and they're going to get. And so whatever we do for the civil case should be, I would think consistent with their practices, unless we see some terrible flaw in what they're doing.

CHAIRMAN RYAN: Just for the sake of a

number, there's 5,247 curies of uranium-238 disposed at Barnwell as we speak. That's it. And it will be there for a long time unless they add to it with some more.

Most of it is, or a lot of it is depleted uranium metal that's been used as counterweights, shielding packages, those kinds of things, and has, you know, been declared waste through DOD. So that's a lot of, but that's the numbers, 5,247 rounded off, curies.

MR. ESH: Yes, I believe we got numbers like that. I don't remember what they are off the top of my head, but from each of the disposal facilities when we were starting this process, they gave us some numbers for what they actually had disposed of to date.

CHAIRMAN RYAN: Yes, that's as of 7/12/2011, from Barnwell. I didn't look at the other sites because quite frankly they didn't take nearly as much, that's most of it, was Barnwell.

MR. ESH: Now I believe the Clive facility has more curies of uranium.

CHAIRMAN RYAN: Than Barnwell?

MR. ESH: Yes.

CHAIRMAN RYAN: Okay, I didn't know that.

MR. ESH: Than Barnwell, yes.

CHAIRMAN RYAN: So anyway that's, I can't imagine it would be a huge amount more.

MR. ESH: I think it was something like 17,000 but my memory is.

CHAIRMAN RYAN: 17,000? Okay, all right, well that's fine.

(Off microphone comments)

CHAIRMAN RYAN: Thank you. I guess we're back to you, Andrew.

(Laughter)

(Simultaneous speaking)

CHAIRMAN RYAN: Thank you very much for your patience.

MR. CARRERA: Let's get to the last bullet of number 8, Long-term Analysis, which is a new requirement, and when we see a few comments along the line of proposing a higher dose limit for the analysis beyond 20,000 years.

We also received comments concerning what was the purpose and uses of this long-term analysis, and some comments also suggest that we should eliminate the definition of long-lived waste.

Other propose turn it up where the limit of the ten percent of the initial radioactivity, which

is in the proposed definition of long-lived waste in the preliminary proposed rule language, should be stated as a requirement somewhere else.

CHAIRMAN RYAN: So in other words their proposal is that no more than ten percent of the total inventory should be long-lived?

MR. ESH: No, it's --

CHAIRMAN RYAN: I didn't quite understand what he --

MR. ESH: Yes, the definition that we derived was based on, if you look at the tables in 61.55, one of the isotopes that they identify as long-lived is carbon-14. And if you decay carbon-14 after 20,000 years, you have about nine point something percent of it left at 20,000 years.

So we figured a consistent definition with that is, if you have ten percent or more of your activity remaining at 20,000 years, we would call that long-lived waste. It's consistent with the existing table.

CHAIRMAN RYAN: It's an activity-based consideration, not a risk-based consideration.

MR. ESH: Yes well, I mean, the risk comes into play when you do the assessment against the various performance objectives, but the characterizing

the material as to its longevity, I don't know how you do that besides looking at its half-life for instance.

CHAIRMAN RYAN: Yes, but that's not necessarily risk-informed although, I agree it's a metric you can use.

MR. ESH: It's kind of like whenever you do a performance assessment, you may do in the biosphere area, a screening evaluation to determine what pathways you may need to include and which ones you don't need to include.

I think this is kind of analogous to that. You do some sort of processing up front to know how to do the calculations for different types of materials down the stream.

CHAIRMAN RYAN: And that's not dissimilar than how physics rules of thumb, ten times the half-life, and I don't have a health physics problem and, you know, those kinds of things, but that's based on practical limits for, you know, well established scenarios as opposed to being risk-informed. It's really not risk-informed to just use that kind of rule. It can be very much not risk- informed.

MR. ESH: Well, and we looked at what other people do to define long-lived waste and they'll do things like say, if the half-life is greater than

30 years, that's long-lived waste.

So we thought this approach was better than that, but there's not a very eloquent way of doing it that we could think of. If the Committee has some ideas, we'd be happy to entertain them.

CHAIRMAN RYAN: Thanks. But, you know, again I think the emphasis shouldn't be on that definition to drive the bus, and I think this is the case you've certainly emphasized, is it that emphasis should be on the risk-based performance assessment to drive the bus. So that's the fact that I think gets us over this hurdle.

MR. ESH: Well, hopefully you'll see that, because the only place that this definition comes into play is when you have long-lived waste and you hit the 61.13(e) criteria as we've developed it, to show how your system is performing over time, and to provide the number for what you think's going to happen at very long time.

But we didn't assign a dose limit to that number. It's basically a transparency for our stakeholders, and I'd call it a engineering/scientific criteria to demonstrate, or show how the various components in your system are going to limit or reduce the amount of, the release of long-lived waste.

CHAIRMAN RYAN: Well we'll hold that thought until we get into more detail.

MR. CARRERA: Slide number 9, please. Period of Performance, which is a topic dear and near to Dave's heart. David talked about it at great length for the past couple of briefings.

We received comments supporting a range of numbers for a period of performance, and the rule language from 1000, to 10,000, to 20,000 years and even out to peak dose. However, we see few or limited technical basis supporting period of performance other than the 20,000 years.

Others thought that the period of performance should be specified though guidance instead of regulation. We've also received comments that the 20,000 years period of performance places unnecessary burden to facilities that accept short-lived waste, and I believe that's what we've heard from the Committee as well last time, and we appreciate that position.

That next bullet, agreement state compatibility. Some comments suggest that we should recommend the strictest compatibility level to ensure a consistency in implementation among the agreement states, while others suggest a more flexible level of

compatibility, and to work with the states so that there would be no unintended consequences.

MEMBER ARMIJO: Andrew, could you refresh my memory of what you mean by compatibility?

CHAIRMAN RYAN: Look.

MR. CARRERA: Jim?

MR. DANNA: I'll take it. This is Jim Danna, Rulemaker Branch. I'll take a shot at it. I'm not an expert, but the compatibility category is the way in which Agreement States have to adopt the NRC regulations.

The strict compatibility category is like a B, where the Agreement States have to adopt our regulations as written. And a Category C would be where they have to adopt something that has the intent of the regulation, but they have some flexibility and they can be stricter. And then there's other compatibility categories, but --

MEMBER ARMIJO: But currently, let's say facilities that aren't dealing with depleted uranium, I get the impression that flexibility is one of the, is pretty standard with the Agreement States.

MR. DANNA: It depends. For every regulation, and the regulation is broken down into different quantities of different compatibility

categories, so it would depend on exactly what requirement we're talking about.

MR. WIDMAYER: What's the compatibility requirement for the performance objectives currently, for Part 61? And that's the portion that you're adding to, right, so you'd assume it would be stricter compatibility?

MR. DANNA: It could be either way with the way it's implemented, in which the different requirement could be a C which provides flexibility in the implementation. The objective could be the same, but the implementation could be different.

CHAIRMAN RYAN: I think it's helpful for the Subcommittee and the full Committee to recognize that at least so far, all the low-level waste sites are Agreement States. So this will be a state regulation issue, at least at this point for the foreseeable future. I don't know of any initiatives to sites in non-agreement states at this point.

MR. CARRERA: Lisa, did you have anything to add to the compatibility?

MS. LONDON: No, I think Jim covered it well. Compatibility --

(Simultaneous speaking)

MS. LONDON: This is Lisa London from the

Office of General Counsel. I think Jim covered it well. Compatibility Level A and B are essentially identical, they don't adopt our regulation, they adopt regulations that are essentially identical.

MEMBER ARMIJO: To meet the intent, yes.

MS. LONDON: C is to meet the intent, but A and B are essentially identical, so that was all I wanted to add. Thank you.

CHAIRMAN RYAN: Thank you.

MR. CARRERA: Thank you, Lisa. Moving on to the last bullet of Slide number 9, Near Surface Disposal. We received comments questioning whether it's even appropriate to dispose of depleted uranium at near surface facility, while others proposed a minimum disposal depth requirement for it's disposal.

Others suggest that to limit changes in this rulemaking is not protective of public health and safety. Slide number 10, please.

We also received comments in the areas of the Commission's direction, saying that this rulemaking is consistent with the comprehensive revision of Part 61, and this is not a limited scope rulemaking as directed by the Commission.

Others suggest that depleted uranium should not be classified Class A waste. And we

received comments in the areas of the rule language saying that it, at some sections, specifically 61.7(a)(1), 61.7(c)(2) and 61.55(a)(6) is confusing and could be shortened, deleted, or clarified.

And speaking to the waste stream neutral approach, there are support and disapproving comments of this approach. The disapproval would suggest that this rulemaking concentrate on DU rather than adopt a one-size-fits-all approach, and that blended waste should not be part of this rulemaking. Slide number 12, please.

As I mentioned earlier the staff appreciate all the comments that we received from stakeholders. As a whole we see the comments going either way, in support and disapproval of what we proposed, and overall the comments balance out pretty well.

We didn't see any showstopper, and we are okay and comfortable with the current direction that this rulemaking is going. However, there are instances where we felt that certain issues is not balanced. In that case, we looked at the technical aspect of the comments and considered revisions for the proposed rule language.

And in the next few slides I will talk

about the revision that the staff is considering for the proposed rule language, resulted from the comments received.

And on this slide, Slide number 12, we received a couple of comments that we should include, natural system and environment as part of the evaluate uncertainty in a performance assessment. We thought it was a very good comment and revised the language in Section 61.13(a) to clarify that the evaluated uncertainties in a performance assessment covers the disposal system, which encompass the disposal facility, natural system, and the environment.

And the staff is considering this revision for the proposed rule language, and on the screen you see red text with strike out and underline. The strike out are the text that's in the preliminary proposed rule language, and the underlined is the new text that the staff is considering as a revision to the already proposed rule language. Slide number 13, please.

As I mentioned before, we received comments regarding the requirement that intruder barrier must be shown to be affective over the duration of the compliance period, and we've received comments saying that's unreasonable, it can not be

done.

We appreciate the comments and revised the language in Section 61.7(c)(7) to clarify that the technical basis provided for the performance of future, I apologize, of the intruder barrier, will determine how long the performance should be credited. And we crossed out that over duration of the compliance period part.

And the Staff is also considering this revision for the proposed rule language.

CHAIRMAN RYAN: Okay, that's a good step, I think. I still struggle with the fact that an inadvertent intruder becomes an advertent intruder at some point. An example, I'm familiar with this bylaw, there are brass plates stamped radioactive material, do not dig into concrete, alarmed, concrete reinforced barrier, over them is Class C disposal cells.

(Simultaneous speaking)

CHAIRMAN RYAN: Somewhere along the line, our brass may rot somewhere down the line, but for a while it's going to hold up for, you know, quite a long while. Why can't some of those kind of things be incorporated into the rule?

I think at some point we have to address the idea that an inadvertent intruder, which we have

an obligation to protect, I don't deny that for a second, becomes an archaeologist and at some point, you know, buyer beware, I mean they're --

MEMBER ARMIJO: Well, you know, I just don't understand this obligation to protect someone far into the future from low-level waste exposure, and putting incredible burdens on people living today where no safety benefit, you know, this whole concept is, to me it is unjustified.

But the way you've changed the language of these barriers, there has to be some barriers. And they don't have to be evaluated over the period of performance of the facility or 20,000 years. So that means these are the barriers that probably exist today in a low-level waste facility.

CHAIRMAN RYAN: Correct.

MEMBER ARMIJO: Which is great, you know. I agree that they're buried, I mean, I think our job is to protect people --

(Simultaneous speaking)

CHAIRMAN RYAN: And I'm adding to this point by saying at some point we need to bring a closure to the inadvertent intruder, because they are going to become archaeologists at some point.

MR. GROSSMAN: Dr. Ryan, this --

CHAIRMAN RYAN: Once they intrude, whenever they intrude. Yes, I'm sorry, Chris.

CHAIRMAN RYAN: This is Chris Grossman of the NRC staff. The original Part 61 did envision such a scenario. There were a series of what I'll call generic scenarios that were used on a reference site to develop the Waste Classification Tables in 61.55.

And one of those scenarios included a variant which was an intruder discovery scenario in which the original scenario was a construction type scenario where someone may come onto the site to develop a residence, begin excavation --

MEMBER ARMIJO: Love Canal. Okay, you know, but I think we've learned a lot since Love Canal and does that really apply today --

MR. GROSSMAN: Let me finish my thought, please. The advantage of this is, the discovery is that as they dig into the soil, some of this material becomes recognizable. Operations stop. The assessment examines the exposures to that point and then is done. And that helped form the basis for some of the values that are in the table at 61.55. We envision continuing that philosophy in the intruder assessment, that becomes site-specific.

We will talk a little bit more about some

of the guidance that we would provide and how to deal with that for a site-specific assessment, in terms of demonstrating that the material would be recognizable, et cetera, and we can discuss that further when we get to that section.

But we feel we do incorporate that kind of a philosophy into, well one, that it's already incorporated into the rule, and that we plan to continue that as we add to site-specific intruder assessments.

MEMBER ARMIJO: So you would have very strict constraints on what the intruder is capable of doing? He's capable of reading the sign, or recognizing he's dug into a waste thing and at that point, he just can't keep going. He can't build an orphanage there, or, you know.

MR. ESH: Yes, that's --

MEMBER ARMIJO: Somehow you've got to truncate this thing or it becomes so open-ended.

MR. ESH: I think that --

MEMBER ARMIJO: There's no solution.

MR. ESH: The problem is that in that, okay, in current disposal practices, they put material in carbon steel drums for instance, maybe in some cases cementitious packaging of some sort, and those

sorts of materials have durability over, certainly the tens of year time frame. And for cementitious materials we do a lot of research on that in waste disposal programs, and try to determine what sort of durability they'll have over much longer time frames.

And we generally think that people can take into account that sort of information if they have it. In many cases we find that they feel it's just easier if they don't credit that sort of information, and just do the analyses, and set some limits on what they take operationally, whatever to get through the licensing process. They want to minimize their pain in getting through the licensing process --

CHAIRMAN RYAN: Another aspect is you have to assume the failure of institutional controls, and by that I mean, you know, there's huge amounts of money in long-term care products --

MR. ESH: Yes.

CHAIRMAN RYAN: Wait a second. And those funds are capable of going basically forever. Because they're earning interest, and the amount that they take out for maintenance every year is trivial compared to the total amount in.

So, you know, we assume institutional

barriers end at some point. Now I'm not sure that end means, you know, 100 years, probably not, 300 years, probably not. You know, so there's long periods of time where the money's still there to make sure that folks recognize it for what it is.

MR. ESH: Yes, and the institutional control period was not pulled out of thin air. I mean, when the regulation was developed in the early '80s, they had a series of public meetings with, like interactions like this where they got all sorts of opinions, and that kind of reflects the consensus opinion at that time. Now is there a different opinion today? We didn't have a lot people comment --

CHAIRMAN RYAN: But at that time the amount of money collected wasn't set at all.

MR. ESH: And that's probably a good point. But I think that --

CHAIRMAN RYAN: Especially if there's lots of money for the one site, I'm very familiar with, there's lots of money in place at the Barnwell facility, for example. Yes, sir?

MR. MCKENNEY: This is getting into the territory --

CHAIRMAN RYAN: Could you?

MR. MCKENNEY: -- specificating

performance assessment branch issue. Our limit to rulemaking was not to change the entire framework of Part 61. And the institutional control period, and the use of institutional controls, and the inadvertent intruder are all the major portions of the framework. That is what the second rulemaking is supposed to consider, is to changes to the overall comprehensive change to Part 20.

CHAIRMAN RYAN: But it's very hard for us Chris, to separate the dancer from the dance here. We have to kind of understand the whole picture, the way things are going, you know, in order to formulate an opinion.

MR. MCKENNEY: You know, the staff has not fully went to all of those hind positions and areas for the briefing.

CHAIRMAN RYAN: Fair enough.

MR. ESH: And the one point I would add about, Dr. Ryan, your point about the inadvertent intruder becoming an advertent intruder. For something like depleted uranium, you do not have to become an advertent intruder, ever.

Because if you bury it and it's below, say the depth of where somebody puts in a foundation for a home, you can run into technical problems with radon

emanation without ever digging into the material. So you could effectively put a house above it. You don't know you put your house on a waste disposal facility, and you get a lot of radon in your house. All of us have radon in our houses today.

CHAIRMAN RYAN: I was going to say, that happens anywhere in the eastern U.S.A.

MR. ESH: And it's derived from much lower concentrations of uranium in the environment surrounding our homes than what we're talking about putting in the disposal facility here. So just an additional point to think about.

CHAIRMAN RYAN: But that is so token, the amount of land involved is very much smaller than the amount of, or from the amount of concentrations are right now. So there's populations in our society.

MR. ESH: Yes, I agree with that.

CHAIRMAN RYAN: Okay.

MR. CARRERA: All right, let's move on to Slide number 14, please. Period of Performance Language. The staff considers revision to the language in 61.41(b) and 61.42(b), to provide flexibility to facilities that only except short-lived waste or low concentration of long-lived waste.

These requirements call for an estimation

of peak annual dose that occurs within 20,000 years following closure of the disposal facility. Staff considered this revision based on comments received, indicating that 20,000 years period of performance placed unnecessary burden to a facility that accepts only short-lived waste.

And as far as what the staff heard from the Committee, this change reflects the requirement for disposal facility to perform a dose monitoring out to 20,000 years to find the peak annual dose. And once you found the peak annual dose and it's less than 20,000 years, the facility has an option of justifying why they don't need to do a full-blown assessment out to 20,000 years for that particular case.

This helps alleviate the resources needed to do a full-blown assessment out to 20,000 years if your site that only accepts short-lived waste. And there are the technical staff to my right will talk more about this in their draft guidance document presentation.

MEMBER ARMIJO: What is, you know, I'm sure you understand the difference between what you mean by evaluates and estimates, but to me it looks like pretty much the same thing. And so is that really a substantive change that you've made. So

could you explain what this change really means, from evaluates to estimates?

MR. ESH: That change is not significant, it is just a word change. The second part of it I think, we believe gives more flexibility for the situation where if you have a facility that's only taking short-lived waste, or they take low concentrations of long-lived waste, they'll run their calculation, estimate their peak, and then make an argument as to why they've captured the peak. That argument could be running their calculation out to 20,000 years and showing --

CHAIRMAN RYAN: This is a subtle way of saying, very little bit of uranium or a lot of uranium.

MR. ESH: Yes, and it's a way that allows somebody to make a risk-informed argument for their specific facility performance, that they've captured it in the evaluation. From a practical standpoint, we don't see that there's a large additional burden to needing to run your calculation out if you set up your calculation.

There is a big additional burden if you have to argue about what exactly is going on out at those longer times, and you have disruptive processes,

and climate change, and all those sorts of things, that becomes a much harder problem. And we believe it should be a harder problem for concentrated long-lived waste. So that's kind of the approach we made. It may look subtle, but we think it's more significant than subtle.

(Simultaneous speaking)

CHAIRMAN RYAN: -- change from, I mean it's a big difference if you're in.

MEMBER ARMIJO: Yes, at some point, I'd appreciate it if you would address the difference in the NRC's proposed rule language and the Department of Energy's use of 1000 years and why you think they're wrong. You must, because they've got the bulk of DU and they're treating it one way, and you would propose to treat it a different way, so that's got to be resolved.

CHAIRMAN RYAN: Okay.

MR. CARRERA: Okay, thank you. Next slide, number 15, please. We have received comments in regards to the waste stability language in 61.7(c) which we thought was very good comments. That indicates that you can also get unstable waste from mixing low activity waste with long-lived low activity waste. So we went back and proposed revision to the

language to clarify that point, and the staff is considering this revision for the proposed rule language. Slide number 16, please.

In the ambiguous language area we received comments indicating that the language in 61.7(a) and 61.55(a)(6) is ambiguous wording and unnecessary. We agreed, and the staff is considering deletion and revision to the language in these two sections to reduce ambiguity and improve readability. That's all I have for today, thank you.

CHAIRMAN RYAN: Thank you, Andrew. Your brief introductory presentation went a little long, but it was very helpful. I think we've covered a lot of ground we may not have to cover later.

Derek, one comment I'd offer you is, again I took a look at the existing site, and under it a top 20 radionuclides that are in the disposal facility, I used, or I decay-corrected the inventory to July 12th, which is the day I did it.

And there's just a few radionuclides that are still around in any appreciable curie quantity. Cesium is one, nickel-63 is another, very little strontium, a little bit's left, uranium-238, 5000 curies, carbon-14, and Tech-99.

So I offer you that thought, not that I've

got any particular, you know, interest in the number here, but very quickly we're homing in on a half a dozen radionuclides to the report.

And I just offer you the thought, that if the guidance and not necessarily the rulemaking language themselves, but perhaps yes, could really focus on those radionuclides that are around after, I don't know what the right number is David, whether it's 300, 500, or 1000, some of those have changed a little bit.

Cesium's gone, you know. Strontium is gone in just 500 years. Maybe that's a way to focus this a bit, just something to think about. So I offer you that observation. But that's a real inventory for a real site that's operated since '71. And has covered a lot of evolution, so that's I think useful data to evaluate.

MR. ESH: You know, we looked at that data, we had those figures for the Committee in the previous talk about the ratio of the inventories and the activities. I think that all the facilities also had what I would call a fairly significant amount of thorium-232, I believe it was. We got the information from the DOE MIMS database and also we looked at the 2005 Barnwell closure report, I believe it was the

inventory numbers.

CHAIRMAN RYAN: That's inventory as of, received as of, whatever the date was, I've got it on the --

MR. ESH: One thing that a commenter made at a public meeting and really got me thinking was, I wonder if there's some unintended consequences of the Waste Classification Tables, because then that drives people to characterize and report those isotopes.

But there are other isotopes that aren't in the tables that I would expect show up in waste streams, that maybe go under-characterized or under-reported, that I think if we take the, you know, a unit concentration of a whole set of isotopes, and run forward, and look at their dose conversion factors, and their mobility, and the environment, and all those sorts of things.

There are isotopes that aren't in the tables that could cause a problem for a disposal facility, so I would just throw that out as like, you know, moving forward when we go to possibly a comprehensive rulemaking, I think it would address that issue, where the current regulation doesn't really address it.

CHAIRMAN RYAN: That's one possibility,

and the other that I know is true also, is that there's a tendency to go in the other direction. The last thing you want to have happen on a waste manifest is to underestimate what's in the package.

So people will tend to use MDAs for hard to detect radionuclides and report them as being present, because they're required to report it according to the MDA. So you now have an inventory accumulating that's not real.

MR. ESH: Yes, and I --

CHAIRMAN RYAN: You know Jim Harris did a very excellent study on power plant resin waste, you know, that we had certain radionuclides were reported that in fact were there in orders of magnitude less inventory.

MR. ESH: Yes, and I don't know what the cost may be associated with something like that, but certainly the techniques that are available today are tremendously more powerful and more available technically so.

CHAIRMAN RYAN: GE's study was in the '90s so it's not too far away from, you know, real decent detection technology. But, you know, from a generator's point of view the last thing they want to do is say, oh, what you've shipped is more than what

you wrote on the manifest. That's a violation.

If I'm conservative and overestimate what I shipped a little bit, I'm okay. So that's a very important area, that the precision with which what is accumulated in an inventory is an important point on both sides.

MR. ESH: Yes, you'll see strange things when you look at all the disposal sites. Like one site may have a zero for a certain isotope and all the other sites have it. And so you are scratching your head like, was this a specific waste stream that resulted in this isotope, or they just didn't report it because it wasn't part of --

CHAIRMAN RYAN: I think it would be a service to add some, and maybe it's in guidance, maybe it's not in the rule itself, but to say, these are the radionuclides that are in play from a performance assessment standpoint, so the precision and/or accuracy with which they are reporting might be helpful to focus on, you know, early on.

MR. ESH: You know, I don't think we go to that detail, but we do have a section on inventory in Chapter 3 that we talk about the bulk of the inventory that's --

CHAIRMAN RYAN: One thought is, why do we

have these tables? We have these tables for convenience because of Marcus, but now that we can measure a wide array of radionuclides fairly easily, why don't we just say what's the inventory? Write that down.

MR. ESH: Yes, I think it was, at the time it was, I mean the mind set was there were two options. You could take this table approach and then apply it to all sites, or you could allow each site to generate estimates of what it can take, and people can demonstrate what they've, the generators can demonstrate what they've generated and then send it to the appropriate site.

Well at the time that 61 was initially developed, they thought there was going to be a lot of disposal sites, and they didn't want to have a lot of variance in how Agreement States or how people were determining what concentrations they could take, and so they took the table approach, one size fits all.

CHAIRMAN RYAN: I think the other part of it is computing of power, and data collection, and analysis power in computing was terrible compared to what it is today. So these are very complicated things to accumulate and measure and record in the late 1960s.

I mean, we didn't even have a PC in 1960. So, you know, I think, again I just offer you the thought that updating on the technological power of data analysis, collection analysis, and computing needs to be somehow recognized as offering some economies here in this process.

And maybe the regulations can be simplified to recognize that that's, you know, collecting data is not nearly as hard as it used to be. All right, sorry, go ahead.

MS. YADAV: Okay. All right, my name is Priya Yadav, I'm a Project Manager for the Division of Waste Management, Environmental Protection. I'm managing this effort of just creating this guidance document but Dave and Chris are doing all of the hard work.

So I'm just going to talk for a couple of minutes and just kind of give some context about what the document is, what it's not, and then Dave and Chris are going to go into more technical presentations for each section of the guidance document.

You heard from Andrew about, kind of the first part of our SRM, which is to conduct the rulemaking to require site-specific analysis prior to

disposal of large quantities of depleted uranium.

So now you're going to hear about the second part of our SRM, which is to develop a guidance document that goes along with this rulemaking, develop this for public comment that outlines the parameters and assumptions to be used in conducting these analyses.

So we see the purpose of our document then is to provide implementing guidance to go along with these rule changes, and specifically to assist licensees and applicants in conducting their analyses to demonstrate compliance with the performance objectives in Part 61.

We've defined the term site-specific analysis in our document to have these four components, and Dave and Chris will go into specific details about each of these components in their presentations.

But we've organized it by performance objectives, so performance assessments conducted to perform compliance, to demonstrate compliance with 61.41, intruder assessment for 61.42, the site stability assessment is for 61.44, and then the long term analyses are only for long-lived waste, and that extends beyond the compliance period.

This Guidance Document is not an effort to consolidate all of the guidance that currently exists about conducting these analyses, simply because that is a multiple-year effort and would take more people than we have tasked to do this.

And so given the time that we have to complete this guidance document, our approach has been to include enough information that licensees and applicants can conduct these analyses, but then refer to other documents for sort of more background reference information.

MEMBER ARMIJO: Somebody trying to comply with the rule would have to go to these four documents?

MS. YADAV: Well first they would go to our document, and that would give them enough information that they could conduct these analyses. If they need any additional background information, for example we have a chapter on performance assessment, whereas this top document here took, you know, like five to ten years to develop and it's a --

CHAIRMAN RYAN: I think it's fair to say yes, Sam, they would have to go to all the documents. They couldn't get it from the one document.

MEMBER ARMIJO: Yes, and, you know, I

understand. I don't know what's in them, but if they're conflicting guidance, if there's a gaps in the guidance that might have been appropriate before the rule was changed.

CHAIRMAN RYAN: Well, I think it's fair to say that we can not agree. That anybody that's attempting to, you know, meet the requirements under what's proposed and filed up here, will have to, you know, develop a licensing plan, integrate in some way all of these documents plus the new Guidance Document, and make some kind of a proposal to the regulator, whether it's in an Agreement State or the NRC, to say here's what we plan to do.

So it's not something where I could just pick a couple of handbooks off the shelf, and put something together and have high expectation, I'll do it in one pass. It's going to be a, you know, a time consuming, expensive, and complicated interaction to get any new application for any new site through the system. Is that a fair, you would agree with that?

MR. ESH: Yes, I think that's fair. One thing I would add is that, yes, we do intend for this document to fill in any holes. So if we didn't fill in any holes we would want to know that, so we can fill them in.

And the other thing is that two of these documents on this list aren't directly applicable to low-level waste. NUREG-1854 is for incidental waste, new waste determinations, and NUREG-1757 is for decommissioning.

But they are more modern efforts and cover a lot of the same topics of some things that you might deal with in low-level waste disposal. For instance there is a Pendexter section in NUREG-1757 that has to do with engineered barriers, and how you develop bases for engineered barriers and demonstrate them, et cetera.

So there is analogous information in some documents, and as Priya said, ideally we would like to consolidate the Guidance, but that effort at the bottom to produce the Consolidated Decommissioning Guidance was a very big effort, involved a lot of people and a lot of time to produce that.

CHAIRMAN RYAN: Well, I just offer you the thought, it would be an asset in your document if you had three or four pages of summarizing what you think the key features are in these documents, that people could emphasize over, say other parts of the document. So if you kind of road-mapped that so, you know, references for other --

PARTICIPANT: Yes, we saw that.

CHAIRMAN RYAN: -- all the references for yours, and here's the sections and parts that we think are particularly useful and valuable in these four documents, and any others you want to add to the list. But it would give applicants and, you know, licensees I think a leg up on getting the process.

MS. YADAV: That's exactly what we have tried to do. We have a section called The Use of Other NRC Guidance Documents that we call a crosswalk, that we refer the reader to specific sections of these Guidance Documents where we think that augment, you know, in some of our sections if we couldn't duplicate, you know, ten pages, 100 pages in these other documents, we refer them to specific sections to augment for, you know, specific topics. So we hope that's a useful tool that, you know, and you can give us feedback on it, and if it's a useful reference for licensees and applicants.

MR. WIDMAYER: The Standard Review Plan doesn't seem to be referred to here. Was that?

MS. YADAV: This is not a list of all the documents. We have a whole chapter on the documents that refer to, but this just four of the kind of the main ones that we refer to also.

MR. WIDMAYER: But the process that Mike was just referring to, you would go to the Standard Review Plan to generate your license application, so it would seem like that would be the number one reference you'd have.

MS. YADAV: These are specific to actually conducting the analyses so these have a little bit more meat on how to do a performance assessment, how to do an intruder assessment. And these are kind of more of the, a couple of the more recent documents, but we definitely refer to NUREG-1200, which is I think the one --

CHAIRMAN RYAN: Yes.

MS. YADAV: -- you're referring to.

CHAIRMAN RYAN: But again, I think tying these back, I agree with Derek, tying those back in, at least having them, you know, on the list in your reference system, we talked about would help.

MR. ESH: Yes, and what I said about the holes I would say, I think NUREG-1200 is very complete in a lot of ways. When you add in these new materials and the requirements, then you start dealing with some issues that, and considering how things have evolved, there are some things, there are some technical issues that we had to cover in this Guidance that aren't

really in NUREG-1200, such as uncertainty, and risk dilution, probabilistic analysis.

I'm going to talk about that as we go through this presentation, but those are all areas that you will not find in detail or at all in NUREG-1200, which are kind of things that apply today.

CHAIRMAN RYAN: Thank you.

MEMBER ARMIJO: Okay, would the SRP have to be changed at all in order to comply with this, with the amended rule Standard Review Plan?

MR. ESH: I don't believe so. We looked at the Standard Review Plan. Certainly there, you could add, I think, new sections to the Standard Review Plan. But that's part of what the purpose of this document is intended to do.

Whenever we set out about it we said, well, do we want to be prescriptive and make like a Standard Review Plan, or do we want to be risk-informed and afford some more flexibility as to how you would go about the process?

And because of the site-specific nature of a lot of the things we're dealing with, we thought it was better to do the risk-informed approach which is what we've used in our more modern, more recent guidance like NUREG-1854, and even I would say the

high-level waste Standard Review Plan is somewhat risk-informed at least.

It covers topical areas, but then it gives you flexibility about how you go about providing the information within those topical areas. It doesn't give you a punch list of, you know, lock down A, B, C and then do 1, 2, 3, so.

MEMBER ARMIJO: All right, thank you.

MS. YADAV: As Dave mentioned, a key theme that we've kept in mind as we were developing this document is, how to implement the SRM in a risk-informed manner. So as we're discussing the primaries and assumptions to be used in these analyses, we've been trying to kind of talk about them in a broad sense and not be very prescriptive in saying specifically what parameters need to be used.

So we've tried to do that in a way that allows licensees and applicants to kind of adapt the guidance to their site-specific conditions and allow them some flexibility. So we have a lot of examples in the document, a lot of flow charts, and Dave and Chris are today in their presentations, going to give you a few examples of how we've used this approach throughout the document.

This is just an outline of our document.

We're going to walk through all these sections today, most of these sections today, and we'll walk through by author. So Dave is going to cover kind of the general technical analysis section, which covers things like model support, model abstraction.

Chris is going to cover performance assessment modeling, and then have a good detailed section on the intruder assessment, and then we're going to back to Dave for the site stability, long-term analysis, talk about some other considerations like setting inventory limits.

And then we have a section on performance confirmation which includes things like when to update the performance assessment, kind of a maintenance plan. And that's it. But the last section is our crosswalk section I just talked about. So I'm going to turn it over to Dave and Chris now to go into kind of more detail on each of the sections.

(Off microphone comments)

MR. ESH: All right. Thank you, Priya. I'm going to start off with the general technical analysis considerations, so what's covered in this section of the Guidance Document is the scope of the assessment, what we'll commonly in this field see the terminology is features, events, and processes,

scenarios.

It covers what we call general elements of the assessment, and I'll show you what those are. The period of performance, there's guidance provided for it. I'm not going to talk in detail today about the dosimetry section or the peer review and expert elicitation section, but I'm prepared to discuss those if you would like.

And then we also have, in this General Technical Analysis section, we talk about uncertainty. So first in the scope of the assessment, under the scope of the assessment, we provide approaches or how you may go about doing features, event and process identification, screening, and implementation.

And what you'll see if you look at the literature is, people will use formal or informal approaches, and they'll take a top-down or bottom-up approach. Commonly it's iterative, and all of this we reflected in the Guidance.

The features, events or processes the Guidance describes, may be eliminated based on a probability argument, a bounding consequence, or a physical reasonableness argument. And these features, events, and processes form the basis of the scenarios that you use in your assessment.

So this issue, or this area is really about, how do you determine the completeness of your model, or the completeness of your analysis. If we look at the example on slide 10, I don't intend for you to read this, but certainly you can and we can discuss it if you want to.

But basically this example is directly out of the Guidance Document, and we've put material like this in there to facilitate use of the document. It basically, is the question, is my site simple or complex?

And the reason why that is in the document is because under the scope of the assessment, we describe that if you have a simple site, then a more informal process, or especially a top-down process may be appropriate for defining the scope of your analysis and the scope of your model.

Whereas if you're dealing with a complex site, you're probably looking at a more formal process, or a bottom-up type of approach to define the scope of your assessment. That's what's done where you take a database or what may be termed a FEP list, and you go through some sort of screening process of that database.

There's various databases that have been

developed out there in the technical community that people use for this purpose in the waste disposal field. So that example we hope provides some ability to be smart about determining the scope of your assessment and tailoring it to the type of problem that you're dealing with.

In the general elements area on slide 11, this is where we describe the general technical elements of the analysis. And we've broken them up into system description, data adequacy, data uncertainty, model support, model uncertainty, integration and model abstraction.

These are kind of the building blocks that form the performance assessment and the technical analyses. So if we're doing a risk-informed approach to developing a performance assessment and reviewing a performance assessment, if you get these basic building blocks right and you have adequate quality assurance, then you should be able to have confidence in a good product or a good outcome.

So this allows us by making up these general elements to ensure that a proper model and a proper review of that model, or a proper assessment is done. These general elements comprise the framework of the evaluation. And we provide guidance in each of

these areas in the document.

Now if we switch to the period of performance, what we have in the document is what we think is risk-informed guidance. It discusses the flexibility that you can be afforded for short-lived waste or for low concentrations of long-lived waste, and I'll show you an explicit example on the next slide.

The staff views that the primary differences are in the level of detail or justification for the calculation, so if you can demonstrate that I don't have a lot a long-lived waste or I don't have any long-lived waste, I'm primarily dealing with short-lived waste, then your calculations, and the level of support that you have to provide for your calculations are a lot different than if you do have a lot of long-lived waste.

And we think that's an appropriate way to go, and it doesn't induce an extra regulatory burden. In fact, it allows people to be smart about their analyses. The guidance also provides our expectations for the long term analysis, what that looks like.

We had a number of stakeholders comment on that, especially in our Agreement States, and we're sensitive to the effect that this regulation will be

applied, or an equivalent state regulation will be applied in the Agreement States. So if they have questions about how they would do it, then we haven't delivered the mail on it, so to speak.

The period of performance example here is directly out of the Guidance and it talks to the problem of, if you only have short-lived waste or low concentrations of long-lived waste, and in the example we say 1/10th of the values listed in Table 1 of 61.55, which would be comparable to Class A waste.

Well you're going to do the assessments to show that you can satisfy the performance objectives, but you're not going to get into this business of the complexity that comes in at later times. And so we think our intent in the Guidance is very clear of what we would expect from the analyses.

And I would remind everybody that it is guidance, too. And people can and do ignore the guidance as they choose. Not that we intend for them to do that, we hope that they follow the guidance, and it's very clear in what we intend and how we would solve the problem if we were doing it in not an Agreement State.

But the difference between regulation and guidance, and why some stakeholders will comment so

much on it about this should be in one place, or this should be in another place, is because you do have flexibility in guidance where you don't have the flexibility in the regulations, basically.

CHAIRMAN RYAN: So, just to spend a second on the key point, is that if you have 1/10th of the table values for the long-run radionuclides, your burden is really much lower, is what you're saying?

MR. ESH: Is what we intend to say, yes.

CHAIRMAN RYAN: I'm sorry.

MR. ESH: I mean, the text talks about that. I mean, it's basically, that we want people to be smart about it. So, you know, does it make much sense if you say, I have a few parts per million of uranium or whatever that I'm taking in my facility, and the soil beside the facility has those same concentrations, that you would want to spend a lot of detail on a calculation to say what the risk from that may be?

The person is not going to be spending, or the community is not going to be doing any calculations to demonstrate the risk from the natural soil, so why would you distinguish that from the disposal facility?

Unless if it was, of course, of a

different form, different mobility, all those sorts of things, that comes into play. But we expect, I mean the philosophy in the guidance, and hopefully when you eventually see it, is we expect people to be smart about it and tailor their analyses to their problem. Which means more complexity for the hard problems, more basis, less complexity, less basis for the simpler problems.

We have a section on uncertainty in this chapter of the Guidance. It covers a variety of topics, any one of these we could have a great discussion on, I'm sure. We do say that probabilistic approaches are preferred but deterministic approaches are acceptable.

You can certainly for a number a problems, do a deterministic calculation and that's perfectly fine, and demonstrate that you meet the criteria. Particularly when you have a simple problem or, you know, limited concentrations of material, probably the effort and the communication barrier that you run into with a probabilistic analysis may not be worth it.

CHAIRMAN RYAN: Just to test that thought a little bit, I mean one cut to me is, you have a lot of radionuclides that will decay if you accept ten times the half-life as completely. They'll decay

within, certainly, you know, the operational period plus the initial funded, you know, long-term care period.

I'd take those completely out of play and say they'll be detected by routine on-site and closure period monitoring, and we'll deal with it if they show up in a way that's unacceptable. Done. I mean is that the kind of thing you would consider?

MR. ESH: Waste characteristics are one thing that I would consider, yes. The one difficulty with that is that the risk from the short-lived material in these types of problems is derived by, I'd say the discreteness of the features in the system.

So if you have a natural system with a lot of heterogeneity and things like fractures, or dikes, or some complex geology, that can even for short-lived radionuclides cause you some challenges in your performance assessment.

But in general I agree with you. If you're dealing with short-lived waste, make the analysis easy, focus the complicated analysis on the concentrated long-lived waste.

CHAIRMAN RYAN: Yes, and if you've got a highly-fractured system you're probably not going to site there.

MR. ESH: You're probably not going to site it there, but sometimes they learn things later that they didn't learn initially, after all. Now for the probabilistic analysis, we advocate the use of the peak of the mean output to compare to the regulatory limits.

We talk in this section about the limitations of one-off analyses, especially for deterministic analyses. In these types of systems you usually have some pretty sparse information, and you have a lot of uncertainties in the interpretation. The robustness of the one-off analyses and the interpretation of those can create some challenges.

So we talk about that in the Guidance. We talk about risk dilution, which comes into play with uncertainty and parameters, or features that typically affect the timing of the releases from these types of calculations. That's something we felt that there's not, the example that Derek gave about the Standard Review Plan, you won't find that sort of discussion in it.

Model uncertainty, there is a expectation that people will address model uncertainty. It's usually addressed pretty weakly, I would say. If the model support is good, then you're going to have less

model uncertainty. But if the model support is limited, which comes into play for lots of these types of calculations, then you have more model uncertainty.

And there's not, even if you look at our fields outside of waste management, there's not a lot of robust ways that people deal with this model uncertainty problem. They basically just keep cranking on the problem and developing information until they think they have enough confidence to move forward, instead of taking model uncertainty and developing some sort of propagation of it through the system. We have a good data uncertainty example --

MEMBER POWERS: Have you ever seen anybody do this model uncertainty?

(Off microphone comments)

MR. ESH: I'm sorry?

MEMBER POWERS: Have you seen someone deal with model uncertainty?

MR. ESH: Not in low-level waste disposal, no. In the high-level waste disposal program they evaluated model uncertainty. They basically looked at alternative conceptual models and the NRC guidance was basically, you want to look at alternative conceptual models that are consistent with your data.

So if you have very limited data, you

might have a number of models that are consistent with your data. If you have a lot of data you should be able to hone in on one model.

The problem becomes if you have limited data and you get into this issue of people dreaming up models that are consistent with that limited data, and then you put them all together and you may be way out in left field in terms of, like the risk that you're estimating. You still have to come back to some sort of physical reasonableness, and some sort of ability to constrain the results of those calculations.

CHAIRMAN RYAN: There is one example, David, Barnwell is and I'll pick on it again, where there was a tremendous effort previously, and even currently today to calibrate the groundwater model based on the entire system, which is precipitation and all the rest of it.

So they actually have the ability now to predict fairly accurately the response of the saturated zone surface from various rain events.

MR. ESH: Yes they do. And generally I --

CHAIRMAN RYAN: So that's an example I think that have been some significant effort to calibrate.

MR. ESH: They do, generally I'd say

people do much better in the groundwater pathway part of the problem, because there's a lot of experience of dealing with contamination problems and transport in environmental media.

It's in the other parts of the performance assessment that can be very important issues around the source term, release rates, and the material science, and corrosion of engineered systems over time. Those areas, there tends to be maybe a little more uncertainty in these types of problems that you run into some more model uncertainty. So but the Guidance covers a lot of different topics on uncertainty. I think this is Chris' turn now.

MR. GROSSMAN: So what David talked about were kind of general considerations in performance assessment methodology that apply to many of the analysis that the rule will require. What we're going to get into now is just specifically performance assessment modeling issues.

And this again, performance assessment being the assessment to demonstrate compliance with 61.41. We won't spend a lot of time on performance assessment today because a lot has been written on it in the past, and so this Guidance really is intended to supplement previous approaches and it points

heavily to NUREG-1573's PA approach.

And we supplement that in a couple of areas with the source term radionuclide transport. We also point to some of the other documents in the section, such as the Incidental Waste Guidance, which is a little bit more modern PA methodology maybe than 1573, but they're consistent with each other.

So as I said, the Guidance here is intended just to supplement in predominantly these two areas. We outline site-specific parameters to consider, and as Priya mentioned earlier, we don't specify specifically what needs to be considered.

We talk in a general sense about some of the processes and parameters that would need to be considered in an analyses, and I've got some examples here that pertain to specifically the DU issue, like the radon, and modeling of radon in a performance assessment, things like emanation, how do you account for that, as well as migration through the subsurface of the radon gas.

That's a little bit of a unique challenge. That is tied to the uranium issue, and so we did spend some time talking about some of the issues associated with radon. In this Guidance on performance assessment we did make some recommendations based on

staff experience.

We have some guidance on how to treat the evolution of the disposal system over time, as climate systems may change for long periods of time and how do you account for that? Particularly in areas like that affect the geochemistry or potential radionuclide transport characteristics.

And some of that evolution may also have an impact on the engineered barrier system degradation, that's EBS here. I forgot to define that acronym, I apologize. And so things like waste containers, waste forms, how do changes in a disposal system over time affect the degradation rates of those materials.

And finally we have guidance on primary model support, and Dave talked a little bit about this. Developing support for the models, in terms of the, that you would use to characterize degradation rates for waste forms and waste containers, as well as migration parameters.

So next we're going to transition over to the intruder protection, and--oh, there it is, okay, can you still hear me if I am pointing back at the?

(Simultaneous speaking)

MR. GROSSMAN: I realized I pointed at the

wrong people. Okay, so --

MEMBER POWERS: Before you get into this question that I'm totally into figuring out, in this intruder scenario, why did you bring that up? Do we have data on lots of people intruding on disposal sites that leads us to believe that they do so?

CHAIRMAN RYAN: No.

MR. GROSSMAN: I think Dr. Armijo brought up one example that was kind of contemporaneous to when Part 61 was originally developed, which was the Love Canal example. That was a kind of a contemporaneous example of things that were happening at the time, that provided some impetus for the protection of the intruder that was developed in the original Part 61.

MEMBER POWERS: Usually, I write down anything that Mr. Armijo says. I guess I missed his particular example.

MEMBER ARMIJO: Well, you know this is a very difficult thing for me to accept because of the, it's a hypothesis and so the intruder can be a small number of people, a large number of people, adults, children, who knows what their capabilities are?

So to me, if I understood that the intruder is a very well defined number of people with

certain capabilities, he can read, he can write, he can dig a hole so many feet deep, and that's it. Then I can start to say, okay well, I can do an analysis on what would happen to that person if he happened to just land on top of my site and only did those things.

My concern is that this intruder can develop, in time develop all sorts of capabilities, and turn a hypothetical issue into something big, when it shouldn't be a big deal.

MEMBER POWERS: One concern about the origins, I mean, to me, somebody here can say, gee we ought to develop these sites so that intruders can't get to the material, then they must have been motivated by something.

MR. GROSSMAN: There are, I think a couple of considerations, and I'll talk, if I don't address them, what he's thinking. One is, you're in the near surface environment, and humans are much more active in the near surface than they may be in other environments, such as deep geological disposal.

And so that there's a recognition that we are active in that environment. And I think the second then is the concept here of low-level waste, is your concentrating and containing waste and so you have the waste there in the near surface, and because

of that containment then, there is a need to protect someone who may intrude into it unknowingly.

CHAIRMAN RYAN: You know, having been involved when it was first regulated as a licensee, it takes away the first 100 years, because there's institutional controls, there's institutional control funds.

And so everything like cobalt and the other short-lived stuff is out of play. But what it does address at least, and I'm not sure I agree and like all aspects of it, but it does address those radioactive materials that are there for 100s or 1000s of years.

I mean I can give you the numbers right here of what's around after 300, and it's, you know, 5000 curies of uranium and a few other odds and ends. The part where I have seen it evolve to where I'm not sure it's exactly as helpful as it could be, is that pure calculations of radon doses at a house that I've excavated on top of a waste trench, you know, and I've got a basement, that quite frankly isn't realistic.

I mean, I'm going to hit stuff, like 10-inch thick reinforced concrete pads over hundreds of feet. They're going to tell me something's different. So I wonder if it doesn't need to be revisited and

refreshed with regard to what is a realistic intrusion.

And I'm not sure how long it should be an obligation. Is it 10,000 years into the future that we should do it or not --

MEMBER POWERS: My thinking goes something like this, Mike. If I look at the archaeological evidence as was stated, man is very busy on this shallow earth. But mostly he builds on top of things. He doesn't really dig down into things, he builds on top of things, that's why archaeologists can make a living.

Because they go down and actually dig down and, so I'm wondering what motivated somebody to think that intruder, rather than somebody that paves over the thing and builds on top of it, because that's what we've done, historically.

Now I don't know if that's what we would do now, but it's, I mean I've got, well we can't go back 20,000 years, but I can go back 8000 years and in 99 percent of those cases people do build on top.

CHAIRMAN RYAN: But the thing I think that's important is the assumption was at the time that, for 100 years, you know, that's an institutional memory that we'll fund and understand. And we have no

other choice but to assume that everybody's going to dig into it thereafter. And excavate it, that was the APRA assumption, there was no discussion of these kinds of points, but --

MEMBER ARMIJO: So, the 100 --

CHAIRMAN RYAN: -- just a second.

MEMBER ARMIJO: I understand you but you say the 100 years says after that, the regulatory people, the government, what, doesn't exist?

CHAIRMAN RYAN: Whatever dose assessment I'm going to do, the assumption is 100 years plus zero days is when I make the assumption of the intrusion.

MR. ESH: You know, I don't think that, it's not that the government doesn't exist, it's that you have things like government error in records or, you know, financial challenge that then causes somebody to take the nuclear waste fund for instance, and use it for other purposes.

I mean it's like you have those sorts of things occurring, it's not collapse of society that gets you into that scenario. It's much more subtle things that come into play. And I would say that the purpose of it is what Dr. Ryan said, it's not a calculation of, you expect this to happen.

It's a stylized regulatory construct that

does a couple things. It deals with this, people being busy in the near surface issue, and it provides some limits for low-level waste disposal, as to what you may take in that type of facility.

Because you can, material that maybe doesn't pass the low-level waste analyses has other places that it's supposed to be able to go. It's not the last stop.

CHAIRMAN RYAN: It is a good point to open the conversation though and say, well, what's magic about 100 years, and the answer is nothing.

MR. ESH: Yes, well as I said, it was derived based on interactions with stakeholders when the regulation was developed. It wasn't a number pulled out of thin air. It was like people like ourselves coming together.

MEMBER POWERS: Yes, that number it's as good as any, yes, I mean I think it's historically defensible, I mean, I tend to look at things like, how much do you actually recall about what the potensive formations were and were what. Exactly nothing, you know.

MR. ESH: And that, one thing that we're doing, or a couple of other things I would point out. One in the intruder area, we're recommending or

proposing a 500 millirem dose limit, which implies that, you could interpret it as implying an unlikeliness to the scenario.

Because if you expected the scenario to happen, there'd be no reason why you wouldn't set the dose limit the same as what you set in the 61.41 dose limit. And we're proposing that it should be higher, consistent with what was done when the table values were developed.

So we think that is an appropriate way to go in this area. The other thing that we're doing, it's a work in progress, but I got to thinking and I said, you know, instead of just arguing about this topic with people, let's try to quantify it.

Because we have some things available to us that maybe can help us at least get a rough estimate of what we're talking about. So I'm working with one of the individuals in my section who's a GIS expert, to develop disturbance maps over space and time to estimate the depth of the near surface that has been disturbed as development has occurred. That will give us some sort of number to know whether we're in the ballpark or not.

CHAIRMAN RYAN: It's at least a framework to think about it.

MR. ESH: It's at least a framework to think about it besides just this hypothetical number of people arguing back and forth. But let's sharpen our pencil a little bit and see if it yields anything.

CHAIRMAN RYAN: Yes, and the other things that could be taken care of with that kind of an approach I think, David, are the fact that most of these facilities will be in at least currently very rural areas.

MR. ESH: Yes.

CHAIRMAN RYAN: They're not going to be in areas of great disturbance and cities and all the rest.

MR. ESH: There's a second requirement that you're supposed to avoid areas of large population growth when you pick a facility.

CHAIRMAN RYAN: Yes, so if you can somehow calibrate a little bit of what, you know, what are the disturbance rates, and loss of knowledge rates for those kinds of, you know, facilities, areas, and what not. That's a step in the right direction, I think.

MEMBER ARMIJO: I don't have a problem with 100 years, I have big problems with 20,000 years. You know, and does this inadvertent intruder evaluation have to be done out to that time, and I'd

say, why? You know, what obligation do we have today to protect someone 20,000 years in the future?

I'm not talking about huge populations either. We're just talking about the limited number of people that might stumble onto these sites, and when all memory has disappeared and no --

MR. ESH: And I would agree with you. If in fact it was the intruder performance objective that was going to be completely driving your decisions with respect to long-lived waste. But the reality is for some isotopes, you're going to be limited by 61.41, the normal evolution of the system to release into groundwater, et cetera.

And so for other isotopes you're going to be limited by the intruder type assessment. Generally for the short-lived isotopes, you're going to be limited by the intruder assessment, and for the long-lived isotopes you're going to be limited by 61.41, not by the intruder assessment.

If in fact as we go forward, we're finding that, okay the 20,000 year intruder results are driving the decisions people are doing with their material, then I think that would be a reason to look at it and think about the point that you have is, you know, is this the right thing to do?

CHAIRMAN RYAN: And I think that exact point ought to be in the Guidance.

MEMBER BLEY: Well, that's what I was wanting to ask, you know, the kind of things you were talking about just a minute ago, about things you're researching that could make this a cleaner process. When is it likely that, that would be available to people who are going to be trying to do these calculations?

MR. ESH: I was hoping we would have something that I could talk about to the Committee in this time frame, but we're not there yet. It's turned out to be a little more complicated. I'm always optimistic about things like this.

CHAIRMAN RYAN: That's fair, I think, you're in the process of developing, but I think this very topic and these materials that you're developing really should be in the Guidance.

MR. ESH: Yes, in this particular area, I don't know whether it's going to yield results of, well the probability is 1E to the minus 5, or it's 1E to the minus 1. You know, I have no idea how it's going to turn out, I just thought it's an area where we should probably quantify a little better, and that may give us some regulatory basis for whatever we

choose.

And because this is a limited scope rulemaking, we don't feel like we have to go head on about this intruder performance objective right now. As we go forward to the more comprehensive rulemaking, we think that would be the opportune time to bring some of this information into play and see if it's the right framework or not.

CHAIRMAN RYAN: Well it's certainly, you know, if you bring this work to closure, it's certainly a good way to, you know, risk-inform the whole process in this area.

MR. ESH: Yes, this idea came, didn't come early enough to me to allow --

CHAIRMAN RYAN: So you're seeing it better late than never, David.

MEMBER BLEY: I don't have a good mental picture of the overall rulemaking, this limited one in the larger scale, and how the things you're trying to develop would align with when people will have to do something about these things. Are you going to talk about that somewhere along the line here?

MR. ESH: I think --

MEMBER BLEY: I'm sure you hoped to have things already, but are we going to have the chance

that we have a rule out there that people have to respond to, and you haven't been able to give them really good tools yet?

MR. ESH: Well, I think that the rule that we'll have, the staff will have confidence in this rule, and its supporting basis, and its Guidance Document at the time it goes out. If we're doing some other efforts to prepare for a more comprehensive rulemaking, I don't think that affects our decisions about what we're doing in this limited scope one.

So I don't know if I answer your question, but that's kind of how we feel about it. We aren't going to go out with something now that we aren't confident is the right thing to do.

MR. GROSSMAN: Okay, where was I?

CHAIRMAN RYAN: Slide 17.

MR. GROSSMAN: Not yet. I'm sorry. So I don't, I'm not aware of how familiar the Subcommittee is with the intruder protection requirement. We have kind of three legs showing here to the intruder protection, and this is under the proposed rule.

Two of the legs already exist in the current rule, namely being that in order to demonstrate protection of inadvertent intruders, you have to demonstrate compliance with the waste

classification and segregation requirements, so this is going to the tables, determining your classes, and making sure that they are segregated according to class types, et cetera.

CHAIRMAN RYAN: Yes I might, just for everybody's benefit, that's not only the generator's responsibility, it's typically something that's fully inspected before or as the waste is received for disposal, so the Agreement States where the licensing bodies like the NRC itself would certainly have a thumb on that right at the front end.

MR. GROSSMAN: Right. And the classification part was developed during the development of the Part 61, through what I'll call the reference analyses. And so they used a reference site, they developed a set of reference scenarios for an intruder assessment, and they used those then to develop the Waste Classification Tables.

And so there is a set of kind of human activities that could occur, that has been used in the past, and we'll bring those forward in the intruder segments.

CHAIRMAN RYAN: I think it's very important for everybody to understand that those intrusions were envisioned in systems that were much

less robust than what's used now.

These were cardboard boxes, earthen trenches, earthen covers and, you know, the idea that you would build a house on a disposal trench,\ or have some other kind of intrusive activity, did not really recognize the robustness of waste forms, waste containers, or currently technology that's in place currently at the existing sites.

MEMBER ARMIJO: So would the tables be different today?

CHAIRMAN RYAN: Oh yes.

MEMBER ARMIJO: If you generated those tables today based on the way you're --

CHAIRMAN RYAN: In my opinion they would be. Now they certainly would be for, I want to guess, let's just pick a round number for the sake of the argument, 500 years, but after that you could then argue that concrete degrades, or reinforced concrete degrades.

It would be in the longer term scenario that David spoke about, but I think for a large portion of the decay of the radioactive material, it would be very difficult to be an inadvertent intruder today.

MR. GROSSMAN: So part of mentioning that

is to segue into what I'm going to spend the rest of the time on, is the new part, the intruder assessment, because that's largely what we deal with in the Guidance.

But that isn't necessarily something that's all that new, it's an extension we feel of this part of the requirement that was originally there. There was an assessment done. This is using the Commission's direction to make that more site-specific, and allow licensees the flexibility to incorporate some site-specific information into that assessment.

CHAIRMAN RYAN: One key point though, is I'm assuming, the probability of intrusion is still one.

MR. MCKENNEY: Except for the fact that we don't require 25 millirem, which would be true if we had a probability of one, Dr. Ryan. Make probability one then every intruder will be a member of the public, and member of the public dose limit for Part 61 is 25 millirem.

CHAIRMAN RYAN: So I have a probability of a new intruder, the probability of one where 60 out of 500 millirem dose limit?

MR. MCKENNEY: Yes.

CHAIRMAN RYAN: But the probability of intrusion is still one.

MR. MCKENNEY: When you assume it's --

CHAIRMAN RYAN: You assume it's going to happen, period. So that's a probability of one.

MR. MCKENNEY: Well, now that would be saying that every --

MEMBER ARMIJO: Well that's a deterministic analysis, then.

CHAIRMAN RYAN: It's a deterministic number but they use a different dose limit for that long term intrusion. You can split the hairs on how it's viewed, but that's what happens. The calculational rate's a probability of one.

MR. GROSSMAN: So since the intruder assessment in terms of site-specific analyses is new, this section of the Guidance is more of a stand-alone section. It does draw upon, kind of the philosophy that underlies 15.73, being it tries to be PA-like, as much as it can given that it's a hypothetical construct.

It also draws on 1854 for that reason. 1757 in terms of scenario development, we drew on that heavily in terms of reasonable foreseeable scenarios and how to develop those for a site-specific basis.

And it does touch on the branch technical position on concentration averaging.

MEMBER ARMIJO: Do you have a, just definition of what the inadvertent intrusion performance objective is?

MR. GROSSMAN: That's the rule language.

CHAIRMAN RYAN: It's the whole rule?

MR. ESH: No, no, 6142.

MR. GROSSMAN: 6142, it's that section of the rule, that's the performance objective for protection of inadvertent intruders. And so apparently what it requires are the top and the left bubbles. And the proposed rule would add the lower right quads, intruder assessment.

MEMBER ARMIJO: I'm just going to keep on reading and I'm trying to find out in words.

MR. ESH: I can read this to you if you'd like. It's real short.

MS. YADAV: It's slide 14 from Andy's presentation.

(Simultaneous speaking)

MR. ESH: All right. Design operation enclosure of the land disposal facility must ensure protection of any inadvertent intruder into the disposal site who occupies the sites, or contacts the

waste at any time after active institutional controls over the disposal site are removed. The annual dose must not exceed 500 millirems total effective dose equivalent. That is something new we added.

MEMBER ARMIJO: So that the only number I see is the 500 millirem, that's the only quantitative?

MR. ESH: Yes, and in part A of 61.42 as imposed.

MEMBER ARMIJO: And it's 500 millirem?

CHAIRMAN RYAN: TEDE.

MEMBER ARMIJO: TEDE for, okay. So that's the number that you have to meet.

MR. ESH: Okay?

MEMBER ARMIJO: And if you didn't have depleted uranium, if you did it at 100 years, it's never going to get worse?

MR. ESH: Not, well not necessarily. Other uranium goes into these facilities, as Dr. Ryan mentioned, Barnwell has 5,248 curies of --

CHAIRMAN RYAN: Something like that, yes.

MR. ESH: -- uranium-238. They also have thorium-232, so anything that has some ingrowth, and if that material was in some way processed or purified and then disposed of, so it's not a secular

equilibrium, then you can get some ingrowth of some of the daughters over time that can have a greater propensity to cause risk than the parent.

CHAIRMAN RYAN: And those times are very long compared to the --

MR. ESH: They're long for those low specific activity nuclides, I guess you could probably have some shorter ones that have similar behavior.

MEMBER ARMIJO: Okay, thank you.

MR. GROSSMAN: As I mentioned, we'll focus on the intruder assessment for the rest of my portion of the talk. And it's an assessment to estimate potential doses to an inadvertent intruder. It's required for 61.42.

We intend it to be a PA-like methodology. There is some recognition that it's a hypothetical construct, and that you are not explicitly considering probabilities in this like you might in a more PA methodology.

CHAIRMAN RYAN: Well you are, the probability of intrusion is fun.

MEMBER ARMIJO: That doesn't make it probabilistic.

CHAIRMAN RYAN: Well I think it is a probability they've assumed. I just want to make the

point that it is a probability of one, period.

MR. MCKENNEY: So is the person at the fence line.

CHAIRMAN RYAN: Okay.

MR. GROSSMAN: The Guidance though, does bring in some qualitative ways to consider likelihood, and I'll talk about this in scenario formation, ways that you can develop site-specific scenarios that might be more in line with your current site conditions or practices.

And the intent really is to identify, are there any additional site-specific design and control measures that might be required for the site, given the wastes that are taken and the characteristics of the disposal system as a whole.

CHAIRMAN RYAN: You know, I can think of at least one site where their site fence is inside a very large reservation that doesn't have public access. So which fence do I use? I mean, you have the flexibility to allow those kind of patterns, you know, of placement and all of that.

MEMBER ARMIJO: You're talking military reservation?

CHAIRMAN RYAN: I'm talking about, yes, the Hanford Reservation, it has a U.S. Ecology Site

inside it.

MEMBER ARMIJO: Yes but, you know, if you go way out in time and those things exist, and that's --

MR. ESH: I think they would have to shrink their footprints not maintain them, but there's people from DOE here who could talk to that.

CHAIRMAN RYAN: Well I'm just saying, I mean you do have the flexibility to recognize the particular physical realities of a given site.

MR. GROSSMAN: I'll talk about some of that in the scenario analysis.

CHAIRMAN RYAN: Okay great, I didn't mean to pick on you.

MR. GROSSMAN: No, that's okay, it's a segue. So the PA-like methodology here, we draw a lot, this was actually kind of co-authored from 1573, which they used for the performance assessment and then adapted to the intruder assessment, but a similar process.

You form your scenarios that you may expect to occur based on site conditions or your practices. And then you conceptualize and abstract the system or simplify the physical processes going on, conduct your consequence modeling.

And then you evaluate your site disposal performance, at least the performance objective. If the objective is met, fine. If not, then you may need to develop some options. Some of the options may include refining your analysis, maybe you've got to sharpen your pencils and go back and collect more site-specific data, et cetera. You may need to change design, include additional barriers, et cetera, or potentially set inventory limits.

MR. WIDMAYER: Does this allow you the possibility of saying, okay I'm not going to have an intruder?

MR. GROSSMAN: We'll talk about that in the scenario formation, the guidance on that.

CHAIRMAN RYAN: You've made a very important switch in what you just said, set inventory limits. We've got a concentration-based receival system, and we're switching to what I think is the right way to deal with the site, which is the fractional release from the inventory, is what the performance assessment's all about. Now in France, there's a paper out on it or several actually, where they don't limit concentrations, they limit the inventory of a given site.

MR. ESH: But they limit the inventory in

a container volume, which is affectively a concentration, too. It's just a concentration by a different name.

CHAIRMAN RYAN: But that doesn't drive the bus, though. What drives the bus is the site-wide inventory.

MR. ESH: But they do both, they do the site-wide inventory and the container limit, and they can limit what the facility can accept based on either, the container or the facility, not just the total facility.

CHAIRMAN RYAN: Well, the total facility's kind of the end point though, right. They can't exceed that, but they can deal with packaging and arrangements of packages to deal with different concentrations of material.

MR. ESH: Yes, I think the issue is, you have a limit on what you can put in one package, potentially. But then you can have different limits based on how much the facility can take.

CHAIRMAN RYAN: Yes, and the package limit is really designed for operational protection of workers more than it is the long-term performance.

MR. ESH: I would guess so.

CHAIRMAN RYAN: That's true. So it's

still the fractional release from the inventory that drives the risk bus for a low-level waste site. It is not a package by package inventory, except as that aggregates up to some concept, and I know it could be a complicated intricate one of fractional release from that inventory to an environmental vector. That's what drives the risk bus, and if we're heading toward that, that's terrific.

MR. MCKENNEY: Always in the rule. 61.41 always existed.

MR. GROSSMAN: So in some cases for existing sites, at the end of the life, if you're up in PA you may need a performance mitigation or new sites you may decide if your options don't work out, selecting a new site, that's a kind of kick-out clause.

If you need to sharpen the pencils or maybe redesign the analyses, then you might go back through the loop again. And so I'm kind of pointing out the iterative nature of.

MEMBER ARMIJO: It would help me a lot if you could just describe the starting point where this scenario or scenarios, exactly what are they?

MR. GROSSMAN: Okay, that's a good segue for what I'm about to talk about.

MEMBER ARMIJO: And you're going to get into that because, to me that sets, the result's going to depend on what this intruder can do. and how many there are. And how long they stay there, a bunch of other stuff unrelated to the actual site itself. And that's arbitrary, or defined in some way. And so I'd like to understand that.

MR. GROSSMAN: So the first part of the intruder assessment, very much similar to what you might do in a PA, except in this case it's more constrained. It is scenario analysis, and so this would be evaluating what scenarios would result in your greatest dose for compliance.

And here we're qualifying that by reasonably foreseeable scenarios, and so we're not trying to leave this open for unlimited speculation about anything that could happen. We're trying to use site information, site-specific information to constrain that to some degree.

And so we do envision this process, considering the site information, to allow licensees the flexibility to define what reasonably foreseeable is for their site. Now that provides them flexibility in the near term, particularly when it comes to like land use in a region.

Like the example of, potentially it being on a reservation in the near term, if that's envisioned, I can foresee a licensee using that as a rationale for limiting scenarios.

We ran into a problem at longer time frames, when you go out further in time, site-specific scenarios based on cultural information I'll call it, and which I'll explain more on a later slide, things like land use becoming more difficult to defend because predicting human activity over long periods is very difficult to do.

And so we felt that for longer time frames, kind of falling back to the default scenarios that were used or considered in the development of Part 61, would limit endless speculation about future human activities, because these activities are typical activities that humans have been engaged in for periods of time.

Things like residence building, living on a site, you know, agriculture, those kind of activities, and so we felt that would limit then, endless speculation about what could occur for long periods. And so that's described in the Guidance.

The default scenarios for those who may not know. There are four that we'll pull out in the

Guidance. Two of these come from the EIS that was used to develop Part 61, that's the intruder-construction/discovery scenario, and intruder-agriculture scenario.

Intruder-drilling was developed later in an update to that impacts assessment, and a later NUREG/CR-4370. The intruder-well was actually developed in the EIS, the impact assessment for Part 61, but it wasn't a major scenario.

And so I'll kind of run through kind of the concept for each of these scenarios. Intruder-construction is, someone has come on to the site to construct a residence, was the hypothesis used in the development of Part 61.

They began excavating a foundation for a house that included a basement, and intruded into the waste. That waste is brought up to the surface, dispersed somewhat on the surface as they backfilled, and spread around the area and then the workers were exposed. So this is an acute exposure kind of scenario.

CHAIRMAN RYAN: You're assuming though, that, I mean again, this is fine for 1970 when it was written. But wastes aren't going to be used as loam for a lawn. I mean they're concrete, they're resins,

they're things that, you know, would be recognized. How do you, you know I think a lot of that kind of public scenario assumptions really need to be refreshed with what's reasonable.

MR. GROSSMAN: One of the assumptions was that the waste forms were not recognizable. If the waste forms were recognizable it kicked you into the discovery scenario, in this case. And at that point then, the excavator backed off, their exposures were limited to the period that they were digging down to the discovery and then stopped.

And so there is some recognition for that, and we intend with the Guidance to carry that recognition forward.

CHAIRMAN RYAN: And if there have to be intruder barriers, you will get a return on your drill bit that will tell you this is not right, real quick, like within three feet of the surface before you hit any radioactive material.

MR. GROSSMAN: Right.

CHAIRMAN RYAN: That's all creditable.

MR. GROSSMAN: That's the intent, is if you can demonstrate that, that could occur and for how long it can occur, then we would envision that licensees can use that information to limit scenarios.

MR. MCKENNEY: And the Guidance also has, you don't have to use the default scenarios. You can use site-specific scenarios. And using even the default scenarios still would take into account site conditions which it would, what is the actual depth of your burial compared to what the assumptions were where the other thing --

CHAIRMAN RYAN: Yes, okay.

(Simultaneous speaking)

MR. MCKENNEY: -- scenario, dug down three meters, and you're well below that with your waste starting at 15 meters, like WCS affectively after covered, then that scenario would result in big zeros. So you would be looking at the other scenarios for what ones would intersect with your facility.

So it's a combination of the generic structure of the original scenario, but still with your site-specific conditions, and --

CHAIRMAN RYAN: Yes, that sounds pretty good. Because it's very clear that you can use site-specific data to better inform the structure of a given type of scenario, that's fine and dandy. Okay.

MR. GROSSMAN: So the intruder-agriculture was kind of the chronic extension I think then of the intruder-construction, this is the person who would

live in the residence that was built onsite, and they grow some of their food in the soil that was formerly waste that was unrecognizable and spread on the surface.

Intruder-drilling was later considered in an update to the methodology of Part 61. In this case you had a drill crew onsite, they may have been installing a well or exploring for resources. And so they drilled through the waste site unknowingly, and in this case the drilling mud was put into a mud pit and so forth and there was --

CHAIRMAN RYAN: You know, I guess in most soils drilling that I've seen, you start hitting something like what was disposed, one, it won't look the same, again and up and to it, it's going to rattle the, you know, the drill rig right off its feet.

MR. ESH: It depends, and the issue is, it depends on your disposal system. So like, if you're disposing of barrels and carbon steel in a trench and you cover your trench up, and you advance forward 200 years, I don't know how much carbon steel, if it, say, it's a human environment, how much carbon steel you're going to find there.

CHAIRMAN RYAN: If I'm doing that within the last 40 years, I'm going to have some kind of an

intruder barrier on top of it. You know, I just think that's a bit of a reach to, when is it unrecognizable?

MR. ESH: Well, I think what Chris said is we allow people to provide a basis for when it's recognizable and when it's no longer recognizable, so that affords you flexibility to demonstrate what you think you need to demonstrate.

(Simultaneous speaking)

MEMBER POWERS: I actually like what you've done here. I like the fact that you constrain speculation because that can quickly become rampant.

MEMBER ARMIJO: Well, if it's constrained, well defined, prescriptive in my opinion, then you'd say, that's the only thing you'd have to evaluate.

MEMBER POWERS: I think they are, once you get out, the end of this kind of intermediate term period that they've essentially, because of the speculation problem, they've essentially made it prescriptive.

PARTICIPANT: I mean, hopefully by --

MEMBER POWERS: But done with flexibility to say, well, you don't have to do this.

MR. WIDMAYER: I still want to know if I can flexibilize myself out of the inadvertent intruder?

(Simultaneous speaking)

MEMBER ARMIJO: That's a bigger issue perhaps.

MR. ESH: I think if you, did you say flexibilize?

MR. WIDMAYER: Yes.

(Laughter)

MR. ESH: Flexibilize yourself out of the inadvertent intruder scenario completely, you're affectively relying on controls for longer than the 100 years that's put in the regulation. So, because I think you're always going to have some land use.

It might not be very disturbing, you might not build a house, but you can have recreational use, hunting, hiking, all those sorts of things that happen that you should, at a minimum have that type of scenario if you're not going to be doing the disturbance scenario. But it becomes difficult to argue you're not going to do the disturbance scenario --

MR. WIDMAYER: If I put all of my long-lived waste or anything that I have a problem with the intruder, 100 meters or deeper, and I put it out in the middle of nowhere where I don't speculate anybody's going to build a house over the next 10,000

years?

MR. ESH: Yes, I think that's fine, Derek, I don't disagree that certainly disposal depth is a very good way to mitigate this risk.

MR. WIDMAYER: I'm trying to give Dr. Armijo a chance to figure out how to --

(Simultaneous speaking)

MR. ESH: But I would say what's the likelihood, if I asked you 500 years ago, what's the likelihood that there's a multi-million person city in the middle of the desert in Nevada, what would you have said to me? I think you would have said the probability is zero.

CHAIRMAN RYAN: He's got you there.

MEMBER POWERS: People said that ten years before it was built, they said that back when they were trying --

MR. ESH: That's what you're dealing with, with the human part of the process, is that --

(Simultaneous speaking)

MEMBER ARMIJO: But you always go back to this thing if somehow, everything we know up to now, all our technology, all our history, all our regulatory practices, our government, has somehow just been lost.

And all of sudden we know nothing, and we just are innocents wandering around the desert deciding to drill a well. And 500 years from now, 1000 years from now, 20,000 years from now, and I think current generations have no responsibility for those people if society falls apart.

Now if society continues, we have a government, maybe the right thing to do is we don't close up a site at 100 years automatically. You do an assessment then, and say should we close it up or not? You know, the city's building around us.

It seems to me like there's a more practical ways to deal with this as you go, rather than trying to predict what may happen way out in the future, based on an assumption that we're going to close this thing down and then forget about it. Society will fall apart, and then intruders will be wandering around doing a variety of things.

CHAIRMAN RYAN: I think there is an option for that, and that's in the institutional control period. There certainly is for the sites I'm familiar with. There's no guarantee it's going to continue, and there's no guarantee it's going to stop.

It's based on the assessment of the performance data and the environmental monitoring

data, as that closure period marches on.

MR. MCKENNEY: Based on a current experience of institutional controls is that they don't really rely, they aren't reliable. We've had many occurrences of failure of institutional controls over the last 30 years just from Superfund sites, and other sites --

MEMBER ARMIJO: From nuclear facilities?

MR. MCKENNEY: -- and underground sites, and others where you're getting to a point in the environmental monitoring where you're like going back every five years. You don't have anyone there anymore. That's when the intrusion can occur, in between there, is if there is faulty maps or other things like that.

And you can still have well drilling or resource things, or you can just have people who go through. And that is one of the things, not with a full government's release, but there is a period in time which there was access that was available and that was, it will be done.

People doing construction all over the place hit gas lines that should have been well known about it, they're being used right now, but they hit them now.

MEMBER ARMIJO: I think the conditions --

MR. MCKENNEY: -- or obstruction concentrations, so --

MEMBER ARMIJO: I would think that you can go to the Los Alamos Laboratory and find periods where they have encountered in reports of construction discoveries from the late '50s that --

(Simultaneous speaking)

MR. ESH: No, I think that's what we're talking about. I mean we work for government, and we're much less confident putting faith in the intelligence of government, so that's effectively what we're talking about here.

MEMBER POWERS: But, I mean, still you had built this in where you give them credit, and the intruder runs into something, that he's going to respond, he's not a complete idiot. And say, oh, it's warm and nice and I want to get down here and cuddle up into this stuff.

(Laughter)

CHAIRMAN RYAN: On the other side of that coin, you can envision a site that has a very robust institutional control fund in the tens, if not hundred millions of dollars, or $100 million and, you know, there's at least some form of government that's got

cognizance and oversight of the facility that's funded for, you know, very long-term care monitoring and maintenance.

So, you know, you can go to the end of that spectrum. I think the idea is if this, you know, at least allows for a probability that's fairly reasonable that the appropriate long-term care would occur.

(Off microphone comments)

MR. GROSSMAN: Slide 21. We do allow licensees in the Guidance the flexibility to consider site-specific scenarios and this gets into much of what we talked about already. They can account for physical information, and so an intruder who encounters an engineered form that's still intact and recognizable would not be, we don't envision them to be so stupid as to continue.

CHAIRMAN RYAN: Chris, somewhere on the next few slides, I'll let you pick a place to take a break, because we're scheduled for a break, and I don't want to hold folks to long without.

MR. GROSSMAN: Okay, I forget, how many do I have here? Let me finish mine and then we'll take a break at site stability, and then Dave can come back --

CHAIRMAN RYAN: That's at Page 21?

MR. GROSSMAN: That'll be slide 22.

CHAIRMAN RYAN: Okay.

MR. GROSSMAN: Okay. And so some of the information that we talk about that licensees could consider for physical information would be things like waste characteristics. If my waste has disappeared, no need for intruder assessment to go beyond that, and so you can consider the time frame over which your waste would produce a hazard for an intruder to encounter.

Facility Design, do I have barriers in place, et cetera. And site conditions, you know, is it hospitable, or inhabitable environment, those sort of things. Also for the near term, the Guidance focuses on land use and that being acceptable for constraining scenarios.

Longer term, as I mentioned, that becomes more problematic and more challenging to do because trying to predict what human land use would be over long-term is difficult, if not impossible. And so the Guidance, it does kind of specify that, that would be used more for the near-term considerations.

And then the site-specific scenario should consider changes in things like the site environment

over time, the degradation of engineered barriers over time, those kind of things.

So once you've formed your scenarios, and then we would abstract your system or simplify it for mathematical models. And in this case, intruder assessment is similar to PA but probably more simplistic than a PA. It's an onsite assessment and so you're not looking at off-site transport in that case.

What you're probably focusing on here are intruder barriers, source term, what are the concentrations that an intruder might encounter. There may be some onsite migration, and then the dose assessment itself.

And so we have guidance in terms of extracting each of these areas, and how to represent them in a model or ways that a licensee may take to represent them in a model.

And so for like intruder barriers, there's guidance on assessing the capabilities of the barriers, how they'll degrade over time, and uncertainties associated with that degradation in their capabilities.

The source term, we kind of envision two main source term scenarios, I'll call it, for lack of

a better term right now, direct contact and then potential for some onsite migration. The onsite migration being like radon diffusion to the surface, and which the intruder never actually contacts the waste but may be exposed to it unknowingly still. And then we get to the dose assessment. So with that, if there aren't any questions, we can go to a break.

MEMBER ARMIJO: How about just living there? That's the radon thing, you know. Somebody decided he's going to build a housing development right over the --

MR. GROSSMAN: So they never contact the waste, but they say they still --

MEMBER ARMIJO: And you recount that they live there forever. Do you have a scenario for that? Would that be something that the depleted uranium is the --

MR. GROSSMAN: Right.

MEMBER ARMIJO: -- the culprit.

(Simultaneous speaking)

MR. MCKENNEY: We're focused on annual dose. Even I find now, that over a year that a member of public lives there really does not come into the equation that much, because it's an annual dose, saying it's the contact is --

MEMBER ARMIJO: Okay.

MR. MCKENNEY: -- largely, so for an actual individual it doesn't really matter if he lives there for five years, ten years, or anything else.

MEMBER ARMIJO: As long as you stayed below the 500?

MR. MCKENNEY: Yes, right. Because any long period of extra radon that you'd be getting, so that a dose for that individual would actually go up quite a bit, but not increase your volt during that human lifetime because of the slowing growth of all of the parents.

CHAIRMAN RYAN: Or 100 human lifetimes in a row. You remember --

(Simultaneous speaking)

MR. MCKENNEY: Right, the lifetime dose may be quite a bit different than the annual dose.

CHAIRMAN RYAN: Anyway, okay. Well that's a good place to take a break, we're scheduled for about 15 minutes so we'll reconvene at 3:40.

(Whereupon, the foregoing matter went off the record at 3:23 p.m. and resumed at 3:41 p.m.)

COURT REPORTER: Come to order, please.

CHAIRMAN RYAN: Thank you. Okay, who's up? Chris, are you up? Oh, David's up again. David?

Thank you.

MR. ESH: Let's change gears now and we'll start talking about the site stability assessment. What you see on slide 23 here is a diagram of the major components of the site stability assessment, which involves the site characterization. So that's where you're looking at the characteristics of your site including the disruptive processes that may affect it, mainly natural disruptive processes.

The technical assessment that you may perform to evaluate the stability, and in this Guidance Document we cover the approaches, tools, and models, and associated uncertainty with the assessment.

And then you may attempt to mitigate the instability through engineered design, and we give some guidance on developing engineered designs for stability and talk about some long-term considerations. And then how all of these things are integrated or combined with evaluation and monitoring.

So the site stability assessment applies to the stability of the waste facility and the site. For something like short-lived waste, you're going to be primarily focused on the stability of the waste, and maybe somewhat the stability of the facility.

For longer-lived waste, then it becomes much more a stability of the site problem, unless you went to a very robust engineered design, but those typically aren't utilized for low-level waste disposal in the present day.

Stability is required for 61.44 and what we expect, and it's conveyed in the Guidance, is that people will tailor their analyses to the types of wastes disposed, as I discussed under the first bullet.

Now the next three points are important, and I'd like the Committee to think about, and if you have some views, certainly express them or maybe give us some feedback in the future. But one area that we would like some feedback on is the disruptive events cutoff frequency.

So in, say the high-level waste program they defined what events you should consider down to a low probability, cutoff frequency of 1E to the minus 4 chance of it occurring over the next 10,000 years or implied 1E to the minus 8 per year annual frequency.

In this Guidance we didn't specify a numerical value for the cutoff frequency. What we basically say is that, include those events that are probable of course, over your evaluation period

consistent with the type of waste you're disposing of, to unlikely.

So that implies a higher cutoff frequency than, say, what was used for Yucca Mountain. And we think that's appropriate because if we do have the intruder assessment performance objective, 61.42, that involves some sort of human activity at the site and/or some form of disturbance, possibly.

That form of disturbance results in usually higher concentrations and less dispersion than would be associated with a very low frequency natural event of some sort. So that gives you a kind of a floor of where to set the cutoff frequency for considering disruptive events.

MEMBER BLEY: You turned it to Yucca, what did Yucca use? I don't remember.

MR. ESH: They used 1E to the minus 4 chance of occurring over 10,000 years, or affectively 1E to the minus 8 per year annual frequency.

MEMBER BLEY: And you just argued that you want something lower than Yucca?

MR. ESH: No, higher.

MEMBER BLEY: Higher, okay.

MR. ESH: Higher, because we have the intruder performance objective that results in direct

disturbance and less dispersion than would be associated with these very low frequency natural events, is kind of the construct that we came up with.

MEMBER ARMIJO: David, what are these disruptive events, is that a volcano, massive flood, or?

MR. ESH: Yes, I'll show you in the next slide here. The next point is the instability we're recommending is defined by risk, not loss of material. So you could have some situations where maybe you have a large loss of material but you also have low risk.

Maybe there's very high dilution associated with the event, for instance. But we do recognize and some stakeholders expressed this in their comments that hey, it's just not reasonable. If you have a site and it's going to be completely destroyed by some process.

They didn't come out and say that you can't define the risk, but they said, that should be exclusionary for taking that action. You haven't put the site in a good place if it's going to be massively disrupted.

(Off microphone comments)

MR. ESH: So for large loss of material, the risk may not be able to be defined, is what we

talk about in the guidance. So your question, what sort of processes are you talking about? Well, in the site stability assessment we are recommending that it's tailored to the type of material you're disposing of and to the particular site.

So if you're disposing of short-lived waste or say low concentrations of long-lived waste, then you're much more concerned with the shorter time scales and smaller spatial scales than you're talking about with higher concentrations of long-lived waste, where you're worried about the stability of the site itself, as opposed to stability of the waste or the facility.

The types of processes that we're talking about are things related to climate, tectonic, so earthquake type events, faulting, igneous activity, so volcanic activity, but mainly for near surface disposal, the bottom three.

Erosion processes, which can be event-driven, or kind of continual processes, biologic effects, so disturbance of biota for instance, disruption of barrier material for instance, and then climate effects such as glaciation as you go out for longer times.

So this figure is in the Guidance

Document, and it's attempting to help risk-inform the site stability assessment so people can tailor it, the types of things they consider, and the time and spatial scales that they consider for their particular problem.

So the topics that we discuss in the Guidance are disruptive processes, natural and anthropogenic, what are available tools and models to evaluate site stability, what are some approaches that you can use for the assessment.

And in this area we do get a little more prescriptive, we have some steps that you can walk through to try to do the evaluation. We talk about uncertainty, of course. We try to talk about that in all our sections, where applicable.

And then there's guidance on engineered barriers, especially engineered barriers for erosion control, because that's one of the primary processes we consider that may be affecting stability. And then we also talk about some long-term considerations.

So there's a difference, if you need to demonstrate an erosion control barrier for a few hundred years compared to many thousand years, for instance. You're talking about different problems.

And one of the things I would show you is

from this figure in the document, which is taken from NUREG/CR-2642, which shows that under different climate conditions and different conditions at the top, moisture availability, temperature fluctuations, and how, basically organic matter production, you have different processes that are going to really affect your rock durability.

And in this case erosion control review is primarily achieved by using durable rock. The types of rocks you select and how you do that evaluation, should be tailored to the types of material you want to dispose of.

There's a lot of good, old NUREGs and technical reports and guidance documents on this topic and a variety of other topics, and as I said at the outset, we attempted to evaluate this information and bring forward a lot of it that we thought was useful and important.

But ideally that's a much bigger effort. There's a lot of material out there, and if we really wanted to do a great job at it, it's going to be something that we will do in the comprehensive rulemaking. But I do feel that what we have now is a very good product for the limited rulemaking.

So then the next section after site

stability analysis that we have is on long term analysis, and I want to make it clear it's only required for the disposal of long-lived waste. And the two analyses types that we're looking for are an analyses of how the design and site are going to limit the long-term impacts.

MEMBER BLEY: On the last one, could you come to a conclusion about where you were thinking about setting that limit, you said above, higher than at Yucca?

MR. ESH: Oh, I see, the disruptive event cutoff frequency. Yes, we didn't provide a numerical value. What we basically said is, probable to unlikely consistent with the material you're disposing of.

So if you have short-lived waste that you could argue, it's basically gone in 500 years, well probable to likely would, in my interpretation would be up to maybe a ten percent chance of occurring over 500 years, or ten times 500, one over ten times 500, 1 in 5000 type of frequency you would look at for that type of calculation.

If you go out to 20,000 years, then you'd be looking at 1 over 20 times ten, or one in 200,000, is that, five even minus five, I believe, cutoff

frequency.

MEMBER BLEY: Okay. Because I was thinking of what we do with reactors for risk to people alive today, not out in the future sometime, and LERF I think, dose commission still sits at about ten to minus six per year.

MR. ESH: Okay, so it would be somewhat consistent with that.

MEMBER BLEY: And that's a bad, I mean that's a bad release. That's very energetic and very large.

MR. ESH: Yes, and so this issue comes into play though, when you're dealing with the extended time frames as how, what sort of events do you want people to analyze and what sort of frequency you think is appropriate for them to analyze.

MEMBER BLEY: And I was just kind of reflecting on what Sam said earlier and I, whether we totally discount the future, which is hard to buy into, it seems protecting future better than we protect today is a little hard to justify.

MR. ESH: Yes, that's a principle in the transgenerational equity literature that you'll see, that you have an obligation to protect the present generation primarily, and then you also have an

obligation to protect future generations, but not at the expense of the present generation.

And that becomes very complicated if you have to invest a huge amount of resources today to afford that protection in the future.

MEMBER ARMIJO: They make it very clear though, that you're, and I haven't bought into it, it's a moral or legal obligation, but they argue that your obligation is limited to catastrophic. Protect people in the future from catastrophic situations that you've created today.

MR. ESH: Yes.

MEMBER ARMIJO: And that's not unreasonable. So but from a very low exposure, I don't think that's really consistent with that thinking. So that's where I have a problem with it. Low-level waste, why are you protecting somebody 20,000 years out into the future from some limited exposure, low dose of low-level waste. If it creates a burden on present. It just doesn't make sense to me.

MR. ESH: I mean, if you were purely looking at the world from a risk perspective, you would argue that almost all of our nuclear-related limits are probably way too low, considering the risks

that we accept in all sorts of other fields and activities.

But that certainly is a good comment and certainly in this limited scope rulemaking, we didn't feel we had much ability to do anything drastic in that area. In the more comprehensive rulemaking, it's certainly an issue to discuss, but what you'll find in other waste disposal programs or in other problems is, they'll take it a step further.

In some cases they'll say, you have an obligation to protect the future generation the same as today. Not just catastrophic, but you have an obligation to afford the same protection to.

MEMBER ARMIJO: And they have no obligation to protect themselves, that what it implies, and I'd say nonsense.

MR. ESH: Well I would say --

MEMBER ARMIJO: You know, first of all, that's a philosophical point of view.

MR. ESH: Yes.

MEMBER ARMIJO: And a lot of people might agree with it, a lot of people might disagree with it. But the point is, it's not a law. It's not an NRC policy as far as I can tell.

MR. ESH: No, and I think that we would

benefit from, because the waste problems are a little different or a lot different, especially with the time frame, we would benefit from having something like that then we could use to formulate the constructs that we make on these types of problems.

So the site stability analysis we covered, disruptive processes, available tools and models, the approaches to the assessment, uncertainty, the engineered barriers, and the long term considerations.

Two types of analyses that we expect are analyses of how the design and site limit the long-term impacts, and then a calculation of the peak annual dose, and this is kind of a transparency with stakeholders' requirement.

We think at a minimum, this first type of analyses is your showing how your science and engineering is going to limit the impacts from your action. We don't think that's a high barrier to get over. Do the best that you can based on your current science and technology, and show us how your system is working and your site is working.

The second part is calculation of the peak annual dose. We don't assign a limit to it. What we would do if the facility was in NRC space, if we were doing the review and evaluation, is we would consider

these longer term doses in the context of the site environmental assessment.

And that way you can put them in the right, you don't have to be obligated to a very low dose value for a long period of time, the risk context that's a lot different than that. You can put things in the proper context and look at all the impacts, and essentially I believe for these longer term things you would want to make some sort of cost-benefit argument as to what you're doing is appropriate.

So for the long-term analysis section, we provide guidelines for long-term isolation, so those are things that generally are favorable to achieving waste stability and long-term stability, such as, you know, there are some examples in the literature of some very long-lived near surface environments.

And those that are generally hyper-arid, and you want to have low relief, for instance, that's just one example, a couple of features that attribute to long-term isolation. Certainly depth, as I believe Derek mentioned earlier, that's a good way to achieve long-term isolation.

The Long-term Analyses section provides the scope of the long term assessment, what should be done in it and the types of analyses. And in it we

discuss barrier and component analyses, so these are types of things you can do to demonstrate how your system is performing, both your engineered barriers and your natural system barriers. And you can do various approaches, one-on, one-off, or different types of factorial analyses to demonstrate how your system is performing.

So then moving on, our next section in the Guidance is Other Considerations, and this is where we talk about things like inventory limits, and mitigation, and insignificant quantities. The inventory limits we think is important that it is a method to manage irreducible uncertainties.

So if you're getting into one of these situations of like high technical argument or maybe you have sparse data, one way to manage that is to change the amount of material that you're taking. That's a good way to mitigate your uncertainties.

Some uncertainties may be irreducible in these types of problems, but the what you do with the inventory is one that's under your control. Mitigation actions that we don't expect, especially for conservative assessments with a good technical basis, but it's not unanticipated that it could occur.

Sometimes you get new information, new

scientific and technical information, either in general about how things work, or specifically at a particular site, that may call into question your previous assessment and cause you to need to take some sort of action.

In most cases, usually a reassessment technically might be the only mitigation you need, but in rare circumstances you might need to look at removing some material that we would expect and the Guidance talks about, you should do a cost-benefit analysis and look at some things like worker exposures if you were in that sort of situation.

And then we think it's useful to define insignificant quantities to help risk-inform the process. Just because you have a few atoms of some material doesn't mean that you necessarily need to be performing a detailed technical analysis of it.

So the people do define some insignificant quantities for their particular site, that may be a good practice both operationally and from a regulatory perspective, because for all the effort that we have to spend reviewing something that is insignificant it takes away from the effort that we can place on something that is significant.

And I think that's lost when people argue

about small details, and minutiae, and some of these types of problems and reviews is, you simply have to be risk-informed in order to be provide the most protection.

So in the Other Considerations section, we provide things like flow charts that, you'll see this when you get to see the Guidance Document. It's not intended to look at in detail on this slide. It's just an example of, we provide tools to help the people using the Guidance use the guidance to facilitate implementation.

And then the last section before the Crosswalk section of the Guidance is a section that we call Performance Confirmation. It's basically consolidating the information that you would provide under the requirements listed here to ensure that the facility performs as intended.

And basically, technical analyses we expect may be updated during operation, and will be operated at final closure based on our proposed draft rule language. The technical analyses should be updated when significant changes occur.

We aren't specifying in the regulation that it needs to be done at a regular interval. At a minimum, it needs to be done if you have some sort of

significant change so that you can justify you're taking material that you should take and you have basis for it.

CHAIRMAN RYAN: Or you change your disposal technology --

MR. ESH: Or change your disposal --

CHAIRMAN RYAN: -- or something like that.

MR. ESH: A variety of different things you could do to alleviate the problem. We do place emphasis on performance indicators rather than, say, downstream monitoring in a well. NUREG/CR-6948 was the NUREG that was developed by our research group a few years ago, looking at monitoring of nuclear facilities and especially waste disposal facilities.

And for them, there may be significant contamination that could result by the time you observe it in your monitoring well. If you're still doing things at the facility, you want to learn about problems early instead of late, so that you can take some sort of action to mitigate them. So that's what the basis for using performance indicators are.

So our conclusions on the Guidance Document is, we feel it's risk-informed, there's a lot of material in there that lets people do the right thing with their analyses and it provides flexibility

when warranted. We don't provide infinite flexibility.

There's some things the staff have opinions on about the right way to do certain things, and the Guidance Document says, this is what we think, the way you should do it.

We are considering development of consolidated guidance after the second comprehensive rulemaking. That would be a big effort that would have to be budgeted and all those sorts of things.

And one thing we felt might be useful, because as was stated, all of this regulation or implementation of this regulation for the operating disposal facilities happens in Agreement States currently, is maybe we should put together a class and training materials to go through some of this.

And allow the Agreement States ask all the questions they need besides just sitting there and reading a 160 page document. So we thought that might be a useful thing to do. We haven't done that yet, but that might be a useful thing to do. We'd like to hear your thoughts on it, so I think that's all we have on the Guidance.

CHAIRMAN RYAN: Oh absolutely. I think a lot of the Agreement States that have to deal with

this have, obviously limited staff. They usually have one or two folks that have really dedicated their work to the waste site. And, you know, those folks, retired, get better jobs, they come and go, and so it's kind of a constant.

PARTICIPANT: What could be a better job?

(Simultaneous speaking)

(Laughter)

CHAIRMAN RYAN: But I fully endorse your comment that having something to support the Agreement States, particularly in this transitional learning phase that will come, is critical as well as a great idea. I mean, I think it really has to be done because they'll be floundering. Is nobody not in an Agreement State?

PARTICIPANT: Yes.

CHAIRMAN RYAN: So, okay. Path Forward.

MS. JACKSON: I'll just sit here. For the Path Forward we have three points, if Stan wants to go through it. We do plan on coming back in September to meet with the full Committee to --

CHAIRMAN RYAN: That's five times the -- three times the fun that you're having today.

MS. JACKSON: Yes.

(Laughter)

(Simultaneous speaking)

MEMBER POWERS: You need to think carefully about when you come down here. Because you're going to have to bring people up to speed in a short period of time and things like that. And there's a need to enter strong points early.

MS. JACKSON: Thank you, that's a good point.

MR. ESH: We thought you would bring them up.

MEMBER POWERS: Well, maybe with the appropriate introduction from the Chairman, certainly I can help you do that. But I think there are points that certainly you helped me a lot today. But I think that, that could appear very early in the discussion of what you're trying to do.

The kind of conclusion statement that you had that you, flexibility without infinite flexibility and things like that, maybe that ought to show up very early in your presentation so to kind of give them a high sign, so they don't get too lost in the arcane before they understand what you've been trying to do.

CHAIRMAN RYAN: Yes, and early on I would, you know, you've got the goals and objectives for this work, and I would say key results to date. And have

that key results to date right up front, and say we're going to go through some of the background of these key results and how we got there, but we wanted to at least give you the outline of those key results --

MEMBER POWERS: Get your, your bottom line is, in my mind, a lot stronger than your introduction right now.

MS. JACKSON: Okay.

MEMBER POWERS: And you don't want to lead that, the full Committee on, it's not a mystery. Hit them with your best shot right up front, and then tell us why you had that best shot, rather than building up to the best shot.

MS. JACKSON: Okay, thank you for that.

MEMBER ARMIJO: One thing you may have covered but somehow I missed, is the impact that this rulemaking on the existing waste disposal sites, as compared to a brand new site that's going to go into the business.

You know, and under what conditions there could be no impact, or if they start accepting let's say depleted uranium, they've got to do something else. And so that would help to put things in perspective, at least for me it would.

MS. JACKSON: Okay. Did you want to say

something?

MR. MCKENNEY: Oh, for, this is Chris McKenney. Already we have this bias going into the rulemaking, first of all. The State of Utah put into place a rule that required Energy Solutions to create a PA that they had to supply in June of this year to the State of Utah for their, they have a performance assessment covers a lot of these characteristics, a different time line at the time for period of performance.

But they do have a PA already in place, or a PA that they've submitted. And the State of Washington's did go back for an EIS in the past time, that they would have to, of course redo an analysis for if they want to take more uranium or depleted uranium, but they did include uranium in that analysis.

They went up to 100,000 years for total length of time, 10,000 years point of compliance, period of performance 100,000 years for others, did intruder dose analyses for the site. WCS has just gone through it's original licensing with a peak dose of a 40,000 to 50,000 year time period, which is what their analysis had to do.

They did not have significant quantities

of depleted uranium in their original analysis so they'd have to revise that. And I'm not quite up on, eventually exactly what Barnwell tried to do. Oh, I'm sorry about that. So I mean, so for --

MEMBER ARMIJO: You might just kind of let people know up front, okay, in your presentation that hey, this is where the impact is going to be, and this is what's currently going on. It would help.

CHAIRMAN RYAN: Yes, that's something that would be very helpful I think for the rest of the Committee up front.

MS. JACKSON: Okay. And two more points. We'd like to request a letter from the SRS after the September meeting.

CHAIRMAN RYAN: No problem.

MS. JACKSON: Thank you. Because they planned on having the whole package up to the Commission in early 2012.

CHAIRMAN RYAN: Okay.

MS. JACKSON: And that ends the staff presentation, thank you for your time.

CHAIRMAN RYAN: Thank you all very much for an engaging session. I think it's been a real beneficial conversation with the Subcommittee, and you put a lot of work into organizing it for us today. We

really appreciate it very much.

I think it will help us work with you and with the full Committee, and come up with a draft letter that we'll work on at that meeting and finalize during that meeting week. So we'll keep you up to date on our letter writing schedule and plans so that you can --

MS. JACKSON: Okay.

CHAIRMAN RYAN: -- observe that activity as well. We're going on, Dr. Bley, any?

MEMBER BLEY: No, nothing. I look forward to seeing the methodology when you get the --

MEMBER POWERS: I think I have to say that I was very pleased at what I saw you trying to do in, especially when you're trying to constrain rampant speculation in the longer term. And that you were still allowing good credit for barriers and defenses and things like that.

I thought that was a very powerful concept that you were trying to advance. I think I did not appreciate as much before as I do after, that you were working on a limited rulemaking package and that you were constrained on what you could do here.

And that emerged as things went along. I think you might want to lay that out pretty clearly at

the beginning with the full Committee, understanding they will not appreciate what that is, and you'll have to explain what you thought the constraints were on that.

I think, much of the stuff I like. I mean, there were lots of mysteries to me like, why 20,000 years and things like that. You guys could explain that and you're going to have to pick some number, all right 20,000 is the number.

But the general strategy of trying to bring risk into this field, but you can't go whole hog because we don't have what the initiator frequencies are and things like that is, and it was pretty interesting. You know, I think, I'm quite favorably impressed with what they have tried to do here, given the constraints that they had.

CHAIRMAN RYAN: Excellent.

MS. JACKSON: Thank you, the staff has worked very hard.

MEMBER POWERS: It shows. It definitely shows that you've thought about these things. I mean just in the way you answered the questions, you didn't treat us as stupid. You kind of explained things as though you'd thought about it broadly, and I was quite pleased by that.

MS. JACKSON: Thank you.

CHAIRMAN RYAN: Mr. Ray?

MEMBER RAY: Well, this is a learning experience for me. I certainly look forward to supporting the letter to the full Committee when it's developed.

CHAIRMAN RYAN: Thank you.

MEMBER RAY: Based on --

CHAIRMAN RYAN: That you're satisfied with our vigorous examination.

MEMBER RAY: What?

CHAIRMAN RYAN: If you're satisfied with the Subcommittee's vigorous examination?

MEMBER RAY: Oh, well I'd --

(Laughter)

(Simultaneous speaking)

MEMBER RAY: Sufficient is the right word.

CHAIRMAN RYAN: Sufficient, okay. Dr. Armijo?

MEMBER ARMIJO: Well, you can tell I'm pretty apprehensive about, because I've seen, see a lot of the language and the approaches that remind me of what happened to the Yucca Mountain which I think was excessive in so many ways.

But I think you present your case very

well. I don't agree with the 20,000 years, I think the Department of Energy has it right and I think we would have an issue there.

And the intruder, I really got to do a lot more about that intruder, you've helped a lot in explaining what they can and they can't do, and the extent to which you feel obligated to protect them. And that's still debatable, but I understand where you are now.

And I think your wrap-up slide gives me more comfort than what I felt at the beginning, because I just saw this is getting, we're going to turn low-level waste into the Yucca Mountain model, which is, basically was so open-ended, I don't know how anybody could ever make that thing work. So I think you're ready. There'll be controversy.

MS. YADAV: I just want to make the comment. You weren't present at the briefing that we did, I think in June, where we presented our rationale for the period of performance and how we selected?

MEMBER ARMIJO: I was here. I think, I'm pretty sure I was here. And I didn't like it then either --

(Laughter)

(Simultaneous speaking)

CHAIRMAN RYAN: All right. Dr. Armijo, thank you. Let me add my thanks for again, a very productive and I think engaging day. Everybody that presented and those that were helping out, it's a, oh, I'm sorry, we'll do that in a second, but I just want to add my appreciation as well.

We do have time for any members of the public or others that wish to make a comment? If there are any folks who would like to make a comment on the record, now is the time. Say none? All right, great, so there's nobody else who wants to make any additional comments at this time?

MEMBER ARMIJO: How about the bridgeline, was there anybody?-

CHAIRMAN RYAN: Is there anybody on the bridgeline?

PARTICIPANT: I don't think anybody checked in.

CHAIRMAN RYAN: Nobody checked in at the beginning, that's for sure. So if that's that, again I want to thank the staff for a very engaging day, we've learned a lot more. I've gotten a lot more insight into the detail you presented today which helped me a lot.

And it's been a good conversation, so with

that I think we're ready for a productive full Committee briefing and a letter thereafter, so we've kind of met our goal to get prepared for that.

MEMBER POWERS: Again, you want to think carefully about that presentation, because it could descend into just lots of debates over what you call minutiae, and miss the really salient things.

CHAIRMAN RYAN: All right, with that, if there are no objections, we'll call the Subcommittee meeting to a close. We're adjourned.

(Whereupon, the meeting in the foregoing matter was went off the record at 4:16 p.m.)

10 CFR Part 61: Guidance for the Low-Level Waste Rulemaking

Priya Yadav, Chris Grossman, David Esh

Division of Waste Management and Environmental Protection

Office of Federal and State Materials and Environmental Management Programs

Advisory Committee on Reactor Safeguards
Meeting of the Radiation Protection and Nuclear Materials Subcommittee
August 17, 2011

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Commission Direction

- SRM-SECY-08-0147 (March 18, 2009)
  - "…(2) to develop a guidance document for public comment that outlines the parameters and assumptions to be used in conducting such site-specific analyses"

Purpose

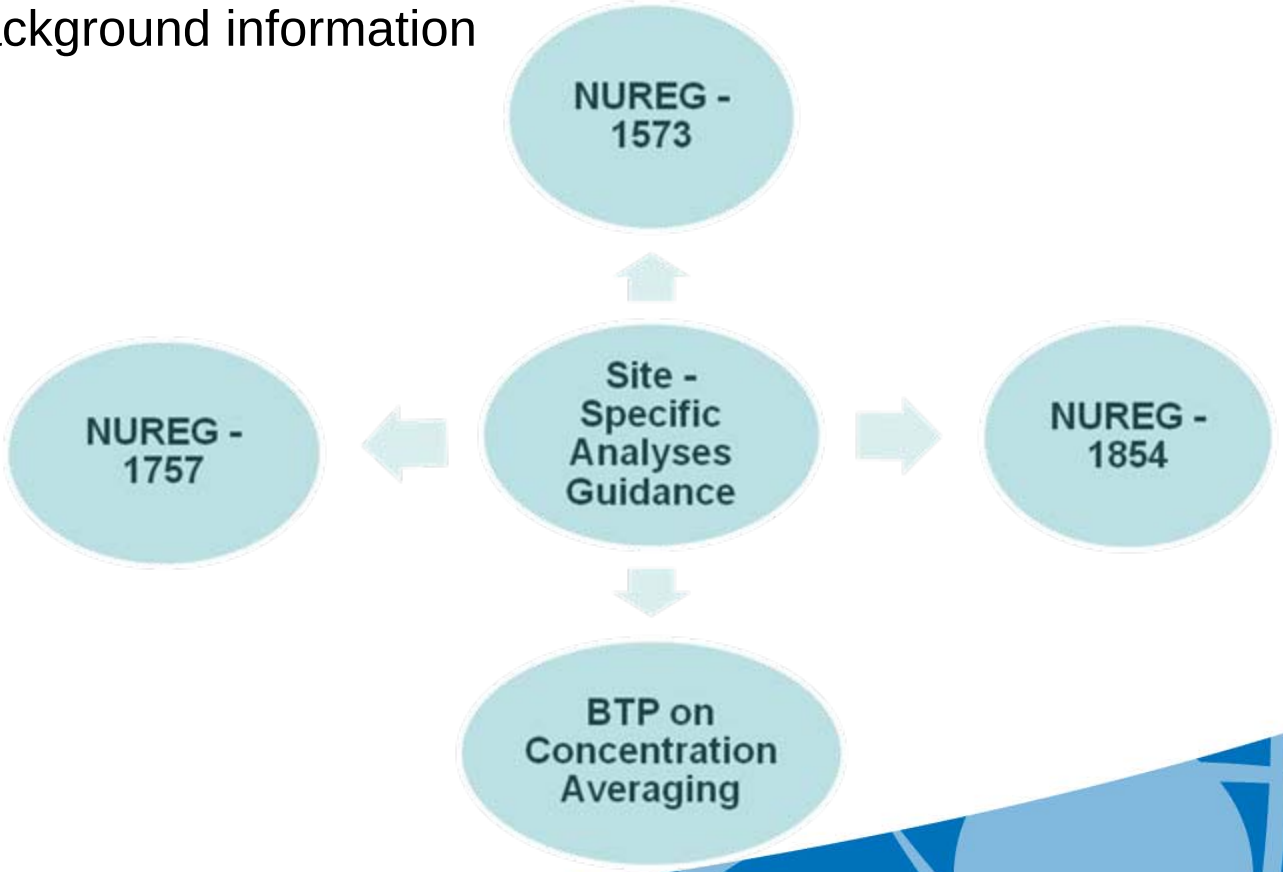
- Provides guidance on conducting site-specific analyses to demonstrate compliance with the performance objectives in Part 61:
  - Performance assessment
  - Intruder assessment
  - Assessment of stability of disposal site, and
  - Long-term analyses
- Provides implementing guidance in support of rule changes

Overview

- Supplement existing guidance:
  - NUREG-1573 , “A Performance Assessment Methodology for Low-Level Radioactive Waste Disposal Facilities” (October 2000)
  - NUREG-1854, “NRC Staff Guidance for Activities Related to US Department of Energy Waste Determinations” (August 2007)
  - “Issuance of Final Branch Technical Position on Concentration Averaging and Encapsulation” (January 1995, staff is currently updating)
  - NUREG-1757, “Consolidated Decommissioning Guidance”, (September 2006)

Overview

- Consolidates enough information to conduct analyses
  - Provides crosswalk to other NRC guidance documents for background information



Risk-Informed Approach

U.S.NRC
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- Discuss parameters and assumptions to be used in analyses in a broad sense rather than a prescriptive manner
- Allows licensees and applicants flexibility to address site-specific conditions
- Examples of risk-informed approach provided throughout document

Outline

- Main topics:
  i. Introduction
  ii. General Technical Analyses
  iii. Performance Assessment Modeling Issues
  iv. Intruder Assessment
  v. Stability Assessment
  vi. Long-term Analyses
  vii. Other Considerations
  viii. Performance Confirmation
  ix. Use of other NRC Guidance Documents

General Technical Analysis Considerations

U.S.NRC
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- Scope of the Assessment – features, events, and processes (FEPs) and scenarios.
- General Elements
- Period of Performance
- Dosimetry
- Uncertainty
- Peer Review and Expert Elicitation

Scope of the Assessment

- FEPs – identification, screening, implementation:
  - Formal or informal
  - Top-down or bottom-up
  - Iterative
- May be eliminated based on probability, bounding consequence, or physical reasonableness.
- FEPs form the basis for scenarios.

Scope of the Assessment - Example

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Example 2.1: Is my site simple or complex?

Simple sites are generally characterized by few disruptive processes, limited fast transport pathways, relatively homogeneous geology, high stability, and stable climatic conditions. Complex sites have higher uncertainty driven by more disruptive processes (individually and with cumulative effects), complex geology including fast pathways such as fractures, decreased stability and more highly variable climatic conditions. When there are more processes that can lead to significant releases, there will likely be higher complexity in the performance assessment of the site. The interpretation of site complexity will be influenced by the type of waste disposed. Long-lived waste disposal decreases the confidence that stability can be ensured and increases the expected variability in climatic conditions (because of the consideration of longer timeframes). In addition, the longer timeframes means that unlikely disruptive events will be more likely to be realized.

General Elements

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- Describe the general technical elements of the analyses:
  - System description
  - Data adequacy
  - Data uncertainty
  - Model support
  - Model uncertainty
  - Integration
  - Model Abstraction
- General elements comprise the framework of the evaluation.

Guidance on Period of Performance

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- Risk-informed, performance-based guidance:
  - Discusses flexibility for short-lived waste or low concentrations of long-lived waste.
  - Primary differences are in level of detail or justification for the calculations.
  - Provides expectations for long-term analysis.

Period of Performance – Example

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Example 2.3: A facility is expected to receive typical low-level waste generated by commercial entities (e.g. limited concentrations of long-lived waste). The waste has concentrations of long-lived radionuclides at or below one tenth of the values listed in Table 1 of § 61.55. Additionally, the facility is expected to receive waste with long-lived radionuclides that are not found in Table 1 of § 61.55 that is less than the natural soils surrounding the facility.

Conclusion: A performance assessment should be completed to demonstrate compliance with § 61.41, § 61.42, and § 61.44. Because the waste is dominated by short-lived activity and long-lived concentrations are limited, specialized models and associated model support for long-term processes (e.g., cycling of climate) are not necessary.

Uncertainty

- Probabilistic preferred, deterministic acceptable.
- For probabilistic, use peak of the mean output.
- Limitations of “one off” analyses.
- Risk dilution.
- Model uncertainty – consideration of physically unreasonable and highly speculative models should be avoided.
- Data uncertainty example: Transfer factors
  - Intra- and inter-site variability

Performance Assessment Modeling Issues

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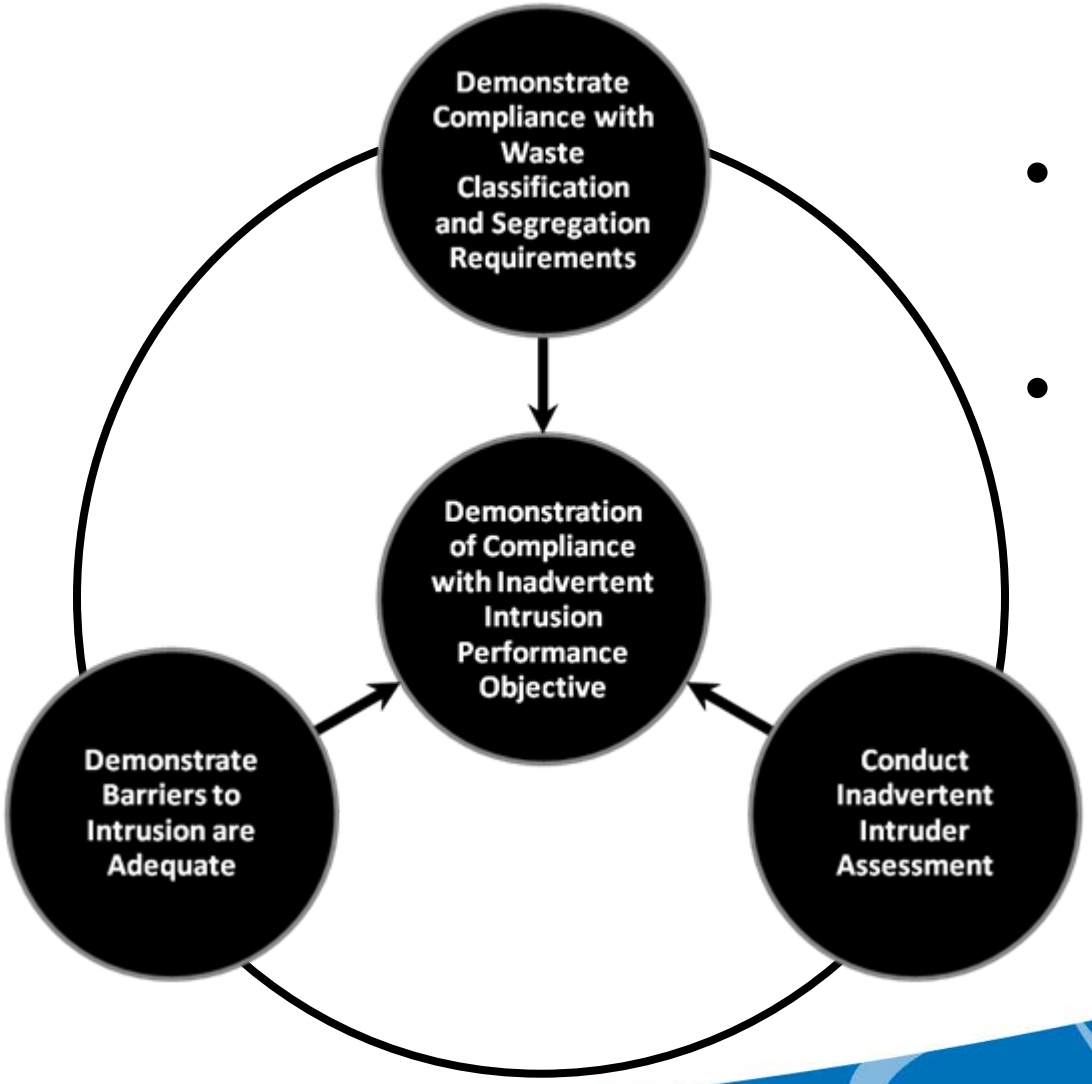
- Supplements NUREG-1573 PA approach
  - Source Term
  - Radionuclide Transport
- Outlines site-specific parameters to consider (e.g., radon, geochemistry, sorption, EBS degradation)
- Recommendations based on staff experience
- Evolution of the disposal system over time
- Parameter and model support

Intruder Protection

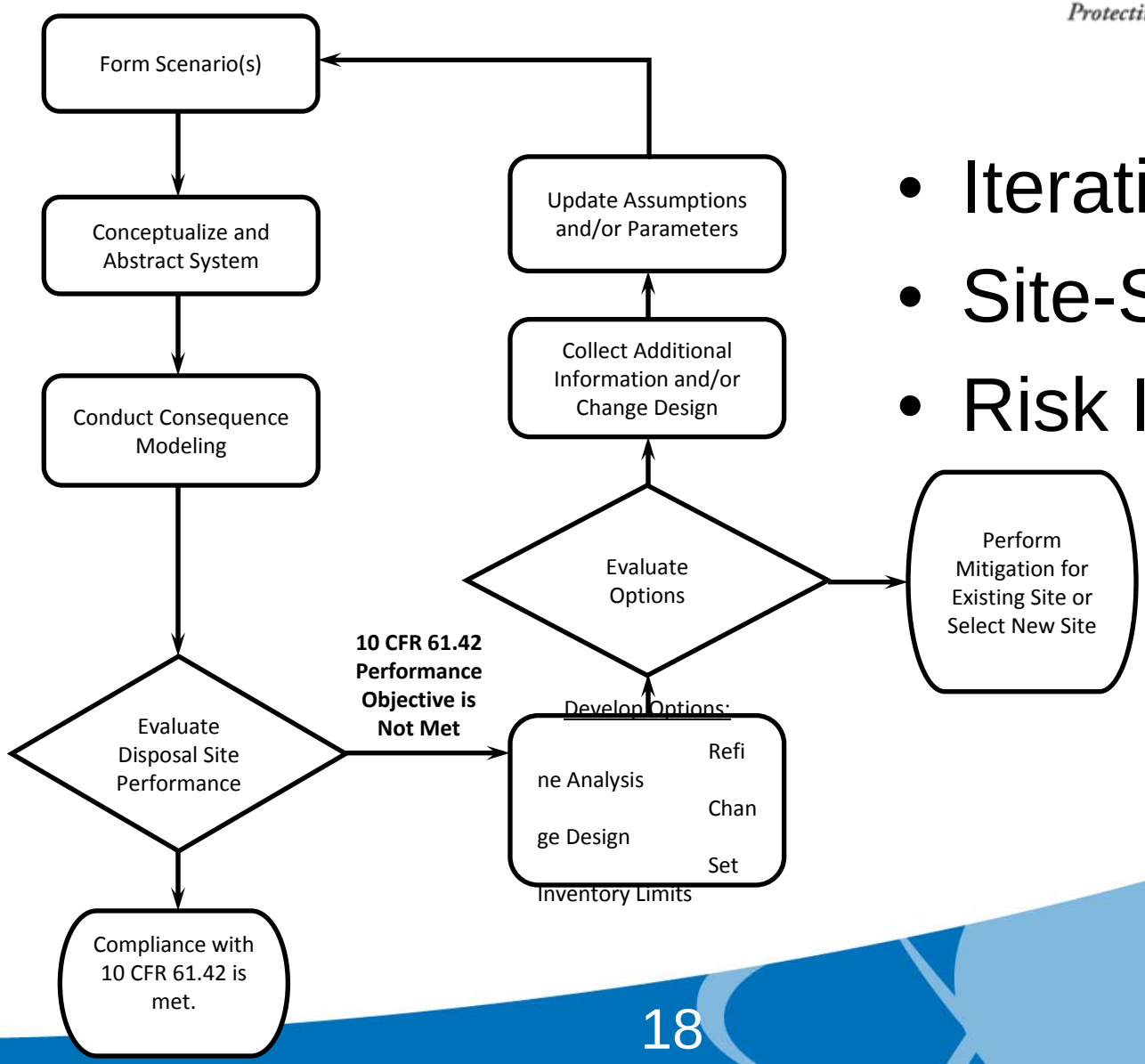


- Standalone
- Draws upon NUREG-1573, NUREG-1854, NUREG-1757, BTP

Intruder Assessment

- Estimate potential doses to an inadvertent intruder
- Required for § 61.42
- PA-like methodology
- Qualitatively considers likelihood
- Identify site-specific design and control measures (i.e., risk insights)

Intruder Assessment



- Iterative
- Site-Specific
- Risk Insights

Intruder Assessment: Scenario Analysis

- Evaluate *reasonably-foreseeable* scenario resulting in greatest dose for compliance
- Consider site information
- Flexibility to identify reasonably-foreseeable scenarios in the near-term
- For longer time frames, default scenarios limit speculation about human activities

Intruder Assessment: Scenario Analysis

- **Default scenarios**
  - Intruder-Construction/Discovery
  - Intruder-Drilling
  - Intruder-Agriculture
  - Intruder-Well
- Hypothetical constructs
- Provide reasonable bounds
- Limit speculation about human activities
- May not be appropriate at all sites

Intruder Assessment: Scenario Analysis

- **Site-specific scenarios**
- Account for :
  - Physical Information
    - Waste Characteristics
    - Facility Design
    - Disposal Practices
    - Site Conditions
  - Cultural Information
    - Land Use
- Consider changes over time

Intruder Assessment: Model Abstraction

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- Intruder Barriers
  - Inhibit contact with waste and limit exposures
  - Assess capabilities, degradation, and uncertainties
  - Risk-informed
- Source Term
  - Estimate concentrations accessible to intruder
  - Direct contact vs. On-site migration
- On-site Migration
- Dose

Site Stability Assessment

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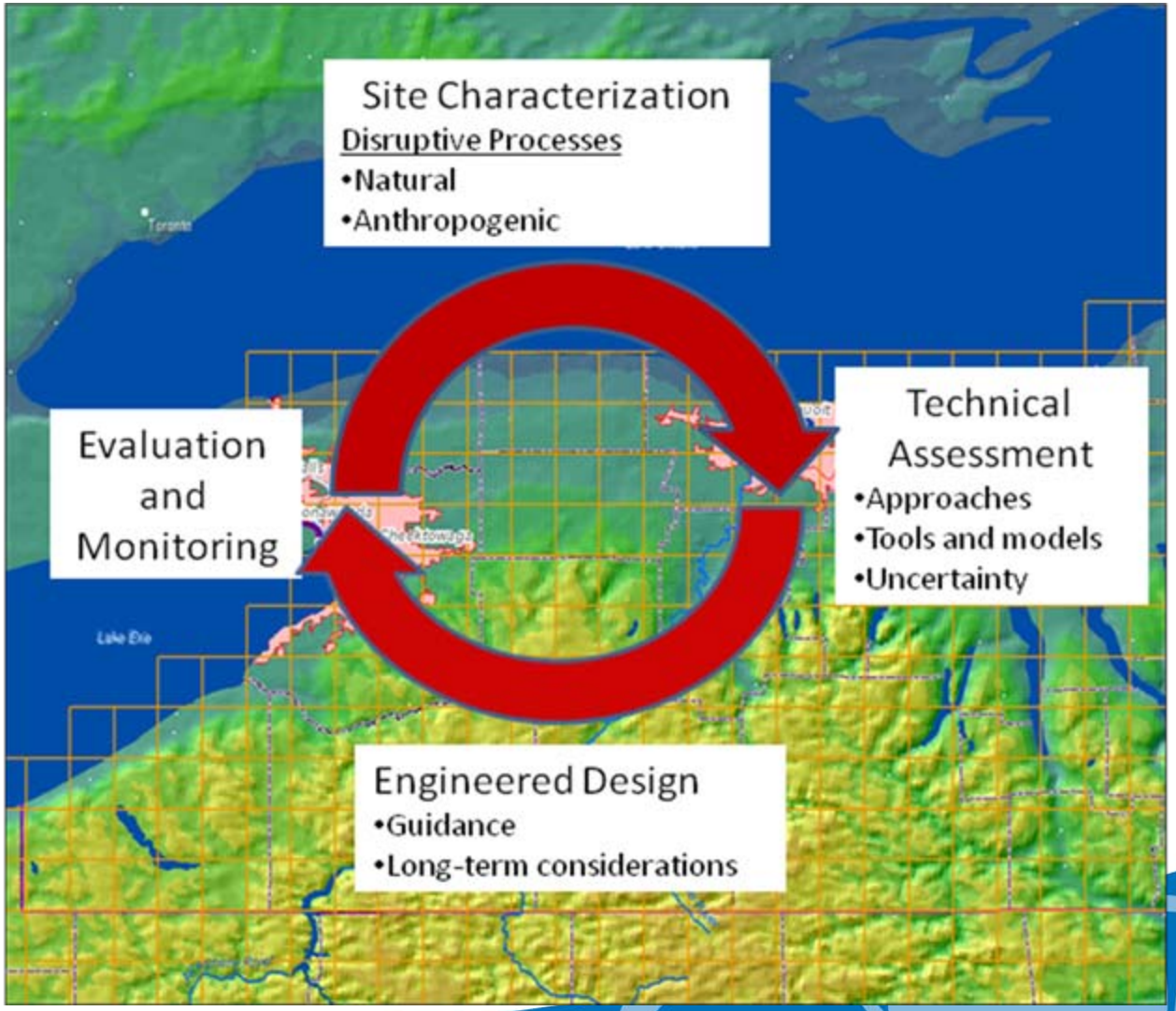

Site Stability Assessment

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- Stability of waste, facility, and site.
- Stability is required for § 61.44.
- Tailor analyses to types of waste disposed.
- Disruptive events cutoff frequency – include those events that are probable to unlikely to occur over the compliance period.
- Instability defined by risk, not loss of material.
- For large loss of material, risk may not be able to be defined.

Site Stability Assessment

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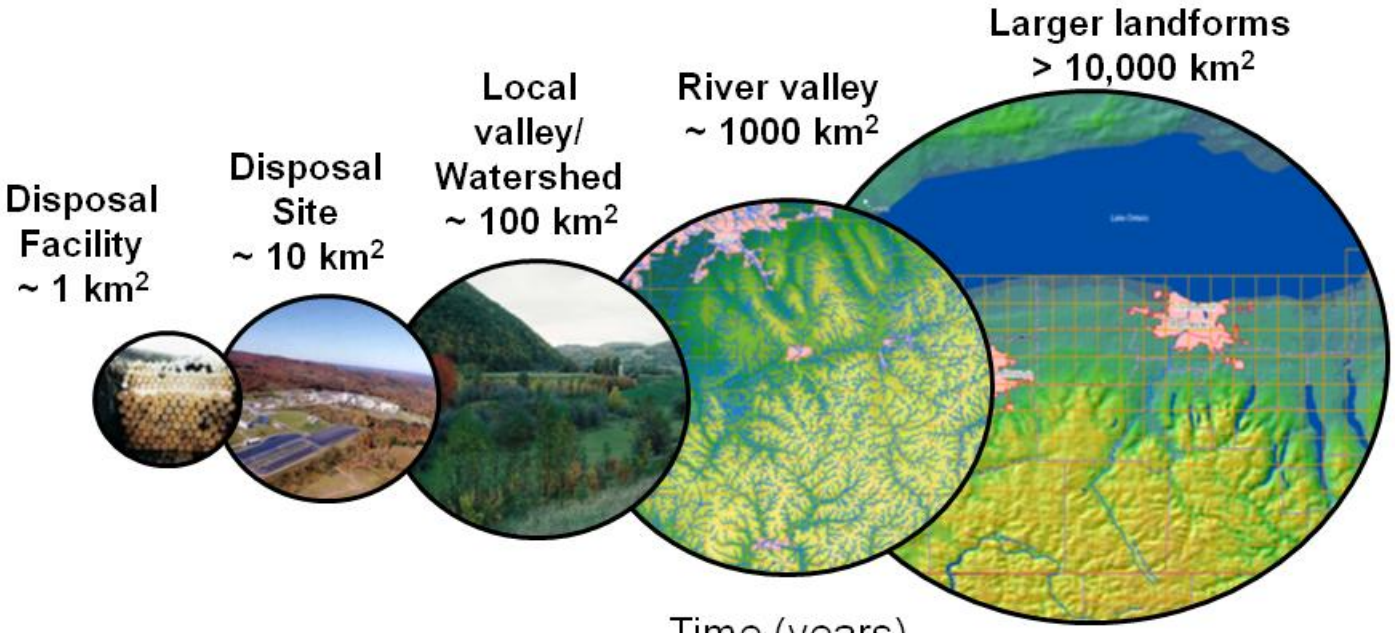

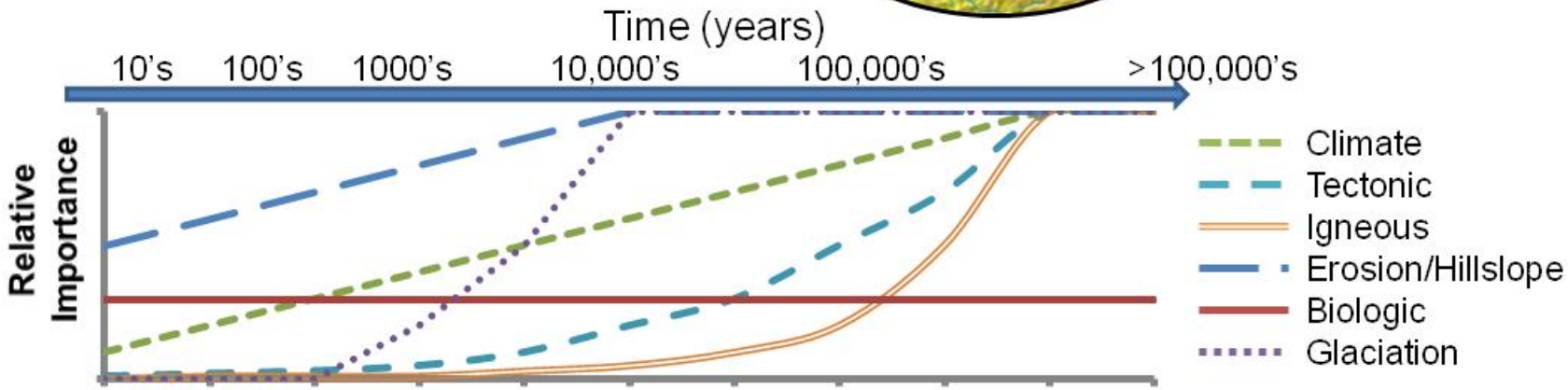

Site Stability Assessment

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- Topics covered include:
  - Disruptive processes
  - Available tools and models
  - Approaches to the assessment
  - Uncertainty
  - Engineered barriers
  - Long-term considerations

Site Stability Assessment

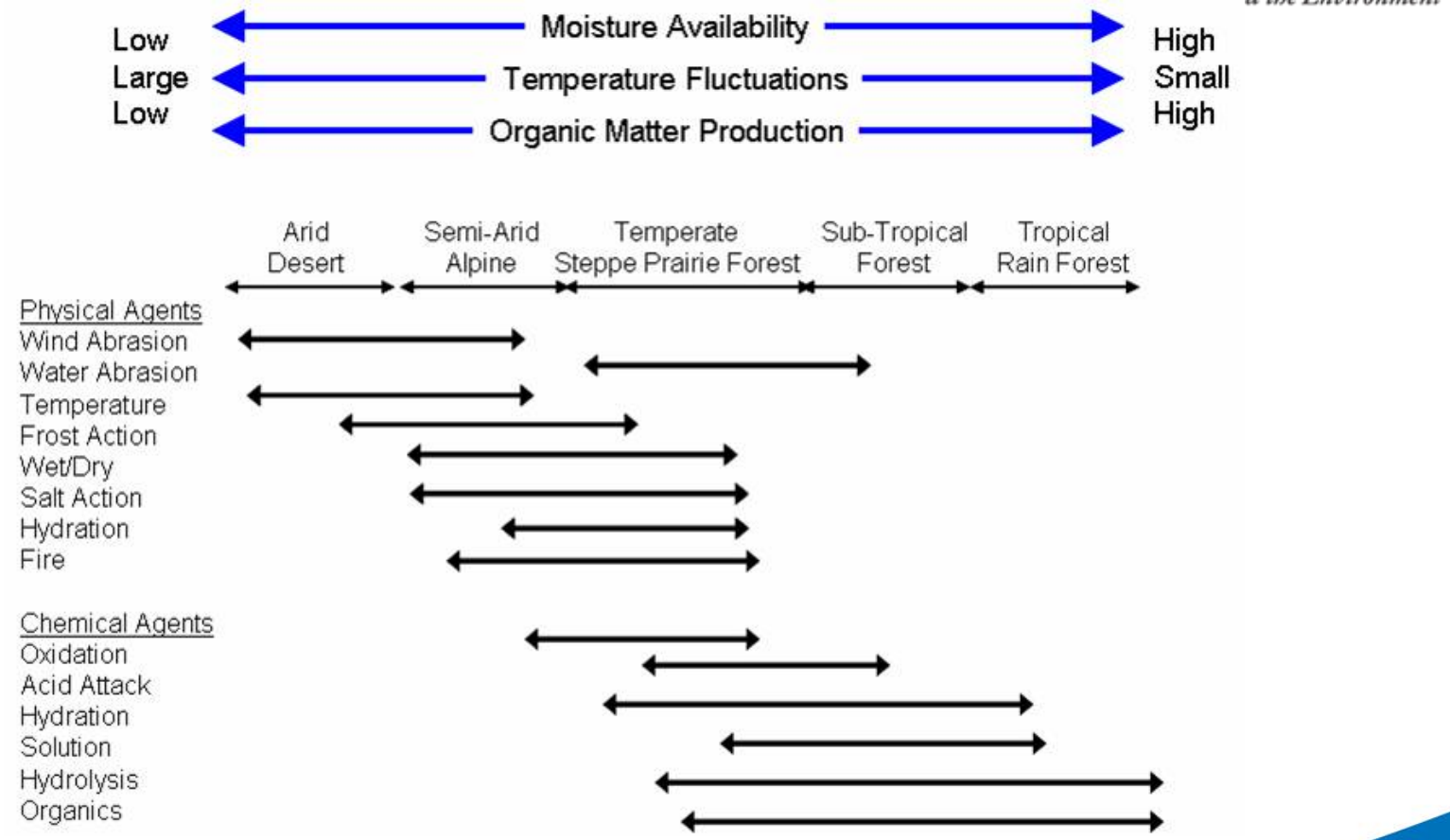

Figure 5-3 Macroscale Relationship Between Climatic Variables, Environments, and Rock Weathering Agents: Occurrence of Weathering as a Function of Climate (NUREG/CR-2642)

Long-Term Analyses

- Only required for disposal of long-lived waste
- Two types of analyses:
  - Analyses of how the design and site limit long-term impacts
  - Calculation of peak annual dose (transparency with stakeholders)

Long-Term Analyses

- Guidelines for long-term isolation
- Scope of the long-term assessment
- Types of analyses
- Barrier and component analyses
  - One-off
  - One-on
  - Factorial analyses (full or partial)

Other Considerations

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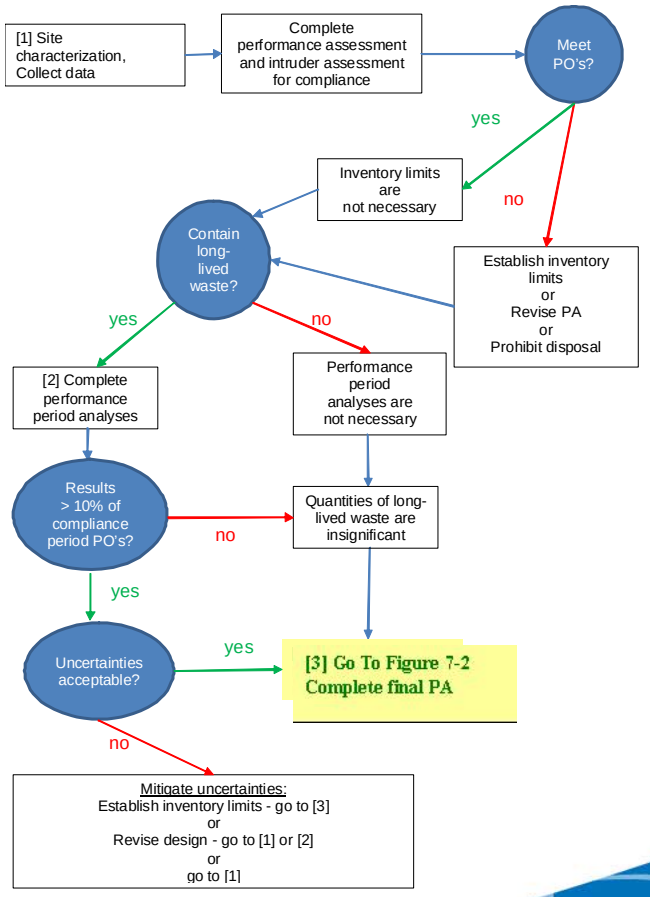
- Inventory limits:
  - Iventory limits is a method to manage irreducible uncertainties
- Mitigation actions:
  - Not expected for conservative assessments with strong technical basis
- Insignificant quantities:
  - Useful to define to risk-inform the process

Other Considerations

- Guidance provides flowcharts to step through.
- Intended to facilitate implementation of the guidance.



Performance Confirmation

- Various requirements are provided to ensure the facility performs as intended [§ 61.7(c)(3); § 61.12(l); § 61.28, § 61.53(d)].
- Technical analyses may be updated during operation and at final closure.
- Technical analyses should be updated when significant changes occur.
- Emphasis placed on performance indicators.

Conclusions

- Guidance is risk-informed.
- Guidance provides flexibility.
- Staff considering development of consolidated guidance after second (comprehensive) rulemaking.
- Development of training materials (class) is being considered.

10 CFR Part 61: Stakeholder Comments on the Preliminary Proposed Rule Language

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Advisory Committee on Reactor Safeguards
Meeting of the Radiation Protection and Nuclear Materials Subcommittee
August 17, 2011

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Purpose of rulemaking

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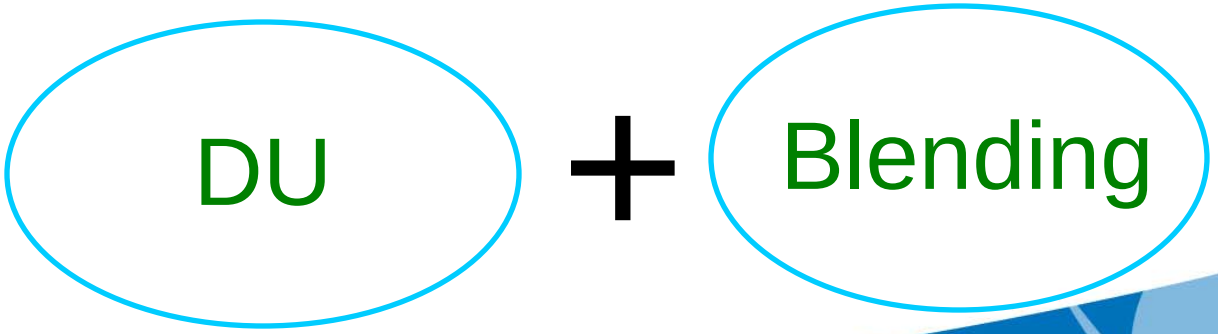
- SRM-SECY-08-0147:
  - Require site-specific analysis for disposal of large quantities of DU
  - Specify criteria needed for analysis
- SRM-SECY-10-0043:
  - Incorporate blending issue into the existing rulemaking for DU
  - Develop supporting guidance



Proposed Amendments to Part 61 Regulations

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- Remain focused on limited scope rulemaking.
- Site-specific analyses:

1. Performance assessment — to demonstrate compliance with the performance objective for protection of the general population from releases of radioactivity (§ 61.41)

2. Intruder assessment — to demonstrate compliance with the performance objective for protection of inadvertent intruders (§ 61.42)

3. Long-Term analysis — to demonstrate how the design of the facility considers the potential long-term radiological impacts (§ 61.13 (e))

4. Update analyses at facility closure — to be updated and included with any application to amend the license for closure (§ 61.28 and § 61.52)

Proposed Amendments to Part 61 Regulations *(continued)*

- Other supporting changes
  1. Concepts, Definitions, TEDE.

- No explicit reference to DU or blended waste.

Stakeholder Involvement

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- Preliminary proposed rule language and technical basis documents published for stakeholder comments on www.regulations.gov web site on May 3rd.
- May 18th public meeting.
- Comment period ended on June 18th.
- Some stakeholders also presented their views during the ACRS meetings on June 23rd and July 13th.

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Stakeholder Comments

Stakeholder Comments

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- 15 Comment letters received.
- Staff reviewed the comments and grouped them into nine issues.
- Issues considered are:
  - Performance assessment
  - Intruder assessment
  - Long-term analysis
  - Period of performance
  - Agreement State compatibility
  - Feasibility of near surface disposal
  - Commission direction (SRM)
  - Rule language
  - Waste stream neutral approach

Stakeholder Comments *(continued)*

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- Performance assessment requirement
  - TEDE.
  - Should exclude radon exposures.
  - Should include PA maintenance plan.
  - Uncertainties.
- Intruder assessment requirement
  - Support of intruder dose assessment requirement.
  - Intruder dose assessment scenario is burdensome.
  - Suggests 100 mrem and even 25 mrem to be consistent with other regulations.
  - Intruder barrier.
- Long-term analysis
  - A higher dose limit for 20K years and after (e.g.100 mrem).
  - Eliminating definition of long-lived waste.
  - How to implement requirement.

Stakeholder Comments *(continued)*

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- Period of performance
  - Support for 1K, 10K, 20K, and peak dose period of compliance.
  - Limited technical support for other period of compliance.
  - 20K places unnecessary burden to facility that accepts only short-lived waste.
  - Should be in guidance.
- Agreement State compatibility
  - Strict compatibility level vs. flexibility.
- Feasibility of near surface disposal
  - Propose minimum depth disposal requirement.
  - Question appropriateness of disposing of DU at near-surface facilities.
  - Proposed limited changes are not protective of public health and safety.

Stakeholder Comments *(continued)*

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- Commission direction (SRM)
  - Proposed rulemaking is more consistent with a “comprehensive revision of Part 61”.
  - Objection to DU as Class A waste.
- Rule language
  - Language in §§ 61.7(a)(1), 61.7(c)(2), and 61.55(a)(6) is confusing and could be shortened, deleted, or clarified.
- Waste stream neutral approach
  - Support and disapprove of waste stream neutral approach.
  - Blended waste should not trigger site-specific analyses requirements.

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Revisions Being Considered for Proposed Rule Language

Revisions Based on Comments

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- Performance Assessment Language (§ 61.13)
  - (a) A performance assessment must represent features, events, and processes that can influence the ability of the waste disposal facility to limit releases of radioactivity to the environment. The features, events, and processes considered in the performance assessment must represent a wide range of phenomena with both beneficial and potentially adverse effects on performance. The performance assessment must consider the specific technical information provided in § 61.12(a) through (i). The performance assessment must evaluate uncertainties in the projected behavior of the ~~facility~~ disposal system (e.g. disposal facility, natural system, environment). The performance assessment must identify the specific characteristics of the disposal site that are necessary to demonstrate compliance with the performance objectives in Subpart C of this part consistent with the specific technical information found in § 61.12....

Revisions Based on Comments *(continued)*

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- Intruder Assessment Language (§ 61.7(c))
  - (7) An intruder assessment quantitatively estimates the radiological exposure of an inadvertent intruder at a disposal facility following the loss of institutional control. The results of the intruder assessment are compared with the appropriate performance objective. If intruder barriers are utilized, ~~T~~the intruder assessment must identify the intruder barriers and examine the performance of the barriers. The intruder assessment must also address the effects of uncertainty on the performance of the barriers. The barriers must inhibit contact with the disposed waste or limit the radiological exposure of an inadvertent intruder ~~over the duration of the compliance period~~. The technical basis provided for the performance of the intruder barrier will determine how long performance should be credited. An intruder assessment can employ a similar methodology to that used for a performance assessment, but …….

Revisions Based on Comments *(continued)*

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- Period of Performance Language
  - § 61.41

    (b) Compliance with paragraph (a) of this section must be demonstrated through a performance assessment that ~~evaluates~~ estimates peak annual dose ~~up to~~ that occurs within 20,000 years following closure of the disposal facility.

  - § 61.42

    (b) Compliance with paragraph (a) of this section must be demonstrated through an intruder assessment that ~~evaluates~~ estimates peak annual dose ~~up to~~ that occurs within 20,000 years following closure of the disposal facility.

Revisions Based on Comments *(continued)*

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- Waste Stability Language (§ 61.7(c))
  - (2) A cornerstone of the system is stability—stability of the waste and the disposal site— which minimizes the access of water to waste that has been emplaced and covered. Limiting the access of water to the waste minimizes the migration of radionuclides, which avoids the need for long-term active maintenance and reduces the potential for ~~inadvertent intruders to be exposed to the waste~~ release of radioactivity into the environment. While stability is desirable; it isn't necessary from a health and safety standpoint for most low-level waste because the waste doesn't contain sufficient radionuclides to be of concern. This low-activity waste (e.g., ordinary trash-type waste) tends to be unstable, which can become a problem if it is mixed with higher activity waste. If lower activity waste is mixed with the higher activity waste or long-lived low-activity waste, the deterioration of the unstable waste …..

Revisions Based on Comments *(continued)*

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- Ambiguous Language
  - § 61.7(a)

    (1) Part 61 is intended to apply to land disposal of radioactive waste and not to other methods such as sea or extraterrestrial disposal……. Technical requirements for alternative methods may be added in the future. ~~While there may not yet be detailed technical criteria established for all kinds of land disposal that might be proposed, a~~Alternative methods of disposal may ~~can~~ be approved on a case-by-case basis as needed.

  - § 61.55(a)

    (6) Classification of wastes with radionuclides other than those listed in Tables 1 and 2 of this section. If radioactive waste does not contain any nuclides listed in either Table 1 or 2 of this section, it is Class A. ~~Any waste classified under this subparagraph must be analyzed in the intruder assessment required by § 61.42.~~

10 CFR Part 61: Site-Specific Analyses for Demonstrating Compliance with Subpart C Performance Objectives

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Advisory Committee on Reactor Safeguards
Meeting of the Radiation Protection and Nuclear Materials Subcommittee
August 17, 2011

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Why are we here today:

- Provide update of Part 61 rulemaking
  - Inform ACRS regarding stakeholder's comments and staff's proposed rule text changes
  - Staff has modified its approach to enhance flexibility
  - Brief ACRS on draft guidance document
- ACRS briefings
  - June 2011 and July 2011
- Commission directions

– Proceed with a rulemaking to require a site specific performance assessment prior to the disposal of significant quantities of DU and blended waste

Today's topics and presenters:

Topic	Presenter
Draft Proposed Rule: *Analysis of Comments Received on Preliminary Rule Language*	Andrew Carrera, DILR
Discussion: *Guidance for Conducting Site-Specific Analyses for Part 61*	Priya Yadav, David Esh, and Christopher Grossman, DWMEP
Path Forward	Deborah Jackson, FSME

10 CFR Part 61: Path Forward

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Advisory Committee on Reactor Safeguards
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Path Forward

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- In September, staff will brief ACRS full committee.
- Staff requests letter from ACRS following September full Committee meeting.
- Staff expects to send the proposed rule package to the Commission at the beginning of 2012.