Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
Regulatory Rulemaking, Policies, and Practices

Docket Number: (n/a)

Location: teleconference

Date: Tuesday, December 5, 2023

Work Order No.: NRC-2566 Pages 1-132

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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REGULATORY RULEMAKING POLICIES AND PRACTICES

SUBCOMMITTEE

+ + + + +

TUESDAY

DECEMBER 5, 2023

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The Subcommittee met via hybrid in-person and Video Teleconference, at 1:00 p.m. EST, Ronald G. Ballinger, Chair, presiding.

COMMITTEE MEMBERS:

RONALD G. BALLINGER, Chair

VICKI BIER, Member

CHARLES H. BROWN, JR., Member

VESNA DIMITRIJEVIC, Member

JOSE MARCH-LEUBA, Member

ROBERT MARTIN, Member

DAVID PETTI, Member

JOY L. REMPE, Member

THOMAS ROBERTS, Member

ACRS CONSULTANT:

DENNIS BLEY

STEVE SCHULTZ

DESIGNATED FEDERAL OFFICIAL:

DEREK WIDMAYER

LARRY BURKHART

ALSO PRESENT:

DAVID ESH, NMSS

BOBBY JANECKA, Public Participant

STEVE KOENICK, NMSS

CARDELIA MAUPIN, NMSS

TIM McCARTIN, NMSS

JANET SCHLUETER, Public Participant

GEORGE TARTAL, NMSS

PRIYA YADAV, NMSS

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

1:00 p.m.

CHAIR BALLINGER: The meeting will now come to order. This is a meeting of the Advisory Committee on Reactor Safeguards Radiological Rulemaking Policies and Procedures Subcommittee. I'm Ron Ballinger, and I'm chairing this meeting of the Subcommittee.

ACRS members in attendance are Joy Rempe -- Dave Petti is remote. Charlie Brown is remote. Vesna Dimitrijevic, I think, is remote. Jose March-Leuba is here. Vicki Bier is on -- well, maybe come on. Tom Roberts and Bob Martin are here. Dennis Bley, our consultant, is, I believe, online. And our consultant, Steve Schultz, is here. Derek Widmayer of ACRS staff is the Designated Federal Official.

The purpose of this Subcommittee meeting is to hear from the staff concerning Proposed Rule 10 CFR 61, Integrated Low-Level Radioactive Waste disposal. The Subcommittee will gather information and analyze relevant issues and facts and formulate proposed positions and actions as appropriate.

There is a session that's scheduled for February 2024 of the full Committee, and the Committee plans -- unless the Committee decides not to plan --

on preparing a letter report on this matter at that meeting. I might add that this has been a long process ongoing. The first -- we wrote four letters on Part 61 so far, first one I think in 2014, the last one I think in 2017. People will correct me if I'm wrong.

And I must add -- it's not on the slides that I went through -- that the staff took the recommendations from those letters to heart, and the new -- the revised -- the updated rule reflects, in large part, with a few principled exceptions, the ACRS input. So the staff should be complimented on the working through this, in spite of us taking an awfully long time.

ACRS was established by statute and is governed by the Federal Advisory Committee Act, FACA. The NRC implements FACA in accordance with its regulations found in Title 10 of the Code of Federal Regulations, Part 7. The Committee can only speak through its published letter reports.

We hold meetings to gather information and perform preparatory work that will support our deliberations at a full Committee meeting. The rules for participation in all ACRS meetings, including today's, were announced in the Federal Register on

June the 13th, 2019. That's a long time ago.

The ACRS section of the U.S. NRC public website provides our charter, bylaws, agendas, letter reports, and full transcripts of all full and subcommittee meetings, including slides presented at these meetings. Meeting notice and the agenda for this meeting were posted there.

As stated in the Federal Register notices and the public notice posted to the website, members of the public who desire to provide written or oral input to the Subcommittee may do so and should contact the Designated Federal Official five days prior to the meeting. As far as I know, nobody has.

Today's meeting is open to public attendance, and we have received no request to make an oral statement at the meeting. Time is provided in the agenda after presentations are completed for spontaneous comments for members of the public attending or listening to our meetings.

Today's meeting is being held over Microsoft Teams as well as in person, which includes a telephone bridge line allowing participation of the public over their computer using Teams or by phone. A transcript of today's meeting is being kept. Therefore, we request that meeting participants on

Teams and the bridge line to identify themselves when they speak and to speak with sufficient clarity and volume that they can be readily heard.

Likewise, we request that meeting participants keep their computer and/or phone lines on mute while not speaking to minimize disruptions and feedback. I'm going to ask people to make sure they're muted.

I will make an additional comment. I have a back brace on. I have back issues that I'm going through. So, if I get up and walk around, it's not out of disrespect or disinterest. It's out of self-preservation.

We'll now proceed, and I'll call Steve -- Koenick? Boy, I can't pronounce that -- Branch Chief of the Division of Rulemaking Environmental and Financial Support in the Office of Nuclear Material Safety and Safeguards for opening remarks.

MR. KOENICK: Thank you.

Good afternoon. My name is Stephen Koenick, and yes, that's how you pronounce it. Up until a few weeks ago, I was the Branch Chief for the Low-Level Waste and Projects Branch for the past five years. And I'm very excited that the rulemaking is progressing. That's in the Division of

Decommissioning Uranium Recovery and Waste Programs.

And we'd like to thank you for inviting us to the ACRS to discuss the Integrated Low-Level Radioactive Waste Disposal Rulemaking with the Subcommittee. We appreciate this opportunity to have this meeting to discuss the rulemaking effort, and the staff has developed the proposed rule package that is currently in concurrence. And our current schedule is to submit to the Commission by May of 2024.

As you mentioned, this is a long-standing rulemaking activity. The integrated rulemaking combines two ongoing efforts. And as you've noted, the --

(Off-microphone comments.)

CHAIR BALLINGER: I think we have some background noise or somebody speaking. Whoever it is, would you please mute yourself?

MR. KOENICK: Okay. So the integrated rulemaking combines two ongoing efforts, some of which, as you mentioned, the ACRS has previously considered. There is the Part 61 rulemaking related to large quantities of depleted uranium and then near-surface disposal requirements for greater-than-Class C waste.

And the Commission has directed the staff

to combine these two activities, with the latter being developing the licensing criteria to allow for the near-surface disposal of greater-than-Class C waste, and to allow for agreement states' regulation of GTCC.

We believe this rulemaking will increase disposal options for currently stored GTCC waste, develop consistent criteria for performing site-specific analysis of all low-level waste streams disposed of at each disposal facility, and allow for agreement states to incorporate these regulations in their existing programs with compatibility, flexibility.

The staff has carefully considered previous stakeholder feedback in developing the draft proposed rule package, including letters from the ACRS. So I really appreciate the Subcommittee's Chair acknowledgment of the staff taking to heart the ACRS comments. And I believe we met with you in October and November of 2016, and I have that letter being dated November 2016. You're very close.

And the three main conclusions were that the -- the first one was the draft final rule that was presented in SECY-16-0106 that the staff submitted to the Commission in September of 2016 can ensure that facilities meet Commission public health and safety

objectives. So that was the first recommendation.

The second recommendation was related to allowing grandfathering for existing operating disposal facilities if they do not plan to add substantial long-lived waste or disposal. And Priya Yadav will discuss that topic in her presentation.

The third recommendation related to compliance and performance periods. David Esh will address that topic in our presentation.

Since the last time we met the Committee in 2016, the now integrated Low-Level Radioactive Waste Disposal Rulemaking includes the near-service disposal of GTCC waste. We believe this rulemaking, when finalized, will provide many tangible benefits to industry and the public.

While the staff maintains the existing low-level waste disposal regulatory framework is fully protective of public health and safety and protects the environment, a heavier reliance on site-specific technical analyses will allow for better evaluation of wastes that were not anticipated when the original Part 61 rule was promulgated, or even wastes that may not have been envisioned today, such as those that may be generated by advanced reactor concepts.

The use of the safety case will better

align the U.S. requirements with international standards to provide a platform for licensees to clearly describe the technical basis for the performance of the disposal facility. And overall, the staff believes the public would have increased transparency of the complex information in the regulatory decision-making process.

So I'd like to introduce to you the staff making the presentations today. But before I do, I would like to acknowledge the efforts of the entire rulemaking group for preparing this comprehensive rulemaking package.

For today, you'll be hearing from George Tartal, a Senior Project Manager in NMSS -- he's the Rulemaking Project Manager for this effort -- Cardelia Maupin, a Senior Project Manager in NMSS -- she's the GTCC PM on this rulemaking -- Priya Yadav, a Project Manager in NMSS -- she's the Part 61 PM -- and David Esh, a Senior Systems Performance Analyst, and Tim McCartin, a Senior Advisor in NMSS, as they are technical leads on this rulemaking.

I'll turn this presentation over to George.

MR. TARTAL: Thanks, Steve. And good afternoon.

CHAIR BALLINGER: I might add you're going to have to almost eat the microphone. They're very directional, very good, but you gotta get pretty close to them.

MR. TARTAL: Gotcha. Okay. Thank you.

So, for today's presentation, we'll start with some background information and discussion about prior rulemaking efforts. Then we'll discuss the safety case and technical assessments. Then we'll discuss time frames for the technical analyses, and then move on to GTCC waste considerations, waste acceptance -- exception criteria in significant quantities. And then we'll discuss implementation guidance, and then we'll end with a brief update on the next steps for the rulemaking.

So, at this time, I'll turn the presentation over to Cardelia Maupin.

Slide 3, please.

MS. MAUPIN: Thank you, George.

It's my pleasure to be here today to talk to you about something that I guess has a been near and dear to my heart for almost 40 years. I was talking to one of the consultants to the ACRS on arriving here today. Back in 1982, we did something phenomenal, and that was to establish low-level waste

regulations in Part 61, which is now right at a little over 41 years old.

And you know a lot of things can happen and change in 41 years, and you still have to change with the times. And as knowledge increase, you must rethink what you have to do. So that's why we're here today. Back in 1982, it was a very important rulemaking because it was right at the time of the Three Mile Island, and waste was stacking up.

And the then-operating governors of low-level waste guys came together and pushed for the Low-Level Waste Policy Act and the Low-Level Waste Policy Amendments Act. And in the midst of that, from 1980 to 1985, we had some very great movement in the area of low-level waste.

So, when we developed the rule some 41 years ago, we planned that in looking at the hazards because the waste was divided into Class A, Class B, and Class C according to their hazards. And we believed at that time that A and B waste would decay to a point that an inadvertent intruder, say a farmer or someone building a house, who inadvertently went into that site 100 years later -- that it would be no hazard to that person.

And we thought for Class C waste, that

after 500 years, that it would have decayed to a level that it would not be hazardous. But as I said, things change in 41 years. And so the current practice is that we have this thing called depleted uranium. And then we had these licensees who wanted to get involved in the enrichment of uranium. That was previously something that DOE was doing.

So, at the time, in 1982, we didn't think this depleted uranium would be a problem. But circa presently, it is. When you're dealing with radioactive material, time is important, right? So we thought that by anything that was not in A, B, or C, it defaulted to A. And as I said, we didn't think that we would be handling this depleted uranium, whose daughters over time -- say after 10,000 years have passed, the issue is not getting better. It's getting worse. Right?

So now we got to rethink our framework. We have to rethink what we did in 1982 to think about what is presently done and some of the present considerations. So the Commission directed us to do that in 2019 -- was to look at this issue of depleted uranium and whether or not it was acceptable.

Staff did an analysis and said that in order for you to determine that, you must do a site-

specific analysis. And then another practice changed. We thought we had this thing all laid out. We thought that, okay, the waste that's coming in as A, B, and C -- you know, it was not going to exceed the framework of what we had constructed in terms of public health and safety and safety to the environment.

But then, of course, you always have something that's going to trip up your system. And that's what we call blending or concentration averaging. So now we're at the third bullet there, the averaging. So now we have this mixing of highly radioactive waste and lower radioactive waste to fit within a certain waste class, to get into a lower waste class. The lower the waste class, generally the less cost in terms of disposal, right?

So these are our challenges that we are looking at in terms of this rulemaking. And then, lo and behold, the state of Texas said they might be interested in the disposal of greater-than-Class C. We're down at that last bullet on the page.

So now, in addition to these other things that we are being challenged with, we now are presented with the challenge of greater-than-Class C waste and considering what we have described as near-surface disposal, which is within that first 30 meters

from -- well -- the surface.

Next slide, please.

So, as I said, we had these challenges, depleted uranium, and we had these challenges with blending/mixing, and then now the issue of greater-than-Class C waste. So we were directed to address these issues by the Commission.

And so, in SECY-16-0106, the staff was moving along, and they presented to the Commission a draft final rule. And in the midst of that, the Commission decided, okay, we want you to look at this greater-than-Class C waste issue as well. We want you to develop a regulatory analysis showing how or if this waste can be disposed of in a near-surface disposal and, if so, which waste streams can go and which waste streams cannot go.

And so, basically, what the staff had thought -- well, we had two trains, basically, Part 61 and greater-than-Class C waste. But these two trains are similar in terms of the things that are needed for implementation. So we thought we were going to hook the train up to Part 61, and then the Commission said separate them.

Then they said -- we said, okay, after we did the greater-than-Class C regulatory basis and we

saw these overlapping technical requirements, so we decided to say, hey, we know that there are some waste streams that can go, and we decided with the regulatory basis that most of these waste streams could go in those 30 meters considered near-surface disposal. We also said there's a potential for agreement state regulation.

Next slide, please.

So then, in a SECY paper in -- it was for my daughter's birthday, October 21st, 2020, great birthday present -- that we sent to the Commission a SECY paper saying, hey, these rulemakings overlap. They have similar regulatory -- need similar regulatory guidance. They have overlapping technical requirements. Logically, we should connect these two separate trains back and have one rulemaking.

And so that's what we presented to the Commission in 2020. And then, in April of 2022, the Commission said, we agree with that, staff; move forward.

Next slide, please.

So what we're here to talk about today is basically those two trains that are now one train. And that one train is called the Integrated Low-Level Radioactive Waste Disposal Rulemaking. And in this

consolidated rulemaking, we're going to address some of those things we've already talked about. We're going to address greater-than-Class C waste issues. We're going to address the depleted uranium issues. We're going to look at a requirement for site-specific analysis for all of those waste streams.

Also, we're going to look at -- we've included a graded approach for compliance period. And back in 1985, with the Low-Level Waste Policy Amendments Act, they changed the definition of waste to no longer exclude some transfer added waste. We hadn't done that to our -- modified our definition. So now is the time to modify that definition, and we're going to do that, as well, as a part of this rulemaking.

In addition to that, there are some things over and above low-level waste when you're looking at greater-than-Class C waste that we will have to address as a part of this rulemaking. And that will be physical protection issues, criticality concerns, and also, we will provide for a mechanism whereby agreement states can regulate some low-level waste -- GTCC waste streams.

That's the end of my presentation.

CHAIR BALLINGER: I have a --

MS. MAUPIN: Oh. Okay.

CHAIR BALLINGER: I have a question. You mentioned that -- you've used the term regulatory basis. Is that the 7125 NUREG?

MS. MAUPIN: No. The regulatory basis was a part of -- it is a published document, and in that document -- it is basically used as what we call a pre-rulemaking document.

CHAIR BALLINGER: I understand that, but do we have that document? I don't think so.

MEMBER MARCH-LEUBA: Can you provide it so we have it?

MS. MAUPIN: Okay. We can provide that. Yeah.

CHAIR BALLINGER: And 7125 -- so what is 7125, then?

MR. ESH: Are you referring to 2175?

CHAIR BALLINGER: Oh, excuse me. I'm sorry. Anyway, 2175 --

MR. ESH: Yeah, NUREG 2175 is --

CHAIR BALLINGER: Yeah, 2175.

MR. ESH: -- is the draft guidance that goes along with this regulation.

CHAIR BALLINGER: And that draft guidance will -- according to the last slide or the second-to-

last slide, will not be ready by our April meeting?

MR. ESH: Priya, if you're on, can you answer that?

I think we're trying really hard to get that -- to get it --

CHAIR BALLINGER: Because that's probably going to be a pretty important piece for us to take a look at before the full Committee meeting. Thank you.

MS. YADAV: Yeah. So it is still -- hi. This is Priya Yadav. I'm working with Dave on the NUREG 2175, which has been published in various forms in 2015 and 2016, but we have updated it for this rulemaking. I'm sorry. I'm jumping ahead in the presentation, so -- but it is currently going through concurrence. So it won't be done with concurrence by April. We will be submitting it to the Commission along with the rest of rulemaking package in May.

CHAIR BALLINGER: Okay. Thank you. Have to think about what we do.

MEMBER REMPE: Yeah. First of all, you keep referring to April. I thought your full Committee meeting was scheduled for March. Right, Ron?

PARTICIPANT: It's February.

CHAIR BALLINGER: February.

MEMBER REMPE: Oh, for February. Okay. So you want us, ACRS, to write a letter solely on this. You have not provided the regulatory basis document, but we will be getting that soon, I guess. But then you don't want us, then, to comment on 2175, right?

MR. TARTAL: We have a draft version of that document that we've been working on all along.

MEMBER REMPE: And ACRS has an MOU that would allow you to have provided that to us.

CHAIR BALLINGER: Because it's -- and that document's been updated to be more reflective --

MR. TARTAL: Oh, certainly.

CHAIR BALLINGER: -- of this? Because the one that I've looked at is from the old -- from the earlier --

MR. TARTAL: Yes. We have a draft of it that's going along and making the same changes that the rule is making. So it's providing updated guidance to the updated --

CHAIR BALLINGER: I might add that the FRN, the thing that we have -- there's enough background information in there, so I'm guessing that you could cut and paste it into -- it is the regulatory basis. Thank you.

MS. MAUPIN: I just wanted to say that the GTCC regulatory basis was issued in August of -- July 2019. We did meet -- myself and the former leader for Part 61 did have a meeting with, then, some ACRS members to talk about what we were doing. I apologize if that has not been passed on, but --

CHAIR BALLINGER: That's got to be my bad, then.

MS. MAUPIN: -- Gary Comfort and I did meet and brief members of the Committee, a smaller group of the Committee.

MEMBER REMPE: It wasn't a Subcommittee meeting.

MS. MAUPIN: It was not. No. It was --

(Simultaneous speaking.)

MEMBER REMPE: -- planning meeting.

(Simultaneous speaking.)

MS. MAUPIN: Yeah. Yeah.

MEMBER REMPE: Okay. Anyhow -- okay. So, yeah, Please provide both of those documents to Derek as soon as possible, please.

MS. YADAV: Yeah, so the regulatory -- the GTCC regulatory basis -- I can paste a link in the chat. That is publicly available, and it's on our website. So I can paste a link in the chat to that

document. And regarding the updates to NUREG 2175, yes, we can share draft versions with you if that's okay with George, whatever the agreement is. I'm just saying it's not going to be publicly available by February.

MR. MOORE: Chair Ballinger, this is Scott Moore, the Executive Director. Please don't --

CHAIR BALLINGER: Is your mic on?

MR. MOORE: Yes, it is. Please do not post in the chat. We're only using the chat for IT-related issues. We would just ask that the staff provide Derek with the actual document, and he'll make it available to the members.

And also, with regard to the draft document, we do receive public draft versions from the staff and NRR all the time. So, if you could provide that as well, that would help. Thank you.

MEMBER REMPE: Public and non-public versions. I think you meant to say non-public.

MS. YADAV: Okay. Thank you.

(Off-microphone comments.)

PARTICIPANT: Right. We didn't proceed with a final regulatory basis. Instead, we took the path that the Commission directed us in integrating the two. And instead of doing the final reg basis, we

just included that in the scope of the rulemaking you're hearing about today.

PARTICIPANT: Okay. So, Ron, that is the document I supplied to you, but the other members have not got it.

CHAIR BALLINGER: Okay. Okay.

MR. SCHULTZ: This is Steve Schultz. Just to follow up on Ron's comment, how does this relate to the draft Federal Register notice, which is also very detailed in terms of the description --

MR. TARTAL: I'm not sure I understand your question, how does it relate to it? What does that mean?

MR. SCHULTZ: Well, we have that one.

(Simultaneous speaking.)

MR. SCHULTZ: It's very detailed.

PARTICIPANT: Very detailed reasons for the changes and things.

MR. TARTAL: Yes. So what's your question?

MR. SCHULTZ: When we read the draft document that we now have available, how's that going to compare to what is in the notice?

MR. TARTAL: I think that's probably better for Cardelia to respond to.

MS. MAUPIN: Okay. Let me give you the backstory on this. We had developed the draft regulatory basis. We had public meetings on it. We collected comments on it. We extended it -- we had a six-month comment period. And then wouldn't you know it -- behold, like I said, changes.

And in the midst of doing this draft regulatory basis, the rulemaking procedures changed. The EDO's -- with the agreement of the EDO's office, the rulemaking procedures changed. And they directed us not to go from this draft regulatory basis with all the policies, technical basis, yada yada, and incorporate the comments, which -- we got probably over 7,000 if we include the form letters.

They said, don't make that a final regulatory basis. They said, take those comments from the public. Take that proposed regulatory basis. We're no longer doing draft to final regulatory basis. That will now be, quote unquote, in your mind, your final regulatory basis.

So then we took what we now were told was our final regulatory basis along with those comments, right? And we implemented that into this effort. As a part of this effort, we -- especially Tim and I had to go through all those public comments, analyze those

public comments, and pull out from those public comments information to be inputted in this proposed rulemaking. That's the backstory.

CHAIR BALLINGER: I mean, again, the point that I'm trying to make and I think Steve is trying to make, as well, is that for the meeting that we have in February, we need to have the members have a complete story that's not confusing. And so it may be -- that's what we're shooting for. So it may be that Derek and I can sit down with folks and make sure that we don't have a lot of excess baggage that doesn't add anything to the conversation for this meeting that comes up in February but is complete.

MEMBER REMPE: So I guess, then, the answer to the question that Steve has is that even if we all had been given this draft regulatory basis document, it might confuse us because what's important is in what was posted in this rulemaking notice that all of us did get, right? The --

(Simultaneous speaking.)

CHAIR BALLINGER: -- very detailed.

MEMBER REMPE: Yeah. So, basically, that's what you're telling us.

MR. TARTAL: Yes.

MEMBER REMPE: Shaking hands is hard for

the court reporter to see or -- shaking heads. But anyway, yes, what I wanted to hear. So that's good to know. The only thing, though, is that it would be good for us to still have the 2175, wherever it's at right now, too, just --

CHAIR BALLINGER: Yeah. 2175 is the guidance document, in effect. So that's the important --

MS. YADAV: Yes. Okay. As long as we're able to share non-public versions with ACRS, then that is totally -- we can do that.

MR. BURKHART: Part of this is my fault. Because it was a draft document, I just gave it to Ron.

MEMBER REMPE: Fine. I think we're good. And we always have MOUs with other offices in NRC, so I don't think sharing us the draft --

(Off-microphone comment.)

MEMBER REMPE: You keep saying public document, but --

(Simultaneous speaking.)

MEMBER REMPE: I thought that we often have access to non-public versions before they go through concurrence, too, that help us with our decision-making and deliberations.

MR. BURKHART: This is Larry Burkhart. Yes. You can share non-public documents with the ACRS. However, just be aware that you need to say why it should be withheld. And from a FACA standpoint, pre-decisional has no basis under FACA. So --

PARTICIPANT: So it can't be withheld.

CHAIR BALLINGER: Well, anyway, let's just make sure we're playing with a full deck.

MEMBER REMPE: That's going to be difficult, but anyway --

CHAIR BALLINGER: Well, whatever it is, present company excluded. Okay.

MR. ESH: Okay. So I'm David Esh.

Next slide, please, please, Derek.

I'm a Senior Risk Analyst, and for good or for bad, I've been involved in this from the beginning, I think as Member Ballinger noted. We're approaching or exceeding three cobalt-60 half-lives now. So it's been quite some time.

So I wanted to start off with your comments at the beginning, that I would say I believe the staff fundamentally agrees with your remarks in your last letter to us in 2016, especially scientifically. When you move into implementation, then that's where we might have some deviations. But

that's what we're going to talk to you about today and explain, maybe, why we're pursuing something that could look a bit different than your recommendations.

I would say on a fundamental level, though, they don't differ substantially. So we're in alignment with you and the previous feedback that we got. And I'm going to talk with you about some pieces of this rulemaking, pieces of the puzzle. There's lots of puzzle pieces that make up low-level waste regulation. We're only changing some of them or adding some new ones. A lot of them are fundamentally staying the same.

So there's not a lot of changes to this puzzle. There's selective changes to certain pieces, and we're doing that to try to modernize the regulation, make it more efficient and risk-informed without disrupting things, because as Cardelia noted, this regulation has been in place for over 40 years, it's been used very effectively in those 40 years for the types of waste that were analyzed in 1982. So there's not a need, an urgent need, to disrupt the applecart, so to speak.

The first part I'm going to talk to you about here is the safety case. So safety case is terminology that's used internationally for waste

disposal, and it has many different components. The staff's opinion and our approach in this rulemaking is that the safety case is -- basically, our original Part 61 has all the elements of the safety case. So we don't need to do anything substantial to implement safety case within Part 61.

Now, if you Google safety case radioactive waste after you leave this meeting, you'll see internationally there's lots of guidance documents with the IAEA and other organizations about how to develop a safety case. Some of it can get very complex. We don't think that's necessary, as long as you have the fundamental pieces, like -- I think last October, I was over in Germany for a workshop, and it was on the digital safety case.

And they were talking about things like using virtual reality to allow people to go into a disposal system and pull the information on the barriers in the disposal system, see the inventory reports, pull the technical reports and the licensing basis for it. That's the level that some organizations are pursuing the safety case.

We don't think that's necessary. From our standpoint, the main aspect of the safety case is to ensure that the stakeholders get a good understanding

of what was done to make that decision to dispose of the waste and then the regulatory review of what was done. And I'll talk about that as primarily like executive summary.

And then I'm going to step through on technical analyses. Those are the components in 6113 in the regulation. There's basically five types of technical analyses here that I'm going to talk about. The first one, performance assessment -- it aligns with 6141, the performance objective 6141, which is protection of a member of the public. It's basically off-site of the disposal facility after it closes.

So low-level waste, as Cardelia noted, is disposed in the near surface. That's roughly defined as upper 30 meters, but it's not a discrete line that if you're below 30 meters, it's no longer near surface or -- so it's a fuzzy line just to illustrate the concept because when Part 61 was developed, the idea was that most of the disposal facilities would be trenches. And so they would be pretty close to the surface. Thirty meters would describe that.

There is an operating facility in Texas, but their depth is greater than 30 meters. But that doesn't mean it's not near surface and needs different regulatory requirements. It's still a trench-type

disposal system at the surface of the earth.

So 6141 aligns with performance assessment. That's the new terminology. But the requirements for what somebody had to do for technical analysis for 6141 in 1982 are essentially the same as now. It's been modernized. We have a lot better tools.

People at the NRC were all excited whenever the 286 computers came in and it was going to allow them to do some of these fancy calculations for low-level waste disposal. I mean, think about the computing power you might have on your wrist or in your pocket right now. Forty years is a lot of technology change, and we expect people to take advantage of that.

The next component, the intruder assessment -- I'm going to talk about that in more detail. That aligns with 6142 performance objective. That's an area that has had a bit of discussion. But this is the only essential component of this rulemaking, is that the way the analysis was done to develop the acceptable concentrations that define low-level waste -- that was based on an intruder assessment performed by the regulator, performed by NRC.

So it's a generic assessment for a generic site that then came up with these concentrations. So I'll step through the challenges with doing that and why it led us to the point that we're at now.

The third one there in the bulleted list, the site stability assessment -- that isn't a new requirement. It's under 6144. It would be somewhat new for significant qualities of long-lived waste, and I'll talk to that, too.

The fourth one, which is a little out of order, aligns with 6143, the operational safety assessment. That's only going to be new for some types of GTCC waste, and I'll explain why that is. With your backgrounds, I think that's an area where you'll completely understand what we're doing there and where we're coming from.

CHAIR BALLINGER: You know, you're speaking of these numbers. And the FRN is very detailed, but if you try to set that FRN next to the old Part 61 and try to look where goes what, it's impossible.

MR. ESH: Yeah. Yeah.

CHAIR BALLINGER: Is there a redline strike-out version of this thing available?

MR. ESH: I don't know the answer to that.

Does somebody else know the answer to that? You mean the rule language itself, right?

CHAIR BALLINGER: Yes, the actual rule.

MR. ESH: Yeah. So what I usually do internally is I will print out or have the old one, and I'll have the new one side-by-side. And I compare them that way and see the changes --

(Simultaneous speaking.)

CHAIR BALLINGER: We don't have the new one.

MR. ESH: Right.

CHAIR BALLINGER: So we have the FRN --

MR. ESH: It's in the back of the FRN.

CHAIR BALLINGER: Oh.

MR. ESH: So the new rule language is in the back of the FRN if you get to the end. It's a long FRN.

MR. TARTAL: It's just not written like a redline strikeout. It's written as a set of instructions to the Office of Federal Register. So it looks different. We do have a redline strikeout version that we've been using as a tool for the working group as we run along, but that's not a required component of the rulemaking package.

MR. ESH: I'm very sympathetic to the

Committee members that will be trying to wade through some of these regulatory products and get your hands around them. So --

CHAIR BALLINGER: I rest my case. So we have the redline strikeout version?

MR. TARTAL: I think so.

CHAIR BALLINGER: Thanks.

MR. ESH: Okay. And then the last point on here is related to time frames, the performance period analyses. So I'll talk about that in great detail because that seemed to be an area where there was a lot of debate about over the last decade-plus. That's going to be a new analysis that you would do if you have significant quantities of long-lived waste.

Next slide, please, there.

The safety case. As I said, this is a high-level summary of the information that's contained -- information and analyses to support the demonstration that the land disposal facility will be constructed and operated safely. We're thinking like executive summary.

In the international community, the safety case is the collection of all the analyses, everything that goes into the basis for the decision. It can be very extensive, so -- even, in some cases, thousands

of pages. The regulatory information that goes into supporting a licensing decision for low-level waste may be in the thousands of pages when you look at all the information the licensee submits.

But the safety case itself -- what our intention is in this rulemaking is for people to provide a clear summary of that information. We think that'll help in a couple areas, especially with stakeholders, because it is a lot of information. It tends to be pretty highly technically complex. It can get a bit intractable even for a bright person to work through that.

So this is part of the information that provides -- I think of it as, if a grandparent was still alive and they asked me about it, how would I explain it to them? Maybe a bit more technical detail than that, but kind of common sense, what's the basis for this facility both in terms of the licensee's information and the regulator's review of that information?

MR. BLEY: Excuse me.

MR. ESH: Yes.

MR. BLEY: This is Dennis Bley. You're talking about the safety case, and it was mentioned earlier. Is the NRC moving to a -- or parts of the

NRC moving to something like the European description of the safety case? Or is this just background information?

MR. ESH: Yes. So that's what I was talking to, Dennis. Thanks for the question. Yes, we aren't moving to that extensive approach that's done internationally because we feel that our existing, our existing regulations kind of predated many of the European or international regulations. And we feel we got all the components of the safety case in there when we started.

There are a few areas that, especially people that practice in that area, in Europe for instance, would debate with us. For instance, they break up their, many of them break up their licensing process. That they will do a safety case for site selection. Then they'll do a safety case for operation. Then they'll do a safety class for closure.

Our licensing process doesn't work that way. You do it altogether in one licensing action. You do your justification for your study, your justification for operations and the closure and all of that put together. I think that's a more efficient approach then continually iterating in the licensing

process.

MR. BLEY: That fits my image of the issue. I'm just kind of curious why you're putting on emphasis on talking about safety cases, is there some international consequence of this rulemaking that you're trying to cover?

MR. ESH: Not necessarily. I think the main impediment is we did get a previous direction from the Commission to put safety case within the Part 61 rulemaking scope.

MR. BLEY: Fair enough.

MR. ESH: I think that's where it came from initially. And we're taking a light-handed approach to it I believe. A fair but light-handed approach.

Okay, so then this safety case, we think it will help provide the reasonable assurance that the disposal site is capable of isolating the waste limiting releases, et cetera. And I will note that isolating waste and contain, isolation and containment are special terms in the international construct, and they have special meanings.

So if you look at guidance that might talk about time frames associated with isolation and containment, they're talking about isolation means

nobody contacts the waste, okay? Containment means, basically zero release.

Those are not necessarily concepts that we apply in NRC's Part 61 space. We are more totally performance based, so we acknowledge, and that's what I'll talk about with the intruder assessment, that there is the possibility that people may interact with the waste in the future and what are the risks that result from that.

And then in terms of releases, we don't have a requirement for zero releases for some amount of time. It's just a matter of whatever releases at what time, and show that you can meet the performance objectives reflected in 6141. Okay.

Now this safety case also will include a consideration, just defense-in-depth protections, and the safety relevant aspects of the site, the facility design, managerial, engineering, regulatory, institutional controls. That's what I mentioned earlier on is that we're not talking about all these pieces with you here today. We certainly can in the future if you want to dive into any one of them. Or in the question and answer session afterwards.

For instance, defense-in-depth was also given to us by direction from the Commission to

include within the scope of the Part 61 rulemaking. Defense-in-depth done in reactor space or in a facility with active controls is different than defense-in-depth implemented for a passive system, like a disposal facility that you've closed. Nobody is there taking active, actively maintaining it. Doing any, there is no active barriers, you're all relying completely on the passive safety of the barriers.

So we went through that in detail. Tim, myself and other staff members, to come up with what we felt was a approach to defense-in-depth because we didn't want to have a situation where, for instance in maybe a reactor system you have a pump and you have a backup pump.

Well, a disposal system doesn't work that way. We don't have a drainage layer and a backup drainage layer. Or you don't have a resistive layer for infiltration and then a backup resistive layer for infiltration.

You have various types of engineered components that fit together with the natural system, and all those managerial and operational controls. All that fits together neatly to provide you some redundancy and resiliency and performance, even if one

layer isn't necessarily doing everything in terms of performance. That's what you want to try to avoid.

So that's pretty much it for safety case, I think. I think we're on to a new topic next. I don't know if you have any further questions on that one or we'll just move on to first one? Okay.

Performance assessment. This is the technical analysis completed for the existing sites for the potential impacts to an offsite member of the public. And they're consider synonymous with this modern performance assessment.

So like I said, the technical analysis work concluded in 1982. We're now calling them performance assessment.

We have new capabilities. Understanding in both in some of the technical areas the tools that are available and the capabilities that are available have significantly evolved, and we're taking advantage of that here.

So whereas it would have been extremely difficult to do, probabilistic assessment with sensitivity and uncertainty analysis for these type of systems in the early 1980s, now you can do that with many different tools that we have available. And so we're modernizing the regulation in this area.

There is some text in the technical analysis, in the 6113 section of the regulation that's new there. And hopefully if they do get you a redline strikeout you can see the new ones compared to the old ones.

Significant guidance has been developed to support these proposed requirements. That's something you referenced, NUREG-2175. It's over 600 pages. There are pretty much three new areas added to it for this effort that you haven't seen previously. Maybe comprising about a hundred of that total. The whole document underwent revision though because the rule language changed and so we had to update the whole thing.

Some of it I looked at, or other staff members looked at and they're like, hey Dave, what you wrote here is confusing and junk, let's make this clearer. So that sort of thing happened too. But we can point you to the sections that are the substantially new ones from the previous version, and I think that would help you review so you don't get lost in all the 600 pages of details. That's NUREG-2175.

And I would say, myself and Hans and Priya and other staff members that helped with it, that

document, I believe, is like 99 plus percent of the way there. So technically I don't have any problem at all handing it to you today and having you look at it. So it's just a matter of the process and procedure of how you can share that information.

And I wouldn't have any concern if the current version even was released publicly. I think it stands on its own merits at this time. It's consistent with the current rule text.

Next slide please. Here is a picture. They don't just have words and take to words the whole time. Slide 10, yes.

So this is out of the guidance. You'll see this sort of thing in there. This is what performance assessment is all about. There's some pictures at the top there of a real disposal facility. It's the state license disposal area at West Valley in New York.

There's a couple of pictures of trenches there. The one the left actually shows some water in the bottom of the trench as they were putting the barrels in. So that was a practice pre-Part 61.

Then as you take the real system and the data associated with it, and from characterization of the site, you take that, you convert it into a

conceptual model, which is shown in the middle of the left-hand side there, the diagram. That conceptual model is the performance assessment conceptual model. That then gets maybe broken down into submodels shown by the dash line there at the bottom, which is the whole figure on the right-hand side. That's the hydrologic system that you might develop a whole submodel and representation for.

So you have at the top kind of the picture of all the science that's going on. In the middle it's converted into a computer model. And the computer model is representing some sort of equations that are solved. And then the rest is all not new to you guys, it's just unique maybe to the field, not the science.

And then that then may be represented by an abstracted model at the bottom. So the abstracted hydrologic model that then is used to estimate system performance.

So we'll use, and licensees will use, a product like GoldSim where you can hook all these submodels and models together. You can run it probabilistically, you can run it deterministically. You can do sensitivity analysis and optimization and all sorts of fancy modern numerical things with it.

But that's what performance assessment is all about. And a lot of the guidance document are a big section of them. Chapters 2 and 3 I believe are about the performance assessment methodology.

MR. BLEY: Can I ask a general question? It's Dennis Bley again.

MR. ESH: Sure.

MR. BLEY: You know, of course running GoldSim and all this stuff through it, you can get answers. But over the very long time periods, when you get out to 10,000 years, or if you go even further, things can happen that change many of the assumptions of the analysis over that kind of time frame.

My own thought is, the benefit here is to identify potential pathways you might not have found otherwise and to make sure something about the design, for the long time periods, will help limit those pathways. Is that way you guys think of it or are you thinking the absolute numbers you get out of this at the end are meaningful?

MR. ESH: Well, I think it depends. So, it's a, it's probably a bit more convoluted than that. Especially because, so in order to do an assessment of these complicated systems, whether you're analyzing a

radioactive waste disposal system or a manufacturing facility, the reliability of a manufacturing facility for bulldozers or, you name it, there's a whole bunch of things that fit together to do that evaluation. And there is always going to be uncertainty in the real world.

I agree with you that the uncertainties in some aspects of these problems increase overtime. But in other parts of the problem the uncertainties can actually decrease with time.

So for instance, early on if you have metallic barriers and a disposal system you may be uncertain about when those barriers are going to fail and how much water is transmitted through them as they do fail. Maybe of differing materials. Carbon steel fails generally a lot quicker than stainless steel or other more exotic alloys.

So you have uncertainty about when those barriers fail. And that's in the short-term. And it can greatly impact the timing and magnitude of doses that would result from disposing of radioactive waste in metallic barriers in one of these system models.

As you go out to longer times, for instance though, at some point you get to a time where all of that metal has failed and there is no more

uncertainty in the performance of that component of the system. And you'll see that in some of the performance assessment modeling results. They generate something that we refer to as horsetail plots because they kind of look like the tail of a horse.

And sometimes the uncertainty range at earlier times is broader because that's when the shorter lived radioactivity might get out of the system. You don't know when it's getting out or what magnitude. It results in larger uncertainty while that's happening.

And then you migrate out to longer time and the tail kind of gets narrower because most of the engineered components you can't justify at those times. You're really looking at just the geology and the long-lived radioactivity. And so, the uncertainty, the computational uncertainty for that aspect of the problem can actually get a bet less with time.

The one that we don't speak to, and I think partly you might be talking to, Dennis, you can correct me if I'm wrong, is we are operating in this context of a human component, or a societal component. You know, what people are doing, where they're living, how they're living, et cetera. How technology

changes, which I referenced earlier in this talk.

That, if you can clear the technology societal component than yes, it makes the uncertainties intractable in this type of problem, right? I'll freely admit that.

But I will also show that what's done, what's being proposed by the NRC, and is done in the international community, is basically you make some cautious but reasonable assumptions for the society technology part of the problem, and then that part gets fixed for the project, for the estimates of performance to the other parts of the system. So I don't know if that completely answers your question.

We aren't trying to predict numerical result at a particular time, we're attempting to estimate, you know, especially preferably a range of impacts at a future time, and understand the uncertainties and how they may impact those range of impacts at a time. And that's what goes into the regulatory process.

So this stuff, waste disposal and performance assessment, is not necessarily easy. It does require strong licensees and strong regulators. So you need both components.

The regulator has to know that I'm not

making a licensing decision based on the long-term dose 24.9, and my standard is 25, right? The regulator has to look at the output of the model and say, okay, it could be above 25 and I can still make an argument why it's an appropriate licensing decision.

Especially at those longer times, which we'll talk about. So it isn't, there is a firm line and there is a compliance standard, but this is part science, part engineered judgment and at least some component of other considerations.

MR. BLEY: Now, thanks very much, that was a really good discussion. Your assumption was partially right. But I also think about the geologic and hydrological things that can change it.

I can sort of think looking out 10,000 years, but then when you turn it around and says, well let's go back 10,000 years.

MR. ESH: Yes.

MR. BLEY: Man, that's before recorded history, that's beyond where the Egyptians were.

MR. ESH: Yes.

MR. BLEY: There is rivers that have changed paths, parts of the world that have been covered up with dust that's eventually become soil and

buried under a hundred feet of it.

MR. ESH: Right. Yes. And I would say, so I understand your comment completely. I don't want people to confound this idea about uncertainty and time with, there are, there disposal systems and disposal sites, natural environments, that are necessarily more stable than others, okay?

So for instance, even in the U.S. our commercial facilities, the disposal site in Texas is, I think geologically been shown to be quite stable over a long period of time. As a very thick clay unit. That they can date the clay unit, they can date the water that's in the clay unit.

And this idea about uncertainty and how it impacts the decisions, how it's managed internationally is primarily with depth. Okay? So if you think there is too much uncertainty with near surface disposal, then you move to deeper disposal.

That's what's done in Germany for instance. They decided, we're going geologic disposal for all of our radioactive waste. Even the lowest levels of low-level waste they're going deep geologic disposal with it. That's not typical, right? That's pretty extreme. But I'm just saying that there is different methods to try to achieve safety if you're

concerned about the uncertainties.

MR. BLEY: Thank you.

MR. ESH: Yes, go ahead.

MR. BLEY: Thanks for the discussion. That was very helpful.

MR. MCCARTIN: Yes, this is Tim McCartin. One addition. And I know you brought up, you look at the number you calculate. And Dave gave an excellent explanation, but the advantage of that horsetail plot is you get a lot of different realizations of what might happen.

And you can look at those curves to see, well, what happened when it was very large? What failed, what worked, what didn't at that incident in time. Or later in time.

And the performance assessment, in addition to calculating the number, is that tool to help you challenge your thinking. Why is it safe, why were these numbers low, why were they high in certain cases? And you can go back and look at the supporting evidence that's been provided via part of the natural system, part of the engineered system.

But that's where the power of doing the site-specific performance assessment lies. It is way more, yes, you ultimately end up with a number that

you compare to a performance objective, but it's all that information it provides you in addition to just that number.

MR. ESH: Let's do the next slide please, Derek? Switching gears a little bit to the intruder assessment.

As I indicated earlier, this is the piece that if you were doing anything in this rulemaking is the one you had to do for the changes that we've experienced, okay? So the way that this was developed originally is, the NRC did calculations in NUREGs, large kind of blurry NUREGs now if you decide to look at them, where the calculations were described.

And basically the NRC made assumptions about what waste would be low-level waste. And then did what we refer to as an inverse calculation. So they put a unit concentration of a particular isotope into the calculation and then actually set a, sorry. Put a unit concentration in, saw what magnitude of dose that resulted in for different scenarios. And then after establishing dose limits, then you could determine, okay, what's the total amount of concentration you could have in the system to achieve that dose.

So it's inverse calculation that was based

on some impacts codes, which were written in FORTRAN. Perhaps Derek wrote them. Or some of them.

(Laughter.)

MR. ESH: So we took those codes and we converted them first into a spreadsheet and then into a GoldSim model. And that's in a product now called TableCalculator. It's on the NRC RAMP website. That if you have the desire to understand where Table 1 and Table 2 came from, you can go register on RAMP, download that tool, install the GoldSim player, and you can trace forward and back how the NRC concentrations were developed.

What you'll see from that is that the regulator, because tables are one-dimensional by isotopes, so it's a vector but it's one, the street value for each isotope, you had to choose the limiting scenario and the particular disposal environment, and make assumptions about the design and how the design was going to be interactive with, by people in order to derive those concentrations.

So they are based on a humid environment. They are based on an excavation scenario by an intruder. So the waste is buried with one meter of cover, two meters of waste. Somebody digs into it to build a house, they excavate the material, they spread

it around. They don't know there is any radioactivity there, and then those calculations are run forward to generate the values in the table.

If you look at that compared to modern facilities, it's almost categorically very, very restrictive. Right? So all the modern facilities, they bury waste deeper. Some of the difficult components are put in reinforced concrete or other metallic barriers.

So is that, are those engineered materials not going to be recognizable at 100 years, which is what that calculation is doing? I would say no. right?

And then the trigger for us in this rulemaking was the depleted uranium, the GTCC waste, potentially other waste streams that might be derived from new fuel cycle or different reactor technology, fusion for instance, those can be radiologically different than what was analyzed by the regulator. By NRC.

So those tables are only developed for a certain type of waste, a certain scenario, certain design, et cetera. So what we're proposing in this regulation is to allow these revised requirements, would allow for a site-specific intruder assessment.

So that basically puts the analysis in the hands of the licensee to reflect what their actual waste is, what their disposal design is, et cetera, et cetera. They can get a much more risk-informed credible assessment of this intruder calculation. And therefore would probably allow for considerable, additional flexibility or margin on what they could accept in a near surface disposal facility.

I think this approach is flexible and risk-informed. One of the criticism that we had from stakeholders is, this is putting the fox in charge of the hen house. I don't agree with that because you're always going to have a regulator, so there's always the farmer to challenge the fox. So I don't know if that's a good analogy or not.

Next slide please. So the intruder assessment. This is some information that I generated since the previous time we talked to you.

What's shown on this chart is the disposal depth of different, these are all either operating or closed facilities throughout the world and the U.S. It's all the ones I could find information on. It was no small task.

I'm going to show you a couple other charts coming up. I think it's like, I don't know,

30,000 pages of documents, or something like that. All the references are going to be in our guidance document that you haven't seen yet. 2175. But all the references for these figures will be there if you want to dig into them and try to do what I did.

There's a couple of things that I want you to highlight on this chart. First, so when these analyses are done and the intruder assessment, it's assuming that somebody is on the disposal facility at some point in the future, okay?

If you look at present day, where are people, the way this information was generated is, I gave the facility information, the names and country, that sort of information, to Allen Gross, our GIS expert, and I said, find me the nearest person to these facilities. Then he used GIS to determine what was the current present day receptors in relation to these facilities.

And what you'll note is that, especially say the green and the red, the green is DOE, the red is U.S. Commercial. The present day receptors tend to be pretty far from the facilities. That's good from a waste isolation standpoint.

And that is in our citing requirements that you basically need to consider a location that's

remote, avoid areas of high population growth. So you're trying to get it far away from people. So that's a number one component. The U.S. does that exceedingly well.

The European community, you'll see the blue ones, they tend to be closer. Still pretty far, but closer. So the point up on the upper left, I think it's a circle there, that's more Morsleben in Germany. I was there last October. Great tour of that facility.

But what was interesting is that the site, the facility is an underground mine, so it's very deep. But the fence at the top, it has crops growing right up next to it, and there's houses like right past the crops. Like, back in my young days when I played baseball I probably could have thrown a baseball and hit a house roof from the facility.

So you compare that to the U.S. where like in the Clive Facility in Utah, the nearest receptor I think was 17 kilometers. I'd have to check my data, but something like that. Seventeen kilometers nearest person from that facility.

So there is a margin of safety that's been applied here in this regulatory construct, both within the U.S. and internationally, by doing this intruder

assessment, considering that people aren't presently located at these facilities.

But it's not unforeseeable that as time goes by, something Dennis talked to in his comment, that things change, people lose knowledge. We do have a few examples.

There is one from the Ukraine that I had just recently where there was a cesium-137 source that was accidentally distributed or disrupted, I think at a construction site. And so they basically had to dig up all the material that was contaminated with cesium-137. And they took it and disposed of it, I don't know, at some nearby location. And then over time people forgot it was there, and some time later the metal scrappers heard that there was metal buried there and so they went and dug it up to get the metal scrap out of the ground and spread the cesium all over the ground that they didn't know was there.

That's kind of, that sort of scenario is what this conceptually is trying to represent. Yet probably pessimistic, but, you know, considering the time frames that you're trying to keep people safe, overly pessimistic, I don't know. It's a tough, it's a really tough question to answer.

CHAIR BALLINGER: I'm not sure that it's

that pessimistic. You folks recall the issues at Los Alamos where the metal detectors discovered trucks that were carrying rebar that were radioactive that came from somewhere? Some scrap dealer in some other country.

MR. ESH: Yes.

CHAIR BALLINGER: Yes.

MR. ESH: Right. It's not, it's -- and that's what some of our critics will say that this whole intruder thing is based on Probability 1. It's not based on Probability 1 because we're applying a 5 millisievert or 500 millirem standard for the intruders. So it is reflecting that it is lower probability compared to our offsite members of the public, which are .25 millisieverts or 25 millirem. So there is a, kind of an inherent probability reflected in these two different scenarios.

Sir, you have a question?

MEMBER MARCH-LEUBA: Yes. We interrupted you with trucks.

(Laughter.)

MEMBER MARCH-LEUBA: I assume, in my mind, for the next ten to 100 years the biggest probability of accident is on transportation to and from the facility. So if you look at the facility in the

middle of the Everglades, it's pretty far away from people. But you have to drive down I-95 through millions of people. So is that considered?

MR. ESH: Yes. These regulations don't deal with the transportation component of it, right? I understand your comment on transportation risk. The operating facilities that have been in implementation for, you know, roughly a 160 facility years, or something like that, I'm not aware of any transportation accidents associated with those facilities.

I know they use the approved standard shipping containers that are pretty robustly designed, compared to other industries. So we have to keep that in mind too is, you know, nuclear has some high standards for safety, especially radiation safety.

In my hometown, in my town near here, just this summer there was a tanker truck that was in an accident and blew up on the highway. And I think that at least the driver was a fatality. And some nearby houses basically had their roofs vaporized.

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: --- by trains.

MR. ESH: Yes, there you go. Right? Perfectly, right. Yes.

MEMBER MARCH-LEUBA: In my mind there is a the threshold. I don't if it's one year, ten years, 100, 1,000 years, but transportation is a risk.

MR. ESH: Yes. Possible. Right. On this figure, you see the blue dot there, that's in Australia on the far right. It's the Sandy Ridge facility operated by Tellus.

They have a hundred kilometer access road to the facility. 100 kilometer access road. And it's fly in, fly out. They have trouble keeping workers there because it's so remote. So they have to give them a lot of incentives so it's an interstate.

MEMBER MARCH-LEUBA: Don't want to overdo it.

MR. ESH: Right. Fair comment.

CHAIR BALLINGER: You know, we deal with license renewals, and there is one particular plant in Texas, not Texas, excuse me, Florida, where over the period, since it was constructed, the population density has encroached.

MR. ESH: Yes. Yes. That's the challenge in like the, you know, obviously if you pick a location that's fairly inhospitable today for a lot of reasons, it's hard to live there, it's likely going to be hard to live there in the future. But not

guaranteed.

Obviously you wouldn't want to put a disposal facility on the coast, which everybody loves to live on the coast. And you have coastal impacts then. Right?

In the U.K. they're dealing with that at the Drigg Facility, so they expect that facility to be eroded into the ocean at some time in the future. But it's not guaranteed.

So the good example is Las Vegas. So if you could go back in time 300 times and stand with somebody at Las Vegas and say, is there going to be a giant city here sometime in the future, they would almost categorically say, no, there is not going to be any giant city here. Right? They say you're crazy, there is going to be no city here.

CHAIR BALLINGER: You should have talked to the Gambino family.

(Laughter.)

MR. ESH: Now I will say that we are not relying totally on just the fact that the environment is going to be difficult to be there. These facilities, when they're implemented, they require landownership, deed restrictions. There's all these other passive controls that go into, hoping to avoid

that scenario where somebody even ever does use it in the future. You know, federal or state landownership of the facility after the institutional control period should hopefully be a barrier to usage, but, you know, nobody is infallible, especially not the government.

CHAIR BALLINGER: I was just at Yucca Mountain a couple of weeks ago, and that place is remote.

MR. ESH: We have our expert right here, which I don't think you want to get him started, Mr. McCartin, on the Yucca Mountain.

So I think that's it for intruder assessment. We can move on to site stability assessment.

Okay. This one is a bit of a challenge originally because the pre-Part 61 sites, they had the idea that you didn't really need technical analysis you could just design your site. You pick a location, primarily clay, that is stable and has been there a while. You dig a trench in it. It was pretty much tip and fill type of disposal methods. So you bring trucks in, you dump them, you cover it up, right?

And those just early disposal sites then, there were a whole of variety of issues that arose with them. They found that it wasn't as easy as that.

As it usually isn't when you're dealing with nature.

And most of those problems were associated with surface water management and being able to make the closure of the facility as robust as the original geology. So, you disrupt it, try to put it back. It's hard to put it back the way it was. Those problems were pretty much resolved through design and site characteristic requirements as I talked about.

And the only difference here is that when we move towards disposal of significant quantities of long-lived radionuclides, then for certain sites you may get into this situation that you need to do a long term stability assessment. And what that means is, and I'll point you to one of the examples that's in NUREG-2175, hopefully when you get it, there's an appendix in there with evaluation of what's being done at the West Valley site in New York.

So the West Valley site in New York was a commercial fuel reprocessing. There are two disposal areas there. The state license disposal area and the NRC license disposal area. Those two disposal areas, and that whole location, they thought was sufficient in the '60s and '70s. But what they've learned going forward is there is a pretty high rate of erosion there.

So it's undergoing decommissioning. And there doing a very, very complex evaluation of, when is that, when are those facilities going to erode, what's the release rates from those facilities and can you leave them in place, do you need to do some sort of engineered implementation to slow the release rate or do you need to remove the material.

And that involves erosion modeling with geomorphology tools, like SIBERIA and CHILD. It's complex system modeling because once the erosion occurs, that's the scenario that people are exposed to, the material can be transported into the nearby stream systems and eventually be transported into the Great Lakes.

So it's a very complicated evaluation. If you go through and you chose a site that has good geologic characteristics, then you greatly lessen what you might need to do for a site stability assessment. If you choose a site that's not ideal or has some temporal challenges with its behavior overtime, then you get into a situation where you're going to need to do some sort of site stability assessment.

But this only kicks in if you have long, a significant amount of long-lived radioactivity. If you don't, the risks are low, you don't need to worry

about this. So that's the kind of performance based approach we're taking to this. Instead of requiring everybody to do a site stability assessment, like involving modeling, we believe what's being done now for site stability is going to be sufficient for the vast majority of sites and problems.

Next slide please. So operational safety assessment. This aligns with our 6143. It's basically safety of the public during operations, and safety of workers during operations.

We have four operating facilities in the U.S. In Washington, Utah, Texas and South Carolina. They've been operating, as I said, for, you know, I don't know, approximately 160 facility years. They've been operating very safely.

So, I'm not aware of any significant impact to workers or the public from the operations of these facilities. It's a testament to the regulatory frameworks that those agreement state regulators are implementing. And the inspections and oversight that they provide for them.

When NRC developed the concentration tables in 6155, Table 1 and Table 2, accident scenarios were considered. So those are reflected in that TableCalculator product that I referenced you to

earlier.

But those were not pulled forward to result in changes to the concentrations, which are reflected in Table 1 and Table 2 because NRC felt that through a combination of systems, procedures, controls and trainings you could mitigate the operational impacts. And that's proven to be true, okay?

So nothing needs to be done at all with respect to operational safety, existing facilities and similar waste steps. For some types of GTCC waste though they may contain sufficient radioactivity that we believe operational safety assessment may be necessary.

So this is where you look at, okay, what are the potential events that could occur. Usually the most risky one is fire. Secondary is a drop of some sort or a mechanical damage to a container that results in release. Fire is the main one, so what's the possibility of potential of fires.

And then you go through the whole analysis of like leak pathway factors, you know. How much is released from the source, how much gets out of the package, how much is the respirable fraction in the air. And then some sort of, like shown on the right here, atmospheric dispersion calculation of what

reaches the fence line and a member of the public.

It's all pretty straightforward and standard. We don't believe even if you are dealing with GTCC waste that you need to get into the sophisticated atmospheric modeling that's done, like for severe reactor accident consequences where they'll do high split and particle tracking and all that sort of stuff. We think the basic atmospheric dispersion modeling is sufficient for analysis of operational safety and low-level waste.

CHAIR BALLINGER: How many DOE sites are there?

MR. ESH: There is a number of DOE sites at, generally at each of their locations. And they have a disposal facility in Savannah River. They have one in Oak Ridge. They have at least one at Hanford, Idaho, Los Alamos. I'm not sure --

(Simultaneous speaking.)

MR. ESH: Yes, Portsmouth.

MEMBER MARCH-LEUBA: They don't ship anything there, but they store an awful lot of stuff.

MR. ESH: So I want to make it clear that these regulations we're talking about do not apply to DOE, they have their own regulations. Right? These are only for the commercial disposal facilities.

MEMBER MARCH-LEUBA: One advantage of the DOE sites is that money is no object.

(Laughter.)

MEMBER MARCH-LEUBA: Where the commercial --

MR. ESH: These are all commercial sites, and they're for profit, for profit entities. So --

MEMBER MARCH-LEUBA: DOE sites --

MR. ESH: They --

(Simultaneous speaking.)

MR. ESH: The commercial licensees, they give us a lot of constructive criticism, and it's fair, you know. We should only be applying requirements that improve safety and do so in the most efficient manner. I think we shouldn't doing things that don't impact safety or unnecessarily complex -- or burdensome. So --

MEMBER MARCH-LEUBA: I want to change the subject back to --

MR. ESH: Yes.

MEMBER MARCH-LEUBA: -- your last bullet or whatever. Are we concerned about the concentration or the total amount of the source there?

MR. ESH: Right.

MEMBER MARCH-LEUBA: And I'm worried about

this, the routine or mixing or blending. In the limit I can take a spent fuel element, which is super high-level waste, mix it with enough sand and they can dump it in the river.

MR. ESH: No.

MEMBER MARCH-LEUBA: And so, obviously you wouldn't approve that.

MR. ESH: Yes.

MEMBER MARCH-LEUBA: At which point do we step, we put our foot down and say, no, you can't do that, this is too high?

MR. ESH: Well, the short answer to your question is that we're concerned with both concentration and quantity. So, in some instances it can make sense to take a concentration of an amount of material at a higher concentration and blend it or average it, right?

MEMBER MARCH-LEUBA: Have some material that's ten percent over the limit --

MR. ESH: Yes.

MEMBER MARCH-LEUBA: -- and you mix it.

MR. ESH: Right.

MEMBER MARCH-LEUBA: Whether you take a spent fuel element, which is a hundred thousand times --

MR. ESH: No, I understand your comment. Yes. So for instance, you want to do two things in this evaluation. You want to determine what is appropriate for your facility design, geology, et cetera, and then you also have to consider the various scenarios, different scenarios.

So like an operational safety for instance, maybe your system is such, your operation controls, whatnot is such that you're only real potential for a fire might involve a single canister, right? The single canister fire then you might be, you might have a canister limit for the amount of radioactivity that you would try to mitigate, right?

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: -- lit a fire. You know what I'm talking about? That was huge. It wasn't, it was not one canister.

MR. ESH: Yes.

MEMBER MARCH-LEUBA: I mean, it's possible to do more --

CHAIR BALLINGER: At some point you run afoul of federal law with respect to high-level waste disposal.

MR. ESH: Well you can't --

(Simultaneously Speaking.)

MR. ESH: You can't blend high-level waste into low-level waste.

MEMBER MARCH-LEUBA: Yes.

MR. ESH: So you can, within the low-level waste space you can do things operationally, like for instance, if you have low-level-waste that you need to treat and stabilize and therefore you need to have media to make it more robust to go into the disposal facility, facility, that's a very appropriate way to essentially lower concentration. You're doing it for an engineered reason to improve the performance of the facility.

But you can't take something that's high-level waste, blend it, and then dispose of it as low-level waste. You would run afoul of federal regulations then.

(Off microphone comment.)

MS. MAUPIN: -- this one, because DOE did this stuff with Savannah and their high-level waste definition where they did take some, because high-level waste a lot of times is based on how it's generated as opposed, not opposed to the actual radioactivity that DOE came out with their definition. And so, we have, I have had counterpart meetings with DOE and they said they were able to take some waste

from Savannah River, do some solidification and was able to dispose of it at Waste Control Specialists.

MR. ESH: Yes. And I think that situation is a little bit different because, as Cardelia noted, high-level waste is defined by how it was created, not necessarily the radiological characteristics of it. So, even within high-level waste you have the whole continuum of risk and radioactivity.

In low-level waste you have the same thing. And at the upper end of the low-level waste it can overlap from a risk and radiological standpoint with the lower end of high-level waste.

And so what Cardelia was talking about is DOE goes through a process, waste incidental through processing determinations or evaluations, where they assess the material and then do an evaluation of, can it be disposed as low-level waste and meet the criteria? So it's dealing with that lower end.

It's not dealing with high-level waste canisters or spent nuclear fuel, it's dealing with some other materials that they go through a lot of, as you indicated, add a lot of resources. So they go through a lot of science to implement that process and then demonstrate that they can dispose of those materials as low-level waste.

CHAIR BALLINGER: This might be apocryphal, but I, is it my understanding that the tank waste out at Hanford is such that if they diluted it they could dispose of it as low-level waste?

MR. ESH: I'll avoid answering that question, so. We did do an evaluation of one of their tank systems out there.

And at that time they're removing, they do a step first where they remove all the radioactivity to the maximum extent practical. Technically and economically practical. And then what's left behind, then they apply this evaluation process and show, okay, if we fill the tanks with concrete and stabilize the system we could meet the performance objectives that are applied to low-level waste disposal. But that's the way that process operated.

We also evaluated vitrified low activity waste. So that's where they take the secondary waste, they're running it into the glass plant, and then they produce a glass waste stream and secondary waste from that. We did an evaluation of that. They asked us for our independent review of their, of their waste determination for that to determine if they could meet the performance objectives associated with that.

CHAIR BALLINGER: Ten billion here, ten

billion there. Who's counting.

(Laughter.)

MR. ESH: Yes. So I think next slide please, Derek.

CHAIR BALLINGER: By the way, it's been an hour and a half, and this is, we're liable to have a fair amount of discussion on this one, so I would like to propose that we take, unless there is another break point that you suggest --

MR. ESH: Perfect.

CHAIR BALLINGER: -- a 15 minute break. I don't, I'm looking at 33, let's just call it 2:45-ish.

MR. ESH: Sounds good. Yes.

CHAIR BALLINGER: Thank you.

(Whereupon, the above-entitled matter went off the record at 2:33 p.m. and resumed at 2:46 p.m.)

CHAIR BALLINGER: I think, Bob --

(Off microphone comments.)

CHAIR BALLINGER: Okay, let's -- thank you.

MR. ESH: So, one thing. Before we move into time frames a colleague here said I should note is that, we do have a branch technical position on concentration averaging that applies to the kind of

discussion we had about how you can evaluate or blend materials.

It's generally applied more on a disposal package level rather than a facility level. So it's not necessarily designed to implement large scale blending at the facility level, but it does apply to things like, if you have a discrete component in a barrel, how do you average it or how much you can average it. It's not unlimited so you can't, there is constraints on the amount of averaging that you can do that's described in that branch technical position classification.

(Off microphone comment.)

MEMBER MARCH-LEUBA: We were mentioning it before --

MR. ESH: Right.

MEMBER MARCH-LEUBA: -- commercial is, is more involved. If you have a conflict of interest, then if you allow it, they'll do it.

MR. ESH: That's a very good comment. So it can be hard to write regulations because you have to think of, you know, how somebody might, where somebody might go with it. Right? Not necessarily what you intended but what would they be allowed to do if you don't word it differently.

And so, we have very long discussions in our working group about wording of various components in the proposed regulation. We've met weekly for a couple of hours. Or, I don't know how long, only five. Over a year. Lots of hours of discussion on the regulations.

So we're going to move into time frames now. The first one is, it's attached at the end of these other ones because it is analyses, but I'm not going to spend a lot of time on this because it will get into the time frame discussion. It's just to say what this is, and then we'll see how it fits in, hopefully, when we get done with the five slides after or whatnot.

The performance period. The way that our time frame approach is structured right now is we'll have a compliance period, a proposed compliance period, of a thousand years if you do not have significant quantities of long-lived waste. And if you do have significant quantities of long-lived waste then you'll have a 10,000 year compliance period combined with this performance period. So this performance period only comes into play if you have significant quantities of long-lived radionuclides.

The expected standard that we would apply

to this period, this very long term period, which is I think something Dennis Bley was alluding to, is to reduce exposures to the extent reasonably achievable. So it's not a dose limit. There is not a dose limit with this period, it's more a cost benefit type of analysis. Not exactly cost benefit.

When I initially thought of this we were going to do ALARA, but a lawyer who is retired from the NRC explained why that wouldn't work. Just a kind of complicated reasons that I partially understood that why not to do that, but he convinced me, so.

And if you'll notice that the previous times, speaking to redline strikeout, we did have this performance period and a standard for it, that was minimized exposures instead of reduced. So we changed that to reduce. We think that's a substantial change, even though it's one word.

There's a different approach and implementation to showing that you've reduced as much as possible compared to minimize.

MEMBER MARCH-LEUBA: For my education, one minute, I'm sorry, at most. What's the different between a thousand and 10,000 years?

Because if you have a repository that is good at 10,000 years, it remains good at 10,000,

unless the geography changes and if the agreement suddenly stops --

MR. ESH: Yes.

MEMBER MARCH-LEUBA: -- so, unless there is a change in assumptions nothing changed, has it?

MR. ESH: Yes. So you ask a hundred minute question with a one minute answer.

(Laughter.)

MR. ESH: So --

MEMBER MARCH-LEUBA: Yes. I didn't want to (off microphone.)

MR. ESH: Yes. So fundamentally, yes, I agree with you. And if you ask many practitioners they'll say, the amount of effort that you have to put in to develop a thousand year performance assessment, develop all those models, collect all the data, describe your site, its characteristics, the meteorology, the hydrology, the waste inventory, how it's released, potential receptors, their intakes, you know, it might be hundreds of parameters that you need for a thousand year assessment, right?

If you have a site like West Valley that is an area of higher erosion, then it will be a lot more expensive to do a 10,000 year assessment than it would to do a thousand year assessment because you

have a whole new set of processes that kick in. You need parameterize them, model all them, put all the information in for that.

If you go through the NRC safety and characteristic and selection process and those requirements, you should, for the most part, end up with sites that are going to be reasonably similar performance for that 10,000 year period as compared to the 1,000 year period.

So, you know, somewhat more expensive but not an order of magnitude more expensive, not even a multiple more expensive.

(Off microphone comment.)

MR. ESH: Yes.

MEMBER MARCH-LEUBA: -- made a difference of (off microphone.)

MR. ESH: Right. And so then, have you justified performance if you have these major processes that are going to impact your facility after a thousand years in that one thousand to 9,000, or 10,000 year period.

If you justified performance if there is these significant processes that are going to affect your, the performance of your facility, right?

(Off microphone comment.)

MEMBER MARCH-LEUBA: There is a possibility, a likelihood that the ocean will move material from the top --

MR. ESH: Yes.

MEMBER MARCH-LEUBA: -- site.

MR. ESH: Now, that reprocess is negative, right? I mean, so --

(Off microphone comment.)

MR. ESH: Yes. So --

(Off microphone comment.)

MEMBER MARCH-LEUBA: -- year.

MR. ESH: Dilution and dispersion is usually a good thing even though if politically it might not be viewed that way. But from a risk perspective that is. So the --

(Off microphone comment.)

MR. ESH: So the short answer is, I agree with you, right? I think the comment that you expressed --

MEMBER MARCH-LEUBA: If you go (off microphone) excavate --

MEMBER DIMITRIJEVIC: Jose, microphone. We cannot hear you well.

MEMBER MARCH-LEUBA: This is, again, my --

MEMBER DIMITRIJEVIC: It's very

entertaining.

MEMBER MARCH-LEUBA: It is a bad microphone. I'm sorry. I'm using two. One of them is bound to be good.

(Laughter.)

MR. ESH: Defense-in-depth.

MEMBER MARCH-LEUBA: Yes. The idea here is, typically most sites go underground. They've done it all, they don't clean up. So maybe one of the requirements should be, when you evaluate these the possibility, the likelihood exists that is going to unearth it, maybe it's not a good sign.

MR. ESH: Yes. So, IAEA has a very figure that they basically show different disposal concepts and depths for different types of wastes. And they're doing exactly what you said.

If the waste lives a long time and therefore you have a lot of uncertainty about what's going to happen with it, they mitigate those uncertainties by placing the waste deeper. And we do have some requirements that, I think Priya Yadav is going to talk about, where we are adding some depth requirements for certain types of waste in this regulation for that exact reason.

So the performance period analyses, I

think I described them here. We view it as providing transparency to the stakeholders on the expected long-term performance. And these are not a measure of projected human health impacts. You know, it's a common metric to compare apples-and-apples, but it's not necessarily meaningful in terms of, if you estimate a dose number at a long time.

We also stress that you can use different metrics for that evaluation. So you don't just have to calculate long-term doses.

There are some programs where they'll specify a flux limit for long-lived radionuclides. And usually they're developing that flux limit based on consideration of natural radioactivity for instance.

So that would make a lot of sense. If nature is moving radioactivity through the system in a certain quantity and rate, if your manmade system is doing it similarly you're not creating any additional. So that makes a lot of sense.

Let's go to the next slide please. 16. Safety and compliance. There are some different ways that you can achieve safety and compliance, as we talked about probably in enough detail already.

The disposal concept. So how deeply

you're placing the waste or where you're placing it. What sort of design you're using.

In the U.S. there tends to be towards the lesser direction of waste conditioning and engineering compared to the international community. In the international community, if you just look at pictures of some of their facilities, they're dealing with low-levels waste that is comparable to our Class A low-level waste.

And they are stabilizing it with cement and containers. Those containers then get placed in bigger containers and surrounded by cement. That whole container then gets put in a vault system. A lot of robust engineering goes into class, equivalent Class A low-level waste disposal in some of these international programs.

Part of that is, as I alluded to earlier, the U.S. has a lot of land, and we have a lot of land and space that might be suitable for disposal facilities, even if we only have four operating. People tend to be located pretty far from those facilities, so we don't need as much engineering if you have a less likelihood of people interacting with the waste. And stable environments.

Now what we're doing in this rulemaking,

as I've talked to, is we're relying more heavily on technical analyses than the first two approaches because we believe that that affords the most flexibility. And in the U.S. especially flexibility is needed.

And many in the international programs they only have one disposal facility. We have four currently. We could potentially have more. They can be located in quite different environments. So Barnwell, South Carolina is a lot different than West Texas. You know, they have much more rain, shallower water table.

So those sorts of considerations need to come in to play and you can do that best with technical analysis rather than us, the regulators, trying to write these complicated regulations like, if you're this type of site than you do this, and if you're this type of site than you do this. It's not very practical, and it would be difficult to implement.

So next slide please. So one of the areas that we had a lot of debate on over the years has been the compliance period. I will stress that in the international community they don't usually use this terminology.

They'll evaluate what they call, they'll do post-closure safety assessments. And they'll have a period that they analyze in the post-closure safety assessment. That's usually it. And they don't use compliance period. They don't usually use multiple time frames, they just do an evaluation of post-closure safety it's called.

In this area we tried various iterations of things. There's a huge diversity of opinion on this topic. And some of it technical, some of it not so much. And there is really no way to appease everyone on it.

We've taken an approach where we think what we came up is meeting the intentions of the ACRS and others to try to provide a system that's going to work effectively for our agreement state regulators but still afford some flexibility that accounts for the risk in the differences in the systems that I talked to.

So the Commission gave us direction that basically has two options. It says peak dose for use of a different compliance period depending on the long-living component of the waste. We're basically considering the latter in our proposal. We think this is flexible and safe. And can be site specific.

And so as I indicated, the compliance period would be a thousand years without significant quantities of long-lived radionuclides. Otherwise it's going to be 10,000 plus this performance period.

Next slide please. So the --

MEMBER PETTI: I had a, this is Dave, I had a question on that. The last bullet.

MR. ESH: Yes.

MEMBER PETTI: Have you guys done any analysis like was done in the, you know, original rule?

And what is significant? Do you have an estimate for what is a significant quantity?

What I'm worried about is two things. One is impurities in some of the, base metals can cause problems because they're very long-lived like niobium-94.

But also, a lot of these advance reactors are using beryllium either in a coolant, molten salt, potentially as moderator material. And with beryllium comes uranium impurity. So you're fissioning, you're absorbing neutrons in U-238 that eventually become plutonium fissions. Have you guys looked at all that to see what would that be significant?

Because I know in the existing rules the

impurities can kill you, and they can be really small. So, I'm just, I'm worried about what this may mean for advance reactors.

MR. ESH: Yes, so that's a good comment. Thank you. So what we've done is we've developed an appendix in that guidance document, NUREG-2175, that basically provides approaches that we would find acceptable for somebody to determine what a significant quantity is. That's going to be a site-specific determination.

There are some screening values in there. So if you have low concentration, very low concentrations and you didn't want to go through any more detailed evaluation, there are screening values in there you could use. And you say, okay, if I'm below these then I'm not significant, here's a thousand years and I'm done with the rest of them.

If you didn't, or couldn't use the screening values, then there are progressively more detailed technical approaches to quantify what would be a significant quantity. But that would be like disposal facility design and site specific.

MEMBER PETTI: Right.

MR. ESH: But it also --

MEMBER PETTI: Okay.

MR. ESH: It also would reflect the waste, as you indicated. So we didn't run like impurities associated with new waste streams or advance reactor technologies through that process, but the framework would be there that you could calculate the value for any isotope that you would then determine what is significant or not.

MEMBER PETTI: Okay. I'll take a look at that then. Thanks.

CHAIR BALLINGER: You know, apropos what Dave was saying, might there be some kind of verbiage in 2175 that identifies what might be red flags? Because if you're designing a new reactor system with new materials, that's a commercial decision. You have to decide what you're going to do when you shut the thing down.

And if there is a particular isotope that you really need to avoid --

MEMBER PETTI: Yes.

CHAIR BALLINGER: -- that's a pretty valuable piece of information for somebody that is designing one of these plants.

MR. ESH: Yes. Like the world spends a lot of money addressing technetium-99, iodine-129 and carbon-14 in low-level waste and then near surface

disposal.

So the neutronics of how they end up in low-level waste, or the production of those isotopes, is important because they're long-lived and mobile and they're difficult to deal with in a near surface disposal system. So if there were other isotopes similar, right, that would be derived in new quantities from new nuclear technologies, you would want to know that ahead of time, I would think, and therefore minimize the impurities that would drive those radionuclides.

The approach is all there that somebody could identify that for their specific technology. That would probably be beyond our capability to estimate for a new technology what would be the impurities and then what would be the ones that we would need to run through the process. But the framework is there.

CHAIR BALLINGER: Yes, okay, I don't mean that you need to identify every isotope.

MR. ESH: Okay.

CHAIR BALLINGER: But some words in there that says, you know, this is something you need to be cautious about.

MR. ESH: Yes. I followed a lot of that

development and discussion. And that's always the question I've had is that they could learn from what's been experienced to date in that area because it doesn't matter, for instance, how much cobalt-60 you generate in your technology. That doesn't matter at all. It never drives the performance assessments that we evaluate.

But there are isotopes that do stand out in the current evaluations. And there could possibly be new ones for other technologies that aren't currently.

You can look at the geochemistry to how mobile they are. And then basically if they're long-lived and mobile, those are the ones you don't want to generate.

MEMBER PETTI: All right. So this was done for the fusion program over 20 years ago where they went through ever element in the periodic table basically and activated it in a fusion spectrum and backed out how low does it have to be to make sure you don't get greater than Class C waste. And they always were worried about niobium-94. It's an impurity in steel. In many steels.

But then there were a couple others that I don't remember now. But the whole issue about

impurities biting you is really the message. You don't, you look at it on the surface and you go, oh, I don't worry about that. Yes, you do have to worry about that, but that's the concern.

MR. ESH: Yes. In the U.S. niobium-94 isn't one that we see all that often, but I think it was just in Belgium. I was over in the U.K. for DISPONET. It's like a near-surface disposal facility operator and regulator forum. There were people from 40 or 50 different countries. And I presented some of what work I'm talking with you about.

And I think it was Belgium that they had a challenge with niobium-94 there. That they had significant amounts of it and how to --

(Laughter.)

MR. ESH: I think the answer to that, how it turned out is they collected some more data on the geochemistry, which is reflected in something called the distribution coefficient. It's partitioning of the radioactivity in the solid media compared to water.

And that new science allowed them to justify that the absorption or the distribution coefficient was going to be much higher than previously anticipated and therefore it took care of

the problem. But your comment on 94 generically is well warranted as a proxy for --

MEMBER PETTI: Yes.

MR. ESH: -- proxy for any impurity that could be enhanced through some process.

So let's step into the next slide then.

MEMBER ROBERTS: While you're on that slide.

MR. ESH: Yes.

MEMBER ROBERTS: Can you explain the difference between peak dose and performance period? They seem like the same thing.

MR. ESH: Okay. So the peak dose is a concept where you just run your analyses for as long as necessary to identify when the peak occurs and see how big it is. And that's what you compare to your standard.

That is the regulatory easy approach, okay? I wouldn't necessarily say it's risk-informed or there can be unattended consequences with that approach. One of them being, for instance, in the U.S. a commercial entity can choose any location that they can own the land and justify it meets the characteristics to locate a disposal facility.

So if you're in the camp that the long-

term analyses are too uncertain or very expensive to implement, if you're a implementer or a potential disposal facility, you would necessarily, under a peak dose standard I believe, choose a location that has a shorter, a shorter time of arrival for the radioactivity released from the system.

In your view it would be less expensive to justify, right? But from a societal standpoint you do want it to be as long as possible. You want it, you know, the longer the better, right, for the time for the radioactivity to reach people. So you have those sorts of effects with implementing a peak dose approach which in a practical world get complicated.

In the scientific world by far that's the easiest, right? You just say, okay. And that's what's done in Texas. They're regulation, our agreement state, the agreement state regulator there, their standard is a thousand years or peak dose, whichever is bigger. Okay?

So they did license the disposal of large quantities of depleted uranium in Texas, and their peak dose was at about one million years. So they ran the technical assessment, the licensee ran the technical assessment out to one million years, and that's what their regulator, the regulatory agency,

the TCQ, Texas Commission on Environmental Quality evaluated, and that's what they based their decision on.

MEMBER ROBERTS: But in that, what performance period is getting at? I've read the FRN, I assume. It was more of a qualitative standard as opposed to a quantitative standard.

MR. ESH: Oh, okay. Yes, yes.

MEMBER ROBERTS: You --

(Simultaneously Speaking.)

MR. ESH: Right.

MEMBER ROBERTS: -- if you do a calculation out to a peak dose to make sure you understood it.

MR. ESH: Yes.

(Simultaneously Speaking.)

MR. ESH: So the performance period is the time after 10,000 years. And it could involve going out to peak dose if you choose to use a peak dose standard for that period. Or if you choose to consider peak dose in that time frame.

But the way that's written, is it's written in a flexible way that you don't necessarily have to do that, right? So you can justify that you've reduced the releases to the extent practical

for that time frame without necessarily being obligated to calculate a peak dose.

You could calculate something else too like a flux. A flux rate for instance and compare that. So I think it affords a lot of flexibility for those time frames.

If I was the licensee and I was faced with that, I would just calculate the peak dose and make the justification for all my sciences there to support it. And if it's potentially bigger than my compliance period standard, I'd make an argument for why that was appropriate, you know. Or why the amount that I put in to make the value what it is, is appropriate. Like it's too expensive to do anything more in my calculations.

MEMBER ROBERTS: So if the licensee doesn't go to peak dose they have to show that the release has reached some sort of a steady state value that won't get worse over time, is that what you said?

MR. ESH: I don't know that the releases are a steady state, but just basically like, if you put in a certain amount of money to design your system, characterize it, select your site, evaluate the geology, what more could you do to improve the performance?

So you might look at alternatives. Like for instance, if you do minimal waste conditioning and you run a calculation and you say the result is X, and if I implement higher waste conditioning how does it change it, right? Does it make it go lower, higher, whatever.

The kind of a one at a time sensitivity analysis perhaps. I think that would be --

(Simultaneously Speaking.)

MS. MAUPIN: I think here is that you have to remember that your performance investment is a living document, it's a living system. If you change, like we're coming up with some things where it's going to be dependent upon the waste that you put in there, so then you might need to go back and reassess. Do another performance assessment based on those types of changes.

I just distinctly remember, you don't put it on the back in that, in the back closet on the shelf hidden away, you need to keep that as a living document or a living procedure.

MR. ESH: The short answer to your question, I think, is that the peak dose standard would apply a dose limit regardless of the time whereas the performance period standard is not

applying a dose limit. So you still might do long-term calculations, but you're going to apply a different standard to the result of those calculations.

MEMBER ROBERTS: Yes, thanks. That's the way I read it. Thinking back to the history of 10 CFR 63, Yucca Mountain where they got a peak dose remaining year period added, you know, later and just kind of a change to the overall approach based on a difference of opinion of how you would treat the time period they got going out to peak dose.

I just have one other question. Again, thinking of the Yucca Mountain experience. There was some features, events and processes that were terminated or truncated to 10,000 years even though the overall TSPA went out to a million years. Is there anything like that here or you have to trace all FEPs out to the time period regardless of whether or not, you know, you got analysis up just to 10,000 years?

MR. ESH: Yes. So that's a good question. And we do have a very lengthy guidance section on features, events and processes and development of scenarios and different types of scenarios and how you would incorporate scenarios at different probability

in the evaluation.

And so, depending on your site and your design you could have new FEPs that are important at longer time frames. But for the most part, I believe our guidance says that the FEPs that you develop for your 1,000 and 10,000 year assessment are generally going to be suitable to implement in those longer calculations. So you might have unique circumstances where something would come in at that, a very long time, but for the most part if you do a thorough evaluation of your FEPs for those other time frames it will apply to the longer time.

MEMBER ROBERTS: It seems like engineer barriers, like your metal containment boundaries would be ones that you would be concerned about because sometimes you get to 10,000 years and your corrosion models are getting to a million years. You probably don't have any materials in the world that you could demonstrate are good to a million years.

MR. ESH: Perhaps at Yucca Mountain their C-22 or titanium scientists would argue with you, but yes, I generally agree with you that their experience base is necessarily limited unless you look at meteorites as analogues I think. So.

And low-level waste disposal generally

limited metallic barriers are used in the designs. And limited amounts of credit are applied to them.

To date in the U.S. they just don't use metallic barriers or credit them in the analysis. But the generic point is well founded. You know, there are certain things that you could justify for a thousand or 10,000 years might be more difficult for longer.

And that's what we're looking for is like, a commonsense evaluation of, what do you expect to happen and what does it look like. And can you do anything about it. That's what the performance period is about I think.

MEMBER ROBERTS: Okay, thank you.

MR. ESH: So we carefully examined the comments on this by the ACRS and others. We had lots of comments. One of the primary considerations is the current practices by the agreement states because all these facilities are in agreement states regulated by agreement state regulators and they are the ones that have to justify for the people living near these facilities that aren't necessarily all that close but in these environments why it's appropriate to license and operate this facility.

So we do feel that something you may not

be familiar with, perhaps you are, the compatibility class of the regulations that determines, and Cardelia is our expert on this, whether the requirements have to be implemented exactly, whether the agreement state can be more restrictive, or whether the agreement state doesn't really even have to implement that requirement.

There is various classes and I'm sure Cardelia can give you a dissertation on it if you want it, but that's the gist of it for, you know, my engineering viewpoint.

So the compatibility class for the timeframes in the agreement states, we heard this feedback very loud and clear from them in the last iteration, is they want to be able to preserve what they are doing or be more restrictive than what the NRC prescribes.

So from a high-level standpoint, you know, if we said a thousand years for everything or ten thousand years for everything, the agreement states are still going to implement what they want to implement anyway, right.

So I don't know how -- I know a lot of attention has been given to it, but from a practical standpoint what does it impact and at the end I don't

see it.

We have considered what is done internationally and in the U.S. Some of the previous commenters have asserted that what we proposed is not consistent with international practice and I think I'll show you in a few slides it generally is at least now.

So let's go to the next slide. Something we talked about, I think Dennis mentioned, uncertainties in society and environmental conditions will increase over time.

This regulatory approval process to allow disposal, it need to evaluate the impacts considering uncertainty and stop the analysis. So I am not aware of a nuclear safety, a case where you say the uncertainties are so large, therefore, let's reduce the requirements or let's take action not knowing what will happen. I don't think that's the way the process works.

I think if uncertainties are large you do something to mitigate the uncertainties and as I described what is generally done internationally is you put the waste deeper.

If you think there is too much uncertainty with near-surface disposal then you go to a different

disposal technology to mitigate the uncertainties. It's plain and simple as that.

That is what is done in Germany. They require deep geologic disposal. Almost all of the international programs they place some restriction on long-lived radionuclides appropriate for near-surface disposal. Generally that value is at NRC's Class A values.

Now you can debate, have a lengthy debate about why that is. It could be that NRC's values came out before many of these other requirements and they copied them, it could be that they were derived independently and they ended up at similar values.

You know, it would be an interesting project to see where those values came from, but they are generally all around that value. So when I talked about this and presented it over at Disponet in the U.K., even some of the international operators were a little taken aback with like what NRC or the U.S. was doing and that they said, well, we wouldn't allow near-surface disposal of GTCC. They call that intermediate level waste.

An intermediate level waste goes a hundred plus meters in the ground. So we are pushing the limits of what is appropriate, but when I talk with

them about it and say well where did you get your limits from for, you know, where your boundary is between low-level waste and intermediate-level waste and they'd say, oh, well, it's to however many becquerels per gram or kilobecquerels per kilogram or, you know, whatever units they use, and I'd say, okay, that's basically our Class A limit and that comes from an excavation scenario where somebody is digging up two meters of waste and spreading it around the land surface at 100 years and you're talking about a facility where your waste is 20 meters deep, it's embedded in concrete with steel on top of it, you know, so, yeah, you might say you're a little taken aback by that we would allow near-surface disposal of GTCC waste, but as Tim will talk about, there is other requirements that get put in place to ensure that the scenario is not an excavation scenario where somebody could dig it up at a hundred years and spread it around the surface.

So that's where I think it can get appropriate and our requirements that we have developed I think are smart and flexible and they are going to work pretty well if we get to the point of actually implementing.

You can use design requirements, so you

could say if I am worried about radon from depleted uranium require a 10-meter disposal depth, you know. Even in an arid location usually there is enough moisture in the subsurface that is going to greatly reduce the radon flux with ten meters of cover.

It's a simple solution, a simple engineered solution, if you think that there is problems with the long-term analysis.

Next slide, please. So this is another dot plot that I developed. As I indicated there was an awful of effort to develop this. I am going to spend a few minutes on it because there is a lot going on here.

First and foremost you can see that all the dots kind of trend from lower left to upper right, so as you are dealing with more concentrated waste, and this long-lived alpha, so it's uranium, plutonium, americium, I believe.

It's not the whole list of radionuclides because as I dug through those, you know, 30,000 plus pages of reports, it's hard to find this information. So some facilities might have a list of their total inventory, you know, 79 radionuclides, some might have three, some might just saw how many total curies they have, all right.

So it's all over the board, but we took all the ones that we could find in all these reports and plotted it just to say, okay, what's going on.

So on the "x" axis is either the compliance period, if it has identified that, or the time evaluated in their assessment, that post-closure safety assessment, and what you see here is that throughout the world they are using very long-term assessments to make these decisions.

So when people say, well, if NRC proposed anything more than a thousand we're inconsistent with international practice, I would say, no, international practice is they are analyzing a lot longer timeframes for a lot less concentrated waste.

Our GTCC is going to be falling above that black line and potentially approaching those two green squares up at the top that are WIPP for contact handled and remote handled transuranic waste.

So you can have a lot of long-lived alpha that might be present in some of this greater than Class C waste, what's the appropriate way to analyze it, how do you determine if it's appropriate to go in the near-surface or not.

I think it's appropriate to do a long term analyses, see what the impacts are, and then you know

is it appropriate for the near-surface or not. If it's not you have other choices for what you can do with it. You don't have to put it in a shallow trench. So that's one point.

Second, you see the green dots there, those are Department of Energy. They gave us some good comments on this figure. One of the points they expressed was like even for their low-level waste points there that are found at a thousand, that's their compliance period, but then they do a longer term evaluation even though they use a thousand year compliance period.

The reason that works for them is they are both the licensee and the regulator in those problems. They can look at the results that come in after a thousand years and they can say you need to change, you know, the waste that you can accept, how you are disposing of it, they can basically implement changes based on those results.

In our system, if we don't have a requirement for what somebody needs to do or how they do it say after the thousand-year period then we can't require them to do anything.

So they could generate any number after a thousand years and we wouldn't be able to say, well,

you need to do something about it. In these sorts of problems and systems many times there are delays and lags in the impacts due to transport through the environment, erosion of a metallic barrier, also there's a dynamic system effects that come in that in most of the modern systems the impacts are not even realized in a thousand years.

Maybe tritium shows up, you know, possibly strontium, those are two of the earlier ones. Cesium in most of these systems doesn't make it out of the system even, it all decays during transport.

It's the iodine, technetium, iodine-129, technetium-99, carbon-14, they show up. Uranium starts showing up usually after a thousand years, and then things like plutonium, americium, thorium, those sorts of isotopes are usually way out in time and usually pretty minimal impacts in low-level waste because there is not a lot of those isotopes present.

The open circles there in red, those are the U.S. low-level waste facilities that are closed and had to undergo remediation. Those are plotted as having a compliance period of time evaluated but they really don't.

It's a log scale, so they really shouldn't even be on the figure because I didn't do technical

analyses for those facilities. I just put them on there to kind of give some more data points in terms of the concentrations, but the time presentation of those is kind of wonky.

The red ones there are the commercial facilities, you see there is four of them. The original analysis in Utah used a compliance period of 500 years.

They are undergoing an evaluation right now to accept large quantities of depleted uranium disposal and they implemented a requirement that's very similar to what we are proposing, which is a 10,000-year compliance period followed by something I think they refer to as a deep time evaluation, but basically a two-step evaluation analogous to what we are proposing in this regulation.

Let's see. The red dot on 100,000 years, that is the site in Washington, U.S. Ecology site. They did a 10,000 year evaluation but then out through 100,000 years in their Environmental Impact Statement.

The red dot on the far side is the Texas facility, WCS in Texas. Let's see, anything else on this. That's probably it.

I think basically to me, I put this information together after we came up with our

proposed approach in this rulemaking because I wanted to see, okay, how much merit there was to those comments that were being inconsistent either within the U.S. or with the international community.

To me it says that what we are proposing, which is kind of highlighted by the green area, it overlaps a lot of the dots, so we are being consistent with what is done internationally. That's probably it for that one.

My last one, and then you get somebody new and I think you're all going to applaud, is the similar chart for long-lived mobile radionuclides. This one is a little interesting and that one point I would make is that you see almost all the facilities in the world, the fraction of the Class A limits is below 0.1.

So at a tenth of the Class A limits that's the concentration of technetium, iodine, carbon-14, and those are the drivers. Even at those concentrations those are the drivers for the offsite doses for many of these facilities, okay.

So it doesn't take a lot of those. That was a previous discussion we had about impurities, you get the wrong impurities in there and you can have quite a challenge, so those impurities at those

concentrations create a bit of a challenge.

You will see in some of the international waste that they call low-level waste they have very low amounts of those radionuclides and they are doing very long assessments for those low concentrations, which if you do a peak dose approach it could lead you to that, right, and so is it productive if you estimate, you know, 1/100,000 of a millirem or a millisievert at, you know, 100,000 years in the future, is that a good use of resources and money to be performing that sort of assessment.

I would say no. I think our approach would allow somebody to avoid that, but a peak dose approach it could get you into that sort of assessment.

I think that's it for me. We'll be moving to Tim next. There are probably some questions now and then again at the end, I guess.

MR. MCCARTIN: Okay. I am Tim McCartin if there are no further questions for Dave at this time. I was just going to talk, I have a few slides to talk to some of the things we are doing in the rule to account for some of the characteristics of GTCC waste and recognizing that some of the concentrations and quantities of long-lived radionuclides in some

specific radionuclides we wanted to point out specific aspects of GTCC waste that would need to be addressed.

First, in terms of the near-surface disposal and intruder protection, the current rule requires for Class C waste to be either five meters depth or an intruder barrier.

For greater than Class C waste we are requiring both. It needs to be at least five meters depth and an intruder barrier that is required to last for 500 years, and that's to help decay some of the material that is there.

Additionally, we noticed in looking at some of the waste streams in DOE's EIS for greater than Class C waste there are some streams that have a potential for a very high concentration of certain long-live radionuclides.

We are putting a limit at 10,000 nanocuries per gram as a threshold, that it's not excluded from near-surface disposal, but if you have concentrations at that level it would be decided on a case-by-case basis by the Commission, so just it's getting up there with pretty high concentration.

Additionally, there are certain characteristics of the waste that would not have been considered for Class A, B, and C waste previously in

any significant way, but we looked at you need to consider the heat generation of some of these waste streams, depending on the nuclides, and radiolysis potential effects on the engineered barriers in some of the environment of the disposal facility, criticality, and non-dispersibility, and that's really for the operational phase.

As Dave mentioned earlier, fires is a big problem, dropping a container, and some of these waste streams have a sufficient amount of plutonium that -- You really don't want to see a lot of plutonium get released into the air, so we have some of these considerations that need to be considered.

On the next slide I want to talk to there is -- My next two slides are specific aspects that currently are in Part 61 and there is a requirement for demonstrating criticality safety procedures for preventing accidents during operations.

Unfortunately, the regulation Part 61 has no consideration for the concentration of the fissile material, and so we're proposing to put in an exemption for waste with very dilute concentrations of fissile material.

This material, despite the amount of fissile material there, it's in a concentration that

there really is no credible means for having a criticality accident so we would exempt material of that waste concentration from the need to have procedures for protecting against a criticality accident.

Now that's one side that makes it a little more flexible. The other part though is that there is the potential for fairly, even at some of the concentrations, a fair amount of fissile material in a disposal unit, we're talking hundreds of kilograms of fissile material.

So we have added in a particular requirement that depending on the amount of fissile material you have in a disposal unit they need to identify the design measures that are being employed to prevent a re-concentration of that fissile material in the future and a possibility for a criticality event. Yes?

MEMBER MARCH-LEUBA: The form of material, you have U-235.

MR. MCCARTIN: Yes.

MEMBER MARCH-LEUBA: But there is no way you can make it go critical really, it takes a lot of effort, but you have plutonium that can be separated chemically and concentrated in a location because if

--

MR. MCCARTIN: And this would be part of their consideration that they would have to explain, that it would depend on the form of the material and --

MEMBER MARCH-LEUBA: As part of using it.

MR. MCCARTIN: Right, yes. And you could make an argument, gee, this isn't going to separate, it's not going to -- But there are some fairly high masses of plutonium, you know, on the order of a couple hundred kilograms, and if that's in a single disposal unit you would at least want to consider what might happen in terms of re-concentration --

MEMBER MARCH-LEUBA: -- in optimal moderation condition. I think 300 oz of plutonium are critical. It's a very small amount.

MR. MCCARTIN: Right. Right.

MEMBER MARCH-LEUBA: In optimal moderation.

MR. MCCARTIN: Right. And that's why if you now are disposing of a couple hundred kilograms at least look at this problem and make sure that you have designed it in a way that you are limiting the possible concentration, and that's gets to -- Some disposal units will have drains.

Well if you have -- You know, maybe that's not the best situation. It's a consideration that depending on what you are disposing of and the form then it needs to be considered.

MEMBER MARCH-LEUBA: Yeah, I would find it amazing, but gold mines, the gold has to be concentrated over millions of years but it all goes to the same place, so we have to prevent that, or at least that.

MR. MCCARTIN: Yeah. Next slide. Also with physical protection the current requirements in Part 61 as in 150.14 for receiving special nuclear material.

It requires a, it falls under a Part 73 requirement, which is common defense and security that is enforced by the NRC, which for an agreement state that is not under their purview to implement.

So we looked at some of the waste streams and depending on the attractiveness of this material for theft and diversion, consistent with other exemptions that are provided in 73.67, which is the security requirements for a fixed site, we are providing a concentration limit that if you are below a certain concentration of special nuclear material you do not have to apply the physical protection

requirements of Part 73, and so giving a little more flexibility and making sure that basically the physical protection requirements are commensurate with the threat and the attractiveness of the waste.

Regardless of the exemptions in Part 73 there still would be physical protection requirements under Parts 20 and 37 that the agreement states do implement, but once again it's looking at some of this waste.

Yes, you will trip the threshold for physical protection requirements, which is 15 grams, which is not a lot, but the concentration is such that it would be very -- You would have to divert a large volume and then process it.

This waste really has been already processed to get out all of the special nuclear material you could, and so the threat is not there and we have provided that basis for our thinking in the Federal Register Notice and we'll be certainly interested in the public comments we get on that.

Those are the two considerations that you'll see changes in the rule to address some unique aspects of the greater than Class C waste. If there aren't any questions I believe Priya is next.

MEMBER MARCH-LEUBA: It's the isotope.

It's not depleted uranium, is it? GTCC -- Is depleted uranium or GTCC greater than Class C, depleted uranium is not.

MR. MCCARTIN: I'm not sure -- Well, okay, yeah.

MR. ESH: So uranium is -- This is David Esh. Uranium is not in the Table 1 and Table 2 of our regulations, so it falls to 61.55(a)(6) that any isotopes that aren't in the table are Class A by default, so depleted uranium is Class A by default.

GTCC isotopes can be any of the isotopes that are above the Class C concentrations reflected in Table 1 and Table 2. So you could have cesium GTCC, you could have plutonium isotopes, the long-lived transuranic GTCC.

Anything that is above the C values in those tables would --- that's how it works.

MS. YADAV: Okay. All right, if there is no further questions then I have about six more slides and some of the points Dave has covered so we can go through them pretty quickly.

I will have to apologize, I can't see online, we can't see in the room, so if you have any questions in the room just go ahead and, you know, stop me and, you know, one of my colleagues can stop

me from talking also and we can stop for questions, and online I should be able to see any hands that go up.

So my name is Priya Yadav. I have been working with Dave actually on Part 61 issues since 2008. We've seen many ups and downs over the years and we have come to brief you guys often, so thanks for inviting us back.

So first I'll talk about waste acceptance. So we are envisioning with this rulemaking to allow licenses the flexibility to develop site-specific waste acceptance criteria.

This is a topic that was addressed, given to us in one of the SRMs along the years and our approach is similar to what we had in SECY-16-0106.

So the licensee -- Well, the Waste Acceptance Program would have three components. The licensee would specify the criteria, which is the allowable activities in concentrations for each radionuclide for disposal, they would specify the waste characterization methods and then also have a certification program to ensure that the waste to certify that the waste when it arrives at the disposal facility meets the waste acceptance criteria.

We envision licensees could either have

generic criteria, which would use the limits that are currently in 61.55 and the waste characteristic requirements in 61.56 or they could use their results of their 61.13 technical analyses to develop site-specific waste acceptance criteria, and those analyses are the ones that Dave just ran through.

Licensees would review their programs annually and they would approach their regulators with their criteria and if approved the waste acceptance criteria would be incorporated into their license.

Now for shipping waste generators would still be using the classification system in 61.55, so they would still be shipping waste according to the ABC greater than Class C classification system, and those limits will not be changing during this rulemaking.

Next slide, please. Okay, so a new area that we have received in this rulemaking is the concept of grandfathering, and this one of the recommendations that the ACRS had in their 2016 letter to the Commission, so I just wanted to touch on what our approach is on this.

We are not using the term "grandfathering" because there is some sensitivities with that term, so we have developed the term "exception criteria." The

SRM on SECY-16-0106 directed us basically to allow for an exception and they used the term "grandfathering" for existing facilities who have indicated that they do not want to dispose of large quantities of depleted uranium.

So to address this we are considering including language in the purpose and scope section of Part 61. To 61(1)(b) we would have some exception criteria and those would be if the land disposal facility license was originally issued before the effective date of this rulemaking and the licensee does not accept greater than Class C or a significant quantity of long-live radionuclides after the rulemaking those licensees that meet the exception criteria do not need to comply with certain of the revised requirements that we have kind of discussed in this presentation.

So the main ones we see are the revised technical analyses requirements. So all five of the technical analyses that Dave has run through for the performance assessment and trigger assessment, all of those technical analyses.

In addition, they would not need to comply with the revised performance objectives located in 61.41 and 61.42 and those two reference the compliance

period and 61.42 references the intruder dose limit of 500 millirem, and they would not need to comply with the waste acceptance criteria that I just discussed.

Instead of complying with the revised requirements, these accepted licensees would continue to comply with the original Part 61 regulations for these sections.

Okay, next slide. So Dave touched on kind of significant quantities and we had a question on that. We are planning to include a definition in the rule to kind of help define what we mean by "significant quantities" and that would be, you know, an amount and concentration accepted for disposal that if it was released could result in the performance objectives not being met.

So that is the definition that we plan to include in the rule, of course there would still be calculations, site-specific calculations need to be done based on, you know, specifically what is being disposed and the disposal facility.

The amount of significant quantities would be the amount that would be used to select the compliance period. So if you don't have specific quantities of long-live radionuclides 1,000 years may be acceptable as your compliance period and if you do

10,000 years would be necessary followed by the performance period.

It would also be the amount for demonstrating meeting the exception criteria. So if you are not disposing of the significant quantities of long-live radionuclides then maybe you meet the exception criteria.

So, okay, it would be a site-specific calculation, but for purposes of this paragraph the Staff has done work in SECY-08-0147 that has concluded that up to ten metric tons of depleted uranium was acceptable for disposal in the near surface.

So for purposes of this paragraph we are considering including that less than ten metric tons of DU is not considered a significant quantity.

Next slide, please. So as we mentioned the calculations would have to be performed on, you know, a site-specific basis depending on the specifics of the disposal and the specifics of the waste stream.

These amounts would have to be reviewed by the regulators and then they, the licensee and the regulator, would come to agreement on whether or not the exception criteria can be used and which compliance period to use.

We do have example approaches in our NUREG

and, you know, a table of screening values that could be used.

Next slide, please. Again, as Dave mentioned, we are considering in this rulemaking having adding a minimum depth of disposal for significant quantities of uranium.

So because the decay of uranium can, you know, produce radon that diffuses to the land surface, as Dave mentioned earlier, even ten meters might be appropriate depending on the quantities of uranium, so we are considering for this rulemaking to include in 61.52 that significant quantities must be disposed so that the top of the waste is a minimum of five meters below the surface cover.

Okay. The next slide is about the guidance which we also talked about. Between Derek and George and I we will figure out how we can get the guidance to you and what form and, you know, it's definitely available for you to review and I also have like a transmittal letter that has been following it along and concurrence that identifies kind of the key sections for you to review.

Chapter 1 would be the most important. It gives an overview of the guidance and the regulation and it kind of like steps through all of the changes,

and then the appendices, each one for GTCC and one for how to calculate significant quantities.

That's the last slide I have. Are there any questions?

(No audible response.)

MS. YADAV: No, okay. Well then George will take it away with some updates on the schedule.

MR. TARTAL: Thanks, Priya. This slide shows the next steps in the rulemaking process and where we are currently at. We have been developing this proposed this over about the last year or so.

We held a public meeting in May of this year and we have another one scheduled that we are going to have in January of next year. We have been presenting on this topic to a number of different public audiences in public and non-public audiences over the past year.

We plan to submit the proposed rule and guidance to the Commission by May of next year, as Steve mentioned in his opening remarks.

You see here from the pictorial that the guidance has been following along with the rulemaking and you see some very similar steps between the rulemaking and the guidance, and so we plan to issue draft guidance along with the proposed rule and final

guidance along with the final rule.

Any questions on the rulemaking process or next steps?

MR. SCHULTZ: George, just one question, and Cardelia brought it up earlier, that there have been a number, and you just said, there has been a number of interactions with the public associated with where things are going.

In the information that we have received associated with the public comments we haven't gotten a lot of information about where things, what those comments have been, except the number of public comments, and I know some of those came in a bunch and others came individually from various stakeholders.

MR. TARTAL: Sure. So let me address your question. So I think the answer is, number one, some of the public comments that we have addressed have been dealt with along the first path.

If you remember Cardelia talked about the two trains that are going on parallel paths, the first train that was going along the path of the Part 61 rulemaking we had a number of public comments that came in as part of the proposed rule and we resolved those comments and we published a draft final rule and sent that to the Commission.

So there is a number of comments involved in that part of it and then on the GTCC we did a draft regulatory basis, we talked about that as well. We got a bunch of comments on that.

In the proposed rule that you reviewed we have a section talking about the comments that we got in there as well as well as an ADAMS link over to the public comment document that gives you kind of an analysis, if you will, of the different comments that we got on the GTCC reg basis.

So they are kind of scattered in different places, if you will, but now that we are back into a new proposed rule, so now we are kind of taking on a new phase of public comments, if you will.

MR. SCHULTZ: Yes. And you've got in the Federal Register Notice, and you've got it in your schedule here, another public comment period, and in the notice you've got some fairly interesting requests for comments for the public to consider.

MR. TARTAL: Mm-hmm.

MR. SCHULTZ: A number of areas that you are looking for feedback information.

MR. TARTAL: Mm-hmm, yes.

MR. SCHULTZ: Then what happens? Are you going to be able to perhaps react to those, integrate

those into the process, in what will seem to be I think a short period of time before everything is finalized?

MR. TARTAL: Well in terms of period of time I think that kind of depends on the kinds of comments that we get, right. In any rulemaking you can get one comment or 10,000 comments.

MR. SCHULTZ: Right.

MR. TARTAL: You could get comments that are relatively easy to resolve and comments that are really difficult to resolve. Some comments might require you to go back and do further analyses or significant revisions to the rule.

There is a lot of possibilities based on what you receive in public comment. We react to them accordingly. We deal with what we get. I know that's kind of a very high-level answer to your question, but that's probably the best one I can give you is we'll react to whatever comments that we get and address them in the final rule if that is the appropriate thing to do.

MR. SCHULTZ: Yeah. The Notice also demonstrated the number of different venues in which you've sought public comments and that's been good and that's been over time but also fairly recently you've

done a lot of work in --

(Simultaneous speaking.)

MR. TARTAL: Yes. We have been seeking feedback in a lot of different venues like that. It helps to inform and reinforce what we are doing.

MR. SCHULTZ: Good. Thank you.

MR. TARTAL: Other questions?

(No audible response.)

MR. TARTAL: Thank you. Chair, I turn it back to you.

CHAIR BALLINGER: Questions? Other questions from members or our members that are online just to be sure we have an opportunity?

(No audible response.)

CHAIR BALLINGER: Well, hearing none, now we need to go out for public comments. If there are members of the public that would like to make a comment please state your name and make your comment.

(Pause.)

CHAIR BALLINGER: Hearing none. There's one? Uh-oh, what did I do.

PARTICIPANT: It's a hand up.

CHAIR BALLINGER: Oh, there is a hand up. Number -- Whatever --

(Simultaneous speaking.)

CHAIR BALLINGER: Okay, please state your name and make your comment.

(Pause.)

CHAIR BALLINGER: Fifty-eight is --

PARTICIPANT: I think you are muted, Dan.

(Pause.)

CHAIR BALLINGER: I think we don't have somebody there.

(Simultaneous speaking.)

CHAIR BALLINGER: It will be Bobby Janecka. Are you out there? Your hand is up if you would like to --

MR. JANECKA: Hi, there. Yes, Bobby Janecka here speaking. I just wanted to ask one comment or suggestion. I appreciated Dave Esh's portion of the presentation earlier and heard his suggestion of going to join the RAMP website to get a better idea of plugging things into GoldSim.

I am down in the State of Texas, by the way. Bobby Janecka, Texas Commission on Environmental Quality. We have relied on the use of GoldSim for some of the license review that we have done from our agency.

So I immediately perked up my ears and I noticed that there is no clear opportunity there

through RAMP to join as a member of the public, just a member of a non-profit or an advocacy organization who may be curious and interested about this topic and want to kick the tires themselves.

So for what it is worth I thought I would offer the suggestion that you all might visit with the entity that makes this valuable tool available and explore how that might be possible, just to suggest we make things more transparent and more open to the public and I appreciate you all taking the time to explain this to this advisory committee and get into this level of detail.

CHAIR BALLINGER: Thank you. Our DFO and I am sure the presenters know who you are and they will take care of that. I don't see any more hands. No more hands.

(Off microphone comment.)

CHAIR BALLINGER: Now what? Oh, Janet Schlueter.

MS. SCHLUETER: Yes.

CHAIR BALLINGER: Okay.

MS. SCHLUETER: Yes, it's Janet Schlueter from NEI. I think Dan can't get off mute, but he wanted to know if the Staff has set a date for the January meeting, that would be most useful.

Secondly, thanks to the Staff because this briefing I think was more informative than the last public meeting, so we look forward to the January meeting.

CHAIR BALLINGER: Thank you. If I say no more public comments another hand is going to go up, so I won't.

MS. SCHLUETER: Does the Staff has a January date?

CHAIR BALLINGER: They can get back to you. We can't respond in this forum, but I am sure they will.

Okay. We have a compliance period. No more hands.

PARTICIPANT: Amen.

CHAIR BALLINGER: No more hands. Thank you very much. It was a very informative -- Now for purposes of going forward, Derek has got a list of things that we need to have and the vehicle by which we can get them and things like that.

So we have to have them in enough time prior to the -- And there are some rules about that, so hopefully those will work out.

If there are no other folks -- Well, I should ask, are there people in the audience that

would like to make a comment?

(No audible response.)

CHAIR BALLINGER: I am so used to this being remote and everything nowadays. Okay. Thank you very much for the presentation and we will see you or somebody like you in February. We are adjourned.

(Whereupon, the above-entitled matter went off the record at 3:59 p.m.)

INTEGRATED LOW-LEVEL RADIOACTIVE WASTE DISPOSAL PROPOSED RULE

ACRS Subcommittee Meeting

December 5, 2023

Cardelia Maupin
David Esh
Tim McCartin
Priya Yadav
George Tartal

Agenda

- Background
- Prior rulemaking efforts
- Safety case and technical assessments
- Timeframes (compliance period)
- GTCC waste considerations
- Waste acceptance
- Exception criteria and significant quantities
- Implementation guidance
- Next steps

Background

Challenges to the Current Regulatory Framework in Part 61

1982 Assumption	Current Practice
Waste hazard to inadvertent intruder duration ▪ Class A and B: 100 years ▪ Class C: 500 years	Some defaulted Class A wastes are being disposed of in greater quantities than assumed and could cause hazards past these periods (e.g., Depleted Uranium (DU))
Only DOE enriches uranium ▪ DU only commercially available in small quantities	Private sector entities are operating enrichment facilities
Average disposed waste concentration expected to be well below class limit	Blended wastes create wastes much closer to class limit and may be disposed in large amounts together
Greater-than-Class-C (GTCC) waste disposal in geologic repository or by Commission approval	Considering near-surface disposal (in top 30 m) for certain GTCC waste streams

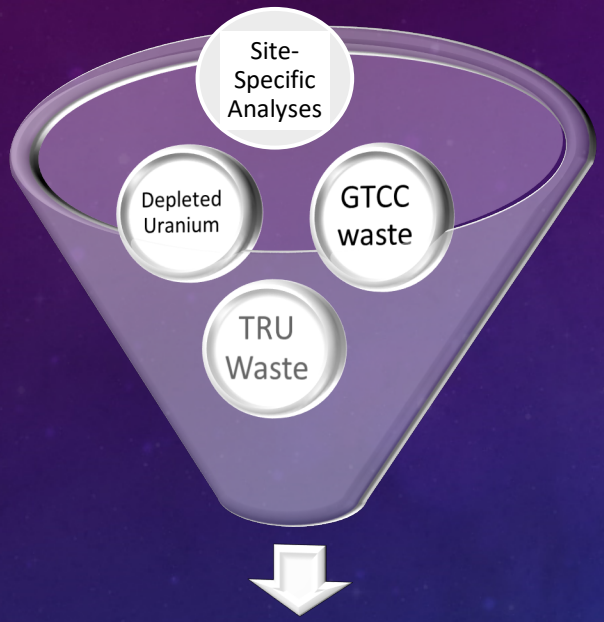
Prior Rulemaking Efforts

- LLW Disposal rulemaking to address waste streams that differ significantly in quantity and concentration from what Part 61 originally assumed
  - SECY-16-0106 to the Commission as draft final rule
- Regulatory basis for the disposal of Greater-than-Class-C (GTCC) waste through means other than deep geological disposal (SRM-SECY-15-0094)
  - In 2019 the NRC issued the draft regulatory basis for public comment
  - The regulatory basis concluded that most of the GTCC waste streams are potentially suitable for near-surface disposal

Commission Direction

- NRC staff recommended combining the Part 61 and GTCC efforts to address overlapping technical requirements, streamline stakeholder outreach, and gain efficiency in proceeding as one rulemaking activity (SECY-20-0098)
- Commission issued Staff Requirements Memorandum (SRM-SECY-20-0098) on April 5, 2022

Integrating the LLW Rulemakings



- Consolidate and integrate criteria for GTCC and 10 CFR Part 61 rulemaking
- Conduct site-specific analyses for all waste streams including DU and GTCC waste
- Include graded approach for compliance period
- Include TRU waste in the definition of LLW
- Address physical protection and criticality concerns in GTCC waste streams
- Provide for Agreement State licensing of certain GTCC waste streams

Safety Case and Technical Assessments

- Safety Case
  - Widely recognized internationally
  - Original Part 61 has many elements
  - Useful to stakeholders to better understand basis for decisions
- Technical Analyses (§ 61.13)
  - Performance assessment (not new – renamed)
  - Intruder assessment (new)
  - Site stability assessment (new for significant quantities of long-lived)
  - Operational safety assessment (for some types of GTCC waste)
  - Performance period analyses (for significant quantities of long-lived)

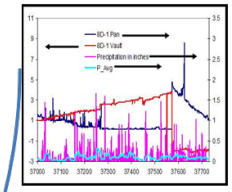
Safety Case

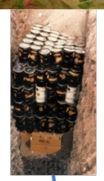
- A high-level summary of the information and analyses that support the demonstration that the land disposal facility will be constructed and operated safely – think executive summary.
- Provides reasonable assurance that the disposal site will be capable of isolating waste and limiting releases to the environment.
- Describes the strength and reliability of the technical analyses.
- Includes consideration of defense-in-depth protections and safety relevant aspects of the site, the facility design, and the managerial, engineering, regulatory, and institutional controls

Performance Assessment

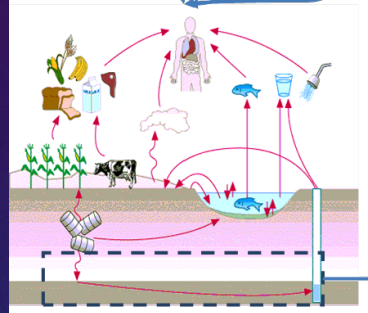
- The technical analyses completed for existing sites for the potential impacts to an offsite member of the public are considered synonymous with a modern performance assessment
- Understanding, tools, and capabilities have improved significantly since the early 1980's
- Significant guidance developed to support the proposed requirements for performance assessment (e.g., FEPs, uncertainty, model support)

Performance Assessment – Guidance Example



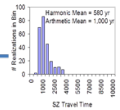


Site characterization data and other information



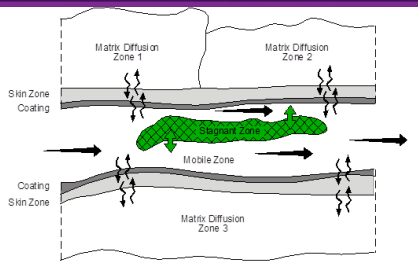
Performance assessment conceptual model development

Hydrologic conceptual model development (see next figure)



Estimated system performance

Abstracted hydrologic model

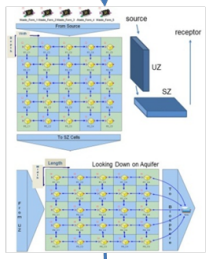


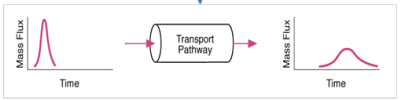
Hydrologic conceptual model

Longitudinal Advective/Dispersive Transport

Advective Mixing

Diffusive Transport





Numerical model development

$$m'_{is} = -m_{is}\lambda_s + \sum_{p=1}^{NP} m_p \lambda_p f_{ps} R_{sp} (A_s/A_p) + \sum_{c=1}^{NC} f_{cs} + S_{is}$$

Intruder Assessment

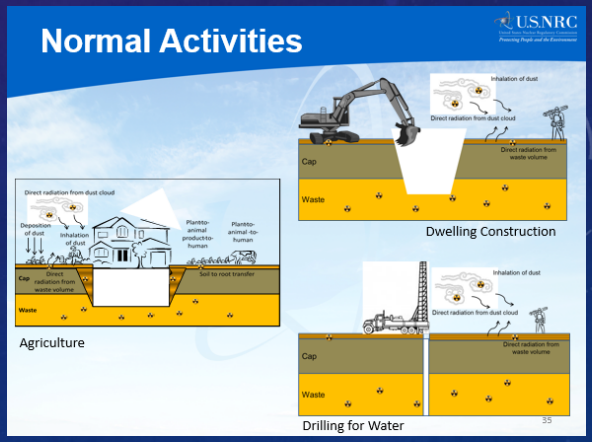
- The basis for § 61.55 in the current regulation is an NRC intruder assessment
- Revised requirements would allow for a site-specific intruder assessment

This is a flexible and risk-informed approach

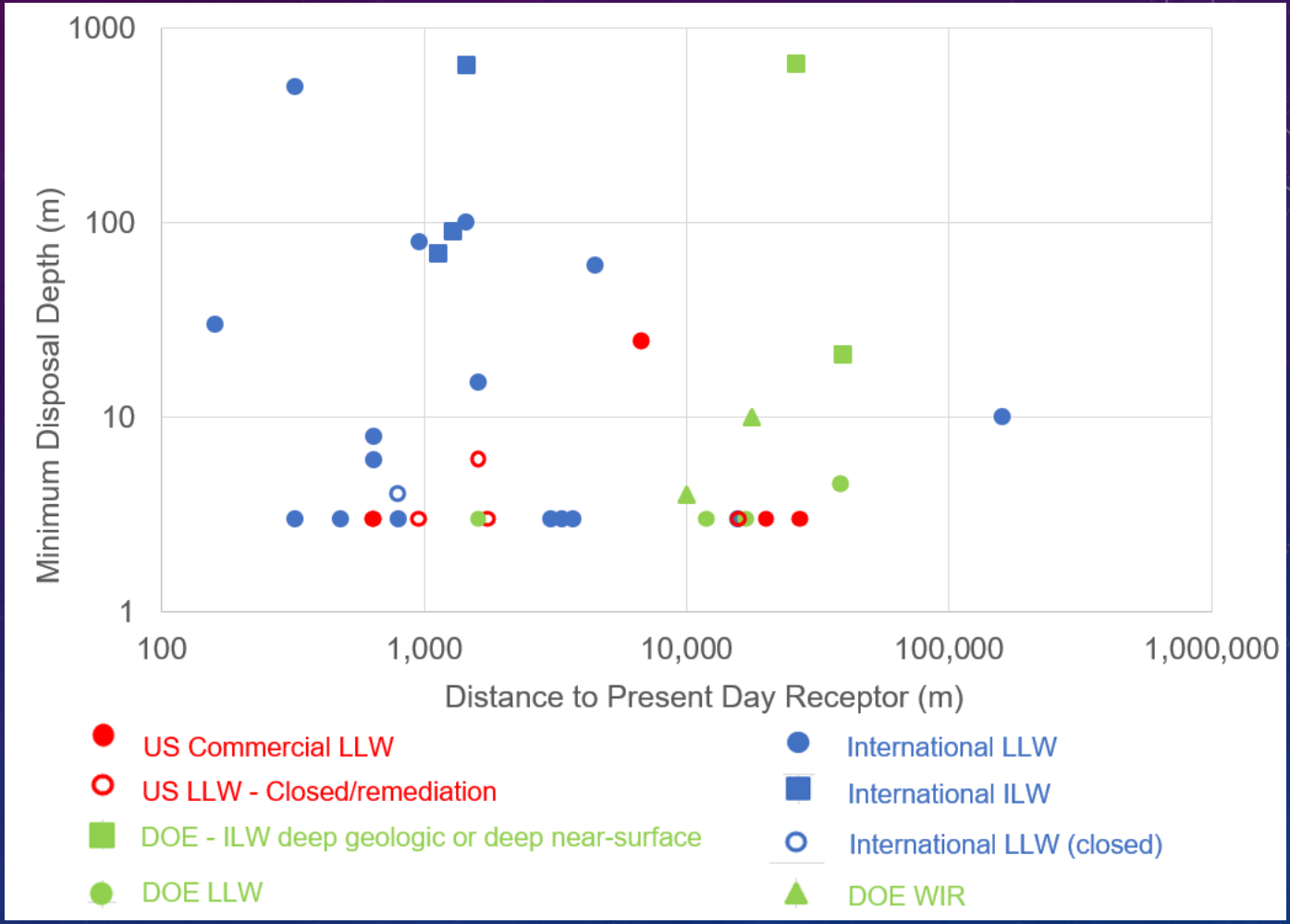
Table 1

Radionuclide	Concentration curies per cubic meter
C–14	8
C–14 in activated metal	80
Ni–59 in activated metal	220
Nb–94 in activated metal	0.2
Tc–99	3
I–129	0.08
Alpha emitting transuranic nuclides with half-life greater than 5 years	[1] 100
Pu–241	[1] 3,500
Cm–242	[1] 20,000

[1] Units are nanocuries per gram.

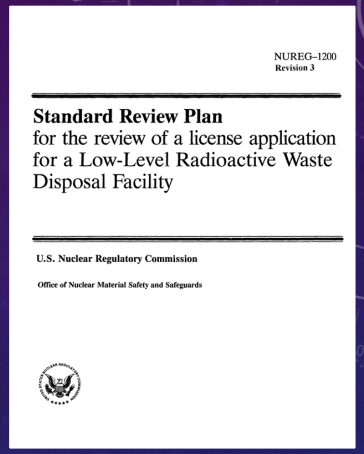


Intruder Assessment



Site Stability Assessment

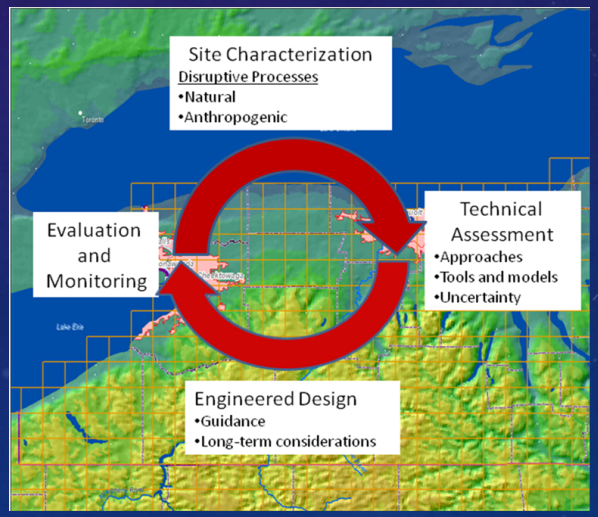
- Most problems with early disposal sites arose from short-term stability issues
- Those problems were addressed through design and site characteristic requirements
- Disposal of significant quantities of long-lived radionuclides may require long-term stability assessment
  - Addressed in the context of § 61.41 and § 61.42


NUREG–1200
Revision 3

Standard Review Plan
for the review of a license application for a Low-Level Radioactive Waste Disposal Facility

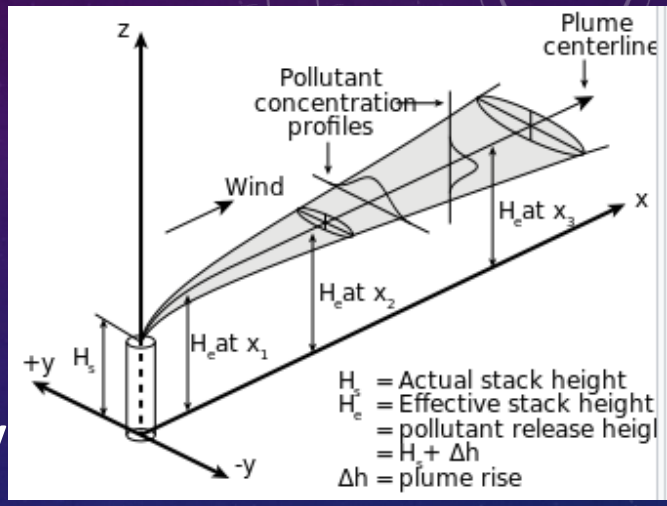
U.S. Nuclear Regulatory Commission

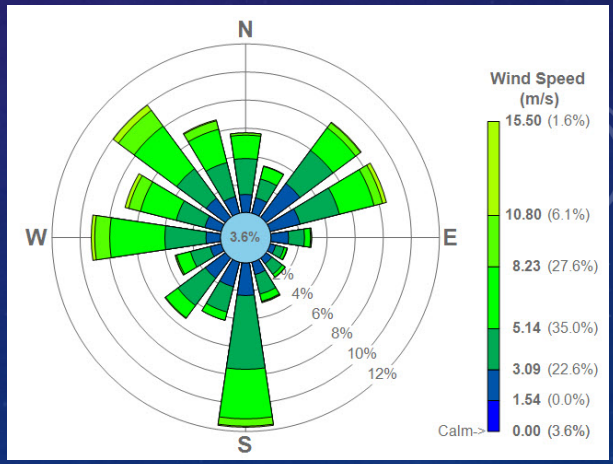
Office of Nuclear Material Safety and Safeguards



Operational Safety Assessment

- Operational safety (§ 61.43) is typically achieved through a combination of systems, procedures, controls, and training
- Accident scenarios were evaluated by NRC when Part 61 was developed
- Some GTCC waste may contain sufficient radioactivity that an operational safety assessment may be necessary





Performance Period Analyses

- Performance period only applies if significant quantities of long-lived radionuclides will be disposed
- Expected proposed standard is to reduce exposures to the extent reasonably achievable
- Provide transparency to stakeholders on the expected long-term performance of the disposal system
- Long-term results not a measure of projected human health impacts

Safety and Compliance

- Safety can be achieved through different means:
  - Disposal concept
  - Prescriptive design
  - Technical analyses
- Proposed approach leans more heavily on technical analyses to afford greater flexibility

Timeframes (Compliance Period)

- Commission direction has two options
  - Peak dose or
  - Use different compliance periods depending on the long-lived component of the waste
- Staff is considering the latter option – flexible and site-specific
- Compliance period of 1,000 years without significant quantities of long-lived radionuclides otherwise 10,000 years and performance period

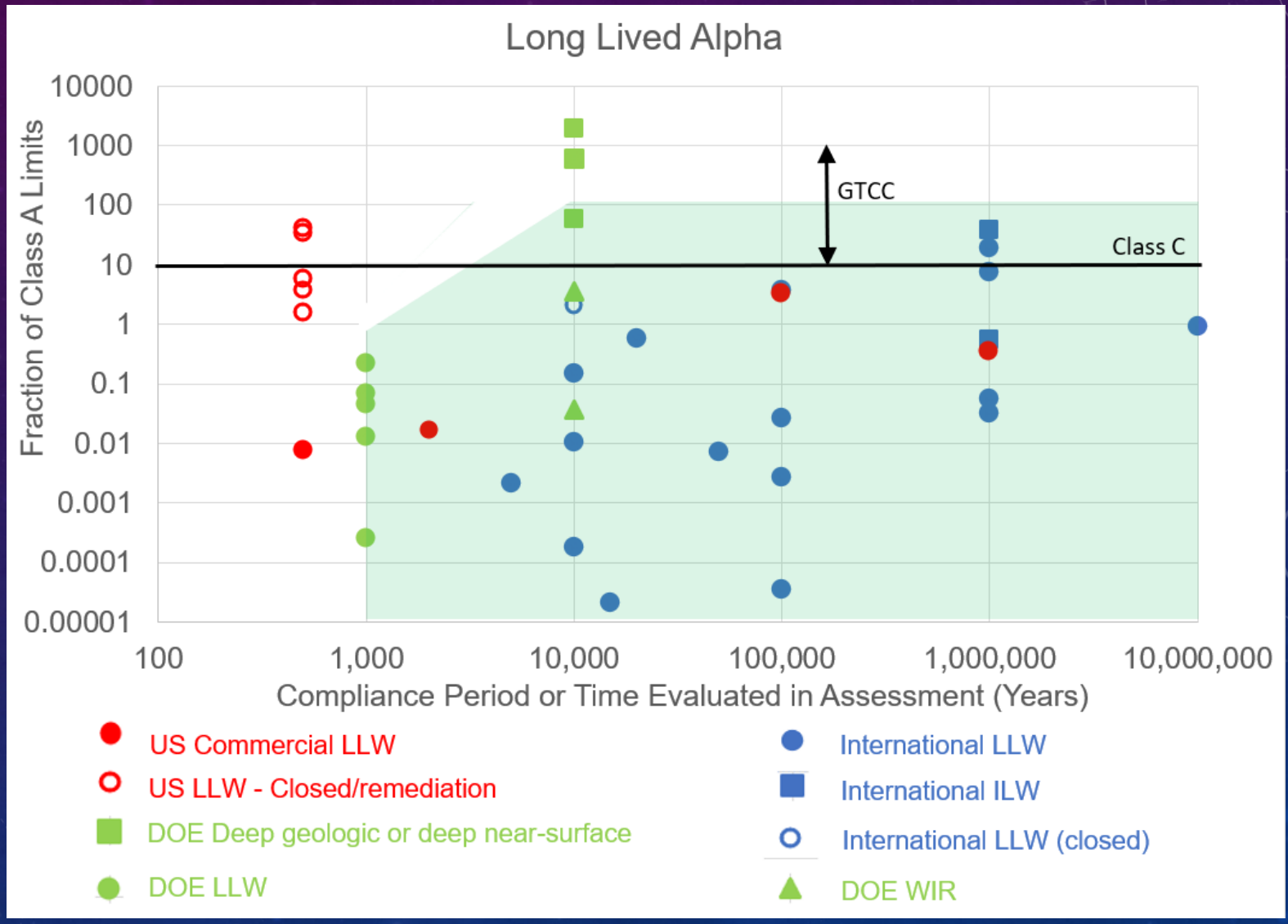
Timeframes (Compliance Period)

- Carefully examined comments on this issue
- Primary consideration is current practices by Agreement States (AS)
  - Compatibility class will likely allow the AS to be more restrictive
- Considered what has been done in the US and internationally

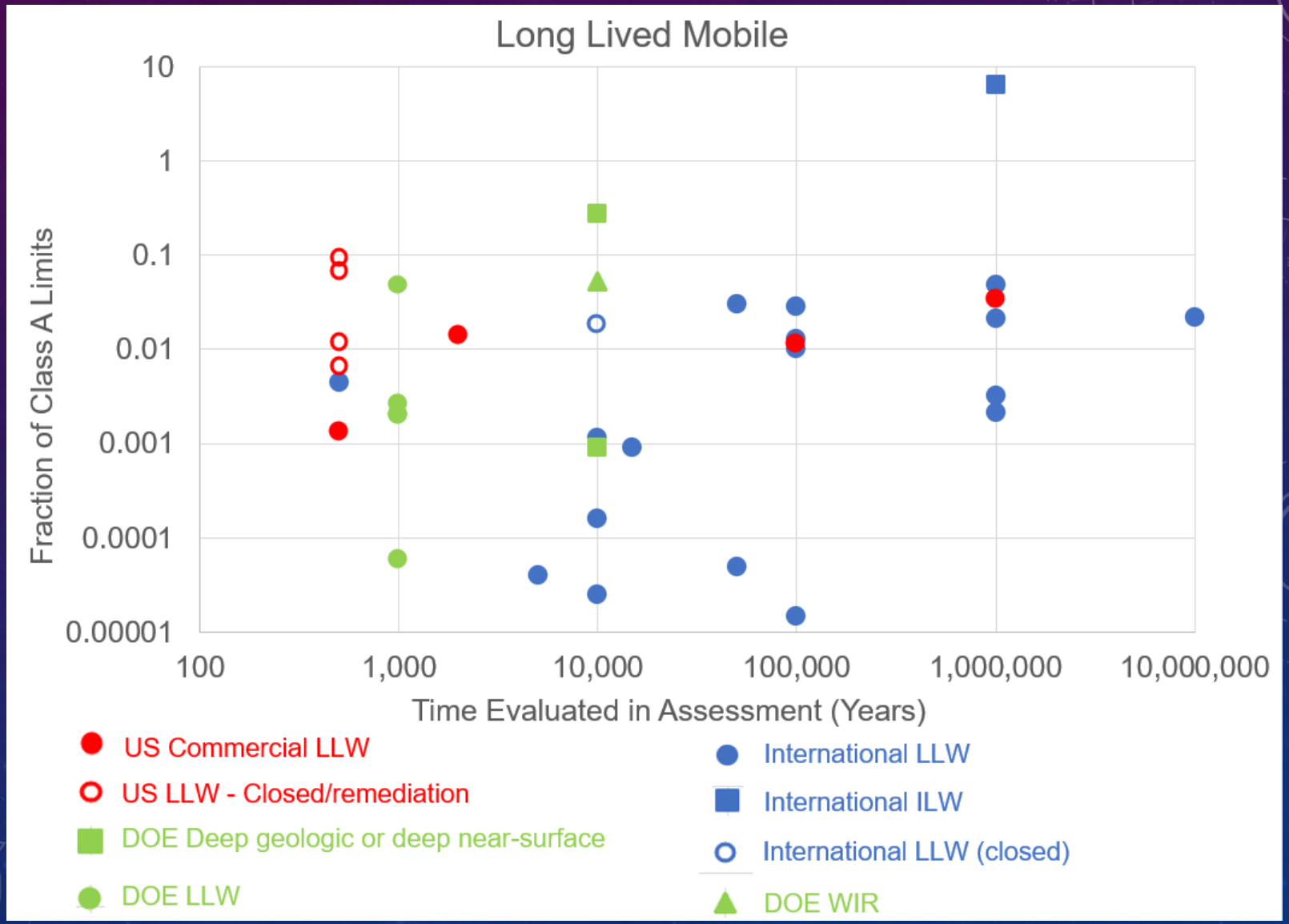
Timeframes (Compliance Period)

- Uncertainties in societal and environmental conditions will increase over time
- Regulatory approval to allow disposal needs to evaluate impacts, recognizing the uncertainty – not stop the analysis
- Other approaches could be used to mitigate uncertainties:
  - Require deep geologic disposal (i.e., Germany)
  - Place restrictions on long-lived radionuclides appropriate for near-surface disposal
  - Use design requirements (e.g., 10+ m disposal depth for significant quantities of depleted uranium)

Timeframes (Compliance Period)



Timeframes (Compliance Period)



GTCC Waste Considerations - Disposal

- Near-surface disposal requires 5 m depth **and** intruder barrier
- 10,000 nCi/g threshold
  - Case-by-case approval by Commission
- Additional waste characteristics requirements in § 61.56
  - Heat generation, radiolysis, criticality
  - Not dispersible

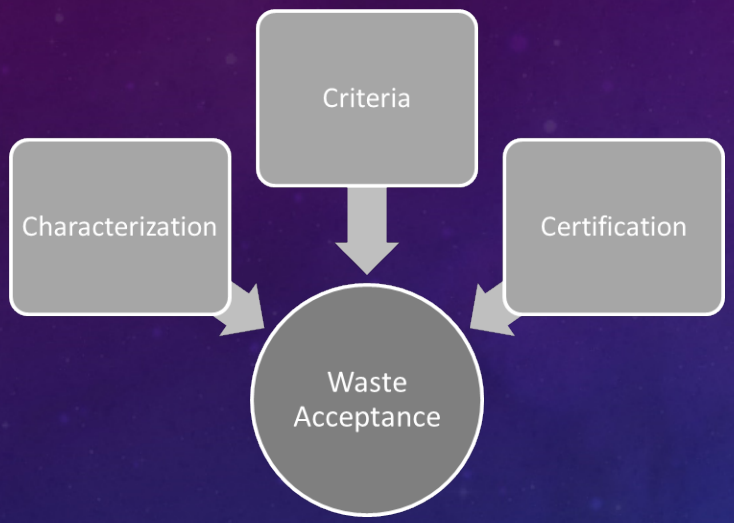
GTCC Waste Considerations - Criticality

- Current requirements under Part 61 require demonstration of criticality safety procedures for preventing criticality accidents without consideration of the concentration of fissile material in the waste (prior to disposal)
  - Provide an exemption for radioactive waste with very dilute concentrations of fissile material for which there are no credible means to achieve a critical condition
- Include an additional requirement for disposal units containing significant amounts of fissile material (following disposal)
  - Applicant must identify design measures that limit the potential for reconcentration of fissile material

GTCC Waste Considerations – Physical Protection

- Current requirements mandate licensees receiving or possessing nuclear material (SNM) in quantities that exceed the 10 CFR 150.14
  - Must satisfy the physical security requirements of 10 CFR 73.67, a "common defense and security" regulation that can only be enforced by the NRC
- Provide an exemption in NRC Regulations (10 CFR 73.67) for physical protection of waste at a near-surface disposal facility containing very dilute quantities of SNM
  - Physical protection of radioactive waste commensurate with the threat and limited attractiveness
  - Physical protection requirements remain under 10 CFR Parts 20 and 37

Waste Acceptance



- Site-Specific Waste Acceptance Criteria (WAC) (§ 61.58)
- Generic: Use § 61.55 limits, § 61.56
- Site-Specific: results of § 61.13 technical analyses
- Licensees review their waste acceptance program annually
- If approved, incorporated into license
- Generators still use § 61.55 for waste classification

Exception Criteria

- § 61.1 (b) (Purpose and scope)
  - Exception criteria
    - the land disposal facility license was originally issued before the effective date of this rule; **and**
    - the licensee does not accept GTCC or a significant quantity of long-lived radionuclides after the effective date of this rule
- Licensees who meet these exceptions do not need to comply with revised Technical Analyses (§ 61.13), revised Performance Objectives (§ 61.41 and § 61.42), and WAC (§61.58)
- Excepted licensees would be required to comply with original Part 61 regulations for these sections above

What are Significant Quantities?

- Definition in § 61.2
  - Significant quantities of long-lived radionuclides means an amount (volume or mass) and concentration accepted for disposal after the [effective date of this rule] that could, if released, result in the performance objectives of subpart C of this part not being met.
- Amount for selection of compliance period (1,000 or 10,000 years)
- Amount for demonstrating meeting exception criteria
- For the purposes of this paragraph, less than 10 metric tons of depleted uranium is not considered a significant quantity of long-lived radionuclides.

Significant Quantities

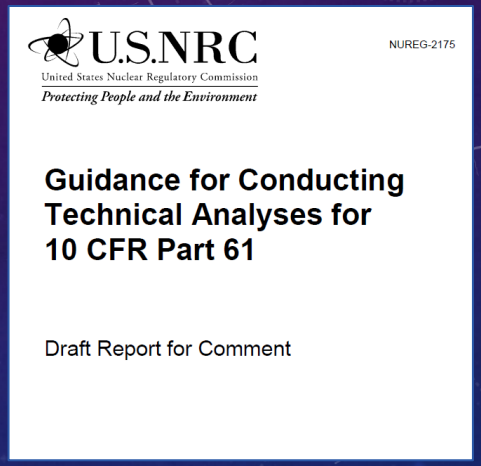
- Site-specific calculations to determine what amounts are significant
  - Though a simple approach is preferred, to properly account for the multiple key factors a more complex approach could be needed
  - Determined by licensee and approved by regulators
- Example approaches included in NUREG-2175
  - Table of concentrations of long-lived radionuclides for potential use as generic screening values

Minimum Depth of Disposal for Significant Quantities of Uranium

- Potential addition of minimum depth requirement
- § 61.52 Land disposal facility operation and disposal site closure.
  - Significant quantities of uranium must be disposed so that the top of the waste is a minimum of 5 meters below the top of the surface cover.

Implementation Guidance

- Draft NUREG-2175 issued in 2015 for public comment
- Draft final version of guidance published in 2016 on NRC Part 61 website
- Updates for Revision 1
  - Appendix for GTCC waste disposal considerations
  - Appendix for approach to calculate significant quantities of long-lived radionuclides
  - Revisions based on proposed rule language

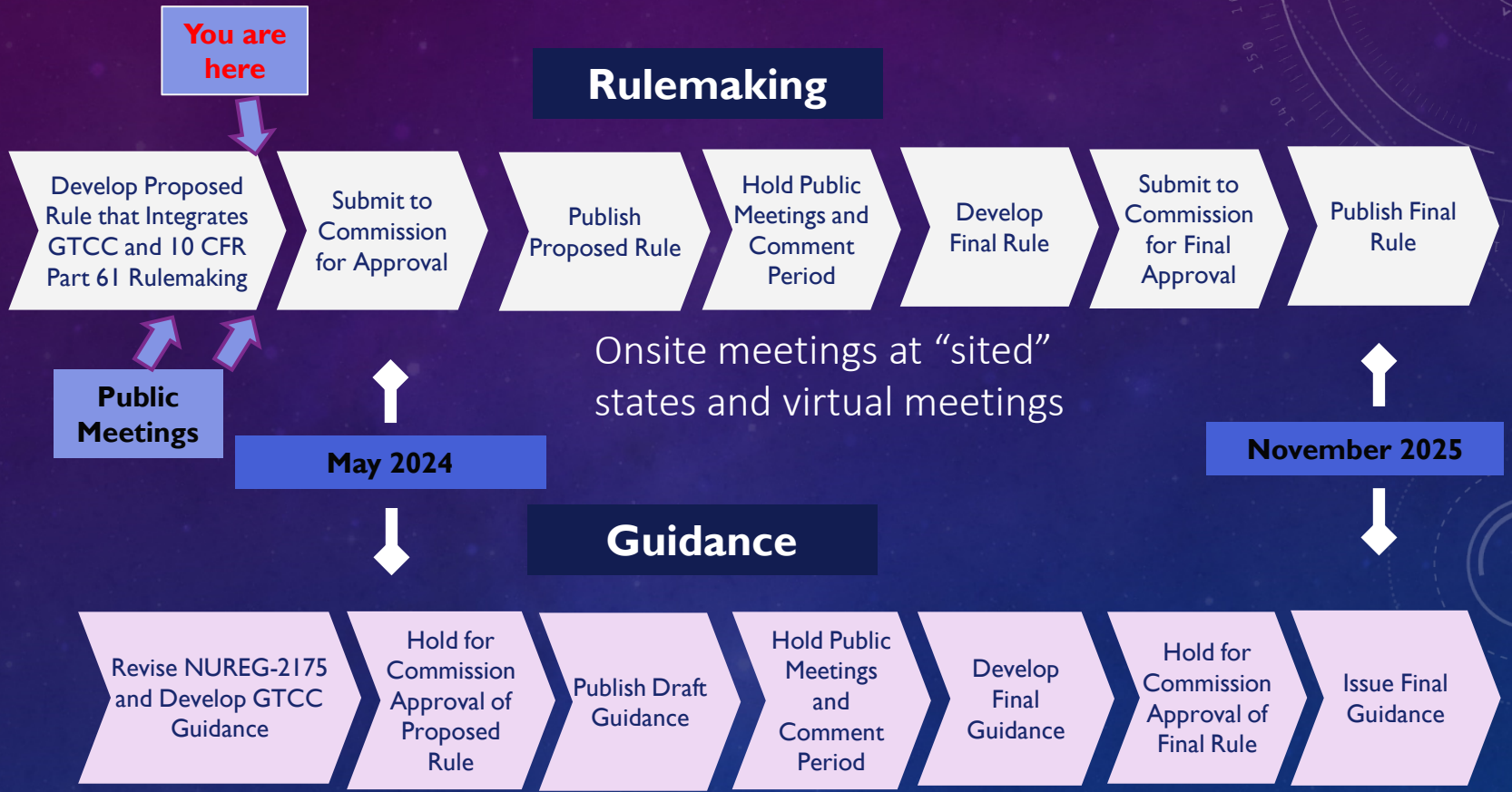

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-2175

Guidance for Conducting Technical Analyses for 10 CFR Part 61

Draft Report for Comment

Next Steps


You are here
Rulemaking
Develop Proposed Rule that Integrates GTCC and 10 CFR Part 61 Rulemaking
Submit to Commission for Approval
Publish Proposed Rule
Hold Public Meetings and Comment Period
Develop Final Rule
Submit to Commission for Final Approval
Publish Final Rule
Public Meetings
Onsite meetings at "sited" states and virtual meetings
May 2024
November 2025
Guidance
Revise NUREG-2175 and Develop GTCC Guidance
Hold for Commission Approval of Proposed Rule
Publish Draft Guidance
Hold Public Meetings and Comment Period
Develop Final Guidance
Hold for Commission Approval of Final Rule
Issue Final Guidance