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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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638TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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OPEN SESSION

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THURSDAY

NOVEMBER 3, 2016

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ROCKVILLE, MARYLAND

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The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:29 a.m., Dennis C. Bley, Chairman, presiding.

COMMITTEE MEMBERS:

DENNIS C. BLEY, Chairman

MICHAEL L. CORRADINI, Vice Chairman

PETER RICCARDELLA, Member-at-Large

CHARLES H. BROWN, JR., Member

MARGARET CHU, Member

WALTER KIRCHNER, Member

JOSE A. MARCH-LEUBA, Member

DANA A. POWERS, Member

HAROLD B. RAY, Member

JOY REMPE, Member

GORDON R. SKILLMAN, Member

JOHN W. STETKAR, Chairman

MATTHEW W. SUNSERI, Member

DESIGNATED FEDERAL OFFICIAL:

GIRIJA SHUKLA

ZENA ABDULLAHI

DEREK WIDMAYER

ALSO PRESENT:

GLENN ADAMS, Xcel Energy

GINA BORSH, Dominion

GARY COMFORT, NMSS

JOSEPH DONOGHUE, NRO

DAVID ESH, NMSS

YOUSEF FARAWILA, AREVA

JOSEPH GIACINTO, NRO

ERICA GRAY, Public Participant*

CHRISTOPHER J. GROSSMAN, NMSS*

JOE HEGNER, Dominion

PAKSIS KALTA, Public Participant*

DOUG KEMP, Bechtel

ROB KUNTZ, NRR

TAMARA MALANEY, Xcel Energy

CHRIS MCKENNEY, NMSS

TIM MCGINTY, NRR

MATTHEW PANICKER, ORNL

GARY PETERS, Xcel Energy

DIEGO SAENZ, NRR

JAMES SHEA, NRO

RICK STADTLANDER, Xcel Energy

RAO TAMMARA, NRO

DAN TINKLER, AREVA

DOUGLAS TONKAY, DOE

ANDREA D. VEIL, Executive Director, ACRS

STEVE WILLIAMS, NRO

ANDREW WYSOCKI, ORNL

PRIYA YADAV, NMSS

*Present via telephone

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

P R O C E E D I N G S

(8:29 a.m.)

MEMBER CORRADINI: Okay. The meeting will now come to order. This is the first day of the 638th Meeting of the Advisory Committee on Reactor Safeguards. During today's meeting, the Committee will consider the following: North Anna 3 Combined License Application, the AREVA Extended Flow Window for Monticello, 10 CFR Part 61 Rulemaking and preparation of ACRS Reports.

This meeting is being conducted in accordance with the Provisions of the Federal Advisory Committee Act. Mr. Girija Shukla is the designated Federal official for the initial portion of the meeting.

Portions of the session on AREVA Extended Flow Window for Monticello may be closed in order to discuss and protect information designated as proprietary. We have received no comments or requests to make oral statements from members of the public regarding today's session.

There will be a phone bridge line and to preclude interruption of the meeting, the phone will be placed in a listen-in mode during the presentations and Committee discussion.

A transcript of portions of the meeting is being kept and it's requested that the speakers use one of the microphones, please identify themselves and speak with sufficient clarity and volume so that they can be readily heard. I will remind members of the Committee and Attendees to turn off all your electronic devices so we don't hear any sort of strange noises.

I also want to make sure that everybody here is aware that this meeting is being Webcast with the ability to view our presentation slides on the Web. Those of you who are out on the bridge line, you may want to do that and dial into the Webcast versus dialing into the bridge line, as that will probably be a much clearer connection. If there's an issue relative to the Webcast or the bridge line, please call our office.

So with that, I'll turn it over to Dr. Riccardella for our first topic.

MEMBER RICCARDELLA: Thank you Mike. The first topic is the Application for a Combined License for North Anna 3 and ESPWR. We had Subcommittee meetings on the North Anna application in September and October of this year. Prior to that, the ESPWR Subcommittee reviewed and approved the generic ESPWR design in October of 2010. There was a subsequent discussion of steam dryer issues and another letter issued by the Committee in April 2014.

And finally, since North Anna is a subsequent COLA, a Combined Operating License has already been issued for Fermi, and we reviewed that and agreed with the staff on that in September of 2014. So with that brief introduction, I'll turn the meeting over to Joe Donoghue from NRO.

MR. DONOGHUE: Good morning. I'm the, I'm Joe Donoghue, the Grants Chief in Licensing Branch 3, as of this week. The staff presentation, when we get to it, will be led by our new Project Manager, James Shea. Some of the faces in the Committee are new. So I wanted to introduce myself, since I was last here a couple of years ago. I believe we're starting with the Licensee's presentation, the Applicant presentation. I think that's you, Gina.

MS. BORSH: It is. Good morning. I'm Gina Borsh from North Anna 3 Dominion. On behalf of Dominion, I'd like to thank you all for having us today. We look forward to making our presentation following up from our Subcommittee meeting. With me is Joe Hegner, who is our Licensing Manager for North Anna 3.

What I'd like to do today is cover with you an overview of the North Anna 3 site and talk with you about the licensing history, give you a summary of that. And then I'll talk about some of the COLA changes that we've made since we were last here in 2009 and then I'll conclude our presentation.

This, Slide 3, is an overview of the North Anna location, the North Anna site location. You'll see the star here in the Northeast section of Virginia. The North Anna 3 site is about 40 miles northwest of Richmond and it's about 22 miles southwest of Fredericksburg, just to give you a sense of the location of the site.

This next slide, Slide 4, is an artist rendering of what the site will look like when the ESPWR is built at North Anna but you'll see here is the existing units, 1 and 2, are over here and then, over here, is the power block for North Anna, Unit 3 and on this far right side, are the cooling towers.

MEMBER RICCARDELLA: Which, which direction is north on that?

MS. BORSH: We're kind of looking north -- north is about this way, so we're kind of looking from the north a little bit west.

MR. DONAGHUE: Right. Looking generally from the north.

MEMBER RICCARDELLA: Yes. Okay. So north is down.

MS. BORSH: Correct. Okay? Slide 5 is the planned view of the North Anna 3 site and you'll see, here is the turbine building, reactor building, control building. Over here are the cooling towers. And then, switchyard is over here and you saw where, in the previous slide, in relation to units 1 and 2.

If there aren't any other questions about that, I'll just give you a brief overview of the North Anna 3 history. We are a plant that started with an Early Site Permit.

So we submitted our Early Permit Application back in September of 2003. The NRC issued the Environmental Impact Statement in December of 2006 and then the permit was issued in November of 2007. We submitted our COLA as an ESPWR COLA -- we were the R-COLA at that time, in November of 2007. We had Subcommittee meetings with the ACRS in June, July, in August of 2009. And then we had the Full Committee meeting in October of 2009 and a letter was written by the Committee at that point.

Then the NRC issued the Supplemental EIS in February of 2010 and last month, as Dr. Riccardella said, we met with the Subcommittee to present the ESPWR changes that have occurred since our last NCR visit in 2009. And part of the reason for this, I think you all know, is because we did change technologies for a time. We went with the APWR technology in May 2010 and ended up reverting back to the ESPR technology in 2013.

So, are there any questions on that before we talk about COLA changes? So we reverted back to the ESPWR design in 2013 and when we made that decision to revert back, we followed two strategies, two basic, the strategy used two basic principles to make the changes to revert back to the ESPWR design.

One was, we wanted to standardize the content that was in the COLA as much as possible with the ESPWR DCD, and with Fermi-3's R-COLA. And we used the design centered working group approach to do that, which was endorsed essentially, or described originally by the NRC in a RIS, I think.

And then the second piece was that we wanted to rely as much as possible on the site-specific COLA information that we had provided previously, that was in the ESPWR COLA before we switched to the APWR. So as a result of that, most of the COLA content that you see before you today is consistent with the information that we previously provided in 2009. Okay?

If there aren't any questions about the approach, I'll start going through, give you an overview of some of the changes.

The first change that I'd like to talk with you about is hazardous chemical analyses. So what we did was, we looked at the potential accidents -- that's described in Section 2.2 of our FSAR and two of the accidents, the categories that we had to consider were explosions and delayed ignition of a flammable vapor cloud.

When we did these analyses, we found that the blast effects would not exceed the peak over pressure of 1 PSI at any of the safety-related structures, except for storage of and transport of liquid hydrogen. So we had to do further analysis there.

MEMBER SKILLMAN: Excuse me, the use of the hydrogen. Are the primary uses static cooling and reactor coolant system chemistry?

MS. BORSH: That, mostly reactor cooling system chemistry, yes.

MEMBER SKILLMAN: Thank you.

MS. BORSH: So, for liquid hydrogen, we did our analysis and what we found -- we had two 6000-gallon capacity tanks that we analyzed for the storage -- and what we did find when we did this more detailed analysis is that the actual distance, distances between the tanks and the nearest safety-related structure exceed the calculated minimum safe distance. So we were okay there.

MEMBER CORRADINI: Just a reminder, what is the minimum safe distance?

MS. BORSH: Oh gosh, we have it, it's 7, we talked about it last time,

MEMBER CORRADINI: Sorry, I wasn't at the Subcommittee meeting --

MS. BORSH: No, yes, that's okay. But what I'm saying is I know we have the number. It's in the FSAR and we'll pull that up for you.

MEMBER CORRADINI: That's fine. That's fine. Just -

MS. BORSH: Yes, it's around 700 feet.

MEMBER CORRADINI: Okay.

MR. DONOGHUE: 750.

MEMBER CORRADINI: Thank you.

MS. BORSH: Okay.

MEMBER CORRADINI: Thank you.

MS. BORSH: Sure. For transporting liquid hydrogen, we assumed that we had a 13,000-gallon capacity tank and we did a PRA, probabilistic analysis, and we concluded that the probability of an accident involving the delivery truck is less than 10-6 per year, which is acceptable per the NRC guidance.

So we didn't have to assume that there would be any missiles from that sort of event. So as a result, we didn't have any design-basis events, with respect to storage or transport of chemicals.

MR. MARCH-LEUBA: Yes. I was at the Subcommittee meeting. Is this is because you design the parking lot so that the truck doesn't have to back, backtrack, I mean, this is low probability of a truck having an accident. Is because you design the approach to the tank properly, right?

MS. BORSH: Yes, it is designed properly. MR. MARCH-LEUBA: Yes.

MS. BORSH: That's your question.

MR. MARCH-LEUBA: So the probability was reduced by taking proactive action and designing it properly?

MS. BORSH: Yes. That's correct.

MEMBER STETKAR: That's not, just for the record, so we're clear for the meeting. That's not the frequency of a truck accident. That's the frequency of a truck accident resulting in an explosion.

MS. BORSH: That's right. That's right.

MEMBER STETKAR: Trucks have accidents more frequently than once in a million years.

MR. BORSH: But before we leave this topic, I think Doug, from Bechtel, has a comment. Yes. This is Doug Kemp, from Bechtel.

MR. KEMP: Hello. It's on?

MEMBER CORRADINI: It's on Doug.

MR. KEMP: Oh. Doug Kemp from Bechtel. The question was on the safe stand-off distance, yes. The calculated safe stand-off distance from the source, analysis was 495 feet and for the vapor cloud, analysis was 777 feet.

MS. BORSH: Thank you Doug. Okay. Any other questions about hazardous chemicals before we go on? Right. We also performed additional analyses for our local intense precipitation work, which was documented in Section 2.4.2 and our analyses of the maximum inundation flood levels that result from probable, from local probable maximum precipitation found that these potential flood levels are bounded by the DCD. The DCD set parameter is 1 foot below grade. And we were, we found that our results were acceptable there.

We did further analysis looking at the sheet flow, because of an RAI that we received and in the analysis, we assumed the, what is stipulated in the FSAR, which were certain flow directions from the rooftops for the runoff. As a result of the flow analysis that we did, we found that there were three locations that, where the sheet flow depths are above the floor elevations at the entrances to some safety-related buildings.

So in the FSAR we committed to place curbs at these entrances or to raise their thresholds to prevent water from entering these buildings.

So as a result of the analysis work we did and the commitments that we've made, we found that the site grading and structure configuration precludes flooding in safety-related buildings during a local intense precipitation event. Questions on that?

All right. Another accident that we had, that we reviewed again, was the accident on release of liquid effluence to the environment. This is documented in Section 2.4.13 of the FSAR. The design of the ESBWR does include mitigating features to preclude any accidental releases of effluence. However, per the SRP 11.2, we do have to do an accidental release analysis and we performed that analysis.

We used the condensate storage tank to be, as the source of our release, based on ranking of the tanks and looking at the mitigating features that we have for each of the tanks. And, as a result of this analysis, we found that the release from the condensate storage tank to the environment would result in concentrations and doses that are well below the 10 CFR 20 limits.

MEMBER SKILLMAN: Gina, would you explain what ranking of tanks means in that context, please?

MS. BORSH: Yes. What we looked at was the concentrations of radioactive material in each of the tanks. So previously, our -- we had used a different tank for -- when we were here in 2009, we used a different tank for doing the analysis but, because it had a higher radioactive nuclei concentration. But because of revisions to the NRC Guidance, we were able to switch over to the condensate storage tank this time. But it's looking at the amount of radioactive material that's in the tank, each tank.

MEMBER SKILLMAN: Okay. And what would be the isotopic burden in the condensate storage tank? This would be from condensate if you had a steam generator tube leak or if you had a, if you had fuel preparation and you're carrying that isotopic inventory over into another condensate storage tank?

MS. BORSH: Let me ask our, ESPWR experts, if that's okay with you?

MEMBER SKILLMAN: What I'm really wondering is what is the source term upon which you would make the statement, we've ranked this tank, thus and so?

MS. BORSH: And I don't have, that

information is in our COLA. Do you want me to pull that up for you? In our FSAR?

MEMBER SKILLMAN: Sometime in the next hour, that'd be fine.

MS. BORSH: Okay. All right.

MEMBER SKILLMAN: Thank you.

MS. BORSH: So, we'll get back with you on that.

MEMBER SKILLMAN: Okay.

MS. BORSH: Okay. Any other questions about this one?

MEMBER SKILLMAN: No.

MS. BORSH: The next change that we made was actually a departure from the DCD and it involves a Radwaste discharge typing change that we made. So overall, Unit 3 is designed to be a zero liquid release plan. So our goal is to not release any radioactive material to the site. But it's designed to recycle all the processed water.

If we do have to make a release though, we will be, at North Anna, we'll be using a dedicated liquid Radwaste effluent discharge pipeline and that would discharge to the discharge canal. We won't be using the circulating water systems cooling tower blowdown line, which is what is currently described in the DCD. So that's the departure there.

And then in FCR Section 12.3, we explained that and make a commitment that this discharge line that we're, we'll be designing, is going to run underground and it will be run in a guard pipe or it's going to be accessible via a trench or a tunnel.

And so this discharge line that we're talking about complies with 10 CFR 20.1406 to minimize to the extent practicable, contamination of the facility and the environment. Any questions on that?

This next slide, Slide 13, is about Reg. Guide 1.221, which provides guidance from the NRC on design-basis hurricane winds and hurricane missiles.

This Reg Guide was not in place, it had not been issued when the DCD was originally submitted, so, as part of the rule making for the DCD, we basically were required to do our evaluation using this Reg. Guide and the guidance therein.

So we did our evaluations and we found that the seismic Category I structures are going to be designed to withstand the loads due to the DCD tornado wind speed and missile spectrum, because the DCD wind and missile demands bound all of the North Anna 3 sites specific tornado and hurricane wind and missile demands.

For seismic Category II structures, and those structures that are housing Regulatory Treatment of Non-Safety Systems, RTNSS structure systems and components, we're going to be designing those to withstand both the DCD criteria and the Reg. Guide 1.221 hurricane and missile demands.

So the conclusion here is that the seismic Category I structures will meet the DCD wind speed and missile criteria and the Category II structures and RTNSS structures, or structures housing RTNSS, will meet the DCD and Reg. Guide 1.221 criteria for hurricane winds and missiles. Okay?

Now we're going to talk about seismic, that's what the next few slides are about. There were a number of drivers of, for the seismic revisions that we made to R-COLA and this is a list of the major ones. You know, on August 23, 2011, there was an earthquake that occurred in the Mineral, Virginia area.

Also, EPRI and the NRC issued some new

criteria, the new Central and Eastern United States- Seismic Source Characterization Sources, so we needed to use that information and then, also, the ground motion model was updated by EPRI.

In addition to that, the NRC revised several guidance documents, three SRPs and one of the, and they issued ISG 17. So, as a result of all these changes, we decided that we had to make changes, both to the vibratory ground motion that is used in the seismic analysis and then, of course, we had to redo the seismic analysis to incorporate these changes.

This next slide, Slide 15, basically shows us the process that we used to develop our seismic hazard. So you'll see, we start with the seismic source which comes from the new CEUS Seismic Source Characterization data and then, we move that source through to the ground motion. As it attenuates, it comes up through the rock site, amplification occurs here and then we eventually develop our sites-specific seismic hazard, which is used in our seismic analysis.

This is a summary of what I just showed you. So what we did was, we updated our seismic sources using the new CEUS and updated seismicity and it included the 2011 Mineral Earthquake. We revised our probabilistic seismic hazards analysis using the updated CEUS-SSC and new ground motion model that was provided by EPRI.

We developed our new site-specific response factor using the revised PSHA and then we developed our new ground motion response spectra and our Foundation Input Response Spectra or FIRS. We refined these using the site-specific response spectra and the new ISG 17 guidance that the NRC had issued.

As a result of doing all this, we identified certain exceedances at certain frequencies of the Certified Seismic Design Response Spectra or CSDRS, and so that was what drove us to, revise, not redo, I'm sorry, because we hadn't had to do this before, but perform seismic analysis of the structures and some of the systems and components.

This slide is, shows you, just as an example, the exceedances that we have for the reactor building control building, and you'll see the black line here is the DCD CSDRS, and then the blue and red lines provide the reactor building control building FIRS and you'll see that just at certain frequencies around, starting at around 10 hertz, we have some exceedances here. The same holds true for the fire water service complex, but I don't have that slide for you.

MEMBER RICCARDELLA: Just, just a comment while we're on that slide. It's not shown, but for those of you who weren't at Subcommittee, the combination of the design spectrum plus the other ones significantly bounds the spectra from the Mineral, Virginia earthquake.

MS. BORSH: Thank you sir. Yes, the Mineral earthquake had, minimal -- it really had no impact on the results overall of the seismic analysis, so, but we did incorporate it, just to confirm that.

Slide 18 now talks about our seismic analysis and our evaluation of the seismic Category I structures.

So after we got the input from the vibratory ground motion, we developed the seismic design parameters using the site-specific soil structure interaction input soil profiles and the ground motions and we performed the site-specific SSI and structure soils structure interaction analyses, so that we could evaluate the Cat I buildings, which are the RBFB, the control building and the fire water service complex.

And we were looking at those using our site-specific ground motion and soil properties. We used the results of those analyses to determine the site-specific seismic demands on the structures and then we performed site-specific analyses of the structures and the components using the site-specific seismic demands, along with the other demands on those items.

Finally, just to point out the methodology and mathematical models that we used for these analyses were consistent with what was used for the DCD structures and systems and components.

The results of the analyses show that there were no changes to the DCD concrete member properties so, for example, the slabs and wall thicknesses all stayed the same as the DCD. We did have to make a couple of minor local changes to the shear ties and the reinforcement in the reactor building, building exterior walls one place there.

We changed the size of a control building girder and then we also made some modifications to the rebarring shear ties that are in the fire water service complex shear case and basement. For the components, there was a slight increase in the size of the support saddle bolt for the Passive Containment Cooling System Condenser and we slightly increased the ankle bolt size and corner base plate welds for the field storage tracks in the buffer pool.

So basically, the seismic constructional analyses that we performed and the minor design enhancements that we made demonstrate the capability of the structures, systems and components to operate at North Anna 3. Any questions about seismic?

In conclusion, we just want to point out that we did, as I said earlier, implement the design-centered review approach to maximize standardization with the DCD and with the R-COLA. We provided site-specific topics that the NRC has reviewed and evaluated. And our determination, along with the SER, is that North Anna 3 site is adequate to support construction and operation of the plant.

MEMBER SKILLMAN: Gina, would you go back a slide please?

MS. BORSH: Sure.

MEMBER SKILLMAN: For the four changes that those four bullets represent, should we be thinking that each place a change has been made, there is a calculation package that has been conducted under 10C-450, Appendix B, demonstrating the seismic capability of the revised device.

MS. BORSH: Yes, that's correct.

MEMBER SKILLMAN: Thank you.

MS. BORSH: You're welcome. And those reports have been submitted to the NRC for review too. They've either seen them through audits or they're on the docket.

MEMBER SKILLMAN: Thank you Gina.

MS. BORSH: You're welcome. Question? Okay. Thank you.

MEMBER RICCARDELLA: Thank you Gina. That I guess will have the staff briefing?

MEMBER SKILLMAN: I'd still like to hear about source term on the condensate storage tank, please.

MS. BORSH: Yes.

MEMBER SKILLMAN: Okay. Thank you.

MR. SHEA: Morning. My name is Jim Shea. I'm the NRC's Division of New Reactor Licensing Lead Project Manager for the North Anna 3 review. The staff is presenting its Phase 4 SER with no open items. This is a follow-on from the Phase 2 SER with open items that was completed based on a full ACRS meeting back in October 2009.

During the last ACRS Subcommittee meeting, the staff presented the review highlights of the Phase 4 review, and focused on, I think like Gina mentioned, the differences between the site-specific differences from the DCD and, of course, the R-COLA with Fermi.

And when you look at it, the review focus essentially is on, there's, there was five exemptions, there's a number of departures from the DCD and then there's some variances associated with the ESP. And that was the staff's main focus on the review. And in the past 24 months, the review focus has really been on the seismic issue.

The seismic closure plan, that was submitted by Dominion in October of 2014 has been, really, the main focus and you could say the longest pole in the tent of the review.

Our staff spent, along with Dominion, spent several hours and review time and a couple of audits in that meantime, and, in fact, we held biweekly public meetings, to go through all the issues of the seismic, to go through the seismic closure plan, answer all the RAIs, address a number of issues that were raised during audits, etcetera. So that's been going on for the last two years.

MEMBER RICCARDELLA: For those members who weren't at Subcommittee, we spent about four hours on this topic at the Subcommittee meeting.

MR. SHEA: So, the structure, to get through the structure, today's meeting, I'm going to do a brief highlight of what we did at the Subcommittee meeting and you're going to see in my slides, a lot of them are coming directly from the Subcommittee meeting, so I just highlighted a couple of the bottom line issues.

And if there's any questions that stems from that, we have our staff that were on the panels, that we had for Subcommittee, are here to answer any of your additional questions.

And I'd just like to point out, we mentioned that our review was really, there's other issues besides the seismic, but that was the main issue that we reviewed and I want to thank Dominion and our staff working very diligently through all these issues, several technical issues, to get to the point where we are now to be able to present this Phase 4 SER.

And there are some of things that we have are direct duplicates of Dominion, so I'm not going to reiterate those, except just to point out like where I highlighted some of the key things that occurred that influenced our, our review from the staff side, including the Mineral earthquake on August 23, 2011.

And a couple of other things there, the seismic closure plan, which I mentioned was submitted in October 22, 2014 and then the last updated revision to the FSAR, which included all the incorporation of all the changes associated with the seismic analysis have been included in that June 22 FSAR update.

This just kind of highlights what we already mentioned, the Phase 2 ACRS review. Mentioned that, just a couple of things, Phase 4 SER. Now this is a 6 Phase review, so if you're not familiar with the NRO review process, Phase 2 is the SER with open items and then Phase 4 is the SER, with, the final SER, with all those items closed and the only thing left really is some confirmatory items.

And that's, really the staff's findings

are associated with the Phase 4. The Phase 6 is more of an admin, the FSAR is an admin review of, to get it ready for basically, a new Reg. so that it can be submitted to the Commission. It goes through an administrative process which is what we're going through now, and we're, we did actually confirm all of the items that were open in the Rev. 9 of the FSAR.

And that will be included in that, those confirmations will be included in the final SER from the staff.

MEMBER STETKAR: So Jim, just to be clear, that, what you're saying -- we had some discussion about what the SER, what the ACRS is actually being asked to review.

MR. SHEA: Yes.

MEMBER STETKAR: And the current document that we have refers to various incarnations of the, various revisions of the Applicant's FSAR, and the supporting DCD. And what I think I hear you saying is you're going to clean that all up between now and when you go final?

MR. SHEA: No,

MEMBER STETKAR: Oh.

MR. SHEA: Really, everything is in

Phase, the Phase 4, and I think I fed back to Girija on this issue that was brought up at the Subcommittee --

MEMBER STETKAR: You did and I didn't understand that, so maybe you could explain it to the rest of us.

MR. SHEA: Okay. Let me see if I can do this again. So, for example --

MEMBER STETKAR: For the Committee's reference, if you read through the different chapters of the SER, some, some of them refer to, and I haven't got it here in front of me, I guess for the record, I should get it here in front of me.

MR. SHEA: Well I could probably explain it.

MEMBER STETKAR: Let me, let me get my thing on the record here. That would be because -- if I look at, for example, all of the chapters, except Chapters 7, 16, 18 and 20, in the SER, refer to Revision 8, of the COL-FSAR, which is based on Revision 10 of the ESPWAR-DCD.

However, Chapters 7, 16, 18 and 20 of the SER refer to Revision 7 of the COL-FSAR, which is based on Revision 9 of the DCD. So there's essentially four chapters in the version of the FSAR that we're reviewing that explicitly, in writing, referred to a previous, not the current revision either of the COL-FSAR and ESPWAR-DCD.

So I was questioning about, you know, why we have that, sort of, time disconnect, in the SER.

MR. SHEA: And, you know, based on your comments from the Subcommittee meeting, I actually updated the slide and you can see that Phase 2 SER was done per the FSAR Revision 6, July 2013, based on DCD Revision 9. And so, when you look at those, those are the confirmatory items.

So open items were closed based on, like you mentioned there, was the DCD Revision 10 and FSAR Revision 8. So you're going to see, there's various stages of the SER and how, over the years, has evolved. In the sense, the staff made a number of findings back in Phase 2 and there weren't, and nothing has changed from those decisions.

And so it was based on those particular revisions that you see on that slide and we're not going to go back, you know, since nothing changed in the FSAR updates except what was requested through RAIs and through these open items. For example, in Phase 2, the open items were closed by the Revision 8.

Because all those open items had RAIs associated with them and the response of those RAIs and then additional, there's been some follow-on RAIs associated with that, you know, our normal process, those were closed by that Revision 8 for the most part.

Those were 71 items, Revision 8, June 2014. So when you read the SER, you're going to see specific sections that were resolved back under those revisions. Now, Revision 9 hasn't changed of the FSAR --

MEMBER STETKAR: In those areas --

MR. SHEA: Yes, in those areas. So, what you're seeing is, the staff at the time, at that time, made a decision and found that acceptable. So the only place where you're going to see in the FSAR where it says, staff made decision based on its, the Rev. 9 of the FSAR, it's really in the area of the seismic in Chapter, Section 3.7 and 3.8 of Chapter 3.

Because just as John pointed out in Subcommittee meeting, there are sections in Chapter

3 that were completed back in Phase 2, that refer back to these previous revisions. And you're going to see the same thing, this is the same, and I had to verify it myself. Based on your question, I went back to the Fermi SER, and they have very similar types of -

MEMBER STETKAR: I didn't check it -- it happened to be the chapters, some of the chapters that I was reading, kind of caught my attention here, that I certainly saw a different revisions --

MR. SHEA: I took back your point, and you know, I didn't look at Fermi, other than, I did a lot of comparison. Really, when you look at this, this SER that we had completed in Phase 4, one of the things that I did is, to make sure that it looked similar to the -- obviously it's incorporated my reference here.

You're looking at Fermi, one of those that line up and so I just confirmed that. And if there's a question there, I went back to the staff and asked them. So, you'll see that. These FSER is very similar to the Fermi FSER, where these decisions were made for, even Fermi back in that time frame of 2009, 2008 and under Revision 9 of

DCD and Revision, and then following, final Revision 10.

So that's how it went and in fact, if you look at -- now every Chapter will say, incorporate, all the incorporations by reference from the DCD, is going to say, NUREG 1966, and that's your key to say that, incorporated by references, the latest staff FSER related to the DCD.

In fact, I remember you read an excerpt out of that FSER for DCD and it referred to, in the I & C area, back to Rev. 6 of the, Rev. 6 of the DCD. Rev. 7. Anyway, so you'll see that throughout, how, you know, how we do these FSERs, because it's not efficient for us to take that issue and go back every time we have a new Rev. of the FSER, to go back to the staff and ask them to, I mean they can do that, if they have the time, but generally, those issues were finalized back in previous revisions. So that's kind of the explanation.

MR. BROWN: I just want to make a point on Chapter 7 in that, in fact when we did the original DCD certification in, Mike, 2009?

MEMBER CORRADINI: 10.

MR. BROWN: 10. GEH had made commitments relative to the configuration of the I & C systems and changes were made, proposed. They said they would make changes to the DCD to incorporate the agreements we had reached during the Subcommittee and the Final Certification. And my biggest concern was, based on going from Rev. 8 and seeing universe references to Rev. 10, did all those agreements translate into the later revisions.

And as soon as I found my earlier emails and other agreement pieces of paper, from seven years ago, and then translated, I actually worked it walking through, I didn't have Rev. 8, which I now have.

MR. SHEA: Yes, I sent that to you.

MR. BROWN: Yes. I got it.

MR. SHEA: Or I sent it to Girija.

MR. BROWN: Yes. He sent it to me and I was able to step through the agreements to Rev. 8. They were documented. Rev. 9, Rev. 10 were consistent.

Whether I agreed with everything that we didn't quite catch back then is a different issue. We issued the certification and I feel that, you know, we got to agree with what we agreed with. And so I'm satisfied right now and think I was the biggest vocal --

MR. SHEA: I think that was the one issue that came out of the Subcommittee meeting was this issue and we weren't going to raise it again, because we thought, like you did, it's the DCD and I'm glad you closed that loophole for us. Because --

MR. BROWN: It's all gone.

MEMBER RICCARDELLA: You know, I just wonder would it help John, if they put something in the introduction to those Chapters that still refer to Rev. 7 that says --

MEMBER STETKAR: You know, what bothers me --

MEMBER RICCARDELLA: That says, these were closed based on, based on that.

MEMBER STETKAR: What bothers me --

MR. SHEA: I already did this.

MEMBER STETKAR: Oh. Okay. That's good because what bothers me is that 20 years from now, people might pick up this safety evaluation report and say, well what was, what was the real technical basis and they'll go back to what it refers to and, you know, it could raise questions. So I thought it was a good point,

MR. SHEA: It was a good point and I thought it was confusing, to me it wasn't confusing because I deal with it every day, but I could see someone from the public or anybody for the first time looking at this --

MEMBER STETKAR: That's, that's, or other, other staff --

MR. SHEA: Right.

MEMBER STETKAR: Or the licensee when the plant is built, to go back and look at, at least, the staff safety evaluation of a particular issue, you know. What was the fundamental traceability of that.

MR. SHEA: So as part as the FSER of Chapter I, we added a short paragraph to explain, this very slide basically explained in a paragraph format, that how these things were reviewed and finalized, these issues.

MEMBER STETKAR: Thank you for doing that.

MR. SHEA: Yes. Thanks for raising that issue, and you know, I was able to add, I think, add clarity for Chapter 1, so I appreciate it.

So, just as last time for the Subcommittee, we split this thing up into two areas, which was really the non-seismic information that were, you know, changes from the DCD or site-specific issues related to North Anna and the seismic issues. And we'll, like I said, we'll go through some of the highlights of those.

Start with meteorology. I don't think, the meteorology was pretty straightforward. The ESP meteorology was finalized way back in '06 and the only thing that was really changed in the later date, was this update analysis to corporate use of both ground level mix-mode releases related to the stack for the Radwaste building.

There was some concern from the staff. They were originally using it as an, it was a mixed-mode release, and the staff questioned that based on the location and they did a re-analysis and did the conservative route and did a ground level release and that was all resolved. It still meets all the requirements and you can see that, you know, all the regulatory requirements were satisfied and no additional open items. But that was really the only issue associated with meteorology over the last couple of years.

And this really reiterates the flooding that Dominion talked about. We, this is the same information. One foot below the DCD high parameter on the maximum flood and then the recent analysis on the LIP, the Local Intense Precipitation sheet flow, found that there's a few doors that needed to have, you know, thresholds that, it's, that, so that water would not ingress into the doorways and that's part of the FSAR.

MEMBER RICCARDELLA: Those aren't considered a departure from the DCD? The fact that they have to build up the doors?

MR. SHEA: I, no, I, they weren't -- it wasn't a departure in a sense because the DCD really, the DCD is neutral to where, you know, you have to do your individual site-specific flood analysis based on the site. It's not really DCD issue, correct?

(Off mic comment)

MR. SHEA: The issue was, the question was, is this a departure from the DCD related to the LIP flow analysis.

MS. BORSH: No.

CHAIRMAN BLEY: I'm sorry. You'd better get on the record with that.

MEMBER CORRADINI: Would you identify yourself?

MR. SHEA: Did our staff, Joe, did you want to add anything to that? We have Joe Giacinto from the staff, if he wants to add anything to that.

MS. BORSH: This is Gina Borsh from Dominion. The answer is no, it's not a departure.

MR. SHEA: Joe, did you want to add anything?

MR. GIACINTO: Well -- Joe Giacinto -- hydrologist. It's not a departure from the DCD. It's just a matter of flood protection which we cover in Section 24.10, so, although it's called out in Section 24.3, in Section 24.10, it explains the type of flood protection. So Hydrologic Engineering Section 24 is built specifically for these types of things. It's not a matter of being DCD. It's a matter of reviewing it, the Hydrology section.

MEMBER CORRADINI: Thank you.

MR. SHEA: Thanks Joe. Okay, again we also did this accident analysis and we essentially, the staff just confirmed what Dominion did, using our own independent confirmation calculations in confirming these accident analyses associated with the industrial transportation in military facilities. Yes.

MEMBER KIRCHNER: May I ask a question, since I asked it of Dominion at the Subcommittee meeting. So, what was the analysis done to waive the accident with the delivery truck, the hydrogen delivery truck? How did you go about confirming their analysis?

MR. SHEA: Do we have, is it Rao Tammara? From the staff, yes, he will come up.

MR. TAMMARA: My name is Rao Tammara. The Applicant has evaluated the frequency of the truck and also calibrated this upon the historical accident event. They determined the probability of the accident and then they had shown the calibration that the probability is less than 104-7, which is acceptable to screen out that kind of accident.

So we reviewed their calculations and we accepted the parameters and also the data that they have presented. And based upon that one, we agreed the calibration is acceptable and the probability is, since it is less than 104-6 with the actual, realistic data, and it is, within the guidelines of all the acceptance criteria. Therefore, we accepted that.

MEMBER KIRCHNER: So as John pointed

out, the probability, or the frequency is probably the right word here, for the truck accident is much higher than 10-6, so --

MR. TAMMARA: An actual accident might be but the design basis accident is defined as the probability of the accident --

MEMBER KIRCHNER: Right.

MR. TAMMARA: In connection with the release that were the 9:18:36 a dose in excess of 10 CFR, 15.34 -- that probability should be less than 104-6. So it is not the, just the mere accident which has a greater than 104-6 would not entitle that to be a designated as a design-basis accident. So the definition is that both have to have the probability of 10 4-6. The accident --

MEMBER KIRCHNER: So let me just --

MR. TAMMARA: In connection with the dose --

MEMBER KIRCHNER: Let me just intuitively compare that to the other accident that was analyzed, which was a leak from the storage tank. So you have a larger source --

MR. TAMMARA: Yes.

MEMBER KIRCHNER: And it's hydrogen in the delivery truck. And --

MR. SHEA: Probably a smaller source in the truck, compared to the storage tank, because you've got a liquid --

MEMBER KIRCHNER: Oh okay.

MR. TAMMARA: You have 6000-gallon tank. So the maximum tank can hold is 6000 meter. Two tanks. So they have calculated the minimum distance that would not yield more than 1 psi to the SSC and that minimum distance is less than the actual distance.

So that is the analysis performed for the tank. So the other analysis is you have a 13000-gallon tanker truck, delivering the hydrogen, which may, for our bound in case, we are assuming that is totally filled with 13 thousand gallons. So this is, you know, this is done on a probabilistic basis, because of the truck route. So that, that is the difference.

MEMBER KIRCHNER: Thank you.

MR. TAMMARA: Thank you.

MEMBER RICCARDELLA: How often do you, you know, you're using the hydrogen regularly in operation. How often do you have to make deliveries?

(Off mic comment)

MEMBER RICCARDELLA: How often would you expect the deliveries to be made? That might affect the probability, I would think.

MEMBER STETKAR: While they're checking, from my experience, you use hydrogen continuously during plant operation, at a PWR, you use some continuously so you're keeping a cover on the volume control tanks so you're losing a little bit of that. You're losing a little through the hydrogen seal oil system on the main generator, there's a little leak. But your usage during power operation is limited to that.

When you, the time where you really use a lot is when you shut down, purge the main generator and have to refill it with hydrogen, you know? So during any time you shut down, and have to open up the main generator, you've got to purge the whole thing, and that's a reasonable volume of hydrogen in there. So make-up requirements are kind of limited by, by those evolutions.

MEMBER KIRCHNER: Not to belabor this, but I just go back to the presentation. You've got two 6,000-gallon capacity tanks on site. So let's assume one of those leaks at some frequency or such. Obviously you go into a calculation based on one of those tanks leaking, delayed ignition, and then some kind of blast over pressure conflagration over pressure. Now you have a single source that could be 13,000 gallons, twice as big as one of the tanks, in an accident, why wouldn't you analyze that, instead of a leaking tank?

MEMBER RICCARDELLA: Because, the reason I ask my question is, the tanks are sitting there 24 hours a day, 365 days a year. The truck only comes in once every 10 years. I'm sure it comes more than that, but, you know, there's a much lower prob --

MEMBER KIRCHNER: You're handling the hydrogen when you have the delivery. It's kind of static tanks. Just, I'll let it go at this point.

MEMBER RICCARDELLA: Yes. Gina, were you going to make a comment?

MS. BORSH: Yes, this is Gina Borsh from Dominion and the analysis assumes 24 deliveries per year.

MEMBER RICCARDELLA: That's twice a month.

MS. BORSH: Yes.

MR. SHEA: And for the record, Pete just reminded me they're employing hydrogen water chemistry here, right? So that's an additional source of constant makeup, so --

MEMBER STETKAR: When I really well What the primary use is, I asked if it was static cooling or if it was primary chemistry and Gina says it was primary chemistry. This is the hydrogen feed to the reactor coolant system for suppression radiolysis.

And, once every two weeks for a delivery of gas? That's probably on a par with most plants. You've got a hydrogen truck coming in every couple of weeks, got a nitrogen truck coming in about the same frequency. So that's not uncommon.

MR. SHEA: Okay, we'll move on to the next slide. Accident release. I have the little pretty picture. Dominion didn't have it - again, we just iterate that the assumption from the condensate storage tank, again it's surrounded by a moat and also a drain line that's designed to capture all of that leakage if the tank just instantaneously broke and spilled its contents.

However, the evaluation is based on all the contents spilling into the yard and finding the closest, finding the fastest path to the water source and all that analysis was done. Staff confirmed that and found it acceptable and meets all the requirements.

MEMBER SKILLMAN: So Jim, I ask you, why is the condensate storage tank the objective of this analysis?

MR. SHEA: We have Steve Williams here that could, from the staff, that could answer that.

MEMBER SKILLMAN: Oh.

MR. WILLIAMS: Steve Williams, from the Radiation-Protection-Accident-Consequence Branch. To give you some background on why the condensate storage tank was chosen as part of the release to the environment was, in 11.2 and 2.13, we do a combined analysis based on Branch Technical Position 11-6.

And that requires you to take the maximum concentration of any activity, in an inside tank and then release that to the environment, even though it does have a dyke and some protection around the dyke, as far as the prevent releases. Then, Hydrology takes that and takes their values for dispersion and calculates an end point ECL concentration, to ensure that they meet 10 CFR 20 requirements.

Initially when Dominion submitted their COLA, they had chosen two tanks that were inside of the ox-belt or inside of the plant. They weren't outside tanks, so it didn't meet the criteria for the condensate storage tank.

And the reason, and for your question, you asked how does the condensate tank get activity in it. Well, it's used at points to recirculate from the stud field pull and cleanup and then just the normal cleanup from the condensate system as during operation. Any contamination may be from primary, secondary leaks and cleanup the iodine or any particulates that they find.

MEMBER SKILLMAN: Thank you, Steve. That takes care of my question to the Applicant and also to the staff. Thank you.

MR. SHEA: Thanks, Steve. Okay. We've talked about this hurricane missiles and really, the affect was on the RTNSS Structures, which was evaluated per the new Reg. Guide. Really, the departure is related to a new Reg. Guide that came out.

Reg. Guide 1.221 an update to that Reg. Guide, following the DCD Final Revision that was approved. And this Reg. Guide came out so subsequently, these COLA Applicants, I believe Fermi even revised their COLA to include this Reg. Guide, this new Reg. Guide criteria.

And so it was a departure. Dominion evaluated it. It essentially affected the RTNSS structures, which is the non-seismic I structures. All the seismic I structures met all the criteria, based on the wind speed and the hurricane.

MEMBER RICCARDELLA: So you're saying Fermi had the same departure?

MR. SHEA: I believe they did. I believe they had a similar departure. Yes. Fermi didn't? Gina has additional information on Fermi on this issue.

MS. BORSH: You were busy with North Anna 3. This is Gina Borsh, from Dominion. Fermi doesn't have a departure here.

MR. SHEA: Hurricanes aren't as big there, I guess.

MEMBER RICCARDELLA: Probably too. We talked about that.

MEMBER STETKAR: This is rather strange and I understand why Fermi doesn't have a departure here and why North Anna does.

MR. SHEA: Moving on. All right so now onto seismology. Essentially in the seismology area, the Mineral earthquake occurred and there was a number of field studies. You can see the field reconnaissance determined presence or absence of surface rupture displacement.

There was a very extensive review of that and our staff talked about that at the last meeting. It also came up from the Public on, it was Fault A, which was previously discovered when Unit I and Unit II were being constructed.

And that was evaluated in addition, and showed that there was, that Fault A has been, you know, for over a million years, has been, it's an old structure that has, had no deformation associated with it when the Mineral earthquake occurred. Any questions? We do have our staff here if you have. Okay.

And the vibratory ground motion, again, affected by the Mineral earthquake, August 23, 2011, that affected the, so the local seismic evaluation was affected by that, along with the other, the new Central Eastern United States Seismic Source Characteristic, Characterization, was, came out around the same time, so that was new.

So they combined both, some of the local information and that new seismic CEUS-SSC to come up with a site-specific ground motion, which was, again, then that affected the seismic I structure evaluations. That was the crux of the whole seismic closure plan and all that input into the final results of the seismic I structures. No questions?

So the staff concluded that the GMRS, the local Ground Motion Response Spectra adequately represents the seismic hazard at North Anna 3, and meets the relevant regulatory requirements provided in 10 CFR Part 52, 10 CFR 100 23. And I think Dominion showed that the input for the seismic I structures.

So associated with the seismic structures, Sections 3.7 and 3.8 of the Staff SCR, reviewed the site-specific Foundation Input Response which is the FIRS, which exceeded the DCD, which is part of the Certified Seismic Design Response Spectra, CSDRS.

So the departure and the exemption associated with the departure essentially was the definition of the site-specific SSE, which is the FIRS plus the CSDRS, so they combined those two rather than just, in the case of, like Fermi, it was the CS, you now, the DCD was bounded the Fermi site-specific results. So they used just the CSDRS.

So that's the difference. That's the

departure that was evaluated through the seismic closure plan. I think someone mentioned all these calculations, the specific calculations for each one of these structures and buildings, the staff completed two on-site audits. One was for the demand side, which was the input based on the, you know, the FIRS and the responses of the input to the structures.

And then, the second, which is, the second audit focused on all the calculations on the site-specific structures and the impact of that demand on those structures. And we spent a week at the GEH site and reviewed all these calculations. Had a team of our staff of 5 or 6 of our staff members, along with our consultant, participated in those audits.

Now that, that also, those were significant efforts associated with verifying these calculations, met our criteria, and met all the appendix B requirements, etcetera, along with all their RAI responses and additional documents that are on the docket associated with our RAI responses. And then this all culminated in the final FSAR Revision 9.

And all this information that was in RAI responses and COLA markups, that's how we reviewed these final sections 37, 38 through the COLA markups, which were responses to the RAIs and then verified those in the final redline that they met what we accepted in the COLA markups.

And you can see the staff did their own confirmatory analysis and seismic input motions and strain compatible soil profiles, SSI effects on the FWSC, which is, that's the, what, for some reason I got S, W, Fire Water Service Complex. Yes, which is one of the three Seismic I structures.

And here's some of their results. In Appendix 3G, in the FSAR, it shows that the site-specific demands, except in a few cases, were met by the DCD. Our staff was very comfortable after reviewing the, all the reevaluation that the actual DCD was only exceeded in a few minor cases that Dominion mentioned, and we mentioned also here about the steel girder weld sizing anchor bolts associated with a couple or the structures.

The thing that really struck me as a guy kind of following this as a non-seismic person that, when we come to the results and found out that nothing as far as the actual physical plant changed, as far as the structure of the walls, the thicknesses, the base mats, you know, the actual DCD structure was already a very robust design and the staff, just in some areas, with all this analysis. And let me tell you, there was a lot of analysis, it came down to just some of these few items. So, you know.

MEMBER RICCARDELLI: You know, the exceedances are at relatively higher frequencies at 7 hertz and above, so. You wouldn't expect to have that much of an effect on the building.

MR. SHEA: And I think I just mentioned this. This last slide that, standard design is adequate to meet the site-specific seismic demand is what the staff determined and meets all the NRC regulations and guidance.

The last thing we, part of this, part of this effort, we looked at, just some of the effects of components and two of them was, really, that the fuel racks inside the structures, we looked at those. And in some cases, we determined that, you know, Dominion, we reviewed Dominion's results and determined that there was a couple of places where they did some reinforcement for the fuel racks. You see that, they found that, for this spent fuel pool, was adequate.

And then there was a, in the buffer pool, I believe, yes, the anchor bolts, there were some anchor bolts in the buffer pool that were upgraded.

And also, the staff reviewed the fuel inside the vessel associated with that seismic exceedance. And the concern there was that in the DCD, some of the stresses in the references to the DCD for the fuel design, exceeded what was in the DCD.

So, even though the fuel design reports had much higher margin as far as those design, you know, conditions, the DCD had a specific number of them, because of their exceedances. They're exceedances obviously where the fuel, some of the fuel, and therefore the staff looked at it and they wanted to get a confirmation that, at the end, that when you combined the loads that you still don't exceed the actual mechanical design of the fuel as referenced in the DCD.

And that was all confirmed and none of those design constraints were exceeded. So that was part of the staff review in Chapter 4.

So in conclusion, the staff completed a thorough review of North Anna 3 COLA and, as we mentioned, that focused on those areas that were site-specific. Much of the COLA, as you can see through our FSAR or FCR, the Advanced Safety Evaluation, much of the information is incorporated by reference from the DCD or in the, or directly Fermi evaluation.

The published Phase 4 Advanced Final SCE represents the staff Final Safety Review Findings for the North Anna 3 ESBWR. So, I think that answers the question. A little question came up about the FSER. The FSER is really just an administrative final product that's going to be, that will be prepared for the new Reg. Just part of a process that we go through. And that's all I have. Any questions?

MEMBER STETKAR: Yes, I had one where we have ample time here. So, the Applicant and the staff, neither of you discussed the departures and exemption on the electric power system. We had some discussion about that at the Subcommittee meeting.

For the benefit of the other members, they're, North Anna is proposing a change to the certified design connections to the switchyard. They're installing what's called an intermediate, they call it an intermediate switchyard but basically, it's three single phase step-up transformers that go from 500 kV down to 230 kV with an isolation circuit breaker and motor operating disk connects.

By doing that, it allows them to use the same design and voltage ratings for their unit auxiliary transformers and their reserve auxiliary transformers. In the certified design description, there's no, you just see lines going off to offsite power. So there's no, there's no particular voltage indications or anything. But this is something new and it required a departure from the DCD because it does affect --

MEMBER BLEY: Even though those things weren't specified in the DCD?

MEMBER STETKAR: Yes, because --

MEMBER BLEY: It's curious to me.

MEMBER STETKAR: No because changes that can -- the DCD implies that there's a single switchyard. It implies that there's a single switchyard

MEMBER BLEY: Oh.

MEMBER STETKAR: It implies that there's single switchyard but it doesn't specifically say that. The, I'll eventually get to what I'm getting to, but I'm trying to get the background to everyone. The reason that it had to be a departure is that it altered the configuration of the connections in a way that is different from what the DCD implies on what's called the normal preferred power supply, which is the generator connection to and what comes back into the unit auxiliary transformers.

So okay. They made a change and they had to do it. It's an exemption because it affects a drawing in Tier 1 of the DCD so it's more than just a point specific departure.

And I got curious. And there's some discussion in the FSA, in the Applicant's FSAR. There's a good discussion about what it is. I mean, it's well documented what it is. So I got curious about, well, how does this affect the risk from things. And we had some discussion in the Subcommittee meeting and the Applicant noted that they did not change the certified design PRA to account for this.

That they will do that for the PRA that's submitted before fuel load, but it hasn't been changed. So in the SER, I then went to look to see what the staff did about this and I found a statement in Chapter 19 out of the PRA part of the

SER that says, the staff finds that the ESBWR design PRA provides a bounding assessment of loss of preferred power events. So I said, well bounding is a strong word.

We had quite a bit of discussion about what that might be, what it might mean. I, since the Subcommittee meeting, and today's meeting, I went and dredged up Revision 6 of the PRA Report, which I found is a public document so, indeed I can talk about it. The long and the short of it is that the ESBWR PRA is not a bounding assessment.

That, indeed, this configuration will increase the risk primarily, the only thing that I could find, the only that it introduces is it increases the frequency of loss of preferred power from the 500 kV supply. Not loss of all off-site power. And those failures, the mass majority of them would be non-recoverable within the PRA ignition time. So it's a, non-recoverable loss of that supply.

When I delved into the PRA models, that particular type of event was not evaluated in the PRA. Now it can be mitigated because the 230 kV supply should not be affected by failures, should not, unless there's some sort of strange electrical transmit, be affected by failures in the intermediate switchyard. So my conclusion, my personal conclusion, and I've got numbers to kind of back this stuff up but that's too much detail.

My personal conclusion is that it's, it's clear that the risk would be higher but I think the increase would be rather small. And the current contribution from switchyard-related losses of preferred power is a small contribution to overall risks. It's not miniscule. It's a couple of percent.

I don't think that that would increase visibly. I mean, it might be in the second significant figure, or something like that. So I think that, I think that, you know, from my perspective, it's okay. It's not a risk-significant change certainly.

On the other hand, I'd caution the staff very carefully about using terms like, the design certification bounds this, is an indication to any rational reader would be that it can't be any higher than the design certification. It certainly will be somewhat higher.

MEMBER BLEY: Sounds like a reasonable caution but helping you beat this dead horse a little bit, I would have kind of thought, and I haven't looked at this at all, but if you'd dug even deeper you might find that there's more flexibility from that kind of arrangement you described and maybe it gives you something back somewhere else.

MEMBER STETKAR: It, what it gives back, is it allows them, and I don't know what their plans are, it allows them to have, for example, one spare transformer on site that they can use to replace any one of the four UATs and RATs which, under the PRA, under the PRA configuration, they had 500 kV UATs and 230 kV RATs.

So this allows the Applicant to have a single spare transformer, rather than having two spare transformers, that they can swap in and out if they do have a failure of one of the UATs or RATs. It doesn't help you in PRA space because it takes you a long time to swap out a transformer that's been failed.

That's the only flexibility that I see. When I dug into the PRA, the PRA, with the exception of what I mentioned on the record here, the PRA does cover, it covers two different voltage switchyards. It covers unavailability of the 230 kV switchyard. It covers common cause failures of all of the transformers. So about the only thing that I could find was the one thing that I mentioned on the record here.

But again, in terms of staff conclusions, just be careful about that word, bounding. Thank you. I don't know if the staff or the Applicant wants to say anything about that.

MS. BORSH: I don't. Dominion doesn't have anything we want to add to that. Thank you.

MR. DONAHUE: Mr. Stetkar, we, this is Joe Donahue from the staff. We didn't have the staff from that branch here to deal with that question, so I'll bring your comments back to them and bring back a --

MEMBER STETKAR: Yes. We had some discussion, a little bit of discussion during the Subcommittee meeting, and well, as I said, at that time I only had the previous revision of the PRA reports, so I didn't want to draw any particular conclusions until I dredged up the current revision and confirmed that, indeed, it can be discussed in public, which it can.

MR. DONAHUE: Thank you.

MEMBER MARCH-LEUBA: Okay, I'd like to put also a comment on the record. And it's going to be in the form of a rhetorical question. I don't expect an answer from this and it's somehow related to this, but it has to do with digital I & C. Okay.

In the generic ESBWR design, everybody concluded it was prudent not to specify the platform of the protection system because it's evolving so rapidly that it makes sense, at least it's very prudent, to wait until the implementation to gain some more benefit of experience and eventually, you install the one that makes more sense. Okay.

Now, but because of that, it had not been reviewed, the platform itself. And we mentioned the PRA for fuel loading that will be executed on the as-built plant, and that PRA will have a probability of failure for scram on demand.

Now, I, and here's my rhetorical question. I expect that the staff, the expectation of the staff be that probability of failure on demand, not the historical number, based on all the analog system that have been implemented in the past, but be an evaluation of that platform as implemented. And, as I say, I don't expect a question.

But I want to put it in the record that whatever platform North Anna decides to implement and build on their plant, use that number in the

PRA, not a historical from 1960 so with analog systems.

MEMBER STETKAR: All right. Thank you Jose.

MEMBER MARCH-LEUBA: Sorry. I, final question. Just a caveat, we realize that PRA analysis of digitalizing systems and so forth and they've all been scram, maybe has to be qualitative on this, okay, but at least an attempt to identify the failure models should be made.

MEMBER STETKAR: Yes. I think the, you know, the, just again for the record, the requirement is that the PRA that's submitted before fuel load has to be a local 1, local 2 PRA, yes, local 1, local 2 PRA for all operating modes consistent with the NRC-endorsed standards that are available one year prior to that date. I believe that's correct.

I think I've characterized that. The methods for evaluating quantitatively and qualitatively digital systems are evolving and maybe by the time they perform their site-specific PRA, one year before fuel load, we'll have a lot better guidance in that area. It's pretty sparse right at the moment.

MEMBER MARCH-LEUBA: Yes, my comment is use this judgement of the time and just because it's difficult don't say we've got to do it. Try to do your best in identifying failures that could be inserted by that system.

MEMBER BROWN: Since everybody else is talking about my area, I feel compelled to amplify -- I'm sorry --

MEMBER CORRADINI: Where does your ownership lie?

MEMBER BROWN: I've got lots of ownership here. They may have confidence that we may evolve methods for PRAs that adequately represent digital I & C in whatever form it takes, either five years from now, or 10 or 15 years from now.

I have voiced in the past skepticism that PRAs and FMEAs would adequately define the performance of these things. I think that's consistent with some of my past comments. And the effort that has been made in the digital I & C world is to ensure that the application of digital systems, computer-based, software-based systems, can't, because of their inherent characteristics of locking up and other types of performance characteristics, have a mechanism built into them to sense that, and translate that into a more deterministic demand for a trip in any division that goes, that comes up, if that division locks up.

So, maybe by the time my grandchildren, okay, have graduated and gone on to the, if they go into the technical world, maybe 20 years from now, there may be somebody that's smart enough to get a PRA analysis.

Right now, I think the approach we're taking to try to get a computer-based system to be monitored by hardware-type systems that trigger themselves and initiate trips in the various divisions, if they are so, if they lock up, is the proper approach right now, while we're in this mushy, ambiguous area for FMEA and PRA.

So that's the path we've been taking. We've been approaching it that way and I just wanted to reemphasize that we did do that on ESBWR in terms of, and it can be done in a number of ways. You don't necessarily always have to trip.

If you can reset the microprocessors or the computer, and it gets back up within a few hundred milliseconds, that's an acceptable approach to doing things, as opposed to issuing a trip. And actually, the GEH systems as they talked about them, do initiate an automatic reset and generate a trip at the same time.

MEMBER RICCARDELLA: Kind of like rebooting your laptop every so often?

MEMBER BROWN: Pardon?

MEMBER RICCARDELLA: Kind of like rebooting your laptop?

MEMBER BROWN: Yes. We do it automatically. Well, no, your laptop will take five minutes, you know, they can take, and if you're looking at one of the other projects, I think, I've forgotten what platform it was. Well I don't want to mention, it takes literally five or ten minutes to reboot, which is unsatisfactory.

So, in the Naval Nuclear Program, if you lose a processor due to lockup, it'll reboot in less than about a 150 milliseconds, faster than you can blink your eyes. So, anyway, that's kind of a design concept. It's a prescriptive design concept but it can be done in a non-technology based manner, which is what we've attempted to do.

So I just reiterate that. Maybe in a little more coherent than I was, ten years or eight years ago. That's, I just wanted to get my two cents' worth in here on the record. Thank you.

MEMBER RICCARDELLA: Thank you Charlie. Okay, with that, are you finished Jim?

MR. SHEA: Yes.

MEMBER RICCARDELLA: Are there any other comments or questions from members? Okay, so then we will then ask for comments from the public. Are there any members of the public in this room that would like to address the Committee? I'm not hearing anything. Could we have the phone line turned on and ask for questions from any members of the public that might be on the line?

ERICA GRAY: Yes. This is Erica Gray, in Richmond, Virginia. Can you hear me?

MEMBER RICCARDELLA: Yes we can.

MS. GRAY: Yes. I would like to know, first of all, I mean, I guess, I'm not watching the presentation, I guess, viewing it so, unusual that I didn't hear an introduction. So don't really even know, when you say full Committee, how many members are there? And who's present?

MEMBER RICCARDELLA: It'll be in the transcript. The entire Committee is here. It's 14 members.

MS. GRAY: Okay. And then, also, for

the members, because this is a full Committee. I've been participating through this COLA application for years and I'm curious to know if all the members, the Full Committee Members, have read through the last two transcripts of the Subcommittee.

CHAIRMAN BLEY: I'm sorry. This is a time for public comment. It's not a time for interaction with the Committee. We're receiving information to help us in our deliberations. So if you have any comments, please go ahead. This is Dennis Bley, Chairman of the Committee.

MS. GRAY: Okay. Well, I mean, I think it's relevant, though, because it was even stated in the very last meeting that this seems to be a very rushed proceeding and there were a lot of other discussion about other departures and exceedances, quite a few, and it seems to be kind of being glossed over here.

I mean, even I the last transcript, it was mentioned by Member Stetkar that you have to recognize that part of the Committee these days, we have new members, who aren't even familiar with the history the ESBWAR, including the Chairman.

And the reason why I'm mentioning this is the last meeting was 9 hours long and the transcript really went over a lot of stuff that, today, is not even being mentioned. The polyfiber piping is not being mentioned.

The Radwaste storage, that Dominion's asking for, for to allow them to store ten years of such storage of Class BC Radwaste and 3 months of storage of Class A for right now, the DCD has 6 months. There's quite a few other issues, including the departure and exemption from Reg. Guide 1.221 for hurricane force missiles. In certain instances, the velocities of certain missiles at North Anna is higher than the velocities that are in the DCD.

I mean, one after the other, this process is being glossed over in so many ways, including the issues of the seismic issues, because, frankly, someone needs to question Dominion how they came up with the numbers, because I have been on these meeting calls before, where obviously we were missing the data and at least for some amount of time, we didn't get the data during our 5.8 earthquake. There was failures and including the failure of free field sensor.

And I'd also like to mention that the USDS has stated, Mr. McNutt, unlike the typical situation in the Western U.S. fault, in this part of the country, we do not have surface expression, making it more difficult to estimate the maximum possible magnitude earthquake that a fault can generate or the expected repeat time of earthquake. And, you know, the data that's being used is not complete.

And I'd also like to mention that how can this full Committee move forward with an approval or proven of the safety, so many issues, including fire safety, site-specific fire hazards need to be analyzed. The issues with the fuel rods themselves being different, need to be analyzed.

There are so many issues with this COLA that's being pushed through. And even my comments at the last, because there were only two at Subcommittee, is why is it being rushed? Because there was a lot of issues that came up and including the one that was sort of mentioned earlier, that didn't want to really be rehashed.

But it frankly stated in the last meeting about that loose end, and that loose end being that there was an issue where the DCD for Fermi, where they were granted their combined license, where the cybersecurity firewall, you know, there was no, there was nothing mentioned in the DCD at all. So there was more than a loose end. Something went through with actually being analyzed, looked at and taken care of.

So, of course, I have a lot of problems with this COLA, in general. And I'd also like to mention that, you know, we've only gotten through, and I'm even sure complete, the Tier I post action items.

You know, risk assessment need to be, will not be required to be completed until 2016, 2019 so, you know, we're not even through the Tiers of lessons learned, yet this Committee, or at least the Subcommittee felt like everything looked so great.

There are a lot of loose ends.

This should not move forward and I'm very disappointed that the way things are worded, in particular also with the issue of how the departure of the liquid waste management system, that's also involved the piping line discharge instead of the blow down. I mean, there are a lot of departures from the DCD and, you know, trying to converge things just to kind of make them look good is way different than actually using data and looking over things well.

So I could probably go on longer but I was told that I would have five minutes and I'd also like to say that, when the public can't even receive the information needed, not even within 24 hours, it makes it very difficult to be able to look over what's going to be looked at and reviewed, including transcripts that are not usually made public, like the last transcript of the Subcommittee.

It took 11 days and finally, I called and I received it from Mark Banks and so, you know if this full Committee, is just going to agree with everything that Dominion has put forward, it really shows that this is not a regulating body to protect the public and the safety in the environment. It's more to just push this process through because Dominion wants it. That's all I have to say.

MEMBER RICCARDELLA: Thank you for your comments. Are there any other commenters on the line that would like to speak?

MR. KALTA: This is Paksis Kalta, a local resident.

MEMBER RICCARDELLA: Okay. Go ahead please.

MR. KALTA: My comment is a little bit an echo of Erika's in that it's extremely likely, unlikely that this reactor is going to go forward quickly. It seems like the Subcommittee and the Committee are pushing forward faster than is necessary, when we actually have the luxury of time to be able to review these issues, especially seismic issues. So, I think that's all I have to say at this point.

MEMBER RICCARDELLA: Thank you. Are there any other members of the public who would like to make a comment? And, with that, I'll turn the meeting back over the Chairman Bley.

CHAIRMAN BLEY: Thank you sir. At this time, we're going to recess until the 10:45 presentation on the AREVA extended flow window for Monticello and there'll be a recess until 10:45.

(Whereupon, the above-entitled matter went off the record at 10:06 a.m. and resumed at 10:47 a.m.)

CHAIRMAN BLEY: We're back in session. At this time, I will turn the meeting over to Professor Corradini for AREVA extended flow window.

VICE CHAIR CORRADINI: Okay, thank you, Mr. Chairman. So our session now is speaking about the Monticello Nuclear Generating Plant and the extended flow window. Rob Kuntz is going to lead us through this.

I'll just mention to the members, because I looked at Rob's slides, and he'll give us the beautiful history of all of this as to where we are, just to mention to the members that we're not at the last two subcommittee meetings.

This is a particular discussion about the application of AREVA methods and with their fuel to the Monticello Nuclear Generating Plant. All of the other specifics, if you've missed the subcommittee meetings, will be dealt with by Mr. Kuntz. Rob?

MR. KUNTZ: Oh, I don't know about all of them.

VICE CHAIR CORRADINI: Well, and I'm sorry, I did forget one other thing. And Member March-Leuba is not going to participate in this discussion.

MR. KUNTZ: Okay, thank you, Chairman. As mentioned, my name is Rob Kuntz. I'm a senior project manager in the division of operating reactor licensing, and I'm the Monticello project manager.

CHAIRMAN BLEY: Maybe pull your mic a little closer.

MR. KUNTZ: Is that better?

CHAIRMAN BLEY: Yeah, thank you.

MR. KUNTZ: So a quick review of the history of the ACRS review of this license request, so there was an information session in July of 2015, and then we've had two subcommittee meetings, a full day on September 19, and then a half-day again on October 5.

Just a quick history of the Monticello licensing pertaining to this amendment, they were approved for APU in 2013, came in for a MELLLA+ and were approved in 2014. They had a separate amendment to transition the AREVA fuel, and that was approved in June of 2015, and then this extended flow window amendment request came in 2014, and this is the first extended flow window amendment request the staff has received.

VICE CHAIR CORRADINI: Just one clarification for the members. When they were transitions to AREVA fuel, until this is reviewed and approved by staff, they are going to be operating in the MELLLA regime.

MR. KUNTZ: Correct.

VICE CHAIR CORRADINI: Okay.

MR. KUNTZ: We issued a draft safety evaluation that went to the ACRS a month before the first subcommittee in September. Since the issuance of that draft, we've received two supplements from the licensee, and they dealt with the safety limit minimum critical power ratio.

So the supplement revised the technical specifications to include that penalty. So the safety evaluation you got stated that the staff felt that that penalty still applied, and to address that penalty, the licensee submitted revisions to the tech spec to include that.

Then there was another limitation 9.23, and that has to do with submitting cycle specific icon value tracking data. The licensee said that that does not apply, and the staff agrees, and so the final SE will note that that limitation is not applicable to Monticello.

And the last one had to do with submitting a reload licensing report, and they're just verifying that they'll do that in the time when that's prepared. And so, all of these, the topics in those two supplements, the staff has reviewed, and the final SE will be consistent with the licensee's request.

This is just a quick overview of the SE that you guys got. I don't think we need to go through all of the sections, just the agenda for today. We'll have an open session. After the staff's done Xcel, go through some of the operations, and then we'll close the meeting as Xcel goes into ATWSi, and then the staff will present the results of their review.

VICE CHAIR CORRADINI: Just one clarification though, Rob, so I understand. So will staff want to come up prior to the closed session to give their evaluation of the open session topics?

MR. KUNTZ: No.

MR. SAENZ: No, we were just going to present it in closed session.

VICE CHAIR CORRADINI: Okay, all right, so then my plan then will be, if we're going to go into closed session -

CHAIRMAN BLEY: I'm sorry, if we have staff review of open public area materials, we really ought to have that in the - we have to have that in the open session. We can't have that closed.

VICE CHAIR CORRADINI: But I thought Diego said - can you clarify? I heard it differently. Are you going to -

CHAIRMAN BLEY: Well, he said it

differently. We can't have your comments on public information in a closed session.

MR. SAENZ: So most of our presentation is geared toward AREVA methods, and that contains proprietary information.

CHAIRMAN BLEY: Okay, so you don't have anything particular to say on the public information?

MR. SAENZ: That's right. It will be proprietary discussion.

CHAIRMAN BLEY: Okay, that's probably all right.

VICE CHAIR CORRADINI: Okay, and so my plan would be then to ask for public comment before we go into closed session so that we don't have to go through open, close, open, close, okay? That was my only clarification.

MR. KUNTZ: Then that will be after the first presentation from Xcel.

VICE CHAIR CORRADINI: Okay.

MR. KUNTZ: Okay, all right, and so now I'll just turn it over to Tim McGinty.

MR. McGINTY: Thank you. Good morning. I'm Tim McGinty. I'm the director of the division of safety systems in the Office of Nuclear Reactor

Regulation. The Monticello application is the first to request operation in the extended flow window or EFW with AREVA methods. EFW is parametrically the same as MELLLA+, and Monticello has been previously approved to operate in the MELLLA+ power to flow domain.

Since the fuel at Monticello was changed to AREVA fuel, the review focus of my staff was on the reactor systems. There are three main parts of the review from Monticello to operate in the EFW, first, the review of the AREVA design basis methods, second, the review of the AISHA and SINANO codes as acceptable codes for an ATWSi beyond design basis analysis, and third, the application of those methods and the acceptability of the plant specific portions of the enhanced option three, also EO3, stability solution.

The staff has been working long and hard on this review. We had a very productive audit at the AREVA facility in Richland, Washington during the week of June 15, 2015. The staff did a thorough review of the areas described above, and was assisted by ORNL, Oak Ridge.

We would specifically like to thank Dr. March-Leuba for the outstanding job he has done for the staff for the last, it says here, 30 years, and so we want to thank you. And I know you already acknowledged that, so appreciate it.

MEMBER POWERS: You realize, of course, that we're now going to have to put up with him.

MR. McGINTY: I apologize in advance for that.

MEMBER POWERS: We will get even for this. We fully intend to get even.

MR. McGINTY: Thank you very much for that.

MEMBER POWERS: You're welcome.

MR. McGINTY: The staff also has had some very productive meetings with the ACRS subcommittee on thermal hydraulics on September 19 and October 5 of this year, and we're fully prepared to discuss the result of the review with the full committee today. Thank you very much, and with that, I'll turn it over to Pete Gardner for the licensee's presentation.

VICE CHAIR CORRADINI: Okay, if the licensee will come up? If the team will come up, I should say. Glenn, are you going to start us off or -

MR. GARDNER: I'm going to start off.

VICE CHAIR CORRADINI: I'm sorry. Excuse me.

MR. ADAMS: You can go ahead and go.

MR. GARDNER: All right, very good, just making sure we're ready. All right, good morning. I'm Pete Gardner. I'm the Monticello site vice president. And on behalf of Xcel Energy, I just wanted to thank Mr. Kuntz, the NRC staff, and the ACRS for performing this review on an AREVA extended flow window for Monticello. This amendment does support our transition from GNF fuel over to AREVA.

Including our informational briefing in July of 2015, this is actually our fourth visit with the ACRS. We have no follow-up open items from the prior meetings, and our presentation today will be an abbreviated version just to kind of give you the highlights of what we've been through.

All right, before we get the AREVA presentation, we're going to go through a couple of particulars specifically from the Xcel team, and who you see in front of you right now is Rick Stadtlander. He's from operations, and currently in engineering from our site, and Tamara Malaney, and she's one of our staff reactor engineers, and she's done a lot of work on this project. So right now, I'm going to turn it over to Tamara, and we'll continue into the presentation.

MS. MALANEY: Okay, so I want to provide a little bit more detail on what this EFW amendment is. This is a site specific license amendment request. We're using many AREVA topically approved methods, but the submittal is site specific, and we are in no way seeking any form of topical review for generic use for any other BWR.

EFW is the region on the power flow map, and it's, as been previously said, is parametrically identical to the MELLLA+ region that we're currently licensed to use with AREVA - or with GE fuel and GE methods. The new EFW domain will be implemented in the core operating limits report the same way that MELLLA+ is implemented in our current core operating limits report.

The main point of similarity is that they're both the same power flow domain. And finally, we're using enhanced option three instead of the detect and suppress solution confirmation density for long term stability protection.

This is the only physical modification required to implement EFW. We have to put the jumper back on, and so we don't use the DSS-CD algorithm anymore, and it greatly simplifies the progression through our technical specifications in the event of an inoperable OPRM, which has honestly been the biggest challenge for implementation. It's a very complicated progression through the tech specs.

MEMBER SKILLMAN: So Tamara, on that note, what is the primary safety benefit of this change?

MS. MALANEY: I would say it's approximately equivalent from a safety perspective.

MEMBER SKILLMAN: As what?

MS. MALANEY: As our current fuel and methodology.

MEMBER SKILLMAN: So neither more safe nor less safe?

MS. MALANEY: On the whole, yes. It's primarily an economic decision.

MEMBER SKILLMAN: Okay, thank you.

VICE CHAIR CORRADINI: You may want to speak up a bit.

MS. MALANEY: I'll try.

VICE CHAIR CORRADINI: Please do.

MS. MALANEY: I'll look down more.

CHAIRMAN BLEY: I'm just a little

curious. Can you give me a little brief tutorial on why the progression through your tech specs was so difficult? I've never heard this one before, so I'm a little - I missed the - I wasn't part of the subcommittee.

MS. MALANEY: Yes, so right now, when your OPRMs are operable, you are not required to use any backup stability regions.

CHAIRMAN BLEY: Okay.

MS. MALANEY: If your OPRMs become inoperable, then you immediately implement your backup stability regions. You have 12 hours to turn on your automatic backup stability protection trip.

Now, if for some reason your automatic backup stability protection trip doesn't work, then you're still using the BSP regions implemented immediately, and then you cut off a chunk of the top of the power flow map that's called the BSP backup region, the BSP boundary.

CHAIRMAN BLEY: So it's kind of a giant set of "and" and "ors" that are confusing.

MS. MALANEY: And everyone gets confused because it all has BSP in it, so we've renamed - there's a stability trip that's based on simulated thermal power on the EPRMs for the enhanced option three. We've renamed it to the Extended Flow Window Stability trip because everyone got confused with BSP boundary, BSP backup, BSP -

CHAIRMAN BLEY: So it's really the renaming that's made it easier for your operators.

MS. MALANEY: And the tech spec progression is a lot easier because we always have the EFWS trip on -

CHAIRMAN BLEY: Oh, okay, you don't have to go back and forth.

MS. MALANEY: - when we're above 70 percent power.

CHAIRMAN BLEY: Okay, thanks.

MS. MALANEY: We did want to update you on how our experience in the MELLLA+ domain has been. Honestly, it's no different from day to day. I talked to a bunch of our operators, and I couldn't get any operating experience that said it was any different. We finished our MELLLA+ testing in June of 2015 with no issues there, and we have had no stability events.

This slide is a little bit big and complicated. It shows all of the methods that we had before for GE analysis in blue, and then it shows everything we have for AREVA in red. And you can see we have equivalent analysis. We have ATWSi methods and analysis over on the right for AREVA, and the GE methods and analysis over on the left.

Besides showing the EFW meets the licensing precedent set by MELLLA+, we also want to talk about three fundamental concepts, one, the AREVA codes are applicable, codes and methods are applicable in the EFW region. We have met the applicable limitations of the MELLLA+ licensing topical reports, and then we have a comparison of the non-proprietary MELLLA+ versus EFW results.

In ANP-3135, which was submitted as part of the initial license amendment request, we describe specifically the applicability of each code and method. First, the method was checked for SER restrictions on power, flow, or the parameters most impacted by the increased power level, so steam or feed flow, jet pump M ratio, or core average void fraction.

The AREVA methods are characterized by technically rigorous treatment of phenomena, and are very well benchmarked. Key Monticello data was plotted against the method qualification data to show that Monticello is within the qualification of the method.

One example of this that was going to be fairly quick and easy to explain is the SPCD and the ACE CPR correlations. We're using SPCD for the GE fuel, the co-resident GE14 fuel, and we're using ACE for the ATRIUM 10XM fuel.

There are no SER restrictions on power or flow on either of those methods, and our data is within the qualification database. That's all I had for methods. If there's any other questions, it would have to be deferred to the proprietary session.

This picture shows where we did analysis, so primarily the thermal hydraulic type analysis. We didn't do every single analysis at every point, but you can see we covered all of the corners of the map and then quite a few places in between.

For MELLLA+ limitations and conditions, like I said, we either met them, or we decided that they were not applicable and showed why they were not applicable.

So one that we met was NEDC-33173, limitation and condition 9.3 requires that extended operating domains are either limited to 50 megawatts thermal per megapound per hour, or additional information needs to be provided. The Monticello application is less than 50 megawatts thermal per megapound per hour, so this limitation and condition is met.

One that was not applicable for us is out of the same topical limitation and condition 9.14 requires that the part 21 on the GESTR-M thermal conductivity degradation needs to be applied until the NRC approves what ended up being the prime methodology. This is not applicable because thermal conductivity degradation is already included or addressed in AREVA methods.

Next, we have the key results comparison. You can see this slide just as well as I can. The one thing to note is the OLMCPRs are for the representative core because we're not quite to the point in the cycle, in the next cycle core designs, that we have OLMCPRs for next cycle. We don't refuel until next April, but we do have the safety limits set up now.

And then on the next slide, we have the LOCA, a short discussion on Appendix R, and then both of the LSI PCTs meet applicable limits, but both of the values are proprietary, so I can't tell you now. This is the end of my presentation. Oh, sorry, I have - I forgot. I added a bunch.

One thing that we talked about at every meeting, and quite a bit with the staff, is the operator action times. The primary action time for ATWSi is the 90 seconds to initiate level reduction by terminating and preventing feed water injection. The other 10 critical operator actions related to boron and - what's the other one - oh, suppression pool cooling, are unaffected by what's going on exactly on the core. It's just about decay heat.

So here, I have a timeline, and this is something that nobody's seen written out like this before, so maybe it will be useful even for the people who were here before. For the two recirc pump trip, which is our limiting event with oscillations -

VICE CHAIR CORRADINI: If I might just ask you to back up, so you might want to tell everybody why the 2RPT is limiting because I think the subcommittee people will remember vividly, but other members might want to hear that.

MS. MALANEY: I can say that now instead of the next slide.

VICE CHAIR CORRADINI: Okay, yeah.

MS. MALANEY: The 2RPT is limiting

because as long as we take our operator action to terminate and prevent within 90 seconds, there are no significant oscillations during the turbine trip with bypass event, so we went looking for another event. It's the same event as was analyzed for the MELLLA+ under GE, and we used the same boundary conditions.

MEMBER REMPE: So I have a question, and I know I kind of kept asking this during the subcommittee meetings, and probably didn't ask it well, but I've thought about it some more since then. And if you want to wait until the closed session, you can answer it there.

But when you did these analyses with the 2RPT and the turbine trip, you assumed the analysis of record feed water flow down reduction, and then to really try and get some oscillations going, I believe it was the 2RPT where you actually did some more conservative run down temperatures.

How do you know what's conservative and what's best estimate? I mean, you have the nominal case, and you have this more conservative estimate. Do you have, like, plant data, or what's the basis for saying something's conservative or nominal?

VICE CHAIR CORRADINI: Let me try

something as your expert is coming to the mic. My memory is from the subcommittee meeting that they basically took the analysis of record that GE used in terms of what was determined conservative. So they were -

MEMBER REMPE: Yes, I know.

VICE CHAIR CORRADINI: Okay.

MEMBER REMPE: I remember analysis of record, but what's the truth is where I'm coming from, and we made other licensees who came in after you guys talk about what the truth is, and that's what I was trying to get to here.

MR. TINKLER: Yeah, this is Dan Tinkler from AREVA. For Monticello, we license typically with a nominal feed water temperature, and we give that versus steam flow, so as the steam flow changes, you get different heating, so we have a nominal feed water temperature that we know.

We also license it with a feed water temperature band. So we say as long as the feed water temperature is within, I believe it's -5 degrees of the nominal, then you're within license space.

MS. MALANEY: It's plus five, minus 10.

MR. TINKLER: Oh, plus five, sorry, plus

five, minus 10. So the feed water temperature is based on plant operation, so the nominal is a plant operation value, but we do license it within a certain band.

MEMBER REMPE: So what's on the analysis of record? Does it just stay pretty constant the whole time, or does it assume some sort of transient behavior, and what is assumed in the analysis of record, and why do you know it's true? Is it just within that band the whole time?

MR. TINKLER: We actually, for our analysis, it was outside of the band.

MEMBER REMPE: And what's the basis for that analysis to make you feel comfortable that the nominal case is correct?

MR. TINKLER: We can get into that in closed session.

MEMBER REMPE: Okay, that's fine.

MR. TINKLER: I think I have some things in the slides. I'll try to - if I don't elaborate on it, please remind me.

MEMBER REMPE: Okay.

MR. TINKLER: I will try to address that during the closed session.

MEMBER REMPE: Thank you.

MS. MALANEY: Okay, so at time zero, both of the recirc pumps trip. Within the first minute, we would expect our operators to take manual action to initiate a trip, but we are not crediting that action in this analysis, which I think is different than some other licensees.

Within 50, 45 to 100 seconds, we would expect the stability trip, the extended flow window stability trip based on simulated thermal power on the APRMs to initiate a trip. We are also not crediting that trip.

We are only crediting the trip to fail at about 300 seconds from when the OPRMs detect instabilities. That is the trip that we are crediting to fail. And then within 90 seconds of that trip failing, we have the operators initiate level reduction.

VICE CHAIR CORRADINI: And that is the same as the analysis of record from under GE assumption, so the timing is identical?

MS. MALANEY: That is correct.

VICE CHAIR CORRADINI: Okay, thank you.

MS. MALANEY: The turbine trip with bypass timeline is much less interesting because at time zero, the turbine trips. There's a failure to scram, and then within 90 seconds, operators initiate level reduction. This terminates the event prior to significant instabilities developing. That's why we had to do the 2RPT analysis to give you an ATWSi analysis. And that's all I have. Questions?

VICE CHAIR CORRADINI: So, to remind the members, staff has nothing to discuss about these topics in open session, so my plan is to get comments from the members, comments from the public, and then go into closed session because of proprietary material. Members, any questions?

Okay, so why don't I turn to - does anybody from the members of the public want to make comments in the room? And can we please have the phone line open so if there is comments from members of the public on the bridge line, we can hear their comments?

I hear noise. Can someone who is on the bridge line please at least acknowledge that they're there so we know the line is open? Anyone? So no one is on the line. Why don't we close the line? And then can we ask members of Xcel Energy and of AREVA to verify that no one in the room is - everybody in the room is bonafide? And we can close the outside line since we're going to go into closed session.

(Whereupon, the above-entitled matter went off the record at 11:13 a.m. and resumed at 1:46 p.m.)

CHAIRMAN BLEY: The meeting will come to order. Again, before we move on to this afternoon's session, we said this morning we had no one who had asked to make public comments. We erred. In fact, Doug Tonkay of the Department of Energy had asked for five minutes to read comments in the record at the end of this session, so we will certainly allow him to do that.

At this time, I'll turn the meeting over to Dr. Chu to lead us through the Part 61 work.

MEMBER CHU: Thank you Mr. Chairman. On October 18th, the Radiation Protection and Nuclear Materials Subcommittee heard from the staff on the final proposed rule language for revisions to 10 C.F.R. Part 61, low level radioactive waste disposal. This full Committee session is the sixth time the staff has briefed the Committee on proposed revisions to Part 61.

The Committee has previously written four letters to the Commission on this matter. The proposed rule is with the Commission now as SECY-16-0106, waiting for the decision of the Commission. The staff has been provided extra time today to present the rule language, but also the guidance on implementing the rule, which was not discussed in any detail at the October subcommittee meeting.

So with that introduction, I turn to Gary Comfort of the NMSS staff to begin with session. Gary.

MR. COMFORT: Thank you, Margaret. Today, as you indicated, we're here to talk about the Part 61 low level radioactive waste disposal final rule, the draft final rule is before the Commission right now for their review. To my right is Dr. Dave Esh. He's going to be doing a presentation on more of the technical aspects. I'm going to be going over the overview of the rule.

I'm a senior project manager in NRC's Office of Nuclear Material Safety and Safeguards in the Division of Material Safety States, Tribal and Rulemaking Programs. We last discussed this topic before the Committee back in -- before the full Committee back in 2013.

So first of all, just to give quick overview of the discussion topics, I plan on going over what the purpose of the rule was, just to remind you all of that, what types of Commission direction we've gotten through the years, and just remind of the letters that, you know, some of the major topics that were discussed before.

Then because what you last saw was really what we submitted to the Commission as part of a SECY paper in 2013, I'm going to go over the transition from the SRM as to what kind of comments they gave us and what we actually published for public comment, and then move into the description, you know, what kind of comments we got and then the description of the final rule. Dave will then take over with the technical elements. Feel free if you have any questions to jump in at any time.

The purpose of the rule, I'd like to star with first, and it's really to ensure the safe disposal of new waste streams not analyzed as part of the original 10 C.F.R. Part 61 regulation. Back when the rule was originally promulgated in 1982 or thereabouts, the rule was based upon what was the waste streams being disposed of at that time period.

And so it didn't include many of the waste streams or some of the waste streams that are now being disposed or were envisioned to be disposed of in the future. For example, depleted uranium. Back in the 1980's, you know, the early 1980's, uranium enrichment was primarily a function of the U.S. government, and there weren't any privatized operations.

So the expectation was a lot of the depleted -- all that depleted uranium would be disposed of by the Department of Energy complex. Since then, enrichment has become a privatized activity and one of the pathways that they're looking at doing is through the low level, commercial low level waste sites, you know.

Similarly DOE, Department of Energy is also considering doing some waste through the commercial waste sites that wasn't envisioned back in the early 1980's. Other things that have changed, that there's some consideration of including blended wastes into the commercial waste stream.

Blended waste is basically taking a class of waste that's higher like, you know, Class B and combining it with a lower class waste such as Class A, but it going to keep it a higher concentration than the Class A level than what was envisioned to be going into these waste sites.

So the idea of the whole rule that we were going forth in this rule is to capture all of these known new wastes, as well as anything that may come up in the future when we developed this rule. Over the years, we've had a lot of interactions with the Commission. This thing really came out of a procedural, a license hearing procedure for Louisiana Energy Services, which was a uranium enrichment facility and the question came up as to was it -- could this material be disposed in low level waste sites?

The Commission came back and asked the staff to evaluate how Part 61 fit into this and what the rule of DU in Part 61 right now, because a lot of depleted uranium wasn't really envisioned to go into these sites. The final rule didn't specifically address DU, so it kind of falls under a default category of Class A waste.

So the question was well, now that we have a lot more, is that appropriate? The staff came back and provided the Commission what they wanted, and the Commission directed us to go forth with this rulemaking. That was in 2008. Eventually, the Commission directed the staff to add into the idea of the blending into the rulemaking in

2010.

The staff went out and it had gone through and developed a regulatory basis for the rule, where we did a lot of public interaction, trying to determine, you know, what aspects we should be considering during the rule. We went out with proposed rule or preliminary proposed rule language, and eventually the Commission came forth during this process and provided us additional direction in 2011, which is the SRMCOMWDM-11-0002 and COMGEA-11-0002, basically giving us more specific direction on how we should require the analysis using a two-tiered approach.

We eventually finally got a final proposed rule to the Commission in 2013, which was SECY-013-0075. In this rule, that's the language where we last provided this Committee to look at, and you guys provided comments back to the -- that were directed to the Commission, and I'm going to go over what was in that in a minute.

But the Commission then eventually came back with their SRM and had us to some significant revisions, which I'll describe briefly that ended up in the proposed rule. But one of the things that they also directed is they encouraged the ACRS to provide an independent review on both the rule language as well as the guidance, and that's a large part of the reason why we're here today.

Now this next slide basically shows a comparison on the left side of the slide is what's known as SECY-013-0075. This is the package that the staff had provided the Commission, including the rule language and it basically encompasses what you saw. During that time period when we went to the Commission, we had recommended going forth as the Commission directed with an analysis of two time frames.

This included a compliance period of 0 to 10,000 years. It would have for the -- a performance assessment would be part of that, which would have a 25 millirem dose limit for protection of the public, as well as we added an intruder assessment as part of that, which would have a 500 millirem limit.

We added also basically waste acceptance criteria, because we're going to site-specific intent. So you could actually use the classification tables, or you could use the site-specific information that you develop to determine what your waste acceptance criteria were.

Then we updated the ICRP dosimetry modeling that would be allowed to be used in the performance objectives in 10 C.F.R. 61.41 and 42, and we recommended to the Commission to allow flexibility to the Agreement States, that the rule should be compatible with Category C.

The Commission reviewed the rule and then as I said had gotten your comments and all, and they provided us back additional direction, which on the right, which is what's shown to be the published portion of the rule. The big changes in that were the Commission directed us to instead go to a time frame with three tiers.

They basically directed a -- they directed -- my mind just went out of words -- a compliance period, thank you, of zero to 1,000 years versus the zero to 10,000 years that we had originally suggested. Again, it had the 25 millirem dose limit for the public, as well as a 500 millirem dose limit for the inadvertent intruder assessment.

And real quickly, on the inadvertent intruder assessments, what we're talking about there is somebody who doesn't -- isn't aware of the radioactive material disposed of at the site. Instead, they're walking onto the site randomly and taking upon activities that would be normal for the activity, and they happen to infringe upon the waste or possibly do.

So what you're doing is assessing it. It's not to evaluate somebody coming advertently into the site and trying to remove the waste or do something to the waste because they know it's there. So the compliance was there to 1,000 years. Then it was followed by a new protective assurance period that the Commission directed that was from 1,000 to 10,000 years. Now this was going to have a 500 millirem dose goal. It wasn't a limit, but a dose goal to try to be compared to.

And then this was followed by a performance period, which we've also suggested in our rule, the original rule as a second tier. This was now the third tier for 10,000 years out. The performance period assessment was basically supposed to be a qualitative review that looked at what was going to -- what the assumptions that would go on after that time period not, you know, very quantitative although you could use quantitative data.

But the intent was to basically provide an opportunity to minimize potential exposures out to the far future. They did include, you know, allow us or they did agree with the performance assessment and intruder assessment. One of the changes, though, they did address in the intruder assessment is we had not really defined down the scenarios the time frame for where those scenarios should be evaluated out to.

The Commission instead directed in their rule or in their SRM for the staff to include that the scenarios should be evaluated based upon the time of closure of the site so you're not looking far into the future and trying to guess what's going on at the site and developing scenarios based on that.

They added a requirement or directed the staff to add an explicit description of what a safety case is. I mean the staff had already thought the safety case was implicitly evaluated and included in Part 61 at the time, but they wanted to describe it explicitly. Similarly, they wanted us to add an defense-in-depth analysis, which we had added per the Commission direction.

Finally, in the compatibility category, instead of doing the C, they directed us to do Compatibility B. Compatibility B basically says that the rule language that the states incorporate has to be basically exactly the same as what the NRC. So things like the compliance period time frames that we incorporated for the three tiers, the states would have to match in their regulations.

If it were in Compatibility Category C, they can be more -- they can be similar or more restrictive than what we had done on that. So that's basically what we published back in -- we ended up publishing as the rule.

Next, I'm going to go quickly over -- we have had, as we said, numerous meetings with you over the years prior to this. What the letter reports that the ACRS had identified as some of the key issues that we saw in the letters. The ACRS directed that we do a -- or suggested that we do a risk-informed based on site-specific realistic performance assessments, with a consideration for uncertainties.

Basically, they wanted us to make sure the scenarios were realistic and looked at a range of site-specific conditions. They suggested that we use time frames based on case by case site-specific basis, rather than finding specific fixed periods for performance.

They also requested that or recommended that we do compliance with the performance objectives after the institutional control period be evaluated, considering features, events and processes or otherwise known as FEPs for a given site for a period, commensurate with a site-specific risk.

For protection of the inadvertent intruder, they were concerned that we were requiring, being too specific in the requirements for that with the dose limits and all, and that the large -- because there were large uncertainties associated with human intrusion, and it wouldn't really help a lot with the decision-making process.

Instead, they felt that durability and stability of the site and evaluation of that should be sufficient. Finally, they recommended that previously disposed waste should not be subject to any additional compliance evaluations. So if a material's already been disposed of, it shouldn't fall under this rule.

These letters went to the Commission. Although we incorporated some of the recommendations of this Committee, we didn't incorporate all of them. Things like we do have time periods, time periods specified and all, and in response to the recommendations, the staff did provide responses as to why we weren't accepting or what recommendations we did accept.

Quickly, I just want to go where we are in the rulemaking process, you know, what we are -- and where we got to since we last had met with you. We issued the proposed rule as SECY-013-0075 in March 26th, 2015. That was after the SRM was issued about a year earlier. Because the Commission provided us so much direction, it took us a period of time to incorporate all the new requirements and get all the documents up to speed.

Per the Commission direction, we issued it for a longer than normal period for review by the public, for 120 days for the comment period. We got a significant number of comments, but we also got a few -- a number of people who requested additional time. So we reopened the comment period from August 27th to September 21st, 2015.

So we finally closed the period and moved forward with development of the rule, to the point that we about a year later just recently submitted the draft final rule to the Commission on September 15th. The paper is in -- part of the package of SECY-016-0106, and currently the Commission is reviewing that package.

As part of the rule, you know, we went out for the public comment period and we received 2,401 comment letters. Approximately 2,300 of those were form letters. While the document was out for public comment, we held six workshops. We did extensive public outreach. We also held a webinar on the guidance document.

We got comments from a large number of people, through both written and during these oral, which we transcribed the oral comments and included them in our package. The people that were represented are listed individuals, public interest groups, Native American tribes, industry groups, licensees and state and federal agencies.

Overall, we had over 800 comments that we identified and then binned them, and we've responded to those in the statements of consideration of the draft *Federal Register* that was part of the SECY that we recently sent.

MEMBER REMPE: I'm curious. 2,300 were form letters. The same form letter or --

MR. COMFORT: Yeah. They were the same form letter basically. We get that often in a rulemaking, that somebody will put out a general form and people will sign their name to it, put their name.

MEMBER REMPE: Oh, so it's almost a petition basically?

MR. COMFORT: Yeah, effectively.

MEMBER REMPE: Got it, okay.

MR. COMFORT: These were a lot from, you know, individuals in some of the states that basically, you know, were concerned are we being restrictive enough or, you know, they were concerned about what waste was going into their sites and all that, that may be nearby.

MEMBER REMPE: But this is the identical same one, 2,300?

MR. COMFORT: They were all -- oh, I mean there might have been a word or two that were different, but yes, they were effectively the same letter and, you know, we go through. We have software that goes through and divides it all out and looks at it to compare it out, to make sure that they are similar and identify where there's objects or statements that are different.

MEMBER REMPE: Thank you.

MR. COMFORT: So I'm going to move on

and discuss a little bit of some of the comments that we received. Remember, this is on a proposed rule that we did actually publish with the three tier system. A big comment that we got from most, a large number of the stakeholders was that the system was much more complicated than necessary.

They felt going to the three tier system would be very difficult to evaluate, you know, the separate tiers. A lot of the individual members of the public had a perception concern that the 500 millirem dose goal that was associated with the protective assurance period assessment period would reduce, actually reduce public health and safety.

In our regulations, you know, for public health and protection we had a 25 millirem dose limit. Now again, you have to look at it that in Part 61, the currently Part 61 it doesn't have any time frames associated with it. So one could argue that time frame goes -- should go out that long. A lot of people, you know, when we were doing the evaluations, it was considerably lesser that we were allowing and applying that 25 millirem.

But what the rule change would do is basically clarify the time period that we would expect, so there's not any confusion. So as part of this rule, in response to those comments, we did go back and we tried to move to a new, more simplified approach that I'll get to in a few minutes.

Another big area was the compatibility category. We got a lot of comments on this. A lot of people thought this reduced the current health and safety provided by some states. Again, under Compatibility B, which is what we went out with the rule, the states would have to meet exactly what we had, which was the zero to 1,000 year compliance period.

Many of these states already had requirements that were longer, 5,000 or 10,000 year requirements, or even at the peak dose in some cases, and that they applied the dose limit to. So by having this Compatibility B, they would be actually having the states have to, you know, go back and change the regulations to effectively reduce the amount of time they were already evaluating against.

Most of the commenters, as a result, recommended Compatibility C. This would allow the states such that if we had a 1,000 year compliance period, that they could make it 10,000 years. They're meeting the 1,000, they're being more restrictive. They could do whatever they wanted to on that and apply the limit. So it gave them a lot more flexibility.

And that's effectively what we did, is we changed the compliance period definition, and then the waste acceptance criteria information in 61.58 Compatibility C to provide them that flexibility.

Not directly stated in the rule, you know, what we did state in the rule for grandfathering, that there would be no grandfathering to sites that were still operating. We expected to those sites to go back and do their performance, redo their performance assessments, to address both the new waste and the old, you know, and the waste that were currently in site.

The intent was not to make them go and find out, you know, we think that if there's anything wrong with their sites currently. We don't, but you really have to have an overall assessment of the site to do your site-specific evaluations and all, and that's all we were trying to indicate with the grandfathering and all.

So basically some of the comments we got, that the grandfathering should be allowed. You know, particularly if a site's not going to be accepting any of these new wastes, why should these rules apply to them, you know? If it does, they shouldn't really have to apply it to the wastes that are already disposed of and all.

There was also a segment of persons that identified that in 10 C.F.R. 61(1)(a), that there's some statements in there that basically say that a state can adopt only part of the regulations that come about. That was kind of an over, an artifact from the original rulemaking, that at that time we really didn't have a framework when Part 61 was put on.

So we didn't want to suddenly throw all these rules at somebody at a state and say you have to meet them all at once. So they were able to adopt them over a longer time period, and address them to their sites as needed.

Our indication from reading of the rule language and finding, you know, reviewing it was that 61(1)(a) really only applied to that first time the rule was implemented. It was never intended to address future amendments to the rule.

So as a matter of fact, one of the things we did as a result of those comments that wasn't in the proposed rule was to remove those clauses in 61(1)(a) that identified that ability for the state to not include, you know, not meet the regulations for NRC or include in their regulations on it. So that is removed from the final rule.

The other big issue that came out of the public comments was the idea of backfit. Part 61 does not have a backfit requirement. We do have to do a regulatory analysis, which is effectively a cost benefit and that's included as part of the package that was sent to the Commission.

Particularly some of the licensees that were fuel cycle operators and stuff had concerns that there are backfit provisions under their requirements. They felt that their backfit provision should apply, since they were going to be indirectly impacted because it was going to potentially impact where they could dispose of their wastes.

We did a review of what the backfit requirements are and how we've applied them before, and in the past we have not applied them to secondary, you know, secondary persons who are affected by a rule. So if you're not part of that rule, that part, you know, we don't really address that.

It doesn't say the Commission can't, you know, go back and take a review of these comments and redirect the staff to do a backfit. There's nothing saying that they can't. We determined that there is no requirement for us to do a backfit in our regulatory analysis, which we did based on public comment also do a lot of revision to provide, you know, more data that was from the states as well as the licensees themselves.

So that's really the major comments that we got. This resulted in the --

MEMBER CHU: Gary, Gary.

MR. COMFORT: Yes.

MEMBER CHU: Can I ask you only a slide question. What was the Commission's direction on -- I'm looking at Slide 5. What was the Commission's direction on the intrusion scenario?

MR. COMFORT: Basically, after the -- when the staff submitted theirs, they basically said we're going to do an intruder assessment and then you'll basically look at what is going on at the site, you know, reasonable activities and all. It didn't define a time period a time period so it could go out, you know, far into the future. You're looking at evaluations past 10,000 years.

The Commission basically came back in theirs and said no, basically put the assessment only at time of closure, what you expect the activities to be at the time of closure at the site. Don't try to look far into the future. But they agreed that we should have an intruder, an inadvertent intruder assessment as part of the rule, as well as with the --

MEMBER CHU: But at closure not --

MR. COMFORT: But at closure, not at yeah. That's one of the things I'll get into is we did have a -- we did get public comment on that, and in the final rule we did change that even further, because a lot of these sites may be operating for 40 years. A lot of things can change in 40 years.

So instead, we changed it to instead -- the rule language would say you do the activities going on at the site at the time that you're doing the actual assessment. Don't try to predict what's going on in the future. As time goes forth, they're going to redo the assessments at renewals, as well as we've got an explicit requirement that they'll have to update their safety case at closure, and at that point they'll actually get the Commission's final, you know, this is what it is.

But we're not requiring to look out after that as to what kind of -- you know, unexpected activities. I mean if they're aware that yes, you know, hey in ten years the building requirements around the thing have changed to allow certain other activities, we'd expect them to probably address that.

But we're not trying to, you know, if that hasn't happened and it's a desert, we're not expecting them at this point to say hey, we expect to major city to be in there in 100 years and stuff on it, and to evaluate it against that.

So going back to the major rule changes and all, so as a result of all the public comments that we received, we did make a lot of, you k now, a lot of changes. I mean we thought the comments, many of them were quite good. They were well spelled out as to what there were problems. I mean everything from, you know, we have some technical issues, that we have areas that we need to enhance direction both in the rule as well as in guidance, you know, as well as just minor editorial that fixed a lot of issues that we had.

But this slide basically shows some of

the major items, you know. Now this is all compared to what's in the current rule, the changes from it, that the new rule is going to require site-specific analysis that you have to do, whether you're using the waste classification tables or not. It provides now for a compliance period that you're going to have to do, that you can evaluate.

But the change now is that we're requiring it only 1,000 years if there aren't significant quantities of long-lived waste. If there are significant quantities of long-lived waste, and Dave will get into what that means in a few minutes in his slides, you'll have to do your evaluation out to 10,000 years for the compliance period, for protection of general public and similarly the requirement is the same out for the -- have similar requirements for the inadvertent intruder.

We do a add new requirement for the technical analysis for the protection of the inadvertent intruder, that -- in addition, it has a dose limit associated with it, which wasn't in the current rule. Protection of inadvertent intruder, the performance objective is found in 61.42, and we now have a new requirement for a 500 millirem limit as part of that assessment that you have to meet.

We now add a new post-10,000 year performance period analysis. Again, as I indicated before, our intent is that's not supposed to be a real detailed quantitative analysis. It's more supposed to be used qualitatively to make sure that, you know, you're minimizing the -- you're aware of what types of impacts you can have, so that you can minimize them out in the future.

The expectation is in most cases, you can just, you know, run your model out further what you currently are for the compliance period. It adds a new requirement, as I said before, to update your technical analyses at site closure, so that you know that what, you know, when you're closing the site, you know what your waste, all the waste that you disposed of and now you can do an evaluation for the final impacts and make any changes that you need to, to make sure that you continue to meet the performance objectives.

Finally, we also add a new requirement to identify defense-in-depth protections, as well as we explicitly state safety cases as was directed by the Commission.

MEMBER SKILLMAN: Dave, before you

change this slide, let me ask a question about the 800 comments two slides back. Among those 800 comments, were there any comments related to the volume of DU waste that would be handled under this rule?

MR. COMFORT: I mean in the way of asking how much would be handled?

MEMBER SKILLMAN: Yes.

MR. COMFORT: I don't remember. I mean I don't remember any specific to asking that specific question at all, I mean, because we would have come up with a response saying we expect, you know, this amount. I know in the rule though, I mean in the statements of consideration, I think we look at where the volumes are coming from. But I don't think we specifically address that. Dave may have more.

MEMBER SKILLMAN: I'd be curious what your and David's thoughts are on this, and I'll tell you why in just a minute. Go ahead.

MR. ESH: Yeah. This is David Esh. Leading up to this phase of the regulation, especially early on we had some workshops on the various topics, of which we communicated about the depleted uranium issues and how much material you might be dealing with. So the estimates, I believe, were there's about 700,000 metric tons in DOE's inventory with Paducah and the other enrichment programs.

Then there was estimated to be maybe about that much or a little bit more that would be generated on the commercial side also. So there was more than a million metric tons of depleted uranium and the potential source term. But I agree with Gary. I don't remember for sure that we received any specific comments about the volume.

The volume is large, but whether it's, you know, a million or two million or 500,000, I don't remember anything like that.

MEMBER SKILLMAN: It seems to me that that's -- that's an important feature that we haven't spoken about, and since our last meeting was about 10-12 days ago, I was reviewing some material that I had, and was involved with the Zippe Centrifuge Plant in Eunice, and see in your mind, a short take off and landing airport, two side by side just north of that facility.

I estimate those landing strips are three to four thousand feet long, and they are only there for the DU cylinders. If the experience at

Capenhurst, which is the -- which is the leading facility for Hobbes is any example, both of those runways will be filled with as many DU cylinders as can be parked there safely stacked two or three high. So we're talking hundreds of thousands of cylinders.

MR. ESH: Right. It's many football fields to use a sports analogy of these cylinders.

MEMBER SKILLMAN: Bingo. That's what I --

MR. ESH: When you see pictures of the ones that exist right now, that's a lot of material.

MEMBER SKILLMAN: That's what I -- that's exactly. That's what I'm communicating. So it seems as though that little piece of information might be a factor in what it is that we're talking about and some of the concerns that the ACRS has expressed, particularly this idea of in the future having to rehandle or rebury or do something else with what's already there, because this is as much material as will fit in a small city. Thank you.

MR. ESH: Thank you.

MEMBER REMPE: So in the subcommittee meeting a few weeks ago, you had another bullet that you seem to have taken off now about better aligning with the requirements with current safety standards. Was there a reason that you -- I mean that was something that was discussed by one of the public comments at the end of our meeting about other safety standards, and is there a reason you decided --

MR. COMFORT: It was more just to keep it, you know --

MEMBER REMPE: Focused?

MR. COMFORT: Keep the meeting focused more on the more technical aspects rather than, you know. I mean that is technical but, you know, something I stated earlier, that we did do that change, you know, in the rule, that we were addressing changing the performance objectives to allow more site or to allow more up to date dose methodologies to be used versus what was, what's in the current regulations and all.

MEMBER REMPE: Okay.

MR. COMFORT: But yeah. I did just do it more -- it wasn't because, you know.

MEMBER REMPE: That you found that you're not aligning with them, okay.

MR. COMFORT: No, no, that we're still aligning with the newer requirements. It's just it didn't seem to be quite the technical area that we were really looking at on this.

Just real quickly, I'm going to go over some of the key areas where we did changes. 61.12, which we covered specific technical information. We added a new requirement O, which is that it -- for defense-in-depth, which requires identification of the defense-in-depth protections, including a description of the capability of each defense-in-depth protection relied upon.

This is not supposed to be a big elaborative analysis. One of the big areas that we got comments from, including one of our Commissioners, was in our original proposed rule we had this in 61.13, which is under the category of "Technical Analyses," and we called it a technical analysis.

Our intent was never that it was supposed to be a big, new evaluation or anything. There was only supposed to be summation of all the other evaluations you've done, so that you can identify what your defense-in-depth. So by moving it to this location, we thought that we, you know, hopefully covered that, that it's not supposed to be that big technical evaluation or analysis.

The biggest changes really in the rule came in 61.13, in the area of technical analyses. First of all in A, we added -- the requirement, you know, in A really covers the technical analyses for protection of public health which were there. We're now making it more defined to call it a performance assessment, and that falls into that category.

We do require you to do it for the compliance period that we've now defined and evaluated. It still meets, you know, goes towards meeting the performance or demonstrating the performance objective in 61.41 on it, and you basically have to meet the requirements as indicated on the slide. Most of those are a lot similar to what it was before.

In 61.13(b), we've now added this new more specific requirement that you have to do an inadvertent intruder assessment, and you have to meet the new limit that's in the performance objective in 61.42 on it.

And basically as I indicated before, one of the big changes from the proposed rule in this area was that instead of doing the scenario at the time of closure, you do your evaluation of scenarios at the time that you're doing the assessment, so there's less, you know, conjecture as to what's going on at that time period or somewhere out in the future.

And then the other big area in 61.13 that we made a change to was we added this new performance period analysis, which is your qualitative review post-10,000 years, to basically assess how the disposal site limits the potential long-term radiological impacts during the performance period. There are performance objectives in 61.41 and 42 for the public and an inadvertent intruder, that basically say, you know, minimize the exposures to -- as I'll come up in a second to say the exact wording.

That's where, again, 61.41, the big changes were for the compliance period for 61.41(a) basically stayed the same. You've got a 25 millirem dose limit, but it's really using the more modern update dose standards that we're allowing. You're going to demonstrate it through 61.13(a) as I said, and now you have this performance period that you also have to do for protecting the public health post-10,000 years.

MEMBER POWERS: A question about this. You have these analyses, a performance assessment and things like that, none of which will be devoid of uncertainty.

MR. COMFORT: Correct.

MEMBER POWERS: And then you've got this defense-in-depth description that you talked. Why aren't the two tied together? Why isn't the need for defense-in-depth tied to the uncertainties in these various analyses you do?

MR. ESH: Right. So the defense-in-depth, I think is tied to the analyses in our mind, and that's one of the primary ways that you may be able to mitigate the impact of some uncertainties, especially unanticipated events or things like that that may go on.

MEMBER POWERS: Well, it seems to me that they really ought to be explicitly tied, that says okay. If you can do your compliance analysis and you come back and you're compliant, and there's no big uncertainty that you've identified here, the heck with defense-in-depth. You've already got it.

MR. ESH: Yeah. Well in --

MEMBER POWERS: And on the other hand, more typically I suspect, you've come along in your performance assessment and they said well, you know, I assume they also have good justification for assuming this, but I could be wrong. And so here, I'm going to do a little defense-in-depth, you know. Why aren't they just tied together at, welded at the hip?

MR. ESH: Right, and I think we were probably more in that direction with the initial proposed language that went up to the Commission, where the defense-in-depth was in 61.13. But as Gary indicated, we had both public comment but a lot of the public comment, I think, parroted what the one Commissioner said.

Basically that, you know, you're requiring this burdensome defense-in-depth analyses of these people and you don't need to do that. You know, okay. That's fair, but also in many cases the defense-in-depth analyses may be quantitative. There's no reason why it can't be if somebody feels they can do a quantitative.

But by making it in 61.12, in basically an information requirement, then it allows somebody to do something more qualitative or softer. They could still do something quantitative, which would be tied more directly to the technical analyses.

So I don't disagree with you at all. I'm just trying to explain where, why we're at the point that we're at.

MEMBER POWERS: I appreciate it.

MEMBER KIRCHNER: I just wanted to concur with Dana. It strikes me odd that it's not integrated. I would build my performance analysis or technical analysis or safety case, there's a lot of terminology out here, based on the measures I chose to ensure that I had defense-in-depth. I mean it's just a logical thing. I mean I don't want to make the reactor analogy but I will.

You know, you start with the fuel and you start with the primary cooling boundary and have the containment, and you go through some kind of performance analysis, actually very detailed technical analysis to show that for, you know, the design that you are proposing for licensing, these key elements provide that level of protection to the public.

It's a way of addressing the uncertainties that we obviously have in something that's going out so many years, 1,000 or 10,000.

MR. ESH: Right, and we hope to have in the defense-in-depth analyses information that's developed by a licensee, we hope that it will describe the defense-in-depth protections, and it will also provide a basis for them. The basis for them, I think, is part of what you're getting at, and there's kind of two ways I think you could go about it.

You could look at the material you're dealing with and then say what protections do I need to add in there to provide safety and to provide resilience of my system. The other way though, and this happens in this field of performance assessment, is people will identify safety functions that they need for their system, and then based on the safety functions, they'll build their analysis of the problem and then they even build out their design and modify their design.

So they might determine I need to limit water contact with the waste. Now what are the ways that I can limit water contact with the waste? And so that kind of top-down approach of coming at it from the safety functions, it starts with the performance objective, which is the, you know, the main criteria. Then off that allows you some, I'd say considerable flexibility of how you achieve the performance objective.

From the other direction, if you come from the waste and build things in, that might in some cases from a regulator's standpoint push you in the direction of building like subsystem performance requirements or objectives, and that was done previously in our high level waste regulations, but it runs into a lot of challenges, especially in the waste field.

Not when maybe when you have one waste site, but where you have lots of waste sites that are substantially different. The subsystem requirements or what you might want to achieve for one site might be considerably different for another site. So that's part of why you have this approach that we have here. I think you can make it work either way, even though I'm very sympathetic to your views and Dr. Powers.

MR. COMFORT: Okay. Next Dave. Continue on. Just the performance period, to minimize the release, the radioactivity to the general environment for 61.41(a), and it's demonstrated through 61.13(e). 61.42 is parallel to it. We do have the in compliance period the new limit of 500 millirems that we've added. But otherwise, it's effectively similar to the requirements of 61.41.

Finally, just going over where we're

going from here, the Commission currently has the paper. They'll be reviewing it, including whatever input that the ACRS provides to them. If the Commission approves the draft final rule for publication, we'll incorporate any changes that they may have if they do.

Then we'll send the package to the Office of Management and Budget for a review of approximately 90 days. Once the OMB approves that, we'll send it to the *Federal Register* publication. Once it's published, it has an effective date of one year from the publication. And then licensee updates are due at their next renewal within five years of an effective, of the effective date.

Now since NRC doesn't have any direct licensees for Part 61, instead the Agreement States will have to incorporate similar regulations or compatible regulations. They actually have three years from the date of publications, and then they would have similar, or likely have similar requirements about the five years. So we may not see an actual update to this for, you know, eight years or something of that sort at all.

So that's where we're at. Next, we're going to turn over to Dave for going over more of the technical portion that you're going to enjoy in the guidance. Or there any other last questions on that?

VICE CHAIRMAN CORRADINI: I wasn't at the Subcommittee meeting, so I have a lot of questions that were probably answered. So just help me. The 25 millirem is an EPA limit. It's set with mutual agreement between EPA and NRC; is that correct?

MR. ESH: The 25 millirem as established by NRC, so like in the high level waste project, EPA set the standard at 15 millirem, when then NRC adopted. But in low level waste, the NRC established the 25 millirem limit.

VICE CHAIRMAN CORRADINI: And the logic of that number is from where?

MR. ESH: The basis for the 25 millirem?

VICE CHAIRMAN CORRADINI: Yes.

MR. ESH: I think it's -- there is the idea that 10 C.F.R. Part 20 public dose limit is 100 millirem per year, and that from other licensed facilities that could contribute to that public dose limit, each of them should be a portion or it could be some portion of that public dose limit. So the low level waste dose limit was established as a fraction of an overall public dose limit, in this case 25. Chris, do you have --

MR. McKENNEY: Yeah. This is Chris McKenney. I'm the Chief of the Performance Assessment Branch. The 25 millirem was established in 1982 as the dose limit, the original dose limit in 61.41, and it is very similar to the fuel cycle numbers and it is based largely similar on that. But it was a question asked during the rulemaking and during the rulemaking for -- in 1981.

VICE CHAIRMAN CORRADINI: And that limit is --

MR. McKENNEY: But it's not directly tied to that -- but it's not directly tied to the fuel cycle rule.

VICE CHAIRMAN CORRADINI: Okay. So if this is -- Margaret, you stop me if this is ground that's being plowed and I'll just be quiet. --

MR. McKENNEY: It's for any sort of --

VICE CHAIRMAN CORRADINI: What I guess I'm getting at is that's from release, right?

MR. McKENNEY: Right, from the release.

VICE CHAIRMAN CORRADINI: So is an intruder an accident or is an intruder a normal release? In other words, I'm trying to get a siting criteria equivalency, 10 C.F.R. 100, where one limit is for some sort of accidental event versus something of normal release. So I assume 25 millirem is normal release, not accident?

MR. McKENNEY: Right.

MR. ESH: Right, correct.

VICE CHAIRMAN CORRADINI: Then is there a different standard for the intruder?

MR. ESH: The intruder is 500 millirem. Well, in the original regulation developed in 1982, there is not a dose limit for the intruder, because intruder protection for wastes that were similar to what was analyzed to develop the regulation, protection is provided by meeting the other requirements in the regulation, such as waste segregation and the waste meets the waste classification tables, Table 1 and Table 2 in 10 C.F.R. Part 65.

But in this rulemaking, where we're now requiring an intruder analysis because some wastes are materially different from what was analyzed in the original regulation, we're using 500 millirem, which is the same value that was used to calculate the waste classification tables. Yes, it is an unexpected or in your language accident scenario.

It's not an expected release scenario for the intruder.

VICE CHAIRMAN CORRADINI: And the 500 is just a -- okay.

MR. ESH: I'm going to talk about that in more detail when we get to mine. If I don't get, scratch your itch, then come back at it.

VICE CHAIRMAN CORRADINI: Okay, that's fine.

CHAIRMAN BLEY: Okay.

VICE CHAIRMAN CORRADINI: Can I try another thing? So some people have thought this through. So what's limiting under this new set of rules for a -- if on 1,000 -- I'm sorry. Let me say it, if I understand the logic. If I don't have DU as 1,000 years I can choose. If it's DU of some threshold quantity, it's 10,000 years, and is it normal release or is it accidental release that tends to limit these sites?

MR. ESH: All right. So first, it could be depleted uranium that triggers that 10,000 years. It could be something else too. It's written generically to just be long-lived isotopes, because we didn't want to get in the situation where this would address depleted uranium, but then some new waste stream comes into play or blended waste, where you're raising the concentrations of say the long-lived isotopes, but you're in the same situation.

So the issue is generic that we wanted to solve, and so we did that with these time frames and the language of the significant quantities, which I'm going to talk about here in a bit. So it was intended to be generic. Yes, the main problem that we're trying to address is the one that the Commission gave us direction for, which was these large quantities of depleted uranium.

That's the one that this rulemaking is supposed to address. But we also wanted to address other circumstances that are similar. So what was the second part of your --

MEMBER POWERS: Wouldn't you get in trouble if a large -- if I have a large pile of banana peels?

MR. ESH: No, because it's -- in some cases it's driven by inventory and other -- I remember now. The other part, it's driven by concentration. So it's a combination of the two, concentration and inventory, and from a risk perspective, of course you can have large quantities of dilute material, and you're not going to trigger that 10,000 year analyses.

Likewise, you could have small quantities of very concentrated material, and you're also not going to trigger that 10,000 year analyses. It's only as you move up the risk spectrum and you have both enough quantity and enough concentration, that that should kick into play. The other part of your question was --

MR. McKENNEY: Which of the --

MR. ESH: Oh, which are the drivers, yeah. So the drivers could be different from site to site, and some sites, say some of our very arid sites, where the releases to groundwater might be very low, in those cases the intruder protection performance objective might be more of the driver. In other sites, say in some arid, especially a humid site, the releases to groundwater might be the driver rather than the intruder protection objective.

So that's -- these two are supposed to work together and cover all the different types of sites that we might have the U.S. The U.S. is, you know, in my opinion a great country and it's a great country for waste disposal too because you have all these different sites, different environmental conditions that you can dispose of material and you can target your solutions to your material.

VICE CHAIRMAN CORRADINI: Your comment almost choked our chairman.

(Laughter.)

VICE CHAIRMAN CORRADINI: Okay, fine. Sorry. That was helpful. I'll wait for your other.

MR. ESH: So I appreciate the opportunity to come give you an overview of the major technical elements. I haven't got a read yet, but I hope the Committee is comprised of Cubs fans and not Indian fans. Okay, we've got at least one.

If I cover something as I go through these slides, feel free to talk about it, either during or after or whenever, anything, because there's a lot of material and we kind of had to make a guess of what material you might want to hear about, and we might not have addressed something in these slides that you want to talk about. But hopefully we're prepared to address it, even if it's not in the slides.

CHAIRMAN BLEY: Dave, you slides I don't think really are anchored to specifics of the guidance. But maybe as you go along, you could highlight places where --

MR. ESH: Right.

CHAIRMAN BLEY: --the guidance is there, because we've only had that very short time to look at it.

MR. ESH: Right, and the guidance is -- it's a decent size and has a lot of material in it. So I can see if you're busy people like we are, that you want to focus your attention on the parts that might be more sensitive or more important to you from the issues you're trying to address. So I'll try to cover that. Gary, you can go ahead.

MEMBER REMPE: The area that I was curious about was I mean we were talking about well, the rule has to stand on its own. But from what I went back and looked at later, the treatment of radon would only come from the guidance in how you expected it to be treated, not from the actual rule. Is that a true statement?

MR. ESH: I believe that is an accurate statement, because the rule does not have explicit language in it about radon. But I have a couple of slides here where I'm going to talk through that issue.

MEMBER REMPE: Yeah, because I'd like to hear more about that issue.

MR. ESH: So on the outline here, it's a little bit different form the regulation, partly because we're going to come from the top down and look at some of the important elements that we felt you wanted to hear about, and then also during the subcommittee briefing, there were a couple of areas that the subcommittee expressed interest in getting additional information on.

So I'm going to cover those in a bit more detail. I hope to explain what we did and why we did it, and I've combined the rule and the guidance in this talk. In some slides, I have guidance on the title. But a lot of it is kind of intertwined. Of course, the rule has to stand on its own and the guidance does not provide requirements. That's a clear thing you need to understand.

Our licensees in some cases will use the guidance and in some cases they will not. So if they can achieve the requirements by their own means, then they're not obligated to follow guidance of course. We feel that those provide a useful tool for them and especially for Agreement State regulators.

I have a lot of respect for our

Agreement State regulators, because they have tough jobs. They have to interface with the public. They have to work on a lot of these complicated things, on essentially a part-time basis, you know. They don't have teams of different ologists to work on various things that go into a performance assessment. So hopefully our guidance is useful to them.

CHAIRMAN BLEY: Maybe there's something I didn't ask at the subcommittee, but this ties to it.

MR. ESH: Uh-huh.

CHAIRMAN BLEY: The rule tells the Agreement States to some extent what they have to do. The guidance, is that up to the -- you know, if they were submitting to the staff, then if you met the guidance you're good. If you're submitting to an Agreement State, does the same thing apply or do they adopt the guidance or do they have their own guidance derived from yours? How does that work?

MR. ESH: In some cases they will use our guidance. In other cases, they'll develop their own guidance. So and they might use not just this NUREG-2175 that we developed now, but they'll also consult other NUREGs and other technical documents in doing their review.

CHAIRMAN BLEY: And so if I'm a licensee who's got a -- in an Agreement State, I can't really say I meet the NRC's guidance; therefore, I'm good. I have to know what my own regulator is requiring of me?

MR. ESH: Right. The Agreement State, because it is guidance, it doesn't hold the weight of the rule requirements. Even the Agreement State regulator, I think, could push for a deviation from the guidance if they chose, based on their state-specific circumstances so --

MR. COMFORT: And remember also, the states can adopt sometimes regulations that are different in ways from what we have. So they would of course, you know, what may meet our guidance for our regulations, if they do something more conservative it may not meet their requirement.

MR. ESH: So next slide please Gary. This is an overview of all the pieces of the regulation that from my viewpoint I would say are risk-informed performance-based. I know that's a sensitive terminology to some, but the argument I would put forth is if you take these things out, do you believe it is more risk-informed and performance-based than if they are in.

I would argue that all these things combined, individually and in totality, give you a more risk-informed performance-based way to do low level waste regulation. An interesting challenge that we face is that some stakeholders, of course, don't view it that way and they even present things in somewhat of the opposite direction, based on the staff's approach in the proposed final regulation.

I'm going to explain many of these in more detail and our guidance document provides quite a bit more detail of most of these topics. Now throughout my presentation today, when I refer to the original regulation and if I talk about things that were done in the past, I might use "they." I'm referring to NRC. I am NRC, but it's just not straight in my mind yet that I should be saying "we." I remember I was playing Little League when that was done.

So it's just understand, I'm speaking of NRC, whether I say we or they. And I also use the language existing and current. So existing and current is what's on the books right now. What we came to talk to you about is what the proposed final regulation would be. So that's some terminology things I might use.

Next slide, please. So the first area that I'll talk about here is the safety case. This was added at the direction of the Commission, and our view is that the safety case has always been an implicit part of Part 61, and it's now being made explicit and at least in the sense of terminology.

It's defined as the combination of defense-in-depth and technical analyses. So this is where you do get some merging of defense-in-depth and technical analyses and how they both come together to form the safety case. We do believe that the safety case should be a plain language description.

So essentially an executive summary of your licensing basis. It should be understandable to many. It may be, have some, quite a bit of technical information, but it should be presented in the language and form that provides your overall safety basis. The overall safety basis is going to be a lot different than just your calculations. There's a lot that goes into developing the safety case for a low level waste disposal facility, of which only one part of it is the calculations.

CHAIRMAN BLEY: Can I ask you about the

language a little bit?

MR. ESH: Yeah, sure.

CHAIRMAN BLEY: I'm familiar with what the Brits do in this area, and what their safety case is and the safety case there is filed by the applicant or licensee, and it's maintained at the regulator's headquarters and they refer to it. Here in the past, we have a submittal from an applicant or licensee, and an SER from the staff, and some could argue that that combination constitutes the safety case under which we operate.

Why did you pick the language, and do you see something different than what we've always had here?

MR. ESH: I don't see it as different. I believe that -- I mean the overall safety basis, of course, is what's supplied by the licensee. But then part of that is the independent regulatory review provided by the NRC. That's a key part of the overall decision process. But the licensee's basis has to stand on its own merit.

So as we get information in, of course if it's not complete or insufficient, we'll develop requests for additional information, which they'll go forth and produce more information. But then ultimately the decision as to whether to approve the application or not is dependent on the licensee's information.

So I don't know if I answered your question or not.

CHAIRMAN BLEY: So now I'm still not sure why we introduced the new language.

MEMBER CHU: Can I add something? Safety case is sort of a standard language in the waste disposal community, especially in Europe.

CHAIRMAN BLEY: And it is in the nuclear power plants in Europe too, but it hasn't been over here.

MEMBER CHU: See, I don't know. I'm just telling you I see the phrase "safety case," you know and used all the time in the European community in waste disposal.

CHAIRMAN BLEY: So this is an effort at harmonization with the Europeans?

MEMBER CHU: I don't know. I think people read it all the time and then they kind of use it, okay. That's my interpretation why it's there.

MR. ESH: And I would concur with Dr. Chu. I mean this was added at the direction of the

Commission, the specific language, the language for the safety case. And our approach is, I believe, in alignment with the IAEA, the International Atomic Energy Agency.

There are some differences though, so for the IAEA and especially in the European community, partly their safety case process may involve very direct and collaborative integration with stakeholders, especially in the siting phase of development of a facility.

So that's different here in the NRC licensing processes. We don't have that step in the process. Then in addition in the European community, some member states will do multiple safety cases. So they'll do a safety case for site selection, they'll do a safety case for construction, a safety case for operation, a safety case for closure. In NRC, our safety case is all wrapped up in one.

So you may and you will update your safety case potentially when you get to the closure step, but everything -- you should have all the basis up front whenever you come in to say yes, I'm going to authorize the facility. To me personally, I don't think it makes sense to do a safety case for site selection, and then do a different one for operation and construction.

What happens if you say well no, you can't operate it and construct it. Well then you spend all that money and energy in doing the site selection, and then you never can see the thing through. It's better if all the information is developed up front, so you can determine whether I get from A to B with what I've done. So that's kind of my personal opinion on it.

VICE CHAIRMAN CORRADINI: So this -- you're going down a path that's going to help us. But let me ask, what is considered a site? If I'm just storing depleted uranium as a gas in a monitored facility above ground, is that a site?

MR. ESH: No. This is for disposal.

VICE CHAIRMAN CORRADINI: So as long as I do that, I don't have to follow these rules.

MR. ESH: No. This is for disposal. So disposal is defined in the regulation in 61.2, a disposal site and disposal facility. There's definitions that describe what those are.

VICE CHAIRMAN CORRADINI: All right, so let me ask my next question then. Is when I do enrichment, which we've stopped doing here. We do it all somewhere else. But if I'm still doing it in New Mexico and I have a bunch of depleted uranium on the LES site, and it's manned, that's not one of these sites? That doesn't have --

MR. ESH: No.

VICE CHAIRMAN CORRADINI: So is the safety there any different than I'd expect from the safety of depleted uranium on a site such as this? It seems to me the mobile nature of it, I'd more worry about LES than I'd worry about a bunch of reengineered chemical form that's a hell of a lot less, a hell of a lot more inert. So am I missing something?

MR. ESH: Well, I mean the material has to be managed safely throughout its life cycle. So if it's in UF6, uranium hexafluoride form, gaseous form in canisters, that material has to be -- that's essentially being stored. But it has to be stored safely, and it has different requirements associated with storage and the safety assessment of that material while it's sitting there in storage.

So when it moves to disposal then, that's where this kicks in for commercial disposal, in facilities licensed by the NRC or one of our Agreement States. That's when this comes into play.

VICE CHAIRMAN CORRADINI: So my final question, since this is totally -- I'm just a reactor person, so I don't understand any of this. Is the front end depleted uranium regulations consistent with the disposal regulations?

In other words, to just my simple mind, I would think the chance of having something as a release to concern the public would be a lot more when I have UF6. So I assume the regulations there are different or restrictive than these? These seem relatively restrictive for a relatively inert substance, but I could be wrong.

MR. ESH: Right, and I can't speak to what those requirements are under storage at this time.

VICE CHAIRMAN CORRADINI: I would think staff would want to make sure that I'm not regulating the apples and oranges and I'm making the oranges super-safe and the apples are not so.

MR. COMFORT: Well again, you're evaluating two different things. I mean like for the onsite storage, you know, you're generally looking that it's going to be actively assessed, you know. You're going to have controls on it and all.

A lot of these regulations are that the

site at some point is going to be, you know, let go, then it's going to be free release. Or not free but released, and you want to make sure that when somebody somewhere down the road comes by, they're not going to be impacted. For the storage scenario, I mean the expectation is that somebody's going to be actively monitoring and making sure there's protections on top of --

VICE CHAIRMAN CORRADINI: And that's the physical difference of my first question. Okay fine, thank you.

MR. ESH: So the safety case is to describe all safety-relevant aspects of the disposal site, the design of the facility, things like managerial control measures and regulatory controls, to inform this overall decision of whether to grant the license or not.

It's the same type of information that is in the current 10 C.F.R. Part 61, and that's to be submitted as part of the license application on Section 61.10 and 61.16. We expect that the safety case will be updated over time, but the safety case also may be somewhat static. It depends on whether the information associated with the performance of the facility changes over time, and how maybe unforeseen things may have been appropriately anticipated at the time of licensing or not.

So next slide, Gary. So the first, one of the two main components of the safety case is the defense-in-depth, and this was also added at the direction of the Commission. It's also in our mind it was implicit in the existing Part 61, and now it's being made explicit. So all the pieces of Part 61 fit together in some ways that I'll explain, to provide you defense-in-depth.

The defense-in-depth requirements, because there was this opposition to the terminology of analyses, are listed here in the bottom three bullets. It's to identify the protections commensurate with the risk, describe the capabilities of the defense-in-depth protections and then provide a basis for those defense-in-depth protections.

We didn't want to add a new definition for defense-in-depth and low level waste disposal because it is a concept that's used in many other regulatory programs, especially in the reactor area that you're very familiar with.

But there are some differences, so in the waste disposal problem, especially as you go out in time, you're relying on passive performance of the system and not active management. This goes to your question just about these storage versus disposal.

So there's a difference between passive versus active and what you may do to achieve protection in public health and safety.

Next slide, Gary. So during operations, you have the opportunity to use active safety systems, and that may include personnel doing things, measuring things and maintaining things. You still also will have passive safety systems commensurate with the hazard and complexity of activities during operations.

When you move to post closure, which is the time when you've done operating, done receiving all your waste and then you move through your institutional control period, the disposal site is a passive system, and you're only relying then on the natural site characteristics and the engineered features.

So that's a bit different from the defense-in-depth perspective, and some of the comments that we received were associated with well does this mean that I have to have multiple barriers of the same type. So in a reactor, you might have a pump and a backup pump. Well, in a waste disposal system, you have engineered cover, you have a drainage layer in it. Does that mean I need two drainage layers?

So we had to explain that no, you're looking at the redundancy or the resiliency of the functionality of the system, not necessarily the specific components. This affords you considerable flexibility about how you're going about demonstrating your defense-in-depth protections.

Now each layer that you're using in this argument about defense-in-depth should be a layer a defense and make a definitive contribution to isolation of the waste. But that isn't to say that everything has to be credited as a layer of defense. You may choose which features of your system you want to bring forward into your defense-in-depth arguments. Next slide, please.

MR. GROSSMAN: Hey Dave, this is Chris Grossman from the NRC staff. If I can interject here.

MR. ESH: Sure.

MR. GROSSMAN: To go back to some of the members' earlier questions about the tie between defense-in-depth and the analyses, if you go back to your previous slide that showed the graph. In the guidance, while the rule may not show as direct of a tie as we'd like.

In the guidance, when we talk about providing a technical basis, a lot of the guidance focuses on drawing from insights from the analyses to develop that basis, and making sure that they're consistent.

So for instance we might use what we term a barrier analysis and performance assessment, where you look at the capabilities of the barriers and how they contribute to the performance of the system, and you would use that information then to perform your defense-in-depth projections.

MR. ESH: Thank you, Chris. So the next area that I'll discuss is the analysis time frames. I believe I have 13 slides or so on this, and hopefully we can give you a clear picture of what we're doing and why.

Throughout this process, the rulemaking process, from the beginning there's been significant interest in this topic. We received significant comments reflecting some diverse opinions, and we've devoted significant effort to the formulation of this final position that we're discussing here today.

The subcommittee desired more information on this topic, so that's why I'm giving you some more material to walk through here, and provide more of the basis for what we're doing. If you're -- if you're going to rely on the technical analyses-based approach, then our opinion is you need to analyze your system to the best of your ability, and you should bring to bearing on your decision the full weight of information that you can.

There's no reason to limit the information, especially if you can clearly explain and discuss the uncertainties associated with it and the caveats associated with the information. The uncertain information is better than no information at all in our opinion.

So in the area of time frames here on this slide, the existing language in Part 61 is that the compliance period is not defined for either 61.41 or 44. That's what Gary mentioned in his talk. For intruder, the inadvertent intruder protection, the language is the inadvertent intruder should be protected at any time under 61.42.

So I mean you can interpret that a lot of different ways, and it has been interpreted different ways, but the language is at any time. So I could see that some people may truncate that interpretation, but the language is there in the existing regulation.

What we're attempting to do in the proposed final rule is we have a compliance period of 1,000 years that the site does not contain significant quantities of long-lived waste, and otherwise it's going to be 10,000 years.

Then the performance period, which is this probably quantitative calculations that are interpreted very qualitatively, occurs after the compliance period and the standard is just to minimize the exposures to the extent reasonably achievable. As Gary indicated, that was in the proposed rule package and the Commission left it untouched in their direction to us that came back.

So we once again preserved that. The difference here in this proposed final rule is that as Gary indicated, we had that three-phased approach with a goal and the goal was above the public dose limit, and there was a lot of confusion, misinterpretation and a lot of stakeholders said this complexity really isn't warranted. You don't need to do this.

And so we were trying to, even then but especially now, balance this idea that low level waste in some ways, much of it can be contained and it is short-lived, and so what is your obligation to do anything burdensome or over the long term if you can manage that short-lived activity?

But low level waste also has a component that's long-lived, and in the case of depleted uranium it's a very big fraction that's long-lived. So what do you do with that? This approach is attempting to tailor your analyses to the type of waste that you're dealing with, so that you don't have the burden of longer analyses associated with the long-lived waste, but you do have it when you do have long-lived waste.

We think that is a risk-informed way to look at these very different waste forms that you may be dealing with. Now go back please Gary. The existing slides or the existing approaches in the regulation, because it's not defined has led to broad variances in how that's been interpreted.

So the compliance periods that have been used in our four Agreement States have ranged to 500 years to 50,000 years. Then in addition, in the area of intruder protection, two of the Agreement States analyzed intruders in their licensing analysis, even though it's not required by the existing regulation, and another one is in the process of doing that now an one of them did not.

So the existing status of what goes on in low level waste is described by those bullets and then my language. Now it has been a very tortuous path to get from existing to proposed final. We're prepared to discuss that with you if you like, but it also is a bit of a tortured path. So you know, if you'd like to we will, but I don't know if it's going to be useful to you to judge the merits of the proposed final approach.

MEMBER KIRCHNER: David, if you skip the torture, could you just explain with -- give us examples from the compliance states how this last line has been interpreted, or you expect it to be interpreted minimize exposures to the extent reasonably achievable?

MR. ESH: Oh, for the performance period, yes. So that would be -- this would be a new requirement. So we don't have any basis yet to how that might be interpreted in our Agreement

States. Now what I would indicate is that that is intended to only apply when you have significant quantities of the long-lived isotopes.

So it might be a very limited number of Agreement States that are going to be doing that interpretation. But we do have in our, the guidance document --

MEMBER KIRCHNER: Wait a minute. Didn't you share with us, we have like four Agreement States, three of which used 10,000 years?

MR. ESH: What we have is we have four Agreement States, and under the existing rule, so at the top part of this slide. Originally, one of them used 500 years, one of them used 2,000, one of them used 10,000 years but then looked longer in their environmental analyses, and one of them used 50,000, okay.

MEMBER KIRCHNER: Okay. I didn't get it quite right, but --

MR. ESH: Right.

MEMBER KIRCHNER: So what would your expectation be going forward with this?

MR. ESH: Going forward under this proposed final approach, if a site came into NRC, we would use 1,000 years for the compliance if they do not have significant quantities of long-lived isotopes, and we would use 10,000 years otherwise combined with the performance period.

The Agreement States are all -- or I mean the four existing states are all under Agreement States, and with the compatibility being C in the draft final regulation, that they would be free to use this or be more restrictive. So the ones that used say 2,000 for their compliance period could still use 2,000.

If they had significant quantities of long-lived waste though, they would be -- they would need to increase that to 10,000. The one that used 10,000 and 50,000 could still use their 10,000 and 50,000 for all waste even -- okay.

MEMBER KIRCHNER: I'm with you that far I think explicitly. My question is how, what's your expectation on how the last line is going to be interpreted?

(Off mic comment.)

MR. ESH: On the proposed final down here, for the performance.

MEMBER KIRCHNER: Analyzed exposures to the extent reasonably achieved. How is that going to be defined? Are you going to -- does the guidance have a standard suggestion?

MR. ESH: I mean this -- this is the standard. The guidance has an interpretation of that standard. It's an interpretation that the staff would find acceptable for somebody to do when they're in this situation. I mean the --

MEMBER KIRCHNER: Could you show that, what you would do as staff for this implementation, your suggested guidance?

MR. ESH: Right. Priya, do you want to look up where that is in the guidance?

MS. YADAV: Sorry, that's really loud. This is Priya Yadav with the NRC. It's actually in Section 6.3. So Section 6 covers the performance period. The whole section covers the performance period analyses. So if you look at 6.3.1.1.3, I know a lot of you have the CDs that we gave out maybe a couple of weeks ago?

MEMBER KIRCHNER: I don't have it with me, no.

MS. YADAV: Well that just -- that just is where we talk about how we envision this being interpreted.

VICE CHAIRMAN CORRADINI: I think all Walt's asking, I think, is this an empirical example that's acceptance?

MR. ESH: Okay. So what we intended for this is that for that post-10,000 year period, when you have significant quantities of long-lived waste, you're probably going to be doing quantitative calculations of what you expect to happen in the system. You're going to then qualitatively interpret that as to whether you've minimized exposures, and part of that might be like traditional barrier analyses.

What are my barriers that are contributing to mitigating those longer-term impacts? If I, for instance, looked at a different engineered cover or a different waste form, how would that change my projection of how I think the system is going to behave? It's a standard similar to our ALARA standard that applies under our current regulation, except for ALARA, you have to have a dose limit, and there was not a lot of support for dose limits for the very long time periods.

So we developed this standard that is conceptually similar, I don't know if you're familiar with ALARA.

MEMBER KIRCHNER: In theory I am.

MR. ESH: So the ALARA standard is

basically a -- I would call it in layman's terms a combined technical analyses, not necessarily an optimization of lowering your doses, but a cost-benefit analyses of your doses and what you might do, the things you might be able to do to reduce those and is it reasonable to take those actions. So in simple terms that's what it would look like.

MEMBER KIRCHNER: So but you said it well. That's what I expected. So how in implementation does that play out with the Agreement States? Is it likely that then the license, the licensee will have to do detailed analyses that go way beyond performance period, where you're more in a compliance. You'll do a calculation, demonstrate to us that the exposure is less than the requirement?

But here, it just suggests somewhat open-ended. What is a cost-benefit analysis going to look like here in terms of costs or how many millirem so to speak?

MR. ESH: Right. Well I think -- well the challenge in waste disposal when you get out to very long times is what or what or even if you do with discounting, okay? So in NRC space, whenever we look at rules and rulemaking, we'll apply discounting to look at whether it's reasonable to implement something.

In waste space, because of the long time frames involved, if you apply discounting at any sort of manageable rate, you say I shouldn't do anything with any impacts beyond a very short period of time, and that's really not in alignment with the principles of what people try to do in waste management. I think it's an artifact of trying to extrapolate this approach with discount rates, the very long periods of time.

So but the cost-benefit, and we talk about this hopefully in Section 6-3 of the guidance document, if I remember, is more like I tried to explain earlier. It could be quantitative, but it could also be qualitative. What are my options for doing things to change these impacts in a positive way from what I estimate with my system?

VICE CHAIRMAN CORRADINI: But I think -- that I figured you'd have to do. But then they'd have to compare it to something to say I've done enough. And so I'm still struggling to what the something is, or an example of what you think the something is that's acceptable. I'm looking for some measure.

MR. McKENNEY: They can either use -- this is Chris McKenney again from the Performance Assessment Branch. We have an example on page 615 of using, still running out the dose model to try to do elevations but not actually using the dose limit to show the relative magnitude of that, which is one area we've used in the area of waste and stone reprocessing, when we've been reviewing long-term analyses related to that with the Department of Energy, to evaluate how system behave past 10,000 years.

Other areas that have been discussed, especially in the international field of using stuff like natural fluxes for those type of things, of how things are relative to the natural functions in the area, so that you can compare to those.

Instead of dose rates, you can compare it to other subsystem performance and relative changes compared to in your system. So you could do it on rates of change and look at that, on how stabilized your system has become. Those are the other modes to say here, my system is stabilized out. This is what I'm doing.

What is my rate of release over time, because when you get out to really long time periods, there are not only -- there's some spikes in the data also that are caused by this modeling artifacts, like the fact that you've got all these individual packages that are in your system, and if you actually assign probabilities of failure then they'll almost all fail at once, and then all of the sudden you'll have this big spike of data, and you're on -- but that's just modeling but --

VICE CHAIRMAN CORRADINI: So let me just ask my question. Let me give you an example and you tell me if I was the licensee, you'd be telling me to go pound sand. So if I prove that at 10,000 years I can meet the 25 millirem, but at a million years I predict, due to wear and tear and just it goes away, it's 250 millirem at a million years and I tell you that I don't want to do anything more than that, because I'm going to spend more than $5,000 a person rem averted, is that good enough?

MR. ESH: Right. I think something like that would be good enough, yeah. I don't --

MR. McKENNEY: That would be good enough.

MR. ESH: We don't have a -- and that's the point is after the 10,000 year period, we don't have dose limit associated with it. The standard is here and it's subjective, and it's going to be subjectively interpreted, but it's similar to ALARA. The ALARA standard is also subjective and it's interpretive.

Now ALARA is reducing below the limit that you're applying, because you do have a limit to compare with and to go down further. This performance standard at the longer time, you don't have a dose limit and it may be larger and you may be able to make a suitable argument to why you've achieved -- why you've achieved as much as you can achieve with your disposal system.

So the fact that the doses may be, and this is one thing that we couldn't really address in this rulemaking, but it bears stating again at least, you know, this fear of radiation and how we regulate it. If you think about what people do in their everyday lives with respect to radiation, and then how they react in -- how they act in reaction to a dose standard in the waste regulations, those two things in many cases can be substantially different.

So I don't know people that live in North Carolina and say I'm not moving to Colorado because I'm going to get two or three hundred more millirem by changing states. But you know, there's a big concern about potentially 25 millirem from the waste disposal system. So I mean that's a problem that we could not resolve in this regulation.

But for the very long time frames, I think that sort of discussion with the stakeholders, where that facility is located is appropriate and can be used as the basis for whether you've achieved this minimum exposures to the extent reasonably achievable.

MEMBER REMPE: In the example, you compare it with -- you had a larger millirem per year at 30,000 years and you're having in the example the licensee includes a comparison with natural occurring radionuclides from the disposal facility. So if they're -- if they were better than background, you'd say oh sure, go ahead probably.

But then it gets a little more fuzzy about if they did an analysis of barriers because there's no cost-benefit that you've said is acceptable. So you just kind of have fuzzy guidance at this time is where they're at.

MR. ESH: Well, I don't think we should focus on trying to put too much precision on this sort of calculation or on this sort of requirement.

I think it's a good principle to have, and I think it's an effective or it may be an effective means to understand your system and make good decisions about the design of your system.

But in order to try to argue that it's precisely providing some public human health and safety benefit at longer times, then it gets kind of the wrong way. The wrong way I look at it, you know, I don't know. We can --

VICE CHAIRMAN CORRADINI: Just one clarification. But the performance period beyond 10,000 years was a direction by the Commission?

MR. ESH: Yeah. The performance period was in the proposed regulation, and it was retained by the Commission whenever they gave our direction back on it. So it was in the proposed regulation, and they didn't say get rid of the performance period.

MEMBER MARCH-LEUBA: Let me ask, if you -- oh, go ahead.

MEMBER CHU: You know, I was reading the past letters from this committee that was before me, and one of the letters, I can't remember from exactly when, one of the recommendations from this committee was why have a fixed time frame, okay?

Why not do it case-by-case? When you think about it, you only have four sites.

You know, it can be a reasonable recommendation, you know, because you only have four sites. It's not that you have 80, you know, that you have to impose some kind of a big rule and because eventually it's almost like you're going to be doing a case by case, right? I just want to make that comment, you know.

MR. ESH: Yeah, let me get the slides.

MEMBER POWERS: It seems more that the compliance period and performance period ought to be a product of the performance assessment. I mean that's the way you ought to look at them and it's the NRC's responsibility to find the criteria that you use for saying okay, my particular site I have a compliance period of 250 years and a performance period of 30,000 years.

MR. ESH: Right, right. Let me get through a few of these slides, and I think we'll hopefully cover both of your --

MR. COMFORT: I just want to bring one comment. You had a question of did the Commission direct us? Yes, in their SRM to CRMWDM-1102, they specifically said use a two-tiered approach with a compliance period covering reasonably foreseeable future and a longer period of performance.

So that was -- that's the way we interpreted that to come out is what they were looking for, something that you can have a quantitative limit and then you've going to have some further period after that.

VICE CHAIRMAN CORRADINI: So if I might just expand. So they were open to a qualitative factors beyond the time period?

MR. COMFORT: Right. They specifically said -- well, they said a longer period of performance, but that's where we took it as qualitative.

MEMBER STETKAR: If I read the SRM to SECY-13-0075, number eight in there specifically says "The Commission has approved the staff's proposal for applicants to provide a qualitative analysis covering a performance period of 10,000 years or more after site closure to evaluate the ability of the disposal system to mitigate long term risks associated with the disposal of long-lived low level radioactive waste."

So that's pretty clear guidance from the Commission on that, but it's -- it specifically says "provide a qualitative analysis."

VICE CHAIRMAN CORRADINI: Okay.

MEMBER MARCH-LEUBA: But let me change the topic a little bit. If you make a good design that satisfies the one to 10,000 year perfectly and you have a good disposal site, under which circumstance will you have you a bad one at year 10,001? I mean if you do the work for the first 10,000 years, it's also going to work for afterwards, right?

MR. ESH: Right. It should, yes.

MEMBER MARCH-LEUBA: Okay. So if you're going to complain about this and nobody's going to fail.

MR. ESH: We don't -- I think it would be rare that you would have a facility that had significant quantities of long-lived waste that you could demonstrate that it meets the criteria for 10,000 years, and then you run into this enormous problem after 10,000 years.

About the only way you do that is if you say you used an engineered barrier design like a canister, stainless steel canisters or something that have discrete failure, and they're good for a certain period of time and then they fail. Maybe you run into it in something like that. But otherwise it should be -- it should not be very likely.

But to follow on with Dr. Chu's point, you know, the ACRS or the ACNW discussed this issue back even in the mid-90's of the time frame. There's a lot of letters. There's a lot of good information in there.

We read all of those and tried to come up with something that would work with the main principles of it, and I think this framework has all those main principles, but there are some ways that it deviates, and that's what I hope to talk through here. You can go to the next slide, Gary.

MEMBER MARCH-LEUBA: How about -- no, going back to the point. I mean if this performance period of 10,000 years precludes you from using a sacrificial barrier, then you know it will only last for 10,000 years. That is a good requirement.

MR. ESH: Right.

MEMBER MARCH-LEUBA: I mean you should not design your thickness that you know it will fail 10,001.

MR. ESH: Right. We would agree with that.

MEMBER MARCH-LEUBA: So I --

MR. ESH: So this slide is out of the guidance document or slightly modified from the guidance document. But this basically summarizes the time frames that are used in Part 61 or required in Part 61.

Most of these are not changed in this rulemaking. They're existing in Part 61, and the area where it is changed is the two, the second one down and in the third one down, the compliance period and the performance period.

That is new material in this rulemaking in this regulation, and that was done because we had fairly extensive stakeholder interactions early in this process, and this was one area where the stakeholders were in agreement, that they wanted the compliance period or the analyses time frames defined in the regulation.

Of course, they could not agree as to what they should be, but they wanted them defined. So that's how -- why we are where we are now. Most of the time frames in the existing -- are in the existing regs besides their compliance and performance period. Overall though, there was some significant confusion even to this date about the time frames.

So there's language in 61.7 that's reflected here on the slide 61.7(a)(2), where it says the site characteristics should be considered for a 500 year time frame or the indefinite future. That was interpreted by some stakeholders, and even it's reflected in their comments on the rulemaking package, that Part 61 was using a 500 year compliance period.

Part 61 was never using a 500 year compliance period. The 500 years comes into play mainly with the Class C intruder barrier with respect, or the intruder barrier with respect to Class C waste. It had nothing to do with 61.41. So that's a misconception that I wanted to make clear here.

And then the other point is that much too much focus is being placed on the technical analyses, especially the dose assessments. When the dose assessments are products of computer modeling and yes, we're in a modern age and we can do so much more than we used to be able to do.

But there's still the output of computer models. The computer models are not making the licensing decisions. It's the regulators, licensees and other stakeholders that are taking that input to make the decisions.

So NRC has always felt that these performance assessments are not projections of a future radiological impact to a person. They're a regulatory tool to make a regulatory decision, and that may be splitting hairs, but it's a very important distinction in what we're doing and why we're doing it.

So next slide, please Gary. So in the development of the technical basis for the approach for time frames we did a lot of things. We did a white paper that I think Derek distributed to you that went through a lot of these considerations. We looked at waste characteristics.

If you look at the top figure here, which is pretty small but it's in that paper I believe, depleted uranium, the trigger for this rulemaking was quite a bit different than commercial low level waste.

The commercial low level waste has a lot of short-lived activity that by 1,000 years it has decayed. But one of the important points though is that even though the commercial low level waste curve drops down, what's remaining there after 1,000 years is not riskless. That long-lived activity, even with normal commercial low level waste can pose risk, depending on the site-specific design and the characteristics of the disposal site.

But I'm going to walk you through these various factors here that we have on the slide, at least most of them. Next slide, please.

MEMBER MARCH-LEUBA: Hold on. Can you keep that? That increase in risk is because of radon accumulation?

MR. ESH: Yes. It's for all the data products, but it's for radon.

MEMBER MARCH-LEUBA: Oh yeah radon.

MR. ESH: It's radium-226, lead-210 and all the daughters in the decay chain.

MEMBER MARCH-LEUBA: The decay of the radon numbers?

MR. ESH: Right.

MEMBER MARCH-LEUBA: But has anybody considered letting it leak? Letting it leak out of the containers, the same way that it does in a mine. In a mine it has been leaking all the time.

MR. ESH: In the analysis for the disposal of say the depleted uranium, yes of course you would look at releases of material, which may occur --

MEMBER MARCH-LEUBA: Controlled leaks of radon. You just vent --

MR. ESH: Oh venting? No. Yeah, right. I don't know. It depends. If somebody designed their system to vent, yeah. Then of course --

MEMBER MARCH-LEUBA: You keep it under -- you have a stack. You put it down there and that's what radon does. It goes out.

MR. ESH: Right, right, right.

MEMBER REMPE: I was curious about this white paper, which I appreciated getting a copy of. But like this composites on the lower right was I guess a composite based on the earlier Figure 3, which had no axis on the different plots.

But it said the staff used their experience with waste disposal systems to generate Figure 3, which I guess was the basis for Figure 4. Some of the information in both of those figures is pretty precise.

There's no code. It's just somebody drawing a line? I mean what was the basis for these things?

MR. ESH: Yeah. I have to admit that I'm the authored of the squiggly line figure and so

--

(Laughter.)

MEMBER REMPE: It's not a really precise drawing.

MR. ESH: I was trying to communicate how uncertainties can change over time, and how they may change differently based on different parts of the system that you're looking at. So the uncertainties associated with engineered components, and this is focused for near-surface disposal, low level waste facility type designs, might be quite a bit different than the uncertainties associated with the natural system, for instance.

Or especially the big one is the green line on here, the societal technology activities component. So what's going on with people and what are they doing? If you think about how people were living 200 years ago, it's a lot different than what we do today. So what are people going to be doing 200 years from now? Well, that's a good guess.

But I would submit that the uncertainties associated with the human aspect of the problem are much larger than the harder science aspects of the problem, and that's all this figure was really attempting to communicate.

MEMBER REMPE: So no calculations; just your --

MR. ESH: Well I mean --

MEMBER REMPE: Shouldn't it be on there?

MR. ESH: Well, I've worked on many performance assessments that have dose curves produced in them, that --

MEMBER REMPE: Look similar and --

MR. ESH: --that have components of this going on. So when you break them down and analyze them and you look at the contributions of NGO barriers and natural barriers and things like that, you'll see this type of behavior. So in a performance assessment so when we do a probabilistic performance assessment, we'll generate what we call a horsetail plot now, which has all the realizations, all the dose histories.

What you'll see many times is that the uncertainty early is larger than the uncertainty at later times, and that's because the uncertainty or variability about when engineered barriers may fail, especially the discrete ones, can cause big impacts for the high specific activity radionuclides of the -- in the system.

Whereas when you move out to later

times, eventually your knowledge and basis for how the engineered systems are going to behave gets very limited, and whether it's accurate or not, most of the analysts do not take credit for the very long-term engineered performance, which I think is fair. That's what I would do if I was analyzing the problem.

So what you see is the horsetail plot sometimes will pinch down at later times because that engineered component is dropping out. So that's the -- this is a crude figure and it was just designed to be a communication tool, okay. But it is based on our experience and on our -- a lot of different projects so --

MR. WIDMEYER: Hey Dave. Could you explain the pedigree of the white paper? What was it used for? You kept calling it white paper and people are asking me, you know, what is it.

MR. ESH: Yeah.

CHAIRMAN BLEY: Derek, identify yourself for the record.

MR. WIDMEYER: I'm Derek Widmeyer of the ACRS staff. Thank you very much.

MR. ESH: So that was a paper that we developed to kind of look at what are all the factors that make go into this decision and what should we do with the analysis time frames.

So that's the pedigree of it. It just supplied -- basically it was a consolidation of information to the staff internal to NRC, to kind of look at what factors should we consider and how should we consider them in developing a position on analysis time frames.

MEMBER RICCARDELLA: So what is the message you're trying to communicate with that plot?

MR. ESH: The bottom figure?

MEMBER RICCARDELLA: Yeah.

MR. ESH: The bottom figure was used to communicate that the -- you have different sources of uncertainty and the influence of those uncertainties can be different as you go out in time in the system. At some point, you have to acknowledge that the natural system uncertainties are going to get very large, you know. When you get out a million years you're talking about like mountain formation and all sorts of things like that.

So it is reasonable to be trying to consider those impacts in your decision-making process? I would say no, not when you get out there. The one challenge in the performance assessment field is the green line though, because the green line occurs early and in our opinion if you truly tried to incorporate it, it would be a big impact.

So like what's the likelihood that we cure cancer in the next 200 years. I can't answer that, but if you did it would totally change what you're doing with radioactive waste, wouldn't it? So those sorts of impacts I think are not really amenable to quantification, and what we've done, NRC and the performance assessment community is say don't speculate on the societal component of the problem, that you really can't get a firm answer on.

You should use cautious and reasonable assumptions about society and what people are doing and what they may need to do today, in order to do these radiological regulatory analyses. But it wouldn't be very productive to speculate, overly speculate on that component.

MEMBER RICCARDELLA: So once the red line and the blue line cross then you don't care anymore? Is that the basis for 10,000 years?

MR. ESH: Well, not necessarily. I'll go through that where that more comes from. But it is a factor in the decision-making process. So at some point in time at long times, and that depends -- see, that's the other challenge though. That depends completely on your site.

So if you go to like the Atacama Desert in Chile, that's been very stable for a very long time. There's a whole variety of meteorites there that have been there for anywhere from thousands of years to millions of years, and because they're all present, you can say okay, that gives me an indication that this environment has been stable for a very long time.

But say if you moved to location in western New York on the glacial material deposited by the last glaciers, those areas are actively eroding and, you know, the stability of that site and the time frame that you might use might be quite a bit different than when look at the other one.

So let me try to get through some of these, and then hopefully that will answer a lot of your questions. So in the domestic part of it, this question came up in the subcommittee, well what's done? Well, this was in that paper and then we thought it would be just good to put it in your slides here for you, that you can see what's been done in various programs.

And what's been done is a lot of different things. As you move down the diagram, I would say you're in the table. You're kind of progressing towards more difficult waste to handle. But not necessarily so. I mean you could argue that chemical waste that's dealt with under EPA and RCRA is every bit as difficult to manage as the radioactive waste that's done.

They made this deliberate decision to tackle the problem in the way that they did, which is basically they look at 30 years for the material. But it's basically a perpetual control management solution.

So every 30 years, they'll look at the RCRA disposal facilities and decide do we still need to control the facility? Is it still operating appropriately, and they just iterate until necessary. But it's an open-ended process.

For uranium mill tailings, the compliance period, the standard is 200 years, but there's a goal up to 1,000. That was really a remediation problem though. It's not really a disposal problem. So the reason why those regulations came into develop is that there were a lot of mill tailings that management problems associated with them throughout the country.

It was a very expensive problem. Some of the entities that have generated those materials were maybe no longer in business or had limited resources. So they had to take that into account, NRC had to take that into account when those regulations were developed.

The ones that I'll point out here that are probably of most interest to the committee, the DOE Order 435.1 that requires 1,000 years compliance period, and then in low level waste disposal that's in brackets, and I put red there, guidance, because the brackets were for guidance.

There isn't a number associated with it in the current regulation, and that's what we're attempting to do in this rulemaking. So this is reflecting what's on the books now, not what will be on the books in the future, which would be 1,000/10,000 if the rulemaking went forward.

For waste determinations, what the Department of Energy does, that's the WIR there, Waste Incidental to Reprocessing, DOE applies DOE Order 435.1, but NRC is involved by statute for Idaho and South Carolina facilities. So in those cases, the law says that DOE is to use NRC's performance objectives for 10 C.F.R. Part 61.

So when NRC and those two states is obligated to consult with the DOE and then perform monitoring activities, we apply our requirements at those locations.

So you know, if DOE is making waste determinations at other facilities, then they'll use their criteria or whatever's determined by their stakeholder. So for instance, at Hanford DOE may apply Order 435.1, but the other stakeholders at Hanford require them to do longer analysis. That's state of Washington.

So there is some ability to control the analyses, but not complete. Let's go to the next slide.

VICE CHAIRMAN CORRADINI: Just so I understand.

MR. ESH: Yeah.

VICE CHAIRMAN CORRADINI: So we're only talking about -- the rule is only going to apply to the one that is identified with guidance; is that correct?

MR. ESH: Yes. That will be changing from undefined right now, only described in guidance to it will be defined in the regulation.

VICE CHAIRMAN CORRADINI: And you're yet to explain to us what is sufficiently large enough quantity to fit that?

MR. ESH: Right. Hopefully we'll get to that. This is an example. One area that we had a lot of interest in, even I think the committee in some of their letters discussed this, is why not use the mill tailings requirements for depleted uranium? They're both uranium, but that's about as far as the comparison goes.

So down at the bottom here it says "Mill tailings, Falls City, Texas. I calculated that, because at the mill tailings sites, the ones that are closed, they'll put a nice plaque there that gives many times the volume and the total curies of radium in the site. So you can just take the volume and calculate the concentration.

So for mill tailings, you're talking about, you know, 100 to 200 picocuries per gram for most mill tailings in the U.S., somewhere in that ballpark. For this depleted uranium, it starts off well but then eventually gets very high, and this was something we discussed in the subcommittee.

If you were to use say 1,000 year

compliance period for depleted uranium disposal, you're only getting about roughly 1/1000th of this ingrowth phenomena. If you move to 10,000 years, you're getting 1/10th.

So yes, we are missing 90 percent of what's going on with depleted uranium disposal in the compliance period. But that performance period with the subjective criteria associated with it, we hope is the ability to look at the safety or make considerations with this other 90 percent that eventually might grow into the material.

Now this is not to imply that the mill tailings requirements are not appropriate. They're appropriate for that problem. But that material is much more dilute than this material that you're talking about, the concentrated depleted uranium. And those regulations were developed to address a problem, which was essentially a remediation problem.

The problem we're dealing with here is a disposal problem, and that's an important distinction to make. There's a few other backup slides related to uranium and uranium in the environment that we can talk about if we have time. Next slide.

VICE CHAIRMAN CORRADINI: The guidance doesn't -- we're talking time frame. The guidance doesn't talk about form of what's disposed?

MR. ESH: Yeah, well in a way because I think in the guidance we may discuss that the hexafluoride form is inappropriate for near surface disposal. So an oxide form, an oxide form is much more appropriate. Sandia did an analysis in 1992 and they found really massive impacts associated with disposal of it in the fluoride form, and those -- you don't -- the solubility of uranium is a lot lower in the oxide -- depending on the oxide and oxide form.

VICE CHAIRMAN CORRADINI: So except for excluding certain forms, you're not including an allowable form?

MR. ESH: Right. We did not specify a particular form it must be. The other point associated with the depleted uranium is that material, depending what's done with it, may end up being essentially a powder. It has a very high surface area to volume ratio. That's bad from a waste disposal standpoint, both in terms of radon release to the environment and in terms of release to the groundwater.

You want low specific surface area to volume ratio to limit risk. So we don't have specific requirements associated with depleted uranium, but ultimately this performance-based approach using technical analyses should determine what form you need to put that depleted uranium in, in order to meet the criteria. We can hit the button here. It's going to --

So this is a different example but a similar problem. This is from a Department of Energy report associated with the Hanford site, and I thought this was a good example because it elucidates the problem associated -- a problem associated with the performance assessments in the analysis time frames.

So what you have here is somebody wanted to know how do I need to design my waste forms? What do I need my release rate to be, and they looked at two different standards. So a 25 millirem at 1,000 years and 25 millirem at 10,000 years. Well in order to achieve the standard at 1,000 years, they could have roughly 70,000 parts per million per year released of the technetium, whereas if they're trying to achieve 25 millirem at 10,000 years, that reduces to about 150.

So it's roughly a four to five hundred factor, reduction factor going from outside the 1,000 year window to the 10,000 year window. And this is because the Hanford site is very dry and has a very thick unsaturated zone. So it can take a long time for the contamination to move through the unsaturated zone until it hits the aquifer.

Now that's a good thing. You do want long delays to create impacts for the public. But also it's a risk deferral, not necessarily a risk mitigation. What we're trying to achieve here, especially for these longer-lived wastes, is that people are making good decisions to achieve risk mitigation and not just risk deferral, and not just shifting of the risk in time, but the risks are actually reduced.

They explained it in words there in B better than I could explain, so I just left it in the slide and you can read it. But we agree with this example. This is a good example. It applies to a lot of the arid sites. It can also apply to humid sites, which are using engineered barriers. So this is the example Jose talked about earlier with, well you wouldn't want somebody designing the facility for 10,000 years and in 10,001 then it fails.

You wouldn't want somebody designing an engineered barrier that can give you 1,000 years of protection that just pushes the risk out, so that after 1,000 years you see this big impact. These requirements that we have are intending to prevent that sort of situation.

Now could somebody push it out past 10,000 and then see a big impact after 10,000? I guess that's true in theory. But that other criteria is meant to allow a stakeholder and especially Agreement State regulators to look at that information and make a decision about those really long term doses, if you had a situation like that.

So the other point related to this is think about this. If you designed your facility for the first case at 1,000 years and you were achieving something close to 25 millirem, you would never want to do that. You'd want some margin of safety. Well that would mean that facility, if you designed it in that way, could produce something on the order of 10 rem in the 10,000 year -- between the 1,000 and the 10,000 year time frame.

I don't think that's good design, and I

don't think if the criteria would result in people doing those sorts of things, it's the type of criteria that we would want.

Next slide, please. So internationally, we considered what people do in this area, and this was difficult. It's hard to find this information. A lot of this information in some form or another is in the joint convention reports. But there's also information scattered throughout various documents, some of it in other languages that some of us may or may not have been fluent in.

But the summary of it is contained on this slide, and that is that most countries either do not allow near surface disposal of long-lived waste, or they place limits on it. Some countries put all their waste in deep geology, whether it's short-lived, long-lived, whatever. They say we're not going to mess with near surface uncertainty; we're just going to put it deep.

Others, many of them determine some sort of limits that are placed and then they say okay, the short-lived stuff is good for near surface. The long-lived stuff we're going to put in some other facility, intermediate level waste facility, deep geologic, i.e., something like a high level waste facility.

In most cases these limits are not determined by site-specific analyses, but rather they're set by the regulators and/or lawmakers. So they come from some other mechanism rather than the site-specific analyses.

In this rulemaking, what we're hoping to achieve if the rule goes forward, is that somebody does the proper site-specific technical analyses to determine these limits based on their specific site. The last point here, even though many countries do place limits on say even the long-lived alpha, they still will assess, do some sort of assessment of what they consider to be peak hazard.

It might be a radiological ghost, it might be flux limit, it might something else. But they do some sort of assessment to look at well over the very long time, what do I think is going to happen with this radioactive waste.

Next slide, please. An important distinction between some of the international communities and our programs in the U.S. is that they have, in my opinion, a better waste classification system and this creates some advantages. They classify waste on both activity and half life, and what that allows them to do is what I just talked about, design their facilities for their particular waste.

Whereas low level waste in the U.S. is a mixture of long-lived and short-lived. So you have this difficulty in designing requirements and/or designing systems to manage that waste. The last three points here are all specific to depleted uranium. It's just if you look at large quantities of depleted uranium from an IAEA perspective and some other international groups, they've -- I can't say for certain, but it looks to me like they would at least put it in intermediate, as an intermediate level waste disposal facility, or possibly even deeper.

CHAIRMAN BLEY: Doug, when you have -- I know you've had a whole long history of meetings with people. Was there any feeling that for future sites, reclassification would make a lot of sense, so that we don't get into these kind of problems?

MR. ESH: There are some people that have -- yeah. There are some people that agree that changing the classification system would have some advantages. A lot of the engineers that I know feel that it would have a lot of advantages. A lot of the policymakers or that type of group realize the challenges associated with that.

So our, excuse me, waste classification system affects a lot of things, and it's in laws that you would have to have Congress rewrite. It's in the way our compact system is set up and, you know, the receipt and acceptance of waste. It's in some state laws. It affects a lot of things.

So if you're -- if you're trying to have minimal impact from your regulatory activity, changing the waste classification approach and system would have many impacts, many practical impacts and things that would need to be worked on and changed in order to achieve that. Technically, I believe it would be a very good idea.

VICE CHAIRMAN CORRADINI: Let me say it another way. If you were going to operate a new site, you could operate within our current classification. But you could do the kind of things you were talking about with your own site and divide the short and the long-lived and store them differently and live within the current rules, but make it a lot easier for yourself, I would think.

MR. ESH: Right. With this -- with this approach in the regulation, as you'll see you can develop waste acceptance criteria based on your site-specific analysis. So that is essentially a site-specific waste classification system, if you will. We have not, for the reasons I just described, removed or eliminated the existing waste classification system because it's used by so many people for a lot of reasons.

But we did want to start progressing towards this idea that the more modern way of doing it, and this is what the Department of Energy does, is they analyze their system and based on the analysis of the system it determines what waste can go in there. There isn't some analysis done by the regulator. They're self-regulating, but in our case it's an NRC and our Agreement State licensees. NRC did analyses to develop the waste classification system in Table 1 and Table 2 of 61.55.

So next slide, please Gary. So here's an example from comments. One thing we ran into is that some people provided information that may have been somewhat limited and didn't give the whole picture of what we think is portrayed. So if you hit the button again, Gary.

So this is the full language associated with the site ICRP guidance. So you heard this at the end of the subcommittee meeting by some of the commenters. I think it's designed, at least the top part of it, to give the impression that we're being inconsistent with ICRP guidance.

I would argue we're not being inconsistent with ICRP guidance. I'd say if you read the full text here, what we're attempting to do in this rulemaking is consistent with ICRP guidance. This wasn't my attempt to set a record for the most words on a slide in an ACRS briefing, but I may have done that.

MEMBER POWERS: You're not even close.

MR. ESH: Okay.

(Laughter.)

MR. ESH: So they are not saying, they being ICRP here, do not calculate these doses and do not use them for regulatory analysis. That's not what they're saying at all, at least my interpretation of it. You can of course make your own interpretation. They're saying though you need to be careful how you talk about this information and not portray it as something it's not.

Those are two different things. They're not saying the information is useless. They're saying use is cautiously, and that's -- and this regulatory analysis and this approach to rulemaking, that's what we're attempting to do, because remember our standard, overall standard for when you're making a decision is reasonable assurance, and that is a subjective decision-making criteria for how you view all these things.

At one of the previous subcommittee briefings, I had figures that had output of performance assessment models, and I tried to get examples out. You might have curves that are way below the limit, and I could still say when I do my regulatory review now, I'm not granting you this application because you have all these problems with your analysis and so on and so forth.

Likewise, you may have analyses that are probabilistic analyses where a number of the results go above the limit, and I could say this is acceptable because I can explain to the stakeholders where all the conservatisms are in your analyses and why I believe the results demonstrate, make a safety demonstration.

So next slide please Gary. So here's a couple more giving comments on time frames. One, this top one is basically trying to say that low level waste is benign. After 1,000 years, you can just forget about it, and the bottom part was this idea that by using a long compliance period, i.e. say 10,000 years for significant quantities of long-lived waste, you're not going to be able to license anything.

So hit the button, Gary. So the first one here, this statement is generally true for 61.42, which is protection of the intruder. That just shows that the intruder protection performance objective and waste classification system works as it should. But it's generally not true for 61.41.

The risks associated with 61.41, which is like release, leaching from the facility and transport through groundwater, those are driven by phenomena and processes that aren't really amenable to reducing to a single concentration to put in the limit.

So I can't say if iodine is one curie per cubic meter that that's safe. It depends on the site. It's extremely dependent on the site. One curie per cubic meter might be completely safe at Site A and be greatly above the performance objective at Site B. So for 61.41, you have all that's needed in Part 61 to do technical analysis, to determine whether you're meeting the criteria or not.

All four of our existing agreement, the existing sites are in Agreement States, and all four of the facilities in the Agreement States have already been licensed, one in the process of being reviewed. So I don't want to mischaracterize Utah. Utah originally used a 500 year analyses, but they issued rules to deal with concentrated depleted uranium or concentrated uranium more generally, where they require a 10,000 year analyses and then look beyond.

It's almost identical to what we have in our proposed rule here. But at the time, right now in terms of licensing basis, they have used a 500 year compliance period. But the other facilities, as I discussed earlier, used 2,000, 10,000 and 50,000 and they've all been licensed. So I don't -- I don't think this argument that if you look at longer times, you're going to not be able to license things is valid, because the real experience shows that they've already been licensed using analyses like this.

In addition to that, we have experience in the area of waste incidental through processing. So that's basically the clean up of the tanks containing material from the weapons program, to put it generally. The material in those tanks and in many cases can be -- or at least in some cases can be less than say a lower classes of low level waste.

In some cases it may be more or at least comparable. They can contain significant amounts of long-lived radioactivity. In Idaho and in Savannah River, the Department of Energy has already made waste determination decisions where they've submitted analyses over those time frames to the NRC that we've reviewed and made technical evaluation reports documenting our findings.

So I don't think even in that area these long or longer compliance periods would be an impediment to making any decisions.

Now say if you decided well, all right Dave. You're rambling on and I don't agree with you. I think you should only use 1,000 year compliance data. What is that going to impact? Well right now, there is very little support in our rulemaking, I mean really maybe only one stakeholder or possibly two, that agreed with the Compatibility B designation for the significant components of the rule, such as the compliance period definition.

Almost everybody agreed with making it

Compatibility C, which affords flexibility to the Agreement States. So what that means, and the Agreement States communicated to us in this rulemaking process is we would like to preserve our current approaches. So my guess is that if this rule goes forward and even if NRC were to reduce the compliance to 1,000 years, those facilities in the Agreement States are still going to use the criteria they already use. It's not going to impact them whatsoever.

In the incidental waste space, by the time this rulemaking is done, Idaho is going to be finished, and it will have been finished using the analyses of 10,000 years. Savannah River would be well underway, but I don't even know if you would characterize it as half finished, because they have a lot more tanks, and Hanford, as I had indicated earlier, the requirements for the Hanford cleanup are determined by the other stakeholders, not just the Department of Energy, and they ask for a longer analyses whenever they make those decisions.

So I don't know what you would achieve by, you know, say for instance reducing the compliance period to 1,000 years. Also, I don't think it would lead to effective decision-making for how you're managing the long-lived activity, especially in the case of say depleted uranium, which was our direction that we were given for even doing this activity.

Next slide, please. So this figure was presented to the -- either the full Committee or the subcommittee before, and I thought it was a good figure to revisit because it's addressing the top bullet on the previous slide, which is that the low level waste is inherently riskless once you get to 1,000 years.

Low level waste in the U.S. contains a lot of different isotopes. Yes, a lot of the activity is short-lived, such as the strontium, cesium and tritium and cobalt-60. But there are a variety of isotopes that are very long-lived, and many of those are at levels such that you do need performance of the system to get them down to values that you would meet the performance criteria.

Out on the far right-hand side of this figure, of course, is uranium and thorium, and those kind of really stand out, because as you go in the direction of the arrow here, that's increasing challenge. If it's longer-lived and you have more of it, it's harder to manage.

So this proposal from industry to dispose of large quantities of depleted uranium, it's even many orders of magnitude above what these other figures represent here. So it's really stressing the system and the regulatory requirements to address this material.

Next slide, please. A few other comments that we got were that uncertainty makes the results meaningless, and then also that don't apply the burdensome requirements for long-lived waste to traditional waste. So the first one, this is something I tried to stress and I'll continue to stress, and NRC will always stress is that these performance assessments are not predictions of the future.

They're regulatory analysis that are used for regulatory decision-making. I don't believe that uncertainty is a suitable basis in and to itself to reduce safety arguments. If that's the only thing that you're really relying on, then that doesn't really make sense. It doesn't resonate with me. I think that that argument could be made by any licensee in any NRC regulated activity.

So say you're interested in plant life extension, and you're looking at some coupled process related to stress corrosion cracking of piping. I can imagine a licensee could come in and say hey, this is so uncertain I'm not going to do anything with it. That's essentially what the argument that was put forth here with the waste disposal is at some point in time it's so uncertain I just -- I shouldn't even consider it.

And I think based on what we know today, you should bring the full value of the information, even if it is uncertain into play whenever you're making your decisions about these facilities.

MEMBER MARCH-LEUBA: Let me agree with you on the record on that, because what this calculation do, it is not the prediction of what will really happen in the year 10,016. But they're showing that there's at least one path that could happen that leads to success.

MR. ESH: Right.

MEMBER MARCH-LEUBA: Whereas if you run the calculations, you cannot find a path that leads to success, then just say well that one is a bad one.

MR. ESH: Right.

MEMBER MARCH-LEUBA: But if you can at least find one path, you can have more confidence.

So you're not predicting what would happen in the year 12,000.

MR. ESH: We're not. These performance assessments should not be viewed as predicting what exactly is going to happen and what exactly is going to be the radiological impacts to somebody. It's a tool to make the regulatory decision today using information to the best of your ability.

MEMBER MARCH-LEUBA: You should frame it on this part. At least it is a path that leads to success.

MR. ESH: Right.

MEMBER MARCH-LEUBA: To give you confidence that you're totally succeeding.

MR. ESH: So I was really baffled by certain commenters that have taken this tact, especially there's some that their businesses are based on doing performance assessments, and then you're going to turn around and say uncertainty makes the results meaningless. Well, why you are even doing that? What's your business model here, and it's kind of baffling to me, but anyway.

The other thing here at the bottom was don't apply the burdensome requirements for long-lived waste on traditional waste. Now we do not believe the requirements are burdensome. That's the first part, but we understood this comment and so we made the change in this proposed final to try to bifurcate it, so that somebody could make something because some people do view their requirements as burdensome.

Somebody could make a decision to use the shorter compliance period for "traditional waste," and use the longer compliance period for when they truly have the problem that creates more long term risk. So that's something we agreed with, and that's what's reflected in the proposed final rule.

VICE CHAIRMAN CORRADINI: So just to clarify, because I think Dana asked something and then Margaret asked it. Are we really talking less than a handful of sites that are going to be affected by the 10,000 year rule?

MR. ESH: Yeah. So I'm going to get through talking about significant quantities here, and then let's ask it again if I don't address it, so -- so here, the significant quantities, how do you determine if you have significant quantities? Well, what we advocate is that you start simple and if necessary introduce complexity.

You're going to do screening based on inventory. That's the simplest thing. You know the inventory or should know the inventory. You can look at how much long-lived radioactivity you have and compare that, and the -- compare that to we have information in the guidance document for 61.41 and 61.42.

The problem is for 61.41, as I discussed earlier, the concentration that you may need to use on a generic basis to assure safety for 61.41 might be significantly different for Site A compared to Site B. So it's really hard. It's a high dimensional problem that you're trying to reduce into a single dimension, and it's very difficult.

I don't think it's necessarily risk-informed to even do that. But some sites may have very limited inventory, and so they would be done here if they just do this comparison of inventory and say look, here's my inventory. It's limited, boom. I'm going to use the 1,000 year compliance period. I don't have to consider the other, the longer compliance period or the performance period.

But as I indicated, in some cases you may have situations where that inventory comparison is not good enough, and then you have to move to maybe a simple five dose assessment. In that case, it would be basically a PA light, which you could use as a basis to determine whether you need to do a more substantial performance assessment based on your projected risk from your PA light.

That is an important component of performance assessment and it is generally an iterative analysis. So this iterative concept within determining significant quantities is very much in line with overall how we view performance assessment. Then ultimately you may get into a complicated analysis, to try to determine if you have significant quantities.

But generally I think if you get into that situation, you should just do the longer analyses. If you have to spend a lot of effort on trying to justify you don't need to do the analyses, just do the analyses and support them. That seems like the practical approach to me.

VICE CHAIRMAN CORRADINI: Dave, these are kind of straightforward. Is there any particular criteria on blended waste, or do you just use these same criteria?

MR. ESH: Yeah. On blended waste, it wouldn't be different. It would still be based on how much of that -- of the different isotopes you have, yeah so -- next slide, please Gary.

MEMBER REMPE: So before you leave that slide, at the end of the subcommittee meeting, one of the members of the public said something about why do we have to treat, and I thought they said radon as part of the dose assessment. Typically, it's treated as a FLEX, and could you -- are you still planning to clarify that point later? I just haven't gotten to it.

MR. ESH: Yes, yes.

MEMBER REMPE: Okay, sorry.

MR. ESH: I have two slides on it.

MEMBER REMPE: Okay. I thought I looked through your package and I didn't -- okay.

MR. ESH: Okay.

MEMBER CHU: Dave, you know, another topic the committee is very interested in is the grandfathering of sites. So later on I would like you to --

MR. ESH: I have two slides on that too. So I'll start moving faster.

MEMBER CHU: Okay.

CHAIRMAN BLEY: May I interrupt? Margaret, are you going to ask for a break or -- do you have an objection to a break? No, this is yours to run. I think we'll take a break at this time.

MR. ESH: Okay.

(Off mic comment.)

CHAIRMAN BLEY: Then you stay Charlie. We'll be recessed for a break. Come back at 4:25.

(Whereupon, the above-entitled matter went off the record at 4:08 p.m. and resumed at 4:27 p.m.)

MR. ESH: So this is definition for what long lived means. You need that as part of this approach. And we wanted this definition to be generic so that if, for instance, agreement state chose to do a different approach with their analysis timeframes, they understand conceptually how it was supposed to work.

Because we were trying to account for the long lived parents with the long lived progeny and the radiation physics associated with the waste. And we think this definition does that. Next slide please.

MEMBER MARCH-LEUBA: If you're using the phrase UF6, for example, it doesn't have any radionuclide. This is the case in two of the other daughters. How do you apply that? There is radioactivity of product.

MR. ESH: Well I have a table here that I'll show you, I think next slide. So this is from the guidance. So the determination of long lived includes both long lived parents and, say, long lived progeny.

And say, for instance promethium-147, it only has a 2.62 or 52 or 62 half life. So it's not long lived from the parent perspective. But it can decay into samarium-147 which has a 100 billion year half life, I guess.

So you would want to consider how much samarium you have in your facility. Or how much promethium because it decays into the samarium. Now that's not a great example because those things generally aren't present in the low level waste inventories.

So we took it a step further. And have this column in the table that identifies the particular isotopes that generally you would expect to see in a low level waste inventory. This gives some guidance to licensees and agreement state regulators when trying to look at this situation of how much long lived inventory they have. And therefore, what sort of compliance period should they use.

VICE CHAIRMAN CORRADINI: But as a rule of thumb, if there's depleted uranium it's long lived.

MR. ESH: Yes. The depleted uranium, the uranium isotopes are long lived. And then they decay into some other things that are also long lived according to this definition.

VICE CHAIRMAN CORRADINI: And what I'm trying to understand, by making a general do you pick up something that would have been missed by uranium and not uranium?

MR. ESH: Yes. So say like neptunium-237, that's long lived. So if a site had a waste stream that was loaded with neptunium-237, you would want them to be doing a longer term analysis just like you would if they had a lot of depleted uranium.

VICE CHAIRMAN CORRADINI: But from a practical nature that doesn't occur yet, it just might.

MR. ESH: From a practical standpoint, most of the low level waste facilities, I believe, have somewhat limited amounts of most of the long lived activity outside of uranium.

It's important to understand that all of the existing sites have taken depleted uranium already -- outside of Texas, they're newly operating and they haven't taken any yet. But they've licensed the facility to take it.

The other operating facilities, I think it might be South Carolina might have disposed of around 7,000 metric tons. Utah has disposed of around 50,000 metric tons. And Washington, I believe, has disposed of 14,000 metric tons. But I'll check my numbers here in a few slides.

So that table is in guidance. And this example is from guidance or something similar to it of how somebody can go about determining, if you're just looking at the inventory, do I have significant quantities or not? And the guidance steps through this in more detail than I think is deserving right now. But if you have questions about it, I think we can revisit it.

That's the end of the timeframes material that I had. I'm thinking that we can certainly take comments now. I should try to get through most of the other material. And then if you want to talk about things related to timeframes, we can jump back at it.

MEMBER SKILLMAN: So David, back on Slide 20 the title is quantities. But you jump on 21 to the definition of long lived. Where is the yard stick for quantity?

MR. ESH: So what I tried to convey is the quantity is going to be very much site dependent, what is significant. And so, the guidance document outlines the approach of how to determine if you have significant quantities.

In there is a table that you can use with respect to 61.42 to determine if you have significant quantities. There's also a table with respect to 61.44 that you can determine to compare your waste to and do some calculations and use the sum of fractions. That's how you go about doing it.

MEMBER SKILLMAN: I understand now. Thanks.

MR. ESH: So in the U.S. who would perform these technical analyses we're talking about? Well it would be the four operating sites that are shown here, the U.S. Ecology site in Hanford and the Energy Solutions sites in Clive, Utah and Barnwell, South Carolina. And then the Waste Control Specialist in Andrews, Texas.

There's some additional information on

the side of this figure about the types of the waste they can take and the compact restrictions they have. Next slide please.

So this is in the area of the grandfathering type discussion, I think. Who will perform these technical analyses? As the draft final requirements are set forth right now, these requirements apply to all facilities that will operate after the regulations go into effect.

That does not mean that the requirements are going to apply to closed facilities. So there are some facilities that were closed in the U.S. The Beatty facility, the other ones were closed prior to the promulgation of Part 61 or around the time of it. So these requirements wouldn't apply to those closed facilities, only the ones that want to continue to operate.

We did have commenters express the idea that you should not apply the requirements to facilities that are only taking waste similar to what they have taken in the past. The issue with that that we ran into is that the waste that has been taken in the past not only must be, the waste must be similar to what has been taken in the past, but the waste that has been taken in the past must be similar to what was analyzed in development of Part 61.

So if an existing facility may have taken waste that differs from what was analyzed in Part 61, that's the reason why these requirements are being put forth. If the waste classification tables were totally generic that could handle any type of waste, then we wouldn't need this rule making.

So this rule making is needed to address situations where wastes are in some ways different. And we didn't have a belief that there was a public health and safety basis provided to justify applying it to only new waste, for instance. Or to apply it to a portion of a facility.

Because the requirements and the public dose limits are based on consideration of all waste and all pathways. We thought it would be very messy to try to separate out old waste from new waste. And then why would you even do that?

So if your requirement is to meet say 25 millirem from, say, your uranium, why would you say well the uranium I disposed of up until 2016 I'm going to leave out of the dose calculation but the new uranium I'm going to show meets 25?

I think that all of your uranium -- maybe I should have used a different isotope or element. If all of it contributes to your potential public health and safety impact, then all of it should be included in the analysis if you want to continue to operate.

But now with that said, there may be situations where you could consider waste that is in some portion of the facility and doesn't combine or contribute to the impacts in another portion of a facility. Then it would be appropriate to look at the differences between how those wastes contribute to a potential receptor. And the new waste might be a bigger impact than the old waste for instance.

So in many cases for these waste disposal facilities, the impacts are likely to combine. Because usually you don't have complicated hydrogeology with different directions of the rate of nuclides flowing. But you usually have a plume that will go in one direction.

So all the source term of the facility is going to contribute to that plume. How would you separate out which portion is contributing to what in the plume? It didn't make sense to use from a regulatory perspective or even from a technical perspective to try to do those sorts of separations.

And as indicated to the subcommittee, and I'll reiterate here, there are no backfit provisions in 10 CFR Part 61. So that's coming at it from the legal perspective. That represents my extent of understanding about backfit. So if you have questions about it, I will call on someone to answer them.

MEMBER CHU: I think we mentioned the last time, it sounds like you suspect quite a bit of long lived stuff in the existing three. Because Texas is different, you know, it's new. Those three, is that the reason?

MR. ESH: Well the existing sites, for the most part, the waste that has been received looks and smells like traditional low level waste in that it's dominated by the short lived activity, it does have some long lived isotopes. But generally those long lived isotopes are in limited concentrations -- either they're dilute and there's a lot of it or they might be more concentrated but there's limited amounts of it. Or it might be in a form that makes it limited from a dispersibility standpoint.

And that's where this approach comes into play determining the significant quantities.

You may well be able to make arguments that none of those existing facilities as of yet have significant quantities of long lived waste.

But it depends on their inventories if you're doing an inventory comparison approach. If you're doing the next step in the process which is to try to look at how much do I have that could, from a screening analysis, contribute to potential impacts? That requires you to have all the site specific information that the licensees and the agreement state regulators in those states would have.

So we don't, I'm not trying to prejudge how that may turn out. But overall, I would expect that it is a limited set of circumstances where you would determine that a site has significant quantities. That should be the exception and not the rule.

MEMBER CHU: So you expect most of the three only have to do a 1,000 year performance assessment?

MR. ESH: Right. And the compliance periods though, so what's put in this regulation, I would say those are the minimum values that you should be using. And so, as I indicated earlier, the agreement states in almost all cases already use values that are above what we would say are the minimum values you should use.

So even if the agreement state, say in Texas, determined I don't have significant quantities, they are in all likelihood still going to apply their standard which is usually using 1,000 years or peak dose, whichever is more.

MEMBER CHU: Do you expect any of the four will not be able to comply with the new rule?

MR. ESH: Well the demonstration of compliance with the -- let's step back a second first. The performance objective in 61.42 and 61.41 have always been there from the promulgation of Part 61. 61.41 has always required an analysis of the impacts of the waste that you dispose. It's silent on the compliance period. But it's always required a technical analysis to demonstrate unique compliance.

61.42 has always required that you protect the inadvertent intruder. And it says for all times. So both of those have been in place since 1982. And they remain in place now.

MEMBER CHU: But there's no 500 millirem?

MR. ESH: There's no 500 millirem for the 61.42 performance objective. But the 61.42 performance objective was developed for certain types of waste. It is was assumed that the waste were going to be within this certain envelope.

So if you took waste that was outside of that envelope, then what have you done to show that you've met the 61.42 performance objective? In at least two of the cases in our agreement states, they've done the intruder analysis anyway. Or in three cases are in the process of doing the intruder analysis. I think only in one case did they not do the intruder analysis even though they may have taken waste that was outside the envelope.

So how do you handle that situation? You know, that's where we felt there wasn't a public health and safety basis to say you should treat them differently because they didn't do the analysis when they took waste that was outside the envelope potentially.

MEMBER CHU: You know, the intruder scenario, my understanding is really the depth of burial, right?

MR. ESH: Right.

MEMBER CHU: So suppose one of the four

sites have buried some depleted uranium way back close to the surface. So if you do the scenario of the intruder analysis, you have to dig up certain, you know, for your construction scenario. I think it's probably going to maybe it's going to violate under millimer.

See we're just trying to figure out what is the next step? What are the remedial actions available to them? You know, because --

MR. ESH: Right. And I understand that. And so we tried to think of if that situation did occur, what should somebody do? That is spelled out in Section 9.5, I believe, of your guidance document.

So we looked at if somebody was in that situation, what would we want them to do? Well the last thing you would want somebody to do is to dig it up. That is the last thing you would want somebody to do.

You would want them to first start with, do you have conservatisms in your calculation that you could look at and maybe reduce that would still allow you to demonstrate that you can meet the criteria? Because in many cases, these calculations can have some conservatisms in them because they are model rich and data poor.

So one way that people mitigate the issue of not having much data is they'll choose to be conservative. And that's appropriate from a regulatory standpoint. We're okay with people being conservative if they don't have much information. It's one way to mitigate that uncertainty or to mitigate the impact of that lack of information.

Secondly then, if you're in a situation where a facility is having a difficulty in meeting the criteria, that isn't any different with respect to this new rulemaking than it would be with an operating facility without the rulemaking.

We have defined approached for people to look at what they would want to do and what they could possibly do including cost benefit analyses, consideration of impact to workers. You know, you basically go through those analyses and say what is it could I reasonably expect to do?

And it would depend on well, do you believe you are going to be way above the standard? Or are you going to be close to the standard? You know, it's not unforseen in these waste disposal systems that what the engineers think whenever the facility was initially developed turns out to not be true.

And a good operator will ensure that they have proper margin in their facility so they don't get themselves into that situation. But it isn't necessarily always the case. And especially over a long operating timeframe of 30 to 50 years, you know, our understanding of how all these things work could change significantly in some areas. And those impacts may be significant to what was done 30 or 50 years prior.

So that's kind of in a general sense what we would expect to happen. You'd have to look at the Section 9.5 of the guidance that walks through what we would want people to consider if they're in that situation.

MS. YADAV: Just a quick correction Dave, it's actually 9.3. It's called mitigation.

MR. ESH: Oh sorry.

MS. YADAV: I just see Dr. Chu writing it down. It's 9.3.

MR. ESH: Thank you.

MS. YADAV: Dave is just saying 9.5. It's actually Section 9.3.

MR. ESH: Too much to remember. Do we want to talk about this further or move on? All right. Next slide please.

The performance assessment, here's the definition that we have. We feel it's pretty consistent with our definition in high level waste because performance assessment is not different from one to the other. It's an analysis technique that you're using. You're developing the scope of the analysis. You're trying to evaluate potential radiological doses to make a regulatory decision. And you want people to consider uncertainties in the analysis.

Now it is important to consider that the, we want evaluation of realism if possible. But as I just talked about, in some cases people may elect to use some conservatism. But there is kind of a misconception that the regulator wants everything to be conservative and be overly conservative.

We don't want that at all. If you can come in with a great scientifically justifiable analysis supported by a lot of information, that's what we would want to see.

But what you run into is that, in many cases the information supporting the performance assessment is sparse. There may be limited support for some of the models or conceptual models.

In those cases then, people may elect to use conservatism. But that can be difficult to do in a complex model. So we don't even really like that. If possible, we really want to see people have adequate information if at all possible. Next slide please.

Here's a picture of what performance assessment is in more generic terms. Performance assessment is not a new topic. This is a renaming of technical analysis in the existing regulation.

And we do have some new requirements under 61.13 related to scope, uncertainty, and model support. But those things, we believe, are also implicit that are now made explicit. Those are parts of any modern performance assessment. And if I was reviewing a performance assessment and they didn't do well on those items, I would reject it.

So those requirements should not be onerous to meet considering it is part of what is done in the performance assessment process. There is a requirement to update the performance assessment at closure. And we did modify the siting characteristics to be consistent with the disposal of long lived waste.

So just to give an example, in 61.50 there's requirements associated hydrologic performance of the site such as the site cannot be located in 100 year flood plain. Well if you're looking at a 10,000 year analysis, how difficult would that be to justify that the site is never going to be in a 100 year flood plain? That might be onerous.

And so, what we've done is those requirements associated with hydrologic characteristics, they are required to either be present or absent for the first 500 years. Because we thought that was practical that somebody could demonstrate it.

But after 500 years then, you get to use a more risk informed performance based approach of how do those things, if they are present, impact the performance objective? So we thought that was a reasonable way to handle these siting characteristics that are part of the existing regulation.

The little figure at the bottom there, the performance assessment is not different than many other technical analyses. You start with data, you develop a conceptual model. That gets converted into a numerical model. And then you can calculate some results and you iterate, if possible, until you demonstrate that you meet the criteria.

It is very much a learning process though. It's about understanding what's going on with your site. Next slide please.

So why would you do site specific analyses instead of just NRC doing an analysis and developing something similar to the waste classification tables? Well here's a good example why.

On the left are retardation coefficients assumed in the technical analysis under which 10 CFR Part 61 was developed. And it gives you an idea, they were trying to assess different sites. They being NRC, being me of course.

And they selected point values, deterministic point values to do the analysis. Well on the right here are some data from this Sheppard and Thibault reference which was a general compendium of distribution coefficients developed for different soil types.

And what you is, say, look at the uranium value. The minimum is two mil and the maximum is 21,000 geometric mean. The GM there is

70. That's quite a bit of variance compared to even the variance that was considered in the basic analysis.

Now this could have a big impact for a particular analysis. If the retardation or the distribution coefficient is two, the uranium might be mobile enough to basically get to the receptor in a, you know, reasonably short period of time. Whereas if it's 21,000, it might not get there in hundreds of thousands of years depending on the site hydrology.

So from a regulator standpoint, if we're trying to develop criteria, what do we choose here to do our analysis? Do we choose 2 or do we choose 21,000 or do we choose 70? Do we choose the whole range?

You know, you basically get this very complicated result that you have to try to distill down into a single point. And I think it's not being fair to the reality of the problem which is many of these things are highly variable and site specific. Next slide please.

The performance assessment guidance, these figures are from it. It's to communicate basically what a performance assessment is all about. You start with a real system, the pictures on the left at the top.

And then you develop a conceptual model of your site including maybe conceptual models of individual components. So the performance assessment is really models within a model. It's a whole combination of different models that feed together to produce a common result.

One thing that we do stress though is that in many cases licensees may use abstracted hydrologic models and abstracted models in general. This is a simplification of a more complex model that you may be able to justify adequately represents your system that you can use to estimate performance.

So a performance assessment has lots of both depth and breadth. But it also depends on the complexity of your problem, what you should be doing with your performance assessment.

And the regulators need appropriate expertise to review these things. They can be pretty large and in some cases pretty complicated.

So if something came to NRC, I believe we definitely have expertise among all the great people I work with. And the agreement states, I believe they also have expertise. But in some cases they may be more limited. Because they can't just have staff sitting around waiting for performance assessments to come in and then periodically working on them.

So in those cases, they may have to hire contractors. Or they also are available to work with the NRC. We do technical assistance requests to provide support to our agreement states. Next slide please.

Okay. Now onto radon finally. So this was a question at the end of the subcommittee meeting. Or a comment that was made, what are you doing with radon and why?

The Department of Energy stated that they felt radon, we should be using a flux limit for radon. And they are accurate indicating that some regulations do have radon flux limits.

MEMBER MARCH-LEUBA: What is a flux limit?

MR. ESH: 20 picocuries per meter squared seconds. So amount per unit area per unit time. So some regulations specify a flux limit. Others specify include it in the dose calculation.

EPA under 40 CFR 61 has a whole bunch of different cases for radon. Some of them listed here at the top for DOE, for phosphogypsym stacks, uranium mill tailings disposal, they apply a radon flux limit.

In other cases within 40 CFR 61, they say include the radon as part of the public doses at 10 millirem per year. The examples given here are for uranium mines and non NRC federal facilities.

So what would say with respect to radon is we really can't in this rulemaking resolve the different treatments of radon that's done in different regulatory environments.

But what we can ensure is that what we do within Part 61 and within the NRC in general is internally consistent. So that's on the next slide.

So currently in Part 61, only limited amounts or small quantities of uranium were considered. And therefore, uranium was not an issue and there was no comment on the issue.

When this issue came up about disposing of potentially large quantities of depleted uranium or other uranium bearing waste, the existing guidance that was put forth in the year 2000 was to include radon in the dose assessment. There wasn't a reason to not include it in the dose assessment.

And part of the reason for that is under Part 61 we have two different types of receptors for the two different performance objectives. You may have a offsite receptor that's at the site boundary and that's evaluated under 61.41. And then we have this intruder, i.e. unexpected accident type scenario that could be located on the site at some time in the future.

The flux limits that you would apply for the intruder, for instance if they constructed a home and had a basement, would be a lot different than the flux limits that you would want to apply for somebody at the boundary that's say standing at the site boundary.

So what value would you calculate? And would you calculate a different value for the intruder compared to the offsite receptor? And one would be overly restrictive. The other would be overly permissive.

So there was a practical aspect to applying a flux limit within 10 CFR Part 61. In addition to that, our public dose limit under 10 CFR Part 13.01 includes all pathways and all radionuclides.

So we would have to change 10 CFR Part

20 to specify don't include radon in that for a low level waste facility in some manner. I don't know how exactly that would work if we were to apply a flux limit under Part 61.

Under 10 CFR Part 40, the offsite public, you do include radon for the offsite public. You don't include the -- you include a radon flux limit for the cover on a mill tailings facility. Because those facilities have perpetual control.

There's no intruder assessed because the government is supplying money or it's provided upfront and the Office of Legacy Management manages it. They provide continual control to ensure that you aren't going to have the intruder scenario for as long as you need to for those types of materials.

So it's materially different than this waste disposal problem with the institutional control period. And the fund is only established to achieve the post closure operations and maintenance and the institutional controls. You don't have a continual funding mechanism from Congress, for instance, to do perpetual control at low level waste sites which you do for the uranium mill tailing disposal facilities.

In addition, 10 CFR Part 20 Subpart E

for decommissioning under restricted release, we don't include or we do include radon there for restricted release. We do not include it for unrestricted release.

But the commission, in the statement of considerations, explained that. That's because when you're unrestricted release, you're looking at uranium and thorium, radium, and the other materials that are accessible in the environment.

And so, the criteria that you calculate to how much you can leave in the environment is going to be more limiting than what you get from a release of radon to the environment. And therefore, you don't need to evaluate radon in 10 CFR Part 20 unrestricted release.

VICE CHAIRMAN CORRADINI: That last part I didn't, you said it quickly. Can you say it again please?

MR. ESH: All right. So in decommissioning, there's two ways you can go in decommissioning. You can do unrestricted release which means, you know, you have contamination at a facility. You know, something that processed rare earths in the past or a closed reactor or whatever the situation might be. You have some sort of radioactivity in the environment.

And you go in and in decommissioning space you do a dose assessment to determine how much of that radioactivity you can leave in the environment. And we have screening values and new regs and tables that you can use.

Or you can do a dose calculation. Basically it's like the calculation that was done for 10 CFR Part 61, the waste classification tables. But you're doing it for a contaminated site.

So you determine how much you can leave there. You don't need to include radon there because that material is in the environment and it gets represented in the dose calculation in the ingestion of soil and the growing of plants and the ingestion of water and all the other pathways that you do in the calculation.

Those concentrations, because of the dose conversion factors that you need to limit the uranium and radium and thorium and all those things to in the unrestricted release calculation, are effectively limiting enough that you don't need to include the radon that you can get from those materials. So that's the general logic of why you don't include radon in unrestricted release.

In restricted release you may have situations where that activity that's in the environment is not readily accessible to the receptors that are potentially there. And you provide perpetual controls to if they do get on the site.

So in that case, you can have a situation where the quantities of the uranium, thorium, radium, et cetera, that you're going to leave at the site might be much larger than under the unrestricted release calculation.

And therefore, the consideration of radon is more important and can be more significant. So that's why it's done differently in those two parts of 10 CFR Part 20 Subpart E. Chris, do you have anything to add on that?

MR. MCKENNEY: The only other thing from the commission was was the high uncertainties for trying to figure out what type of buildings and other things that would multiply the radon dose. What way would be so speculative for the small amount of dose that you would be allowed when you're talking about a small fraction of the 25 millirem when you account for the fact of how much of the uranium and radium and everything else would be in this unrestricted case.

All those things would be -- since you were already limiting it by the radium and the uranium and thorium, that it was not necessary to calculate the radon dose in that case.

MR. ESH: So in summary, radon is a complicated picture here obviously when you look at all of this. So to make this approach of including it in the dose assessment is most straightforward. It shouldn't apply for most of our low level waste facilities if they aren't taking the significant quantities of the uranium bearing waste.

And also, it's really not a large consideration at a humid site. Because at the humid site, the radon and it's daughter products have short half lives. But they don't make it out of the system when the site is humid. The transport rate is strongly influenced by the saturation state of the system.

In arid sites the radon can transport much more readily through the subsurface. And it gets out into the, either the home or the environment much more easily.

MEMBER REMPE: So coming from a place where we used to worry about high radon days because it would get on your polyester clothes.

MR. ESH: Couldn't get out of the facility sometimes if you wear a wool coat.

MEMBER REMPE: But I just am wondering are you missing something because it's more appropriate to do a flux limit because of the characteristics of the radon? I understand your consistency argument. And it would be difficult to do this.

This is more a theory question. But is that why the EPA went that way on some of their requirements, is that they thought it was a more suitable way of characterizing it or anything?

MR. ESH: I don't know the rationale for why EPA chose to do it certain ways for some types of situations and the other way for other types of situations. But I'm sure they had a rationale for it.

Just like the NRC picture may look a bit muddied. But when you actually dig into it, I don't think it is all that muddied. I think it's fairly consistent what they're trying to achieve.

In situations where like, say in the uranium mill tailings where you have a mechanism to ensure perpetual control and limit access to the material, then a flux limit is appropriate.

But you're still including radon at the site boundary of those facilities in the dose assessment. That makes sense to me. Why wouldn't you do that?

In the situation for the waste disposal facility, you are taking a disposal action. Now one of the challenges is that, of course, radon is ubiquitous in our environments and in our homes and everything else.

So you'd say well, are you providing a requirement that's much more stringent for the radon from waste than you would for radon from natural? And I don't think that is the case because for the onsite receptor, we are using a 500 millirem dose limit for the intruder receptor.

And the average person gets about 250 millirem from radon in their home. Now that can vary widely depending on how much radon they have in their home. The variance in radon concentrations can be like 2 to 3 orders of magnitude. So the average person gets about 250 millirem. But there are rare circumstances where people can get much more nationwide.

CHAIRMAN BLEY: Does that include the places that make you vent your basements if you have it? Seriously, I just sold a house in Virginia last year. And they measure that stuff. And if it's a little high, then you've got to put a fan system in and pump it out.

MR. ESH: And that's very locality specific. So EPA have guidelines if you're above four picocuries per liter in your home, then you should install a system. But it's not a requirement.

And that makes sense because depending on the estimates that you see, it's somewhere between 6 and 15 percent of the homes are above four picocuries per liter. So what's the dollar value of that if you're requiring 6 to 15 percent of the homes to install a radon mitigation system? That's an enormous amount of money.

VICE CHAIRMAN CORRADINI: You're switching units on me. So what's that dose 4 to 6 picocuries --

MR. ESH: Four picocuries per liter, so I think it's about on the order of 4 to 800 millirem is around that.

VICE CHAIRMAN CORRADINI: Per year?

MR. ESH: Per year. Right, if you live in that concentration. That's the point, if you live in that concentration. And the flux in the natural environment is around 1 to 2 picocuries per meter squared seconds.

So if you have a 20 picocuries per meter squared seconds, that's about ten times the value that you expect from natural sources. What does that mean for a dose calculation and a dose assessment? It would depend on the specific circumstance and the receptors and everything.

But it would be, in my opinion, quite a bit larger than what you see from natural impacts.

MEMBER CHU: But David, isn't this what DOE's concern was last time when they came to the public comment?

MR. ESH: Well their concern is that you should be using the flux limit. But what I'm saying --

MEMBER CHU: But I think their point was you include the radon in your dose. And then because depleted uranium you're going to have quite a bit of radon coming off. So make the 25 millirem very restrictive because a lot of it's going to be taken up by radon.

MR. ESH: Okay. So this topic we didn't hear from pretty much any other stakeholders on. It was only DOE and DOE employees that made this comment about the radon. So it was a limited set of commenters.

But if I understand their point is they believe that you should be using a flux limit for the evaluation of radon in these disposal facilities. You should not be including it in the dose assessment.

The flux limit, I would say, creates challenges with these different receptors, number one, in the low level waste analysis. And it's a lot more permissive than if you include it with the dose assessment. So if you took it to its end, you take that flux and actually convert that flux into a dose for your receptor scenarios, it ends up in doses that would be a lot more than the current performance objectives.

You know, I think it's going to apply in limited circumstances under Part 61. And the fact that you have this intruder performance objective which is quite a bit larger than the public dose limit -- I mean, if you're getting 25 millirem offsite from radon from a disposal facility, you probably have something pretty bad going on with your disposal facility. That should be a difficult number to generate.

Now whether you could generate 500 millirem onsite -- the big thing with depleted uranium or uranium bearing waste, the solution to mitigating radon is very simple, depth. You only have to increase the depth. And it's a very non-linear function of depth what the radon flux rate is.

You can look at our reg guide 3.64 which is used to develop covers for uranium mill tailings. And you can look at that and see how strong that non-linear relationship with depth and also moisture is for the radon flux rate.

So I understand there's some concern from DOE's standpoint about including it. But the engineering solution to mitigate that concern is so simple. I mean, why would you not do that?

MEMBER MARCH-LEUBA: So radon has a four day half life. So roughly how many meters of earth do you need to have a four day delay?

MR. ESH: So for wet material it might be on the order of inches to feet. For dry material you could be talking five meters, ten meters, et cetera.

MEMBER MARCH-LEUBA: It's not 1,000

meters? We're talking five meters?

MR. ESH: Right. You're talking like -- for the concentrated depleted uranium, if you get 20 meters of desert soil, it basically takes the radon away.

MEMBER MARCH-LEUBA: There is more than 12 days of delay?

MR. ESH: Right. It's a complicated phenomenon because it is affected by discrete pathways just like it is in your home. You know, you have joints around your sump pump or, you know, other fractures in your concrete or all that sort of thing. That's where it comes in through mostly.

The diffusion rate through concrete and those sorts of things is generally so slow that not a lot makes it through those types of materials. Yes, you can seal materials if you needed to. Next slide please.

So inadvertent intruder assessment is similar to the performance assessment. This first item except receptor scenarios, I don't think that's particularly correct. I was reducing some materials in the slides. And that's not accurate because you do consider receptor scenarios in the performance assessment as well as the intruder assessment.

The differences come on that the inadvertent intruder is somebody that unknowingly accesses the site and engages in normal or reasonably foreseeable activities. And so it's an onsite exposure.

We use a 500 millirem or would use a 500 millirem dose limit if the proposed final rule goes forward. It's precluded during the institutional control period of up to 100 years.

So this is not an anticipated scenario. It is more of an accidental occurrence. And I think David Coker put it well in one of our early meetings that the inadvertent intruder assessment can be viewed as a form of defense in depth.

And where he was going with that was, and I agree with it, is that the inadvertent intruder assessment provides some restrictions on the type of material that you can put in your facility.

Now as I talked about earlier, it may be less restrictive than your 61.41 calculations depending on your site. It also may be more restrictive. But it is another part of the calculation to ensuring what you're putting in the near surface is appropriate.

The 61.42 performance objective requires assessment now instead of just relying on the tables. The tables were based on assumptions about particular types of waste that may and in fact are no longer valid. And the tables also, I would argue, are not site specific and they are not risk informed.

So the tables had to use particular point estimates for particular sites. And so, they may have used parameters appropriate for a humid site to do the analyses when then you're applying those tables in an arid site. And those changes to the data and the calculations can have a big impact.

Now this issue about the tables and the analysis and what we're requiring, it's not a new issue. It was documented earlier in NRC documents especially in NUREG-1573, our guidance on performance assessments for low level waste. There's a footnote 7 in there that describes this issue.

So you know, if somebody has this issue, they've had 16 years to take some action on. And it shouldn't be that NRC's rulemaking now is causing a problem for them.

MEMBER POWERS: When I look at this

issue, I come along and I say this is equivalent of an accident. You get an intruder in there. And you have a half millirem dose limit on this. So I'd say what's the rate? Well we assume there's an intruder over 1,000 years so it's like 10^{-3} per year. So I come up with an expected dose of half a millirem.

If I look at 10CFR Part 100 and I say here I have an accident. I have a dose limit of 25 rem at the site boundary. And what are accidents that would release something to the site boundary is like 10^{-4} per year. So I come up with an expected dose of 2-1/2 millirem.

In other words, five times higher than what you've selected here. I don't understand why are those aren't consistent.

MR. ESH: Right. I think there's a conceptual issue that maybe I need to explain here. The inadvertent intruder is not expected but can't be eliminated with all certainty.

MEMBER POWERS: You don't expect severe accidents either.

MR. ESH: Right. But the fact that you analyze an intruder for say 1,000 years or 10,000 years doesn't mean that the probability of the intrusion happening is $1e^{-3}$ or $1e^{-4}$.

What it's saying is the integrated probability over that timeframe of an intrusion occurring is, in this case because you're using 500 millirem and our dose limit for the offsite receptor is 25, it's saying that probability is around five percent, that integrated probability of an intrusion occurring over these long timeframes.

MEMBER POWERS: My analysis assumes it's one.

MR. ESH: Assumes it's one? Right. Okay.

MEMBER POWERS: Yes. Because I mean, you have to take care of the -- so you're sure that it's going to occur once in a thousand years. Sounds very plausible.

MR. ESH: I understand.

MEMBER POWERS: But once I stipulate that intruders can occur, having once in a thousand years does not seem to be an unwarranted assumption.

MR. ESH: So I think the difference is that the protection standard for the inadvertent intruder is the annual 500 millirem in a year to an individual. And so that individual in that particular year for the inadvertent intrusion does not have a $1e^{-3}$ frequency associated with it.

You're not weighting the dose calculated by a frequency of occurrence in this type of evaluation.

MEMBER POWERS: You almost reproduced my point. There doesn't seem to be a consistency here.

MR. MCKENNEY: One other thing they have different between like, for active facilities and a passive facility for a long term waste disposal facility is the fact that in waste disposal for like, the purpose of an inadvertent intrusion calculation is the fact that the reason you have an upper threshold is the fact that you don't want incidents to occur that would require active measures to have to take place.

Because you're assuming that, one of the assumptions is that you cannot rely on the fact that radiation protection authorities are aware of the site at the time and are aware of the incident occurring to be able to take the measures that are prudent to reduce the doses.

So therefore, you may not be willing to have as high of individual exposures that you would be potentially to be calculated under what we would be under an active situation where you can also rely on active measures to also be put into place to reduce those controls.

MEMBER POWERS: But haven't you already taken that into account to get to your assumption that there will be an inadvertent intruder? Haven't you already counted for that?

MR. MCKENNEY: What?

MEMBER POWERS: That the authorities are not aware that this is here.

MR. MCKENNEY: Right. But that's also why I don't want to have a five rem dose. I don't want to put a five rem dose out there, put a concentration out in space.

VICE CHAIRMAN CORRADINI: Can you say what you said again? I didn't understand. What did you mean? What kind of dose?

MR. MCKENNEY: A five rem dose.

VICE CHAIRMAN CORRADINI: Oh, five rem.

MR. MCKENNEY: So if you're saying that I'm too low of a dose compared to 100 is the fact that if I raise my dose limit here to be corresponding, then that would become, that I'd be allowing a much higher individual dose limit to somebody when I don't have any radiation protection controls to have active measures come in and actually reduce those controls.

Whereas when we have an active facility, those people can come in and we can take protective measures.

VICE CHAIRMAN CORRADINI: But if I just use your analogy then, we don't require any protective measures or any sort of protective action until two rem. So wouldn't two rem, at the very least, be an appropriate consistent value?

MR. MCKENNEY: In international space, yes. There's international guidance, there has been discussions between 500 and 2 rem as being the possibilities of making selections in that type of field.

MR. ESH: So if we could go to the next slide please. So the dose limit of 500 millirem or 5 millisieverts, it's higher than 10 CFR Part 41 and it's higher than the NRC public dose limit.

But as you're getting at there, well why isn't it 2 rem? 500 millirem is what was used to develop the waste classification tables in Part 61. So if you set the intruder dose limit at something higher, say for other isotopes, you're regulating some isotopes to 500 millirem and you're regulating some of them to 2 rem.

So you'd have to redo the waste classification tables to make it consistent, in my opinion. And we had asked the commission if they wanted us to redo the waste classification system early in this rulemaking process. And they said no, don't redo the waste classification system. Delay that until after this rulemaking is done and then we'll consider it.

But that doesn't mean they're going to do it. They're just going to consider it at that time whether it makes sense to redo the waste classification system.

VICE CHAIRMAN CORRADINI: But just so that I'm clear, without taking any protective action 2 rem would seem consistent with what would happen in a reactor facility.

MR. ESH: Yes.

VICE CHAIRMAN CORRADINI: For example.

MR. MCKENNEY: Yes. That is much more consistent with the upper bound of that of that range, yes.

MR. ESH: I don't know which came first. You know, but the 500 millirem was not pulled out of the air. It was evaluated when the initial rulemaking in the early 1980's was completed. And there was a series of public meetings where they talked about institutional control periods and dose limits and all these sorts of things. And that was the output of that rulemaking process.

So I'm just giving you some color of where it comes from. It doesn't answer your question about well should it be 2 or should it be 500. But I'm explaining why it is the 500.

MEMBER KIRCHNER: Dave, can I ask a variant on these questions? Is this going to wind up being for the four sites that exist? The dominant, or the most costly is a different way to put it, part of this rule set.

VICE CHAIRMAN CORRADINI: I asked that in a similar way earlier.

MR. ESH: So technically limiting from a meeting the criteria standpoint is different than how much it costs, for instance. So the intruder calculations from a cost and effort standpoint are way less resources than the performance assessment calculations for 61.41.

For 61.41 they are in many cases complicated combinations of models with hydrology and geochemistry and everything else going on. The intruder calculations are very stylized calculations that you can do in a spreadsheet almost.

MEMBER KIRCHNER: I didn't care how much effort went into the calculation. I was more interested in what happens when you actually design and build the repository, excuse me, the waste site. Does that become a dominant concern in closing the site, for example?

MR. ESH: And that's what I attempted to answer earlier is that it depends on the site and the waste whether 61.41 is going to cause you greater restrictions or whether 61.42 is going to cause you greater restrictions.

It also depends on the isotopes. So maybe plutonium is going to be limited by your intruder calculation because it's very immobile in the environment. And so, it doesn't cause risk impacts from 61.41 type calculations. But it will in the intruder calculations.

So it'll even be isotope and element specific which one is more limiting for which performance objective.

MEMBER KIRCHNER: But generally you're not expecting large plutonium disposal in these kinds of sites, I would guess. So of the more common components of waste that are being put in these sites --

MR. ESH: So if you look at the --

MEMBER KIRCHNER: Is intruder analysis going to be a bigger factor in the design and construction and hence cost than the other?

MR. ESH: Yes. For many of the isotopes that are causing dose in the performance assessments, there are greater restrictions associated with 61.41 than there are with 61.42. And you can see that in the tables that are in the guidance document.

The concentrations that are in the tables with respect to 61.42 are much higher than what you would need from a generic standpoint to say things are going to be okay from a 61.41 standpoint.

MEMBER KIRCHNER: So here's a different take on this. To the extent that this inadvertent intruder part of the new rule would dominate things, is it practical to consider marking the site accordingly?

I think pragmatically that's what the states will do anyway. And it's not impractical in engineering terms to mark something for 1,000 years. We have pyramids that are much older than that. I'm not suggesting building a pyramid on top of the site.

CHAIRMAN BLEY: Of course we've had towns disappear in 300 or 400 years as well.

MR. ESH: So we have some material in the guidance document associated with markers. And yes, markers are required under Part 61 to have at a facility.

The issue becomes the long term durability or effectiveness of those markers. And there was an interesting example from, I think it was a site in the southwest that they did maybe a small weapons test. It's in the guidance document.

But they put a marker up to provide people information about the location of this. And that marker has moved a number of meters over the years because cows use it as a scratching post. So there are other examples of these markers that --

MEMBER KIRCHNER: For the record, I was considering much more substantial structure. As a hiker I can tell you that usually the geodetic survey markers on mountain tops disappear on a regular basis.

MR. ESH: And that's the other issue, is theft, vandalism, all the other things that teenagers and some other people like to do. That comes into play when you're dealing with markers.

And there have been studies of markers of, you know, how do you develop them to make them durable and not attractive and warn people, what languages you use, symbols, all those sorts of things.

So that is a consideration. But the effectiveness of the markers to deter an intrusion event is limited over long periods of time. We just don't have the experience base for it totally.

Now we did look at land disturbance values in trying to evaluate is it reasonable to use a 500 millirem dose with its effective implied probability of there's going to be a five percent chance that the intruder accesses the material at any time over the compliance period.

So this was done with GIS. We looked at the disturbances in the U.S. And we got roughly 2-1/2 percent of the land area has been disturbed to a depth greater than one meter over the course, I believe it was over the last ten years. Roughly one percent of the land area has been disturbed greater than three meters over the last ten years.

So what you're talking about is integrating those sorts of numbers over 1,000 years or over 10,000 years. The other thing you can look at is, say, drilling in Texas for instance. Well 200 years ago the number of oil wells drilled in Texas was zero. In 1860 it was one. Today there's like about 190,000 wells in Texas. And over the course of the history of Texas there's been about 1.5 million oil wells drilled in Texas.

If you take the area of Texas and compare it to the area of its disposal facility and the number of wells that have been drilled, you end up with roughly a two percent chance that a well would be put through the disposal facility.

And that's based on history to date. If population increases and energy usage increases, the frequency of well drilling is going to increase. That probability would go up. And you're talking about integrating it over a much longer period of time.

So you know, five percent 500 millirem dose limit, I think is a fairly reasonable number considering what you're dealing with. You are talking about something that is really difficult to quantify. And you really shouldn't go beyond like this sort of level of analysis with it, in my opinion.

MEMBER RICCARDELLA: Could I ask a question just for my understanding? To have a dose limit like that for an intruder, is there some assumption about the length of time that the intruder is there?

MR. ESH: So in NRC space, we look at it as an accident, an unexpected scenario albeit an accident. But if it occurs past the institutional control periods, so 100 years from now, there's no limitation on the time it's going to happen.

Because there's nobody there, besides their knowledge of that they might dig into something metal and say I found some metal here or I hit a waste container, there's not going to be an entity to come and tell them you've made this mistake.

VICE CHAIRMAN CORRADINI: So they start living there?

MR. ESH: They could potentially live there. But that's part of the inadvertent intruder --

MEMBER RICCARDELLA: Is that a permanent dose limit? Or is that a limit per year?

MR. ESH: It's an annual dose limit, yes.

MEMBER RICCARDELLA: And so the assumption is the intruder lives there?

MR. ESH: They could potentially. If we go to the next slide, we look at normal activity such as dwelling construction, agricultural, drilling for water. There may be locations where those things are not reasonable.

You know, one of the existing sites is in a very remote location. The water is not potable. You generally can't use it even for agriculture. So the intruder scenarios that you would look at in that site might be quite different than the ones you would look at generically.

And that's why in this proposed rule you can consider reasonably foreseeable activities consistent with the activities in the vicinity of the site when the assessment is developed.

So you can bring in more realism to what you think are the intruder scenarios. I just caution people as I think that's a slippery slope. Because any time you've dealt with stakeholders, they can be very imaginative and come up scenarios that maybe you don't envision but that they think are very reasonable. And give basis like my uncle does that, you know, he lives close to there and that's what he does. So you're telling me that's impossible?

So you've got to be careful of dealing with receptors. Sorry, go ahead. He's okay. So next slide please.

So what do these activities look like? Well this is the agriculture, dwelling construction, and drilling for water. Those are the types of scenarios that were looked at when the regulation was developed.

And we still think if you want to be reasonably conservative or more than reasonably conservative and not deal with speculation about the receptor scenarios, then this is probably the way to go. If you can demonstrate you can meet the criteria using these sorts of scenarios, then why would you try to use other scenarios? That seems like you're asking for punishment that you don't want to receive. Next slide please.

So we do have the guidance on site specific scenarios. This was developed by Chris Grossman. It's in Chapter 4 of our guidance document.

We do believe it's appropriate to constrain exposure scenarios for the normal or the reasonable foreseeable activities based on consideration of physical information such as, you know, the waste is too deep. You can't put a house foundation into it. Or the water is not potable so you can eliminate the groundwater pathway.

You can also consider cultural information but that's much softer as we talked about with the uncertainties and the societal component. It's more difficult to argue that over the longer timeframes.

MEMBER RAY: Can I interrupt for just a second? You may this comment about not potable a couple of times. I just have to observe that we just recently went through an operating license review in which it used deep well injection for liquid radwaste.

And in that case the staff did assume drilling inadvertent intrusion into non-potable water. So it seems a little inconsistent here to say you don't need to consider here and we did consider it there. I don't have any other comment than that. We did consider it in that case.

MR. ESH: I mean, that's a good comment. And I don't want to confuse you. Here I'm talking about, say, elimination of the drinking water pathway because the water is not potable. But not the fact that somebody might try to drill.

So somebody might still try to drill and get impacted from the drill cuttings and everything that goes in the drilling scenario. But if the water is not potable, then we don't say we're going to assume they drink it anyway when it's at like, you know, a couple hundred thousand milligrams per liter chloride, for instance. So just so we're clear, that's what I'm talking about here. Next slide please.

So site stability is another component under the 61.44 performance objective. It is a cornerstone of disposal according to the regulation. And that's because a lot of the problems in early facilities were associated with stability.

The site stability is required for the compliance period but it may be performance based. So we had this comment from people saying why do you even have this? And the answer is because of the problems that were experienced by facilities and because we also have a requirement that the facility must be capable of being modeled and analyzed. That's an existing requirement in the regulation.

In some circumstances, if you have a

very unstable site, say from a geomorphological standpoint or otherwise, it may make it prohibitive to model that facility, for instance.

And in those cases, we do see cases where, you know, engineers can calculate anything. But does the number mean anything? So engineers I'm sure, even in the most unstable site, can generate some numbers.

But the agreement state regulator may in some instances say, fine you calculate that under these scenarios the doses are going to be very small. But this is such a speculative uncertain scenario that I'm still going to say this does not meet the stability performance objective. And therefore, is not an action you should take.

So that's why it's a stand alone performance objective. The guidance talks about design and model based approaches. So there are models out there, Child and Siberia for instance, that can be used for these for these long term geomorphological calculations.

And we also, NRC has existing guidance on using designed based approaches such as used in uranium mill tailings. I worked with our two experts that developed that guidance. One of them is retired and one is now mostly retired, I would say, to ask them the question of well you developed to apply for uranium mill tailings for 200 to a goal of 1,000 years, how would you extend that to apply for beyond 1,000 years up to 10,000 years?

And so, you start considering the mineralogy of the rocks a lot more. But in either of the design based approaches, whether it's for a shorter timeframe or a longer timeframe, it's still based on the PMP and the PMF. So the probable maximum precipitation and the probable maximum flood.

And if you ever have an opportunity in your life to go see one of those facilities, I encourage you to do so. They've very impressive, these facilities and these rock covers that are designed from them. It's hard to imagine how they would go anywhere based on looking at them. Next slide please.

This is just some information from the guidance that we do have that you should consider the scale of your problem. And that's going to be determined by primarily your waste. If your waste is simpler, shorter lived, then you look narrow in, make sure you don't have subsidence in the facility, that sort of thing.

If you have longer lived waste, then you have to consider what's going on around the facility in addition to maybe what you've done in geomechanical design of your facility and your trenches.

On the right is kind of the evaluation process. It's similar to the performance assessment. It's just tailored to site stability. And there's a lot of additional information on site stability provided in our NUREG-2175. That's in Chapter 5.

So waste acceptance requirements are provided in the regulation. So that was the end of kind of the technical analyses. It feeds into the waste acceptance requirements. Or it can feed into them.

The waste acceptance requirements are basically how to determine if the actual waste that you have received is in line with the analyses. And the three components are the characterization, the criteria, and the certification. Next slide please.

So the waste acceptance criteria have components such as the allowable limits on radioactivity, the waste form characteristics, and container specifications and restrictions and prohibitions.

These things are very important to low level waste disposal and all waste disposal. When you have problems in these modern facilities, it's usually associated with something going on associated with the waste. It's usually not associated with something going on external to the facility and external to the waste. Next slide please.

Our waste acceptance approach in this proposed or draft final regulation has considerable flexibility to the licensees. Because they can develop site specific waste acceptance criteria. They can also use the 61.55 limits that are in the regulation. Or they can do a combination of both to develop their waste acceptance criteria.

But either way the licensees must demonstrate that the criteria will demonstrate the performance objectives are met. Next slide please.

NUREG-2175 the guidance document, it provides a lot of information that we hope is helpful and can ensure some consistency for all these activities that are going to be undertaken within the agreement states.

We tried not to just have all text and pages and pages of information to put you to sleep. But it does have a considerable amount of text as well as other things like flow charts and tables.

It does provide guidelines for what the licensees or applicants should include. And what regulators should review for each of the types of analyses. There are suggested references, screening tools, and case studies.

Priya Yadav who is here and you heard from earlier, she was our Project Manager on this. And has hopefully helped us get out a very high quality document. This document, of course, you were provided. And it's also available on the link provided at the bottom of this slide. And I think that's it.

MEMBER CHU: Thank you. We have DOE.

CHAIRMAN BLEY: Yes. Mr. Tonke from DOE wanted five minutes. Is he in the room? It's your turn.

MR. TONKE: Thank you. I'm Douglas Tonke. I'm the Waste Disposal Office Director with the Department of Energy's Environmental Management Program.

I think most of you are familiar with

DOE and we've talked about us today. So I won't go into what we're about. But we self regulate our low level waste program. And are doing a lot of performance assessments and composite analysis.

We not only do them for our own facilities but we have a policy that allows us to use several of the facilities but that Dr. Esh showed on the chart, some of the commercial facilities particularly in Clive and in Texas.

We're also touched by the fact that it went into the one chart we are, NRC reviews for our high-level waste tank closures and applies the staff guidance. So this is very applicable to us for that.

So consequently we've had significant interest. We've provided letters. I appreciate the committee allowing me to talk at the subcommittee meeting and a few minutes here, just to continue to push some of our points.

Last week the NAS hosted a low level waste workshop. I attended it and was frankly surprised by the amount of discussion there that the participants had on this particular rule. So there's a lot of interest out there. And I think they view it as being a bit complex.

So I do appreciate Dr. Esh and the additional slides he added today to address some of our comments. And the fact that the full committee, a lot of the questioning went along the points that we've been making.

I boil it down at this point into sort of two areas. The first one is the compliance period. I think I can say that the Department is in line with the 1,000 year. And we've been in line. And we've noted that the Commission directed at one point the 1,000 year compliance period.

This committee pointed out about the significant uncertainties in the performance analysis beyond that roll in for millenia, et cetera.

Our folks believe that the time of compliance should also consider intergenerational equities and allocation of resources. You know, these are equal to or just as important as PA projections. And maximizes the benefits to the government. Or to future generations from today's resources.

Dr. Esh's chart showed that there are other programs using the 1,000 year at most requirements. And we saw those on the chart. Some of the programs that had higher levels in the 10,000 range were siting a pile of OH facilities, et cetera.

So we appreciated see those. And as he pointed out, mill tailings are being, the standard being applied there is 1,000 or at least 200 years.

So in light of that, you know, we'd prefer to see the annual dose limit to 1,000 years. We do long term performance assessment and calculations. But we see it going, you know, we do it long term. But our compliance period is 1,000 years.

The other area I'll bring up is radon. And I think there were excellent questions there about radon. So I don't think I need to really go into it. I think our issue is the contribution of the radon when it's combined into the small factor.

We do separate radon calculations against the flux limits on the side. So it's, you know, within 25 millirem limit proposed. And out there a ways it's sort of uncertain at this point how that will all play out.

So to establish more restrictive limitations in the context of an extended performance assessment entails significant and irreducible uncertainties that we don't think would be particularly unwarranted.

And likewise, we echo the comments about the comparison to the, you know, the other agencies and the indoor air for radon alike.

Finally I'll point out that the draft that DOE -- although we do inadvertent intruder analysis, we do not apply a dose limit to those. We appreciate the discussions you had.

One thing to consider is, I think it was brought by the gentleman about plutonium, the guidelines are applied to our high level waste tanks which do have plutonium in them.

So I'll stop there. We just had a few days to look at the guidance. But thank you again for the opportunity to sort of reiterate our views. We appreciate it. Thank you.

MEMBER CHU: Thank you. Anybody on the line public?

CHAIRMAN BLEY: The way it's working now, ask for comments from the phone line. And see if anyone -- does anybody on the phone line care to make a comment?

MS. GRAY: This is Erica Gray from Richmond, Virginia. Can you hear me?

CHAIRMAN BLEY: We can. Please go ahead.

MS. GRAY: So I guess when you're saying comments, am I allowed to ask any questions at all?

CHAIRMAN BLEY: No. We don't have an interaction. This is just an information gathering session for the committee. So we invite people to make comments, about five minutes if you have that many. And that's all at this point.

MS. GRAY: Okay. So when I do have questions, who do I ask them to?

CHAIRMAN BLEY: You can send questions to the NRC staff.

MS. GRAY: Which staff? The ACRS or who?

CHAIRMAN BLEY: No, the Nuclear Regulatory Commission staff.

MS. GRAY: There's got to be somebody in particular that's managing that's in oversight of this particular waste issue. Is there not?

CHAIRMAN BLEY: Derek, do you have anybody we can point this person to?

MR. WIDMAYER: Well I would say Gary at this point in time.

MR. COMFORT: Yes, you can send them to

me, Gary Comfort. I'm at gary.comfort@nrc.gov. So G-A-R-Y.C-O-M-F-O-R-T@nrc.gov.

MS. GRAY: Okay.

CHAIRMAN BLEY: And for the ACRS Derek Widmeyer is our staff lead for this Part 61 work. So you could address a letter to him too.

MS. GRAY: I'm sorry. Who was the second person?

MR. WIDMAYER: It's Derek Widmayer. My email is derek.widmayer@nrc.gov.

MS. GRAY: Okay. Well I guess the one comment I guess I would have to say that it is really quite startling to hear about how big this problem has gotten. And I will obviously have to write and ask questions.

Because you know, this idea of depleted uranium -- and obviously it looks like it's going to be classified as low level waste. But it could actually peak in one or two million years. It'll actually go past A to a C value as it goes for waste. So this is going to increase.

So it'll very interesting to find out how, with just these four sites, these four agreement states have agreed to take on something like 100 million tons and counting. If I understood correctly, that was only counting for the depleted uranium.

So I'd be very curious to find out, you know, how much low level waste we've already created. And how much we create annually. I'm extremely disturbed. We obviously have a huge problem.

But it sounds like we also need to look at how we can possibly stop making more of this waste. But since I can't ask any questions, I will be writing to the two fellows you all gave me names for. Thank you very much.

CHAIRMAN BLEY: Thank you. Is there anybody else on the line who would like to make a comment please? Anyone in the meeting room? Okay. Margaret are we finished? Okay. Thank you.

Thanks for the presentations. We will be getting together and trying to write a letter. I know you have interest in what we might say on the guidance. We'll have to discuss that among ourselves.

But it was a heroic effort today to get us through a lot of that that we didn't talk about before. And we appreciate it. And I think on the other side though -- I don't know until we talk to each other how many people have had a chance to really study that small document you sent. Thank you.

We are at almost 6:00. I know we have -- I do. Thank you. At this point we're going to go off the record.

(Whereupon, the above-entitled matter went off the record at 5:48 p.m.)

North Anna 3

North Anna Unit 3 COLA

Meeting with Full Advisory Committee on Reactor Safeguards

November 3, 2016

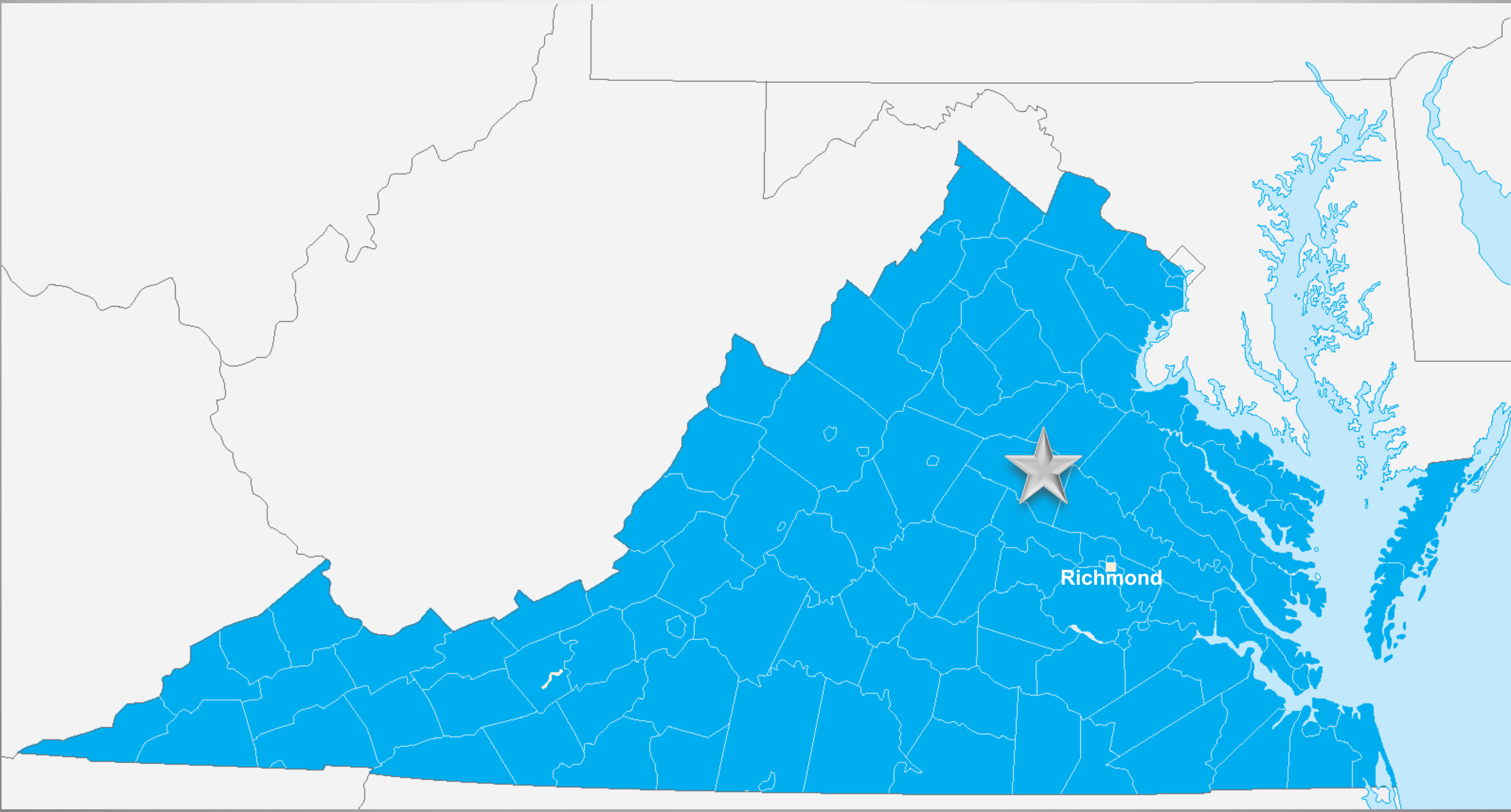
Dominion

Agenda

- North Anna Unit 3 (NA3) site
- NA3 licensing history
- COLA changes
- Conclusions

Dominion

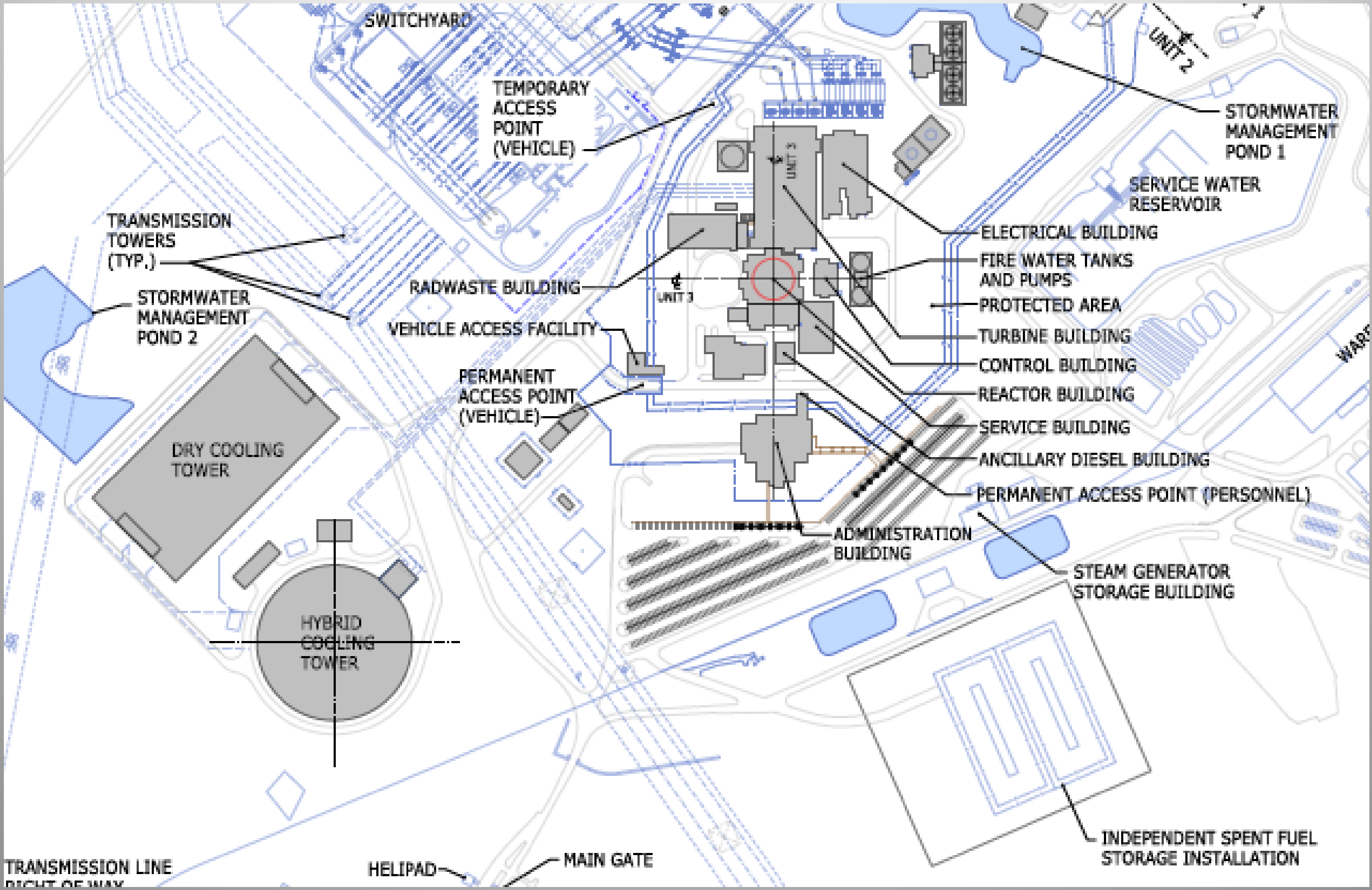
North Anna Site Location



North Anna Site with Unit 3

Dominion

NA3 Plan View



NA3 History

- ESP
  - ESP Application submitted — September 2003
  - EIS issued — December 2006
  - ESP issued — November 2007
- COLA (as ESBWR)
  - COLA submitted — November 2007
  - ACRS Subcommittee meetings — June, July, August 2009
  - ACRS Full Committee meeting — October 2009
  - ACRS Letter — October 2009
  - Supplemental EIS issued — February 2010
  - ACRS Subcommittee meeting — October 2016
- Technology Changes
  - Changed to APWR technology — May 2010
  - Reverted to ESBWR technology — April 2013

Dominion

Approach to Post-2009 COLA Changes

- Standardized content with ESBWR DCD and R-COLA (Fermi 3) through design-centered working group approach
- Relied, as much as possible, on site-specific COLA content from previously reviewed NA3 ESBWR COLA

Most COLA content is consistent with information previously reviewed by ACRS

Hazardous Chemicals Analyses (Section 2.2)

- Evaluation of Potential Accidents
  - Accident categories considered included:
    - Explosions
    - Flammable vapor clouds—delayed ignition
  - Analysis demonstrated that blast effects would not exceed peak overpressure of 1 psi at any safety-related structure with exception of storage and transport of liquid hydrogen

Hazardous Chemicals Analyses (Section 2.2)

Liquid Hydrogen

- Storage of liquid hydrogen - two 6,000 gallon capacity tanks
  - Actual distances from tanks to nearest safety-related structures exceed the calculated minimum safe distance
  - Therefore, storage of liquid hydrogen would not adversely affect safe operation or shutdown of NA3 (including the Radwaste Building)
- Transport of liquid hydrogen - 13,000 gallon capacity truck
  - Probabilistic analysis concluded probability of an accident involving delivery truck is less than 10^{-6} per year, which is acceptable per NRC guidance

No design-basis events were identified with respect to storage or transport of chemicals

Dominion

Local Intense Precipitation (Sec. 2.4.2)

- Maximum inundation flood levels resulting from local probable maximum precipitation (PMP) are bounded by DCD site parameter value of 0.3 m (1 ft) below plant grade
- Sheet flow analysis:
  - Flow directions for runoff from roof tops are stipulated in FSAR
  - Transitory sheet flow depths at 3 locations are above floor elevations at entrances to safety-related buildings
- FSAR commits to place curbs at these entrances, or raise their thresholds, to prevent water from entering these buildings

Site grading and structure configuration precludes flooding of safety-related buildings during a local intense precipitation event

Dominion

Accidental Releases of Liquid Effluents (Sec. 2.4.13)

- Design includes mitigating features to preclude accidental release of liquid effluents
- Nevertheless, per SRP 11.2, analysis of accidental releases of liquid effluents into environment was performed
- Condensate Storage Tank (CST) was assumed to be source of release, based on ranking of tanks

An accidental release of liquid from CST to environment would result in radionuclide concentrations and dose well below 10CFR20 limits

Dominion

Radwaste Discharge Piping Departure (Sections 11.2 & 12.3)

- NA3 operational goal is zero liquid release plant - Liquid Waste Management System (LWMS) designed to recycle all processed water
- FSAR 11.2 - Liquid radioactive releases will be discharged using the liquid radwaste effluent discharge pipeline to the discharge canal and not into the circulating water system's cooling tower blowdown line
- FSAR 12.3 - LWMS discharge line will be run underground in guard pipe or is accessible via trench or tunnel

Dedicated discharge pipeline complies with 10 CFR 20.1406 to minimize, to the extent practicable, contamination of facility and environment

Dominion

RG 1.221, Design-Basis Hurricane Winds and Hurricane Missiles

- Seismic Category (SC) I structures will be designed to withstand loads due to DCD tornado wind speed and missile spectrum
  - DCD wind and missile demands bound NA3 site-specific tornado and hurricane wind and missile demands
- SC II structures and structures housing Regulatory Treatment of Non-Safety Systems (RTNSS) structures, systems, and components will be designed to withstand DCD and RG 1.221 hurricane wind and missile demands

SC I structures meet DCD wind speed and missile criteria. SC II structures and structures housing RTNSS SSCs will meet DCD and NA3 RG 1.221 hurricane wind and missile criteria

Dominion

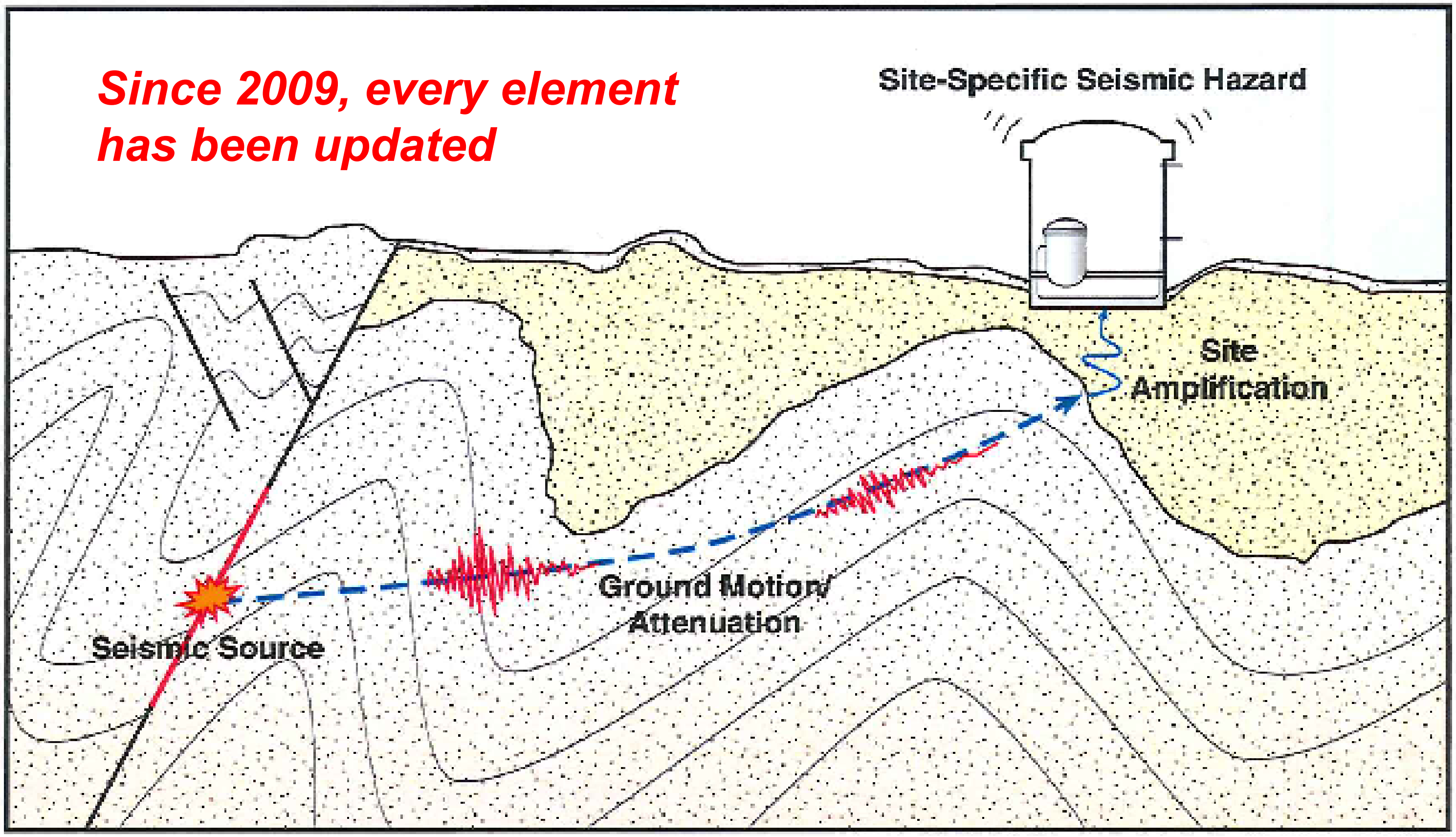
Drivers of Seismic Revisions

Seismic-related FSAR sections revised to address events/guidance changes:

- August 23, 2011 Mineral, VA earthquake
- New Central and Eastern United States-Seismic Source Characterization (CEUS-SSC) (NUREG-2115)
- Updated Ground Motion Model (GMM)
- NUREG 0800, SRP 2.5.2 (Rev. 5), SRP 3.7.1 (Rev.4) , and SRP 3.7.2 (Rev. 4) & DC-COL-ISG-017

Vibratory Ground Motion Methodology

Elements of the Site-Specific Seismic Hazard



Graphic Source: SIGMA Project Plan

Vibratory Ground Motion Methodology

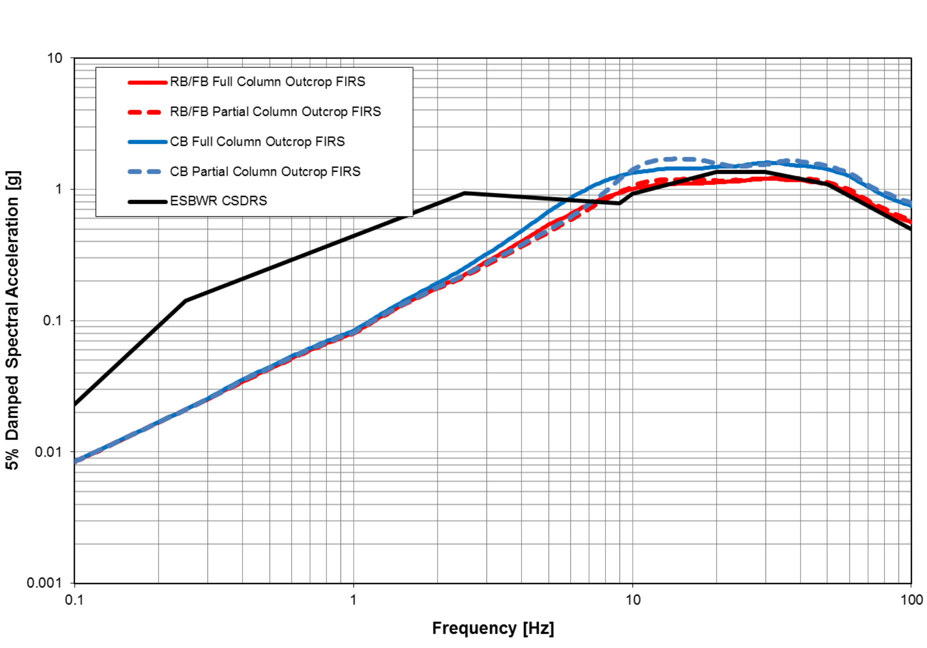
- Updated seismic sources using CEUS SSC and updated seismicity, including 2011 Mineral earthquake
- Revised probabilistic seismic hazards analysis (PSHA), using updated CEUS SSC and EPRI 2013 GMM
- Developed new site-specific response spectra using revised PSHA
- Developed new Ground Motion Response Spectra (GMRS) and foundation input response spectra (FIRS); redefined using new site-specific response spectra and new DC/COL-ISG-017 guidance
- Identified certified seismic design response spectra (CSDRS) exceedances

Dominion

Foundation Input Response Spectra

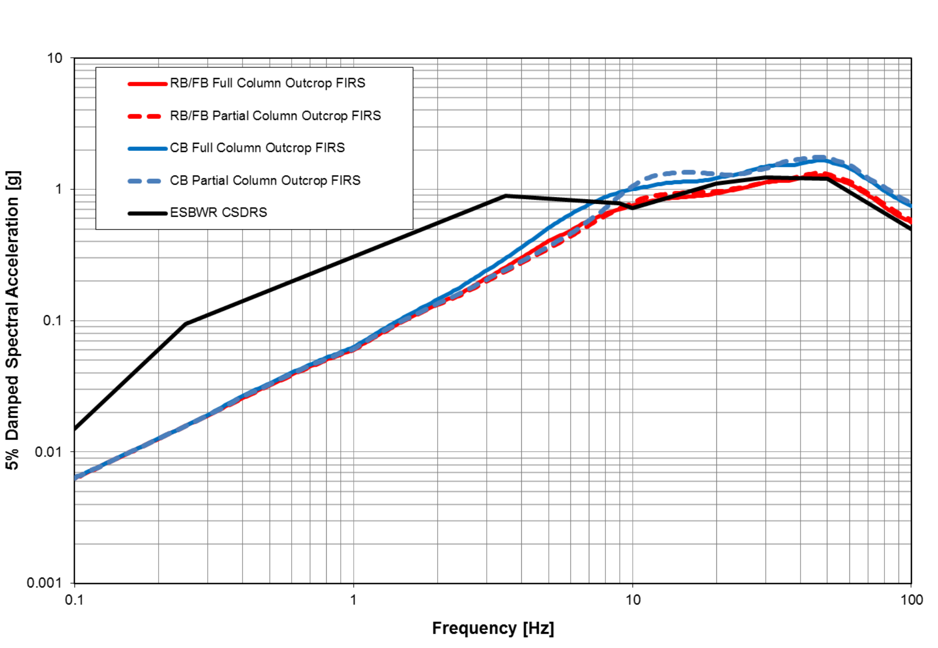
FIRS for Reactor Building/Fuel Building (RB/FB) & Control Building (CB)

Comparison of Horizontal CSDRS with Unit 3 FIRS for RB/FB and CB



FSAR Figure 2.0-201

Comparison of Vertical CSDRS with Unit 3 FIRS for RB/FB and CB



FSAR Figure 2.0-202

CSDRS exceedances identified

Dominion

Seismic Analysis & SC I Structures

- Developed seismic design parameters site-specific soil-structure interaction (SSI) input soil profiles and ground motions
- Performed site-specific SSI and structure-soil-structure interaction (SSSI) analyses to evaluate SC I RB/FB, CB, and Fire Water Service Complex (FWSC) structures for site-specific ground motion and soil properties
- Used results of SSI and SSSI analyses to determine site-specific seismic demands
- Performed site-specific analyses of structures and components using site-specific seismic demands
- Methodology and mathematical models for site-specific analyses were consistent with approved ESBWR DCD methodology

Dominion

Seismic Analysis & SC I Structures

Results:

- No changes to DCD concrete member properties (e.g., slab or wall thicknesses)
- Minor local changes to shear ties and reinforcement in RB/FB exterior walls, size of CB girder, and rebar and shear ties in FWSC shear keys and basemat
- Slightly increased support saddle bolt size for Passive Containment Cooling System (PCCS) Condenser
- Slightly increased anchor bolt size and corner base plate welds for fuel storage racks in the buffer pool

Seismic and structural analyses and resulting design enhancements demonstrate capability of structures, systems, and components

Dominion

Conclusions

- Dominion implemented design-centered review approach to maximize standardization
- Site-specific topics have been evaluated
- North Anna site is adequate to support construction and operation of NA3

Acronym List

Acronym		Acronym	
APWR	Advanced Pressurized Water Reactor	LWMS	Liquid Waste Management System
CB	Control Building	MOD	Motor Operated Disconnect
CEUS-SSC	Central and Eastern United States Seismic Source Characterization	NA3	North Anna Unit 3
COLA	Combined License Application	PCCS	Passive Containment Cooling System
CSDRS	Certified Seismic Design Response Spectra	PMP	Probable Maximum Precipitation
CST	Condensate Storage Tank	PSHA	Probabilistic Seismic Hazards Analysis
DCD	Design Control Document	RB/FB	Reactor Building/Fuel Building
EPRI	Electric Power Research Institute	R-COLA	Reference-Combined License Application
ESP	Early Site Permit	RG	NRC Regulatory Guide
FIRS	Foundation Input Response Spectra	RTNSS	Regulatory Treatment of Non-Safety Systems
FSAR	Final Safety Analysis Report	SC	Seismic Category
FWSC	Fire Water Service Complex	SSCs	Structures, Systems, and Components
GMM	Ground Motion Model	SRP	Standard Review Plan
GMRS	Ground Motion Response Spectra	SSI	Soil-Structure Interaction
ISG	Interim Staff Guidance	SSSI	Structure-Soil-Structure Interaction

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Protecting People and the Environment

Presentation to the ACRS Full Committee

Staff Review of North Anna 3 ESBWR Combined License Application

November 3, 2016

North Anna 3 Application Summary

- September 25, 2003, North Anna ESP submittal
- November 26, 2007, North Anna 3 ESBWR R-COL Application
- June 28, 2010, Dominion revised its application to the US-APWR
- March 9, 2011 - NRC staff issued the ESBWR DCD FSER.
- **August 23, 2011, Mineral Virginia Earthquake**
- **April 25, 2013, Dominion reverted back to the ESBWR**
- August 30, 2013, submitted S-COL RAI reconciliation from Fermi R-COL after May, 2010, through May 31, 2013
- June 24, 2014, Dominion revised application that incorporated by reference the ESBWR DCD, Revision 10
- **August 16, 2014 - ESBWR DCD Final rule was issued**.
- **October 22, 2014, Dominion submitted its Seismic Closure Plan (SCP).**
- **June 22, 2016, Dominion submitted Revision 9 FSAR incorporating FSAR markups from RAI responses**

North Anna 3 Post Phase 2 COLA Review Summary

- **ACRS Phase 2 Letter** - October 23, 2009, ACRS Letter to EDO Phase 2 SER (ML092890370)

- **Staff SER Phase 2 Confirmatory Items** - Incorporated in FSAR, Revision 6, July 2013 (40 Items) Based on DCD Revision 9.

- **Staff SER Phase 2 Open Items** - Closed by incorporation of approved RAI response In the North Anna 3 FSAR, Revision 8, June 2014 (71 Items) Based on DCD Revision 10.

- **Staff SER Phase 4 Completed-9/16** –DCD Revision 10 Staff SER (NUREG-1966)

- **Staff SER Phase 4 Confirmatory Items - Staff confirmation in progress in FSAR, Revision 9, June 2016 (34 Items) - Phase 6 FSER**

- **Tier 1 [Fukushima] recommendations SECY-11-0137, as modified in SECY-12-0025** - Applicable to North Anna 3 COL review SER Chapter 20

North Anna 3 Site-Specific Review Focus

- Site Specific Non-Seismic Information:
  - **Meteorology and Hydrology**
  - **Industrial Accidents**
  - **Ground Water Accident Release**
  - **Hurricane Missiles**

- Site Specific Seismic Information:
  - **Site Ground Motion**
  - **Seismic Structures**
  - **Fuel Pool Racks**
  - **Fuel & Control Rods**

Section 2.3 - Meteorology

- 2.3.4 - Short-Term (Accidental) Diffusion Estimates:
  - EAB & LPZ accident χ/Q values incorporated from ESP SSAR
  - COL FSAR presented Control Room χ/Q values
  - ESBWR Control Room and offsite χ/Q values conservatively bound the NAPS site-specific values
- 2.3.5 - Long-Term (Routine) Diffusion Estimates:
  - NAPS ESP VAR 2.0-1
  - **Updated analysis to incorporate use of both ground-level and mixed-mode releases**
  - ESBWR routine release offsite χ/Q and D/Q values conservatively bound the NAPS COL site-specific values
- Conclusions:
  - All regulatory requirements have been satisfied
  - No “Open Items”

Section 2.4.3 - Lake Anna Probable Maximum Flood

- Staff accepted ESP Variance 2.4-4 to raise the normal pool elevation of Lake Anna by three inches (from 249.14 ft to 249.39 ft NAVD88)

- Staff's confirmatory analysis and review conclusions:
  - PMF on Lake Anna increases by 0.03 ft with the rise in the normal lake elevation
    - Staff accepted ESP Variance 2.4-5
  - **The Lake Anna PMF elevation remains well below the DCD site parameter elevation of 1 ft below design plant grade**
  - The staff concluded that the LIP flood would remain below the ESBWR DCD site parameter for maximum flood level
  - **The staff concluded that under the LIP sheet-flow depths, certain critical doors to safety-related buildings would require flood protection confirmed in FSAR.**
  - The staff confirmed that the ultimate heat sink does not require an external source of safety-related make-up water, and that there are no safety-related issues associated with the intake, the discharge, or low Lake Anna water levels

Section 2.2 - Nearby Industrial, Transportation, and Military Facilities

❖ <u>**Evaluation of potential accidents:**</u>

- The staff reviewed whether the applicant addressed the additional site specific evaluations of potential accidents. **Staff also performed independent confirmatory calculations in confirming the applicant's conclusions** that the potential impacts due to potential accidents from these additional sources addressed would not impact adversely the safe operation and safe shutdown of the North Anna 3.

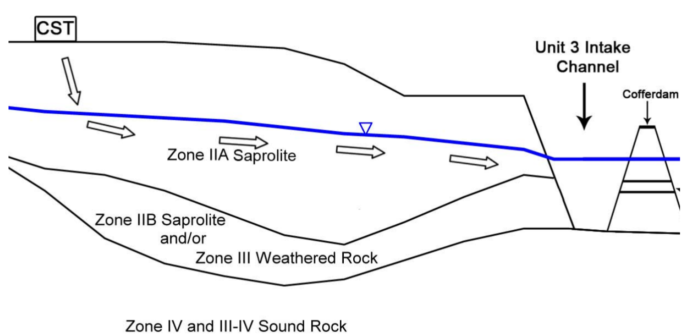
- Based on the review of the applicant provided information, responses to the RAIs, staff evaluations and staff's independent confirmatory analyses.

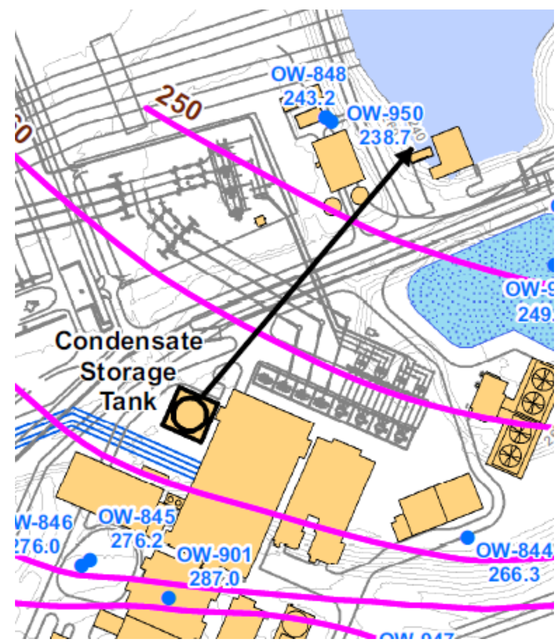
- The staff found the applicant's conclusions to be acceptable as the evaluations are in accordance with the guidance provided in NUREG-0800 Section 2.2.3, and meet regulatory requirements of 10 CFR 100.20(b).

Section 2.4.13 - Accidental Release of Radioactive Liquid Effluent in ground and Surface Waters

- Applicant described features to preclude radioactive releases into potential liquid pathways to satisfy ESP Permit Condition 3.E(3), but nonetheless analyzed an accidental release to groundwater from the condensate storage tank

- The staff confirmed that the shortest and most plausible pathway was to the Unit 3 intake channel. The staff concluded that:
  - Applicants analysis was appropriately conservative
  - **Maximum radionuclide concentrations were below limits**
  - Radionuclide concentrations would be further diluted in Lake Anna before reaching the exclusion area boundary





Chapter 19 Departures - Staff Conclusion

- Staff evaluated Exemption 5 (NAPS DEP 19A-1):
  - The staff finds that Exemption 5 and NAPS DEP 19A-1 appropriately considered hurricane missiles from RG 1.221
  - The design requirements added by the departure ensure RTNSS structures will be designed to the most limiting hurricane missile

Sections 2.5.1, 2.5.3 – Seismology Conclusions

- The applicant's assessment for potential surface expression from the Mineral earthquake was sufficient and appropriate and reveals no measureable surface rupture based on:
  - A suite of geologic maps in consideration with earthquake aftershocks
  - Detailed topographic maps derived from LiDAR data
  - Specific field reconnaissance to determine presence or absence of surface rupture or displacement of numerous river profiles and the South Anna river terrace profile
- Surface deformation at the North Anna 3 site is negligible:
  - **Fault 'a' was previously found to be a geologically old structure (ESP SER)**
  - **Post Mineral VA earthquake field reconnaissance and examination of high resolution topographic maps reveal no rupture or deformation associated with fault 'a'**

Section 2.5.2 - Vibratory Ground Motion

- New and significant information:
  - Occurrence of August 23, 2011 Mineral Earthquake
  - Publication of the Central and Eastern United States Seismic Source Characterization (CEUS-SSC; NUREG 2115)
  - Publication of the new Ground Motion Models (EPRI, 2013)
  - Availability of additional site-specific geophysical information
- Mineral, Virginia Earthquake:
  - August 23, 2011
    - M5.8 earthquake approximately 11 mi (18 km) from NAPS Site
    - Located in Central Virginia Seismic Zone (i.e., known region of elevated seismicity, and small to moderate earthquake)
    - Exceeded SSE for currently operating Unit 1 (post-earthquake evaluations found no damage to plant SSCs)
  - **Prompted staff to request reassessment of ESP PSHA**
    - **Using CEUS-SSC (NUREG-2115)**

Section 2.5.2 - Conclusions

- The applicant adequately addressed new and significant information related to the Mineral, Virginia earthquake, the CEUS-SSC model, and additional pertaining subsurface geologic condition

- **The site-specific GMRS adequately represents the seismic hazard at the North Anna 3 site and meets the relevant regulatory requirements provided in 10 CFR Parts 52 and 10 CFR 100.23**

- The site specific vibratory ground motion meets the ESBWR DCD design criteria

Sections 3.7, 3.8 Departures - Background & Scope

- Background:
  - The site-specific foundation input response spectra (FIRS) exceed the DCD certified seismic design response spectra (CSDRS)
  - **The seismic inputs include both the CSDRS and site-specific FIRS for evaluation of RB/FB, CB, and FWSC**
  - The applicant performed site-specific seismic analyses and design evaluations to demonstrate the adequacy of the ESBWR standard design at the NA3 site
- Review Scope:
  - The Review of seismic analyses and design evaluations of RB/FB, CB, FWSC, RCCV including PCCS Condenser, CIS, New and Spent Fuel Storage Racks
  - Review of applicable Tier 1 and Tier 2 information in the FSAR (NAPS DEP 3.7-1, COL Part 7 Departure Report), technical reports, RAI responses, and supporting calculations (during audits)
  - **Confirmatory analyses of the seismic input motions, strain-compatible soil profiles, and SSI effect on FWSC**
  - Review of V&V of seismic analysis codes for NA3 application

Sections 3.7, 3.8 Departures - Staff Review Results

- Results of Staff Review:
  - Staff issued 29 RAIs based on review of FSAR Rev. 7 and Rev. 8
  - In response to RAIs, the applicant modified its approach to performing certain aspects of the seismic analysis and developed a Seismic Closure Plan (SCP)
  - The applicant performed 18 SSI analysis cases for each of the RB/FB, CB, and FWSC, and 17 SSSI cases, for a total of 71 cases to establish the seismic demand at NA3
  - Staff conducted review in two phases with two on-site audits: (a) Phase 1 site-specific seismic demand, and (b) Phase 2 for reviewing the structural evaluation of the standard design for NA3 seismic demand
  - **The FSAR Appendix 3G shows that the standard design is adequate to resist the site-specific seismic demand except in a few cases.**
  - **The design changes include: modifying the arrangement of some steel reinforcements and shear ties, the size of a steel girder, weld size, and anchor bolt sizes. No changes to the thickness of the concrete walls and slabs were needed**

Sections 3.7, 3.8 Departures - Conclusions

- Conclusions:
  - As documented in Chapter 3 of the FSER, the staff confirmed that the site-specific seismic design methodology for SSCs is acceptable. At the NA3 site, with the identified changes, the **ESBWR standard design is adequate to meet the site-specific seismic demand**
  - The site-specific ISRS that exceed the standard design ISRS, are used along with the standard design ISRS for seismic design and qualification of equipment and components
  - The staff has reviewed the NA3 COL application and the relevant information in the ESBWR DCD incorporated by reference and concludes that sufficient information has been provided to satisfy the NRC regulations and guidance

Fuel Storage Rack Departure - Evaluation

- Staff evaluated the Fuel Storage Rack (FSR) departure and determined that:
  - Standard design of spent FSRs in the spent fuel pool is adequate
  - For the spent FSRs in the buffer pool deep pit, changes in the size of the anchor bolts and welds were necessary
  - For the new FSR in the buffer pool, changes in the size of the anchor bolts were necessary

Chapter 4 Departures - Reactor Design

- Staff evaluated the Seismic Departure on the Fuel and Control Rod Design:
  - Staff confirmed that the methodology used to determine site-specific fuel accelerations was consistent with methods approved in the DCD
  - Staff confirmed that the methodology for combining loads was consistent with the DCD methodology and regulatory guidance
  - Staff assessed applicant’s evaluation and agrees that the fuel and control rod capacities are sufficient to bound the site-specific exceedances, and as-built values will be confirmed by ITAAC

North Anna 3 COLA Review

Staff Conclusion

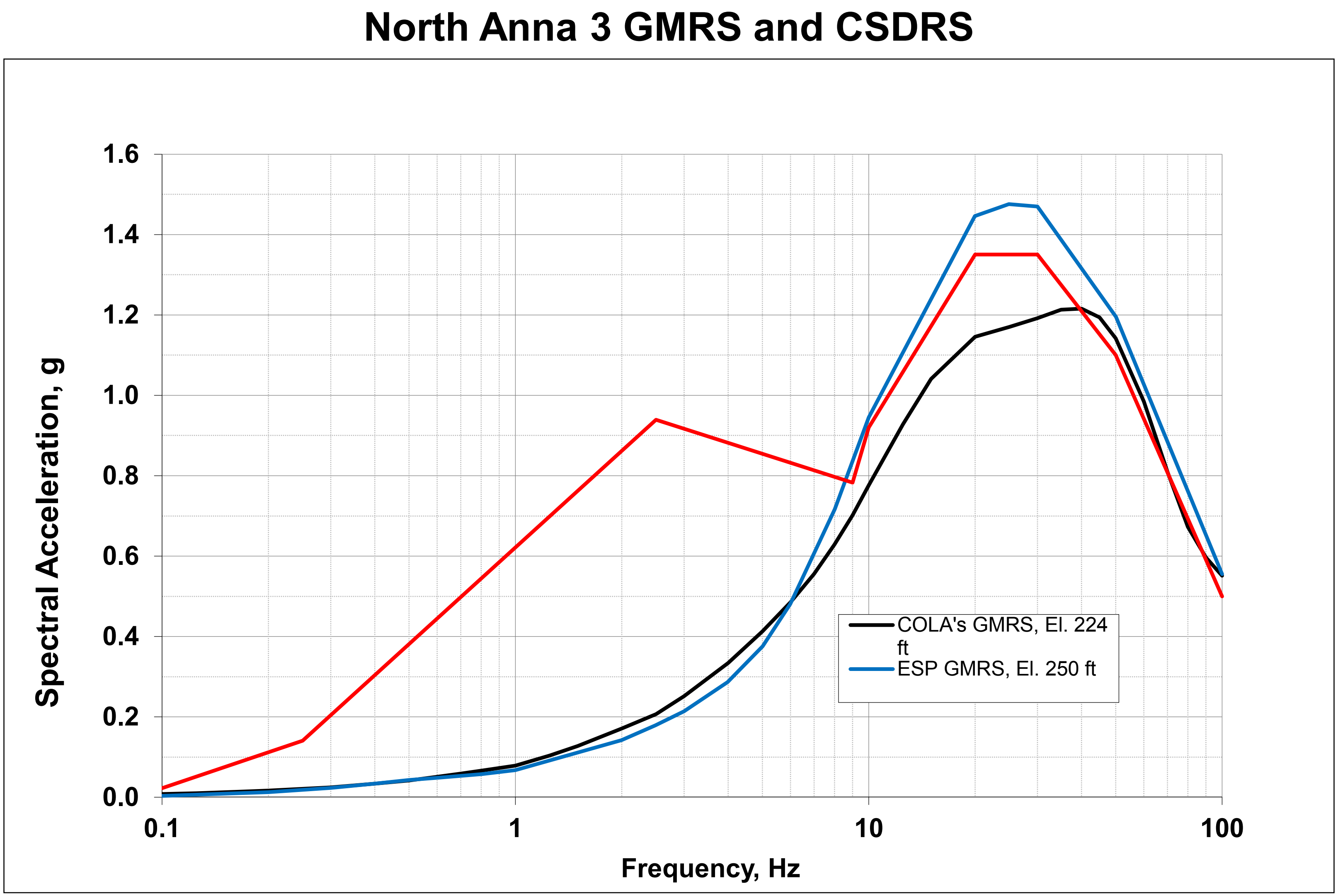
- Staff has completed a through review of the North Anna 3 COLA
- Staff has addressed all Confirmatory Items / Open Items from Phase 2 SER.
- Published Phase 4 AFSE represents the Staff Final Safety Review findings of the North Anna 3 ESBWR COLA.
- The Phase 6 FSER (December 2016) completes the Administrative final preparation for NUREG Publication of the staff NA3 COL SER.
- Staff looks forward to the Committee letter following its review of the Staff AFSE.
- Turnover to ACRS Subcommittee Chairman

Backup Slides

North Anna 3 COLA Review List of Abbreviations Used

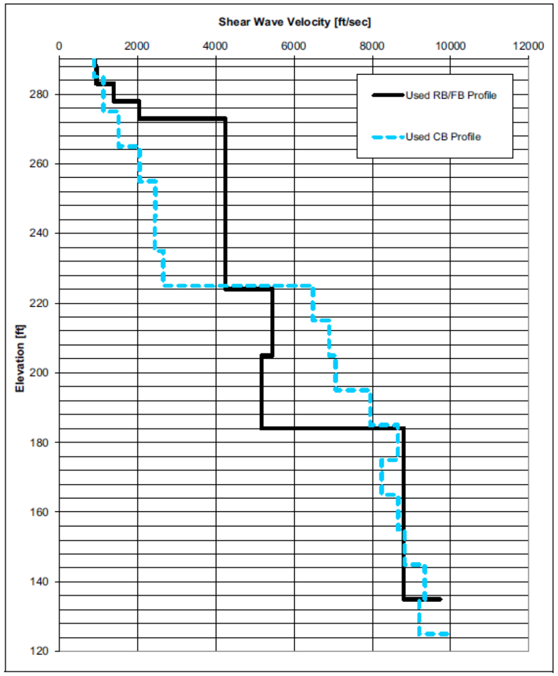
- ACRS – Advisory Committee on Reactor Safeguards
- ATWS – Anticipated Transient Without Scram
- BNL – Brookhaven National Laboratory
- CB – Control Building
- CCF – Common Cause Failure
- CEUS SSC - Central and Eastern United States Seismic Source Characterization
- CIS – Containment Internal Structures
- COL – Combined License
- CSDRS – Certified Seismic Design Response Spectrum
- DBA – Design Basis Accident
- DCD – Design Control Document
- DPS – Diverse Protection System
- EPRI- Electric Power Research Institute
- ESBWR – Economic Simplified Boiling Water Reactor
- ESF – Engineered Safety Feature
- FB – Fuel Building
- FIRS – Foundation Input Response Spectrum
- FSAR – Final Safety Analysis Report
- FWSC – Fire Water Service Complex
- GDC – General Design Criteria
- GMRS- ground motion response spectrum
- I&C – Instrument and Control
- I/O – Input and Output
- ICP – Independent Control Platform
- IEEE – Institute of Electrical and Electronics Engineers
- ISRS – In-Structure Response Spectra
- LTR – Licensing Technical Report
- N-DCIS – Non-Safety-Related Distributed Control and Information System
- NA3 – North Anna Unit 3
- NMS – Neutron Monitoring System
- NRC – US Nuclear Regulatory Commission
- OBE- Operating Basis Earthquake Ground Motion
- PCCS – Passive Containment Cooling System
- PSHA- Probabilistic Seismic Hazard Analysis
- Q-DCIS – Safety-Related Distributed Control and Information System
- QA – Quality Assurance
- RAI – Request for Additional Information
- RB – Reactor Building
- RCCV – Reinforced Concrete Containment Vessel
- SCP – Seismic Closure Plan
- SRP – Standard Review Plan
- SSC – Structure, Systems, and Components
- SSE- Safe Shutdown Earthquake Ground Motion
- SSI – Soil Structure Interaction
- SSSI – Structure Soil Structure Interaction
- V&V – Verification and Validation

North Anna 3 COLA Review



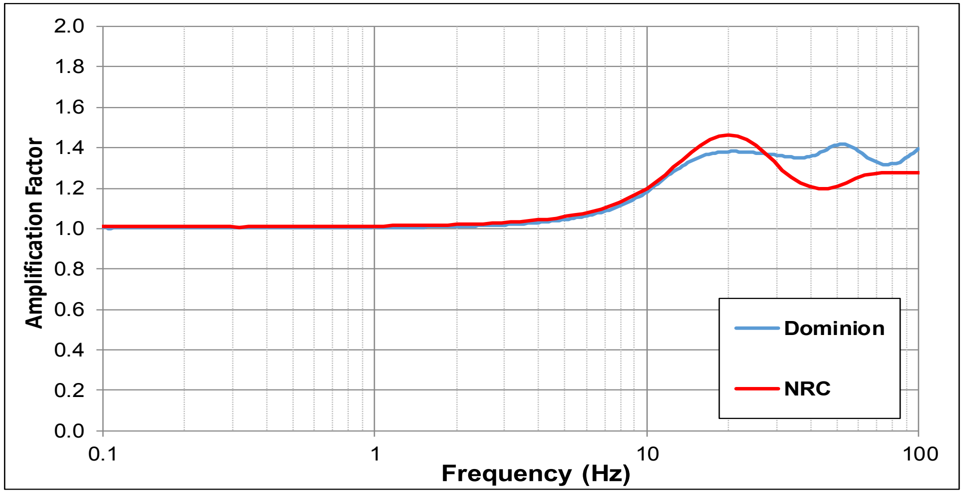
North Anna 3 COLA Review

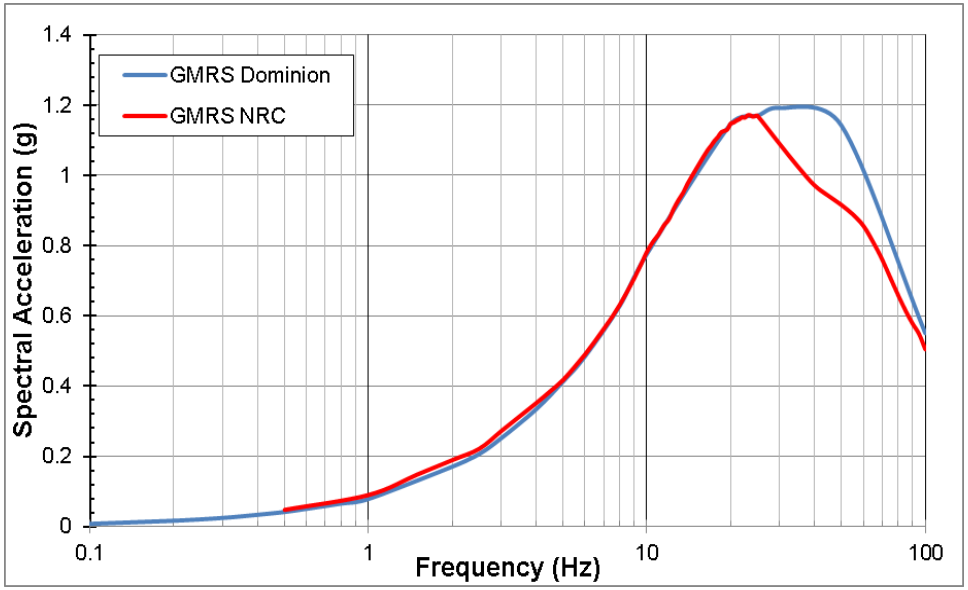
Confirmatory Site Response Analysis



Shear-wave velocity profiles for the RB/FB and CB buildings used for site response calculations (from FSAR Figure 2.5.2-259)

The staff performed an independent site response analysis and confirmed applicant's site amplification and GMRS calculations



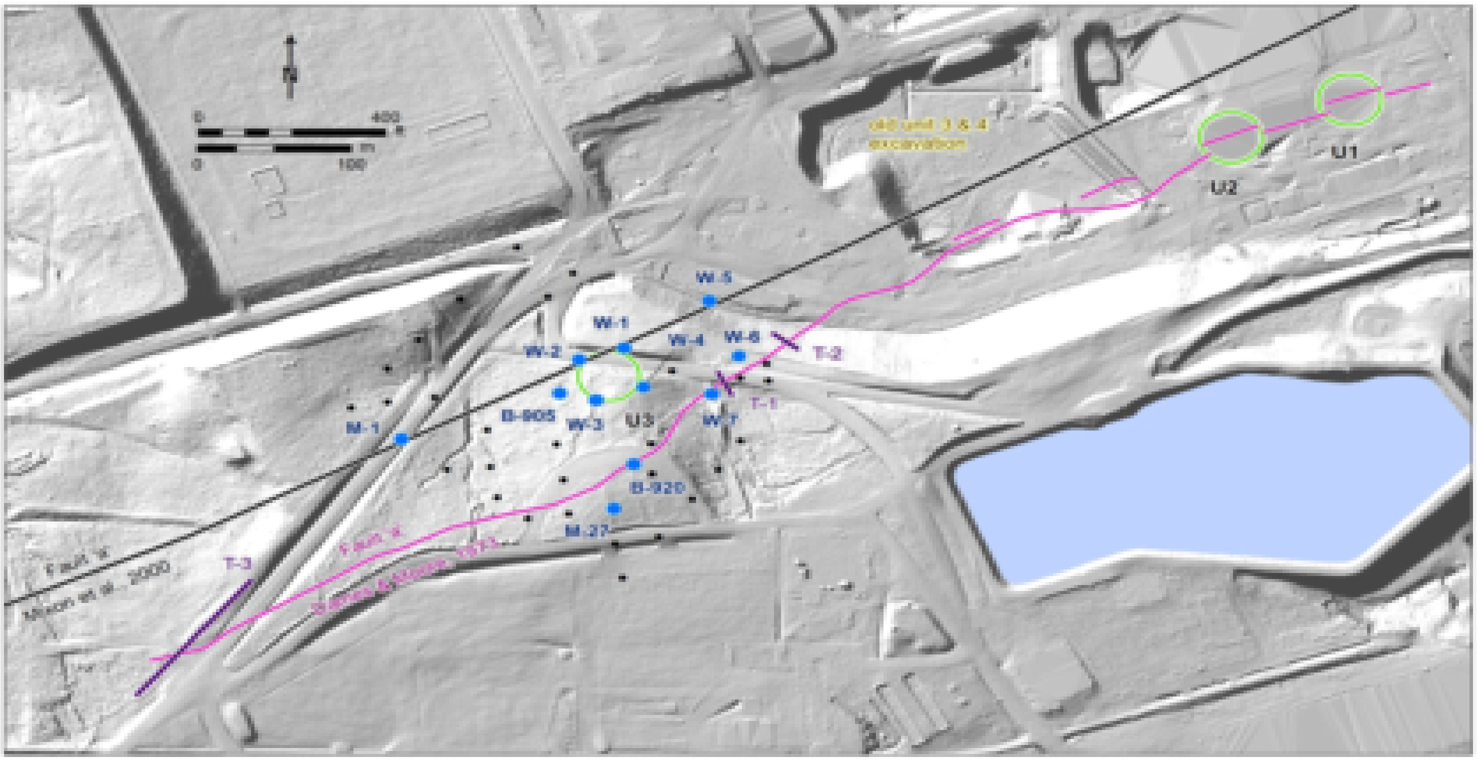


Section 2.5.1 - Geologic Mapping and Faults

- Chopawamsic fault:
  - Remapped by Burton et al, 2014
  - Structurally below the aftershock sequence
- Harris Creek and Roundabout Farm faults:
  - Newly identified by Burton et al, 2014
  - Trenches in soil/ saprolite reveal no quarterly deformation
- Longbranch fault:
  - Structurally higher than aftershock sequence
- Fault 'a':
  - No alignment of aftershock data with this fault
  - Field reconnaissance and LiDAR data confirm no reactivation of fault
  - Previous ESP SER concluded fault is certainly older than 1 Ma.

North Anna 3 COLA Review

Fault 'a' Near North Anna 3 Site

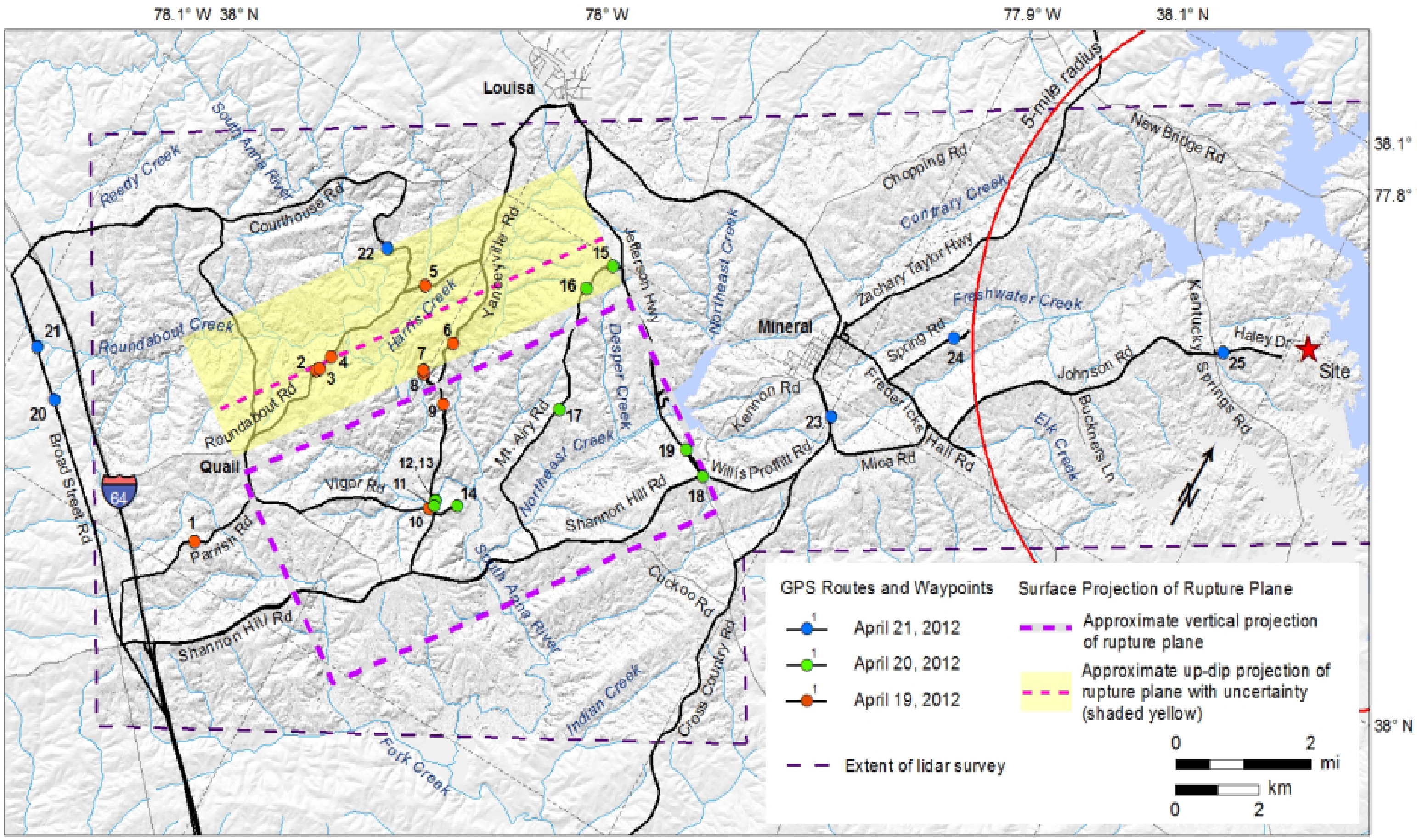


Map of fault 'a" showing 3 trenches from Dames and Moore, 1973, also reconnaissance level interpretation (Mixon et al, 2000). Basemap LiDAR-derived hillshade map showing locations of key Unit 3 borings. (from NA Response to RAI 7477 Question 2.5.1-6d, Figure 1).

From NAPS FSAR Figure 2.5.1-214

North Anna 3 COLA Review

Geologic Field Reconnaissance Program: Epicentral Area, LiDAR Survey Extent, Routes, and Waypoints



From NAPS FSAR Figure 2.5.1-204

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Overview of Major Technical Elements of 10 CFR Part 61

David Esh, PhD
Senior Risk Analyst
United States Nuclear Regulatory Commission

Presented to the Advisory Committee on Reactor Safeguards, November 3, 2016

Outline

- Part 61 Overview
- Safety Case
- Defense-in-Depth (DID)
- Analysis Timeframes
  - Technical Basis
  - Significant Quantities
- Technical Analyses
  - Performance Assessment
  - Intruder Assessment
  - Site Stability
- Waste Acceptance Requirements

Part 61 Overview

- Safety case and defense-in-depth protections.
- Site-specific technical analyses (performance assessment, intruder assessment, site-stability).
- Time of compliance considering waste characteristics.
- Site-specific intruder receptors.
- Waste acceptance criteria may be developed based on the results of the technical analyses.
- Modern dose methodologies.
- Consideration of uncertainty.
- Model support.
- Site characteristics consider waste characteristics and are risk-informed, performance-based.

Safety Case

- Added at direction of Commission. Defined as combination of DID and technical analyses.
- Plain language description of the arguments and evidence to demonstrate the safety of a land disposal facility.
- Describes all safety relevant aspects of the disposal site, the design of the facility, and the managerial control measures and regulatory controls to inform the decision whether to grant a license.
- Includes the same type of information that the original 10 CFR Part 61 required to be submitted as part of a license application (i.e., 10 CFR 61.10 – 10 CFR 61.16).
- The safety case will be updated over time as new information is gained during the various phases of the facility's development and operation.

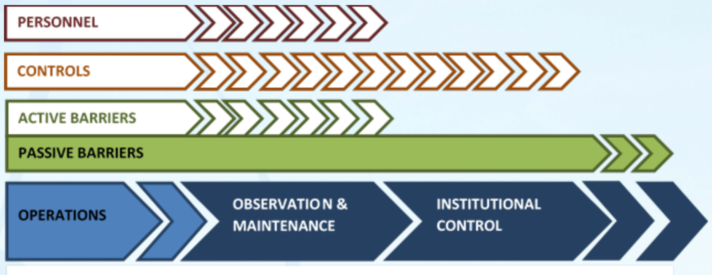
Defense-in-Depth

- The use of multiple, independent, and, where possible, redundant layers of defense so that no single layer, no matter how robust, is exclusively relied upon.
- Identify defense-in-depth protections commensurate with risks.
- Describe capabilities of defense-in-depth protections.
- Provide a technical basis for capabilities of defense-in-depth protections.

IMPLICIT

↓

EXPLICIT



Note: Lifecycle timeframes not to scale

Defense-in-Depth for LLW Disposal

- Operations
  - Provide for active and passive safety systems commensurate with the hazard and complexity of the activities.
- Post-Closure
  - Disposal site is a passive system, relying on both natural site characteristics and engineered features.
  - Each layer of defense must make a definite contribution to the isolation of the waste.

Timeframes

- Throughout the process, significant interest in the analyses timeframes.
- Significant comments received reflecting diverse opinions.
- Staff devoted significant effort to the formulation of the final position.

Timeframes

Existing:

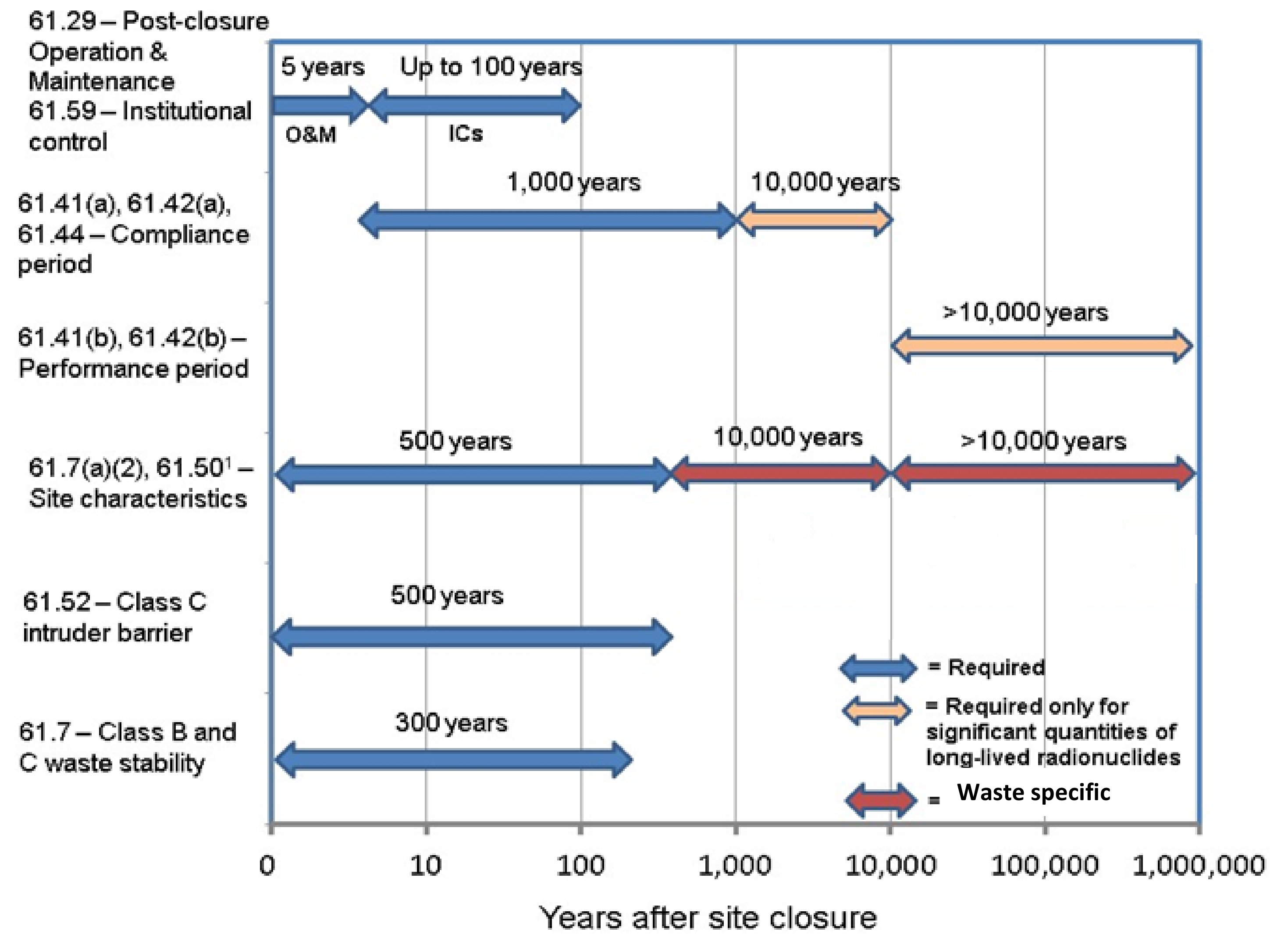
Compliance period not defined for §61.41 and §61.44. Inadvertent intruder protected at any time (§61.42).

Proposed Final:

Compliance period is 1,000 years if a site does not contain significant quantities of long-lived waste, otherwise 10,000 years.

Performance period for > 10,000 years only applies if longer compliance period used. Standard is to minimize exposures to the extent reasonably achievable.

Timeframes

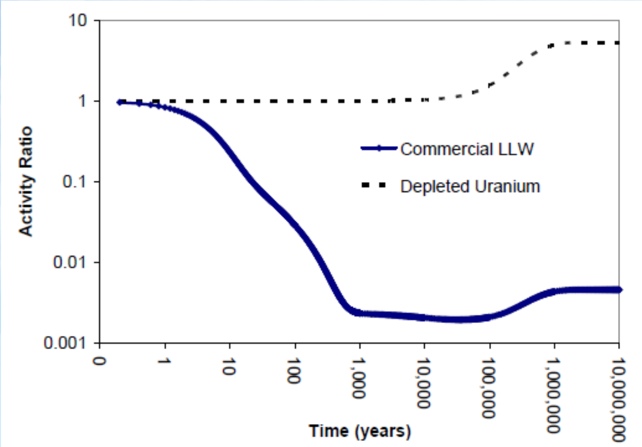


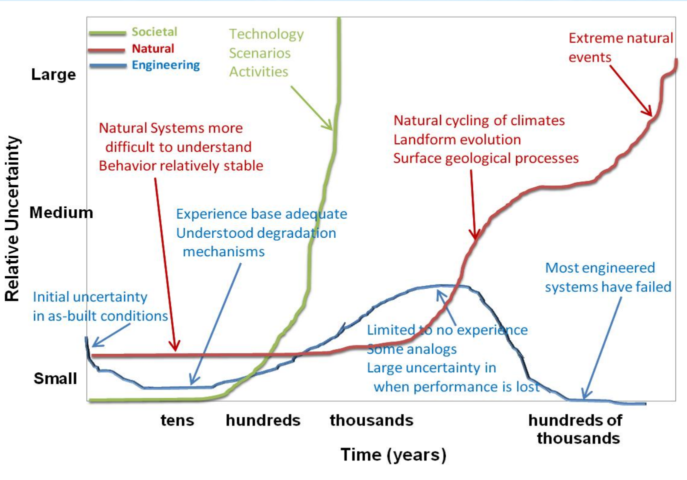
61.29 – Post-closure Operation & Maintenance
61.59 – Institutional control
5 years
Up to 100 years
O&M
ICs
61.41(a), 61.42(a), 61.44 – Compliance period
1,000 years
10,000 years
61.41(b), 61.42(b) – Performance period
>10,000 years
61.7(a)(2), 61.50[1] – Site characteristics
500 years
10,000 years
>10,000 years
61.52 – Class C intruder barrier
500 years
61.7 – Class B and C waste stability
300 years
= Required
= Required only for significant quantities of long-lived radionuclides
= Waste specific
0
10
100
1,000
10,000
100,000
1,000,000
Years after site closure

Timeframes – Technical Basis

- Waste characteristics
- Domestic experience
- International experience
- Uncertainties
- Policy
- ACRS interactions

"White paper" – ML111030586





Timeframes – Domestic

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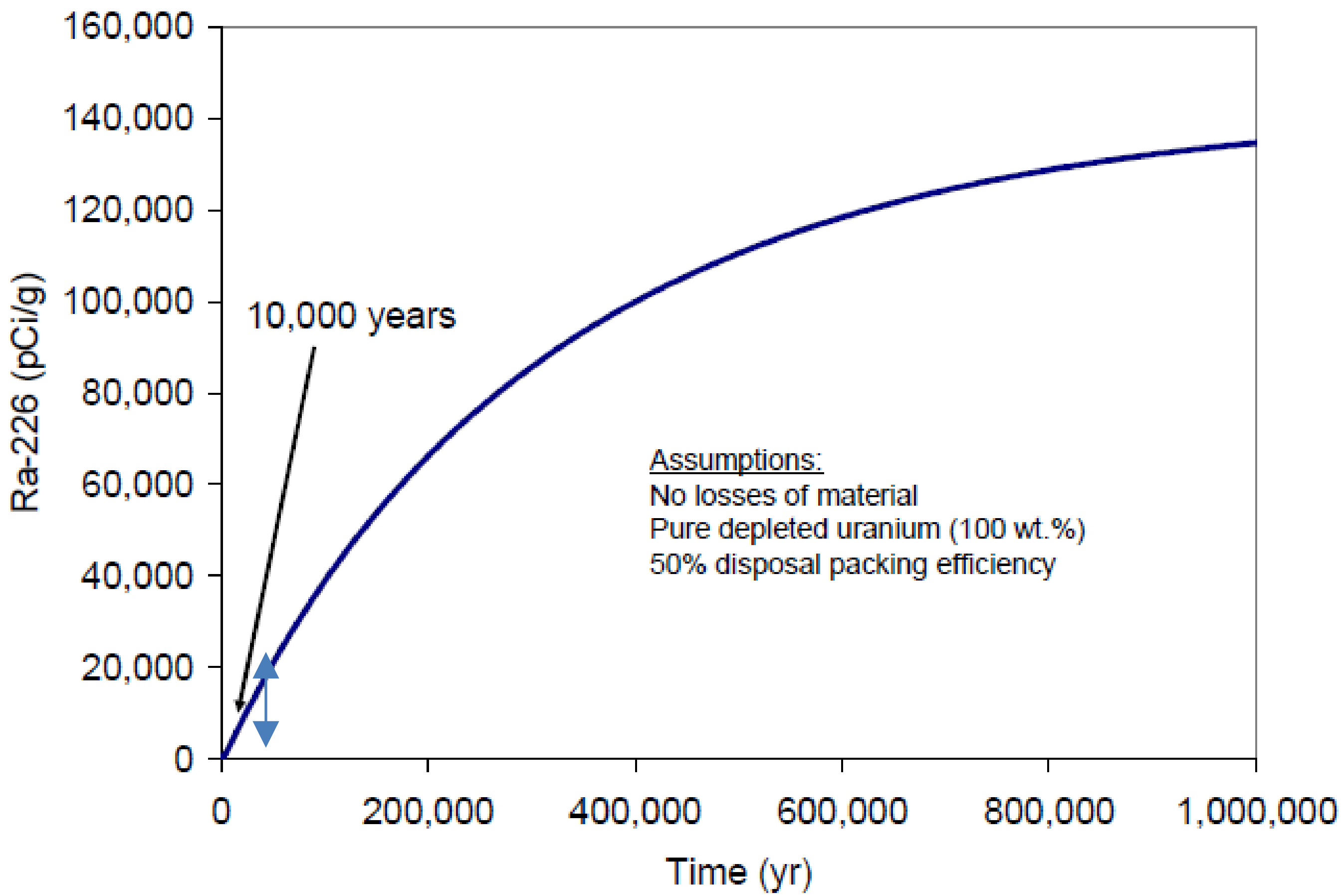
Material	Hazard	Hazard Duration	Action	Compliance Period
EPA RCRA	Chem	∞	Disposal	30+ yrs
Uranium Mill Tailings	Rad	LL	Remediate	200 yrs (<1000 yrs)
Part 20 Decommission Criteria	Rad	VSL	Release	1000 yrs
DOE Order 435.1	Rad	SL	Disposal	1000 yrs
LLW Disposal Facility	Rad	SL	Disposal	[10,000 yrs] Guidance
EPA Underground Injection	Chem	∞	Disposal	10,000 yrs
DOE WIR Determinations	Rad	SL-LL	Remediate	DOE: 1000 yrs NRC: 10,000 yrs
DOE Siting Guidelines (10 CFR 960)	Rad	LL	Screening Action	100,000 yrs
EPA HLW/SNF/TRU Generic Standards	Rad	LL	Disposal	10,000 yrs
EPA HLW/SNF Site-Specific Standards	Rad	LL	Disposal	10,000 yrs – 15 mrem 1,000,000 yrs – 100 mrem

LL = long-lived, SL = short-lived, VSL = very short-lived

Why not use mill tailings requirements for DU disposal?



Mill Tailings - Falls City TX ~ 180 pCi/g

Timeframes – Example

Time (Yr)	Radiological Dose Performance Objective	Inventory-Normalized Contaminant Release Rate Limits (ppm/yr)			Basis
		^{99}Tc[(a)]	^{129}I	$NO_3^- + NO_2^-$ (as N)	
1,000[(b)]	25 mrem/yr all-pathways	< 7.2E+04	<1.8E+05	< 4.4E+04	Calculated using 2001 ILAW PA data (Tables 4-1, 4-5, 4-8, and 7-6) and equations (page 7-19)
	4 mrem/yr beta/photon	< 5.2E+04	<7.3E+05		
10,000	25 mrem/yr all-pathways	< 153	< 400	< 93	
	4 mrem/yr beta/photon	< 110	< 162		

(a) Tc release rate limits calculated from the 2001 ILAW PA base analysis case were divided by 5 to account for the total (100%) estimated Tc inventory to be immobilized.

(b) Due to long travel times (>5000 years) through the vadose zone underlying the disposal facility, large contaminant release rates can occur without exceeding the dose performance objective during the 1,000 year time of compliance. The 10,000-year release rate limits more accurately reflect the rates required to ensure that the all-pathways dose performance objective is not exceeded at longer times after contaminants have migrated to the groundwater.

PNNL-14280

Timeframes – International

- Most countries either do not allow near surface disposal of long-lived (LL) waste or place limits on how much can be disposed.
- Most countries place explicit limits on LL-α.
- Limits are not determined by site-specific analyses but are set by regulators/lawmakers.
- Analyses timeframes are set within this context.
- Many countries assess peak hazard.

Timeframes – International

- Many countries classify waste on both activity AND half-life, which creates many advantages.
- IAEA waste classification system does not provide numbers but DU is comparable to intermediate level waste (ILW).
- ILW requires deeper disposal.
- OECD-NEA – Based on ethical considerations, long-lived waste requires deep geologic disposal.

Timeframes – Comments

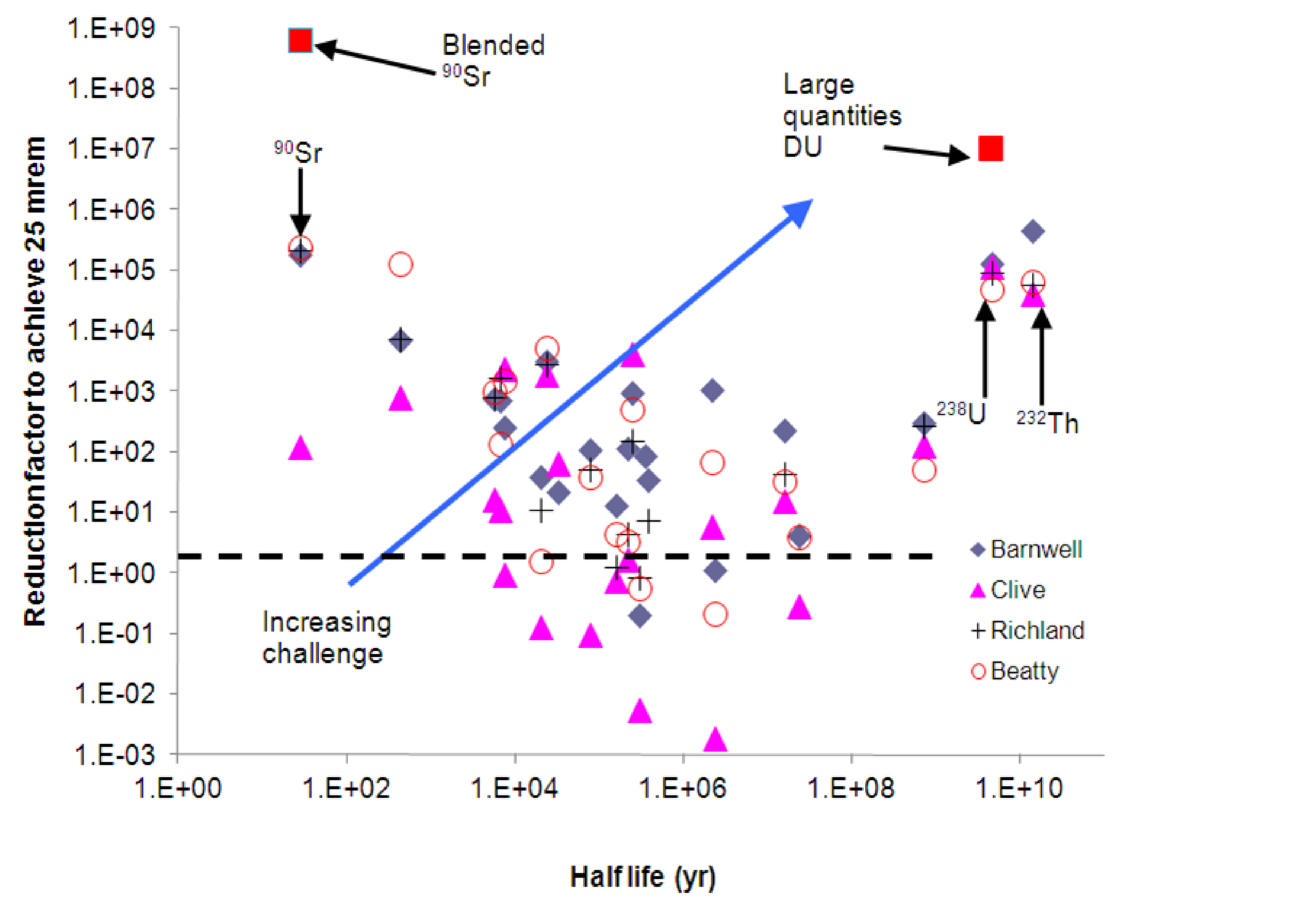
from ICRP 103 - "[D]ose estimates should not be regarded as measures of health detriment beyond times of several hundred years into the future." Rather they represent indicators of the protection afforded by the disposal system. The commission [ICRP] has given specific guidance for disposal of long lived solid radioactive waste in publication 81 and this guidance remains valid."

"Nevertheless, the Commission [ICRP] recognizes a basic principle that individuals and populations in the future should be afforded at least the same level of protection from the action of disposing of radioactive waste today as is the current generation. This implies use of the current quantitative dose and risk criteria derived from considering associated health detriment. Therefore, protection of future generations should be achieved by applying these dose or risk criteria to the estimated future doses or risks in appropriately defined critical groups. These estimates should not be regarded as measures of health detriment beyond times of around several hundreds of years into the future. In the case of these longer time periods, they represent indicators of the protection afforded by the disposal system."

Timeframes – Comments

- "…research results indicated that after 1,000 years, LLRW generated during the course of the normal operation of a nuclear plant poses little risk to the public"
  - Generally true for § 61.42 but not true for § 61.41. LLW may result in significant impacts for longer timeframes.
- Long compliance period will prohibit future licensing
  - Existing facilities licensed (or in process of being reviewed) with longer than 1,000 year compliance period.

Timeframes


Blended ^{90}Sr
^{90}Sr
Large quantities DU
^{238}U
^{232}Th
Increasing challenge
Barnwell
Clive
Richland
Beatty
Reduction factor to achieve 25 mrem
Half life (yr)
1.E+09
1.E+08
1.E+07
1.E+06
1.E+05
1.E+04
1.E+03
1.E+02
1.E+01
1.E+00
1.E-01
1.E-02
1.E-03
1.E+00
1.E+02
1.E+04
1.E+06
1.E+08
1.E+10

Timeframes – Comments

- Uncertainty makes results meaningless
  - Performance assessments are not predictions of the future. Uncertainty is generally not a suitable basis to reduce safety requirements.
- Don't apply burdensome requirements for long-lived waste on traditional waste
  - Proposed final approach will assign analyses timeframes based on the waste.

Significant Quantities

How does one determine if they have significant quantities?

- Start simple and if necessary introduce more complexity

1. Perform screening based on inventory
2. Perform screening based on simplified dose assessment
3. Site-specific analysis (case-by-case)

Long-lived Radionuclides

- *Long-lived radionuclide* means radionuclides:
  - Where more than 10 percent of the initial activity of the radionuclide remains after 1,000 years
  - Where the peak activity from progeny occurs after 1,000 years; or
  - Where more than 10 percent of the peak activity of the radionuclide (including progeny) within 1,000 years remains after 1,000 years

Significant Quantities - Guidance

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

Table 6-1 Long-lived Isotopes Potentially Present in LLW Performance Assessment Inventories

Isotope	Half-life (yr)	Long-lived		LLW PA Inventory[1]	Isotope	Half-life (yr)	Long-lived		LLW PA Inventory[1]
		Parent	Progeny[2]				Parent	Progeny[2]	
Al-26	7.17×10^5	X			U-233	1.59×10^5	X	Th-229	Yes
C-14	5,730	X		Yes	U-234	2.45×10^5	X	Th-230	Yes
Cl-36	3.01×10^5	X		Yes	U-235	7.038×10^8	X	Pa-231	Yes
K-40	1.3×10^9	X			U-236	2.342×10^6	X	Th-232	Yes
Ni-59	7.5×10^4	X		Yes	U-238	4.468×10^9		U-234	Yes
Se-79	1.1×10^6	X			Np-237	2.14×10^6	X	U-233	Yes
Zr-93	1.53×10^6	X			Pu-238	87.7		U-234	Yes
Nb-94	2.0×10^4	X			Pu-239	2.41×10^4	X	U-235	Yes
Tc-99	2.14×10^5	X		Yes	Pu-240	6.54×10^3	X	U-236	Yes
Pd-107	6.56×10^6	X			Pu-241	14.4		Np-237	Yes
Sn-126	1×10^5	X			Pu-242	3.76×10^5	X	U-238	Yes
I-129	1.6×10^7	X		Yes	Pu-244	8.26×10^7	X	Pu-240	
Cs-135	3×10^6	X			Am-241	432		Np-237	Yes
Sm-146	1×10^8	X			Am-242m	16 hr		U-234	Yes
Pm-147	2.62		Sm-147		Am-243	7.38×10^3	X	Pu-239	Yes
Sm-147	1.06×10^{11}	X			Cm-242	0.446		U-234	
Eu-152	13.3		Gd-152		Cm-243	28.5		Am-243	
Gd-152	1.08×10^{14}	X			Cm-244	18.1		Pu-240	
Ra-226	1,600	X		Yes	Cm-245	8.5×10^3	X	Np-237	
Th-229	7.3×10^3	X		Yes	Cm-247	1.56×10^7	X	Am-243	
Th-230	7.7×10^4	X	Ra-226	Yes	Cm-248	3.39×10^5	X	Pu-244	
Th-232	1.41×10^{10}	X		Yes	Cf-249	351		Cm-245	
Pa-231	3.28×10^4	X			Cf-251	898		Am-243	
U-233	1.59×10^5	X	Th-229	Yes	Cf-252	2.64		Cm-248	

Significant Quantities - Example

Example A licensee wishes to dispose of waste at a disposal site that does not have a potable groundwater pathway or any credible mechanisms for release other than from disturbance by inadvertent intruders. The total volume of disposal cells for existing waste is 400,000 m^3. The inventory of waste located in the facility is comprised of: 50,000 m^3 of C-14 containing waste at 0.2 Ci/m^3, 200,000 m^3 of waste containing C-14 at 0.1 Ci/m^3 and I-129 at 0.002 Ci/m^3, and 50,000 m^3 of Tc-99 containing waste at 0.01 Ci/m^3. The uncontaminated fill and material used to construct the cells represents 100,000 m^3.

Conclusion: The licensee uses the Class A waste concentrations to calculate the volume-averaged sum-of-fractions (SOF) per the following equation. This equation is used to calculate the SOF for *n* waste streams containing *m* isotopes. *V* is the volume, *C* is the concentration on a volumetric basis, and *CA* is the Class A waste limit for the particular isotope.

$$SOF = \frac{1}{V_T} \sum_{i=1}^{n} \left(V_i \sum_{j=1}^{m} \frac{C_{i,j}}{CA_{i,j}} \right)$$

$$SOF = \frac{1}{400{,}000\ m^3} * \left(50{,}000\ m^3 \left(\frac{0.2}{0.8} \right) + 200{,}000\ m^3 \left(\frac{0.1}{0.8} + \frac{0.002}{0.008} \right) + 50{,}000\ m^3 \left(\frac{0.01}{0.3} \right) \right) = 0.223$$

Because the SOF is less than 1, a 1,000-year compliance period can be used and performance period analyses are not required.

Who will perform these Technical Analyses? Commercial LLRW Sites in U.S.

Facility	Waste	Compact Restrictions
Richland, WA	A, B, C	11 Western states in 2 LLW Compacts only
Clive, UT	A only	None, all US generators OK (Compacts must approve)
Barnwell, SC	A, B, C	SC, NJ, CT only (Atlantic Compact)
Andrews Cty, Texas	A, B, C	Texas and VT (Texas Compact), Others with Compact approval

Who will perform these Technical Analyses? Commercial LLRW Sites in U.S.

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

- Requirements apply to all facilities that will operate after the regulations go into effect.
- Requirements do not apply retroactively to closed facilities.
- No public health and safety basis was provided to justify limiting the applicability of the requirements to “new” waste.
- Compliance with public dose limit based on consideration of all waste and all pathways.
- There are no backfit provisions for 10 CFR Part 61.

Performance Assessment

Performance assessment is an analysis used to demonstrate compliance with 10 CFR 61.41(a) and (b) that identifies the features, events, and processes that could affect the disposal site performance; and estimates the potential dose as a result of releases caused by all significant features, events, and processes including the uncertainties.

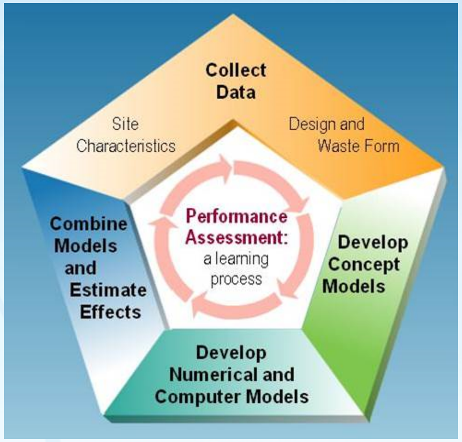
Performance Assessment

- Performance assessment is not a new topic – renaming of technical analyses
- New requirements in §61.13:
  - Scope (features, events, and processes)
  - Uncertainty and variability
  - Model support
- Requirement to update the performance assessment at closure
- Modified siting characteristics consistent with disposal of long-lived waste

IMPLICIT

↓

EXPLICIT



Low-Level Waste – Site-Specific Technical Data

Table 10.2 Retardation Coefficients Assumed for Regional Disposal Facility Sites

Isotope	Regional Site NE	SE	MW	SW
H-3	1	1	1	1
C-14	10	10	10	10
Fe-55	5,400	2,640	2,640	1,290
Ni-59	3,600	1,750	1,790	860
Ni-63	3,600	1,750	1,750	860
Co-60	3,600	1,750	1,750	860
Sr-90	73	36	36	18
Nb-94	10,000	4,640	4,640	2,150
Tc-99	5	4	4	3
I-129	5	4	4	3
Cs-135	720	350	350	173
Cs-137	7,200	350	350	173
U-235	7,200	3,520	3,520	1,720
U-238	7,200	3,520	3,520	1,720
Np-237	2,500	1,200	1,200	600
Pu-238	7,200	3,520	3,520	1,720
Pu-239/240	7,200	3,520	3,520	1,720
Pu-241	7,200	3,520	3,520	1,720
Pu-242	7,200	3,520	3,520	1,720
Am-241	2,500	1,200	1,200	600
Am-243	2,500	1,200	1,200	600
Cm-243	2,500	1,200	1,200	600
Cm-244	2,500	1,200	1,200	600

MI Sheppard and DH Thibault provides a compendium of distribution coefficients (Kd's) *Health Physics*, Vol. 59, No. 4 pp. 471-482 (October) 1990

$$R_f = 1 + \frac{\rho_b K_d}{\theta}$$

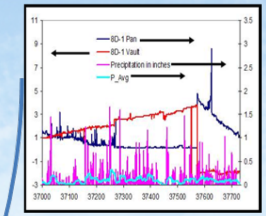
	min	max	GM
Sr	1	1400	90
Tc	1	3	1
Cs	2600	280000	21000
U	2	21000	70
Pu	500	30000	5000

Calculated retardation coefficients

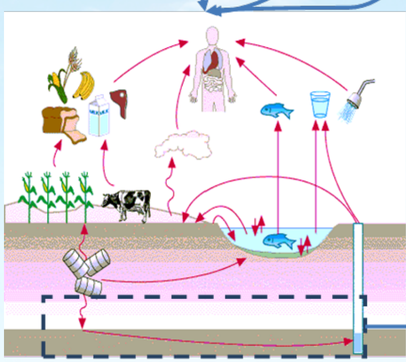
ρ_b=1.6 g/cm^3

θ= 0.35

Performance Assessment - Guidance

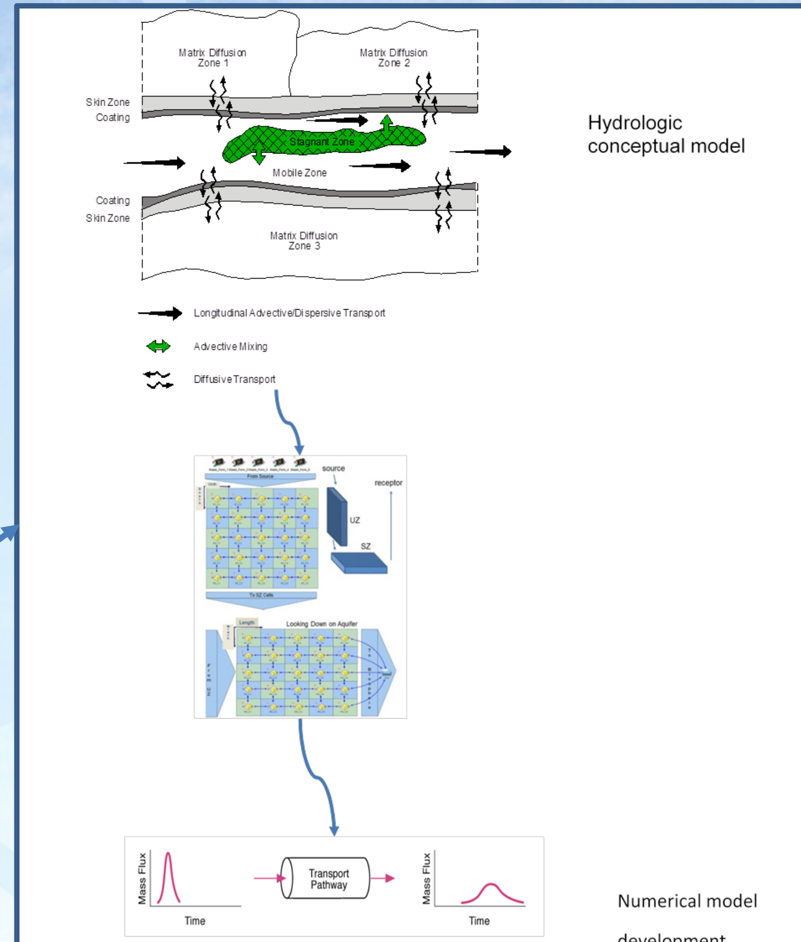


Site characterization data and other information

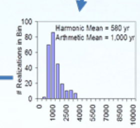


Performance assessment conceptual model development

Hydrologic conceptual model development (see next figure)



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



Abstracted hydrologic model

Estimated system performance

Performance Assessment - Radon

- Some regulations have radon flux limits whereas others include radon in dose limits.
- EPA - 40 CFR 61 in some cases provides radon flux limits (DOE, phosphogypsum stacks, uranium mill tailings disposal) and in others provides standards to include radon as part of public dose limits @ 10 mrem/yr (uranium mines, non-NRC federal facilities).
- Can't resolve the different treatments of radon in regulations in this rulemaking, but can ensure treatment is internally consistent within Part 61 and within NRC in general.

Performance Assessment - Radon

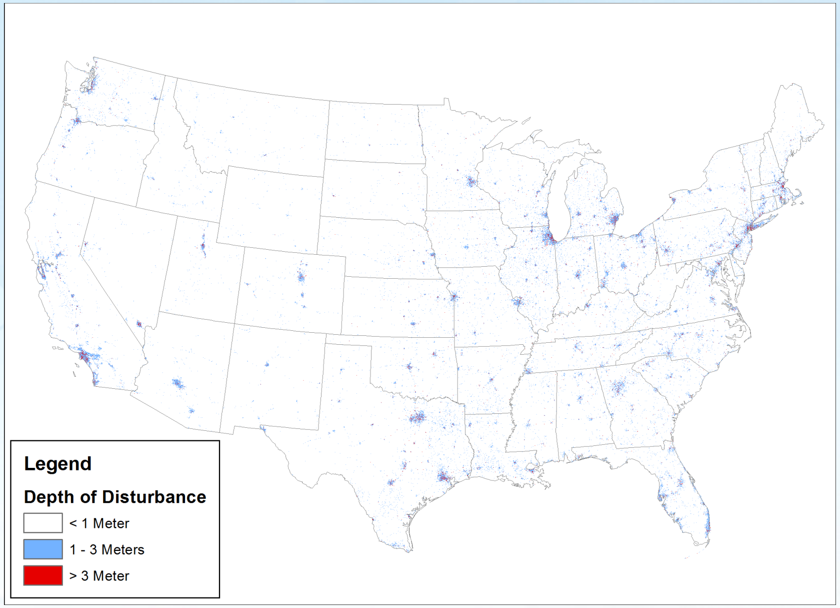
- Current Part 61 considered only small quantities of uranium, therefore radon was not an issue.
- Existing guidance – include radon (NUREG-1573).
- The receptors for different performance objectives (offsite vs. intruder) create practical challenges for application of flux limits.
- NRC public dose limit (10 CFR Part 20.1301) includes all pathways and all radionuclides.
- 10 CFR Part 40 (offsite public) and 10 CFR Part 20 subpart E (restricted release) include radon.

Inadvertent Intrusion Assessment

- Similar to performance assessment, except:
  - Receptor scenarios
  - Onsite exposures
  - 500 mrem/yr limit
  - Precluded during institutional control period (i.e., 100 yrs)

Inadvertent Intruder

- Dose limit (500 mrem/5 mSv) higher than §61.41 and higher than NRC public dose limit (10 CFR Part 20)
- Intruders unlikely albeit possible
- Staff evaluated current national land disturbance (Esh and Gross, 2014)
  - 2.5% of land area disturbed > 1 m



Inadvertent Intruder Receptor - Guidance

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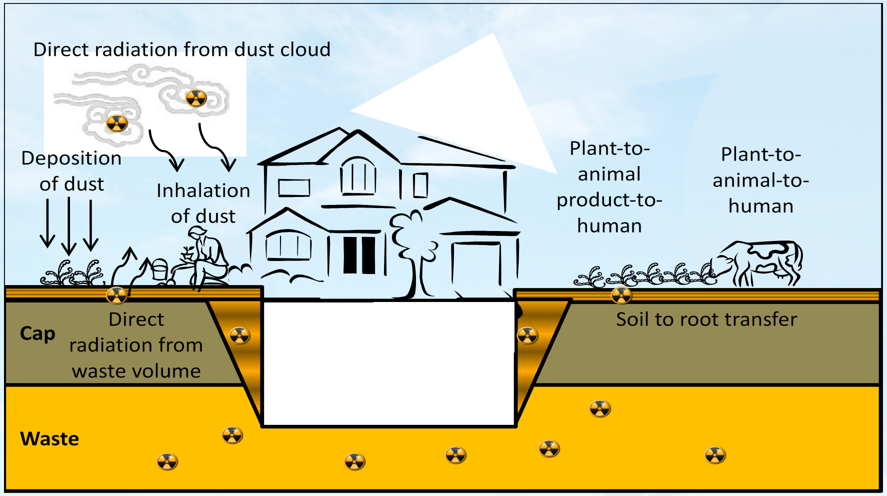
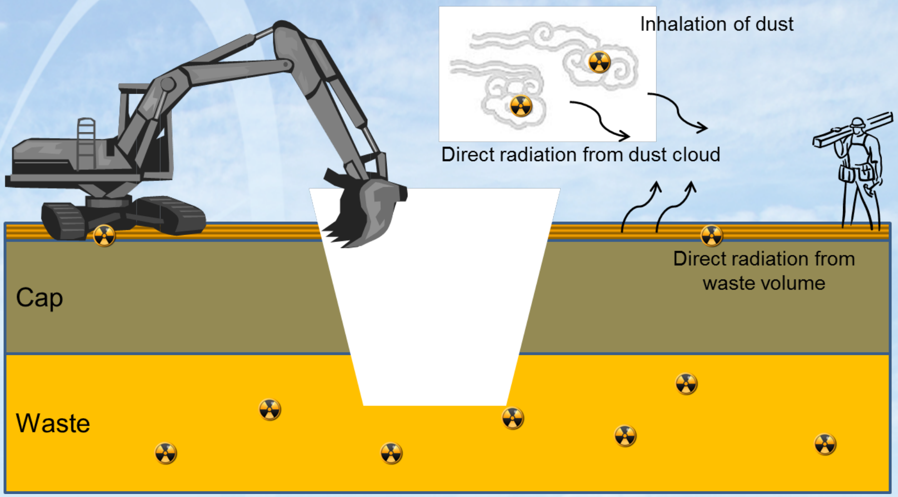
- Normal Activities
  - Dwelling Construction
  - Agriculture
  - Drilling for Water
- Reasonably Foreseeable Activities
  - Consistent with activities in vicinity of site when assessment developed

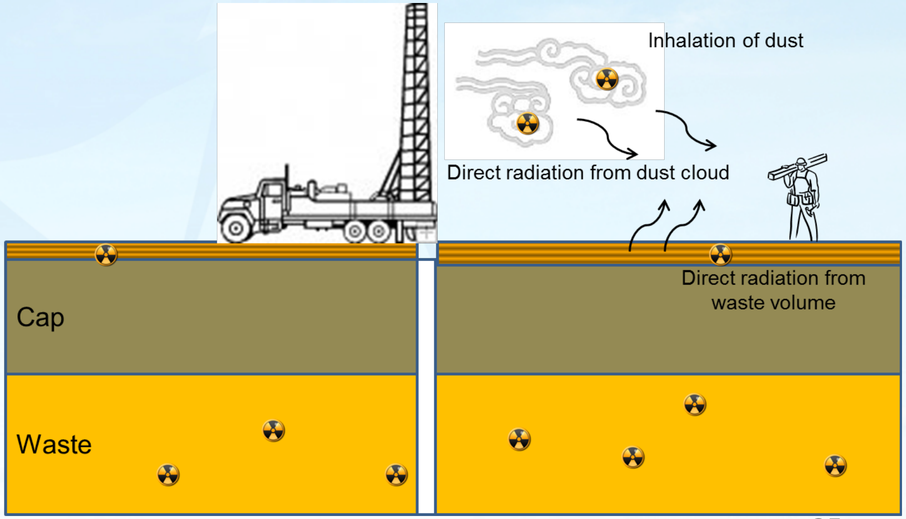
Normal Activities



Agriculture



Dwelling Construction



Drilling for Water

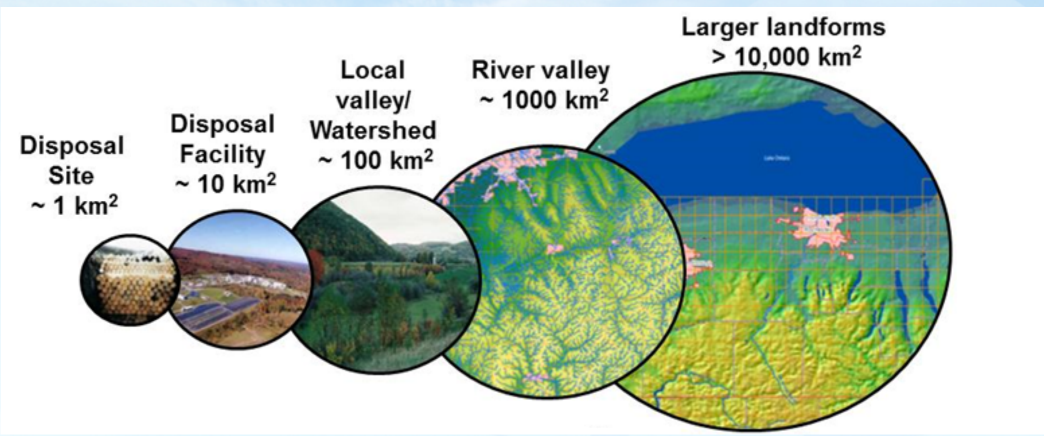
Site-specific Scenarios - Guidance

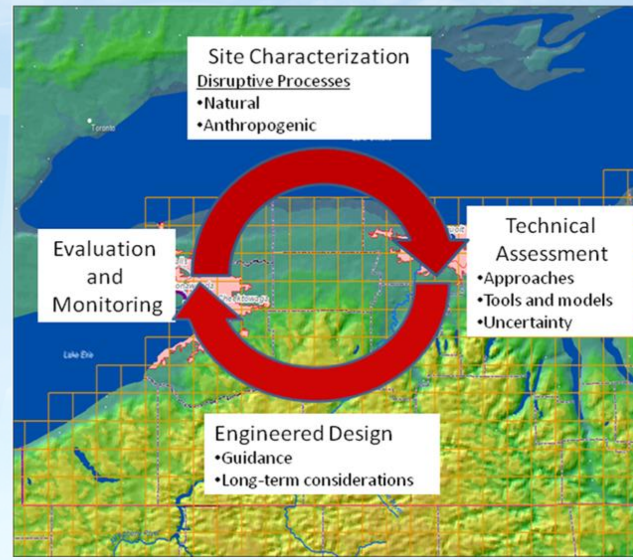
- Constrain exposure pathways for normal or reasonably foreseeable activities based on:
  – Physical information
    - Waste characteristics and disposal practices
    - Disposal site characteristics
  – Cultural information (e.g. land use)
- Provide comparison of results from site-specific scenarios to generic scenarios.

Site Stability

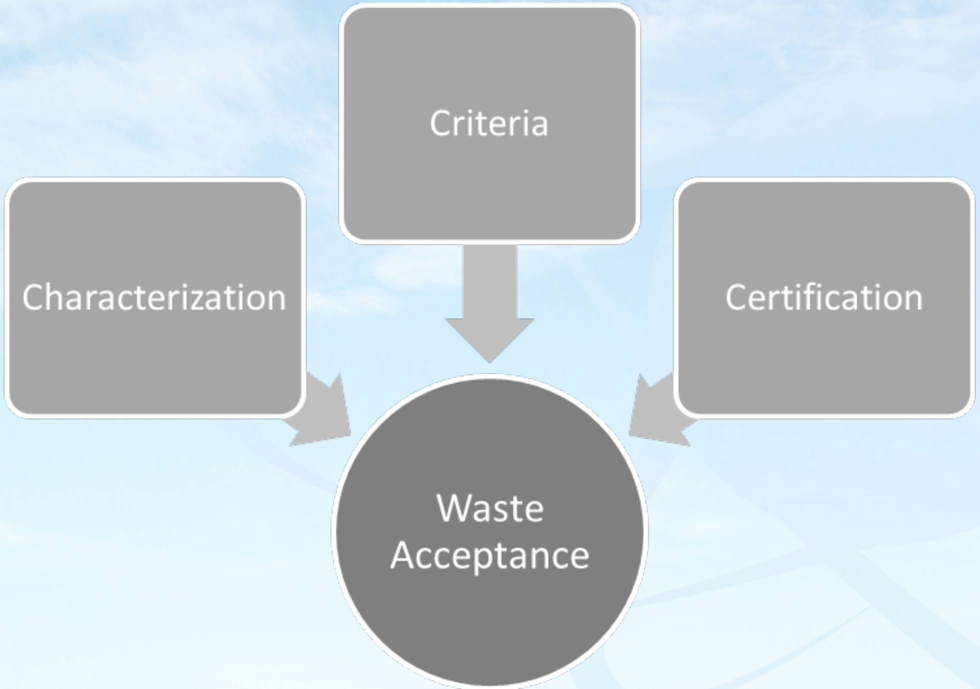
- Consideration of site stability is an important part of the safety strategy.
- Site stability is required for the compliance period but may be performance-based.
- Guidance describes design-based and model-based approaches.

Site Stability - Guidance



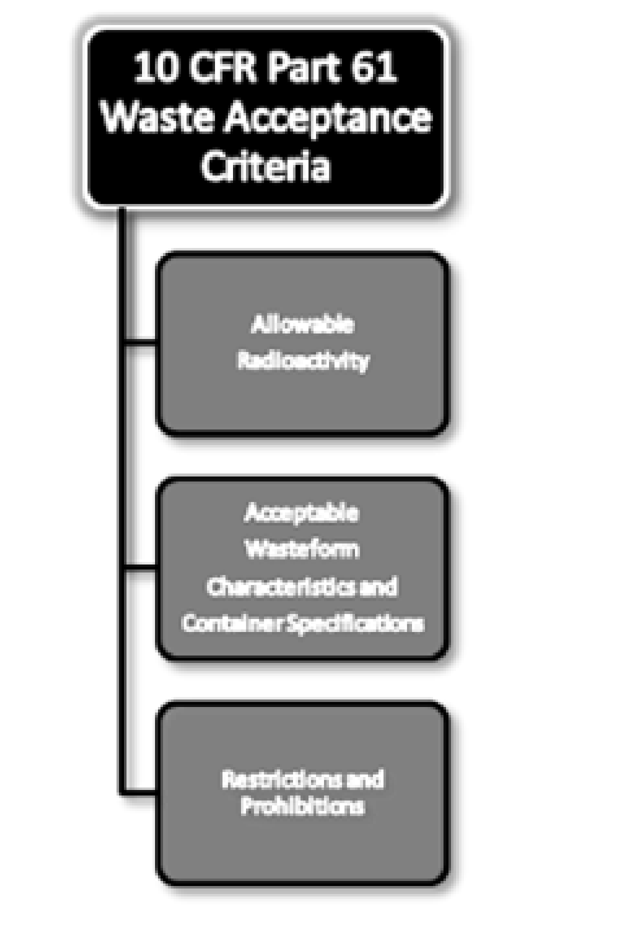


Waste Acceptance Requirements



- Licensees must review their waste acceptance program at least annually
- Ensures that the program continues to be adequate and is being implemented in a way that continues to protect public health and safety

Waste Acceptance Criteria



- Allowable Limits on Radioactivity
- Wasteform Characteristics and Container Specifications
- Restrictions and Prohibitions

Waste Acceptance

- Flexibility to develop site-specific waste acceptance criteria.
- Use §61.55 limits, results of technical analyses, or combination of both to develop criteria.
- Either way, licensees must demonstrate that criteria will demonstrate that performance objectives will be met.

NUREG-2175

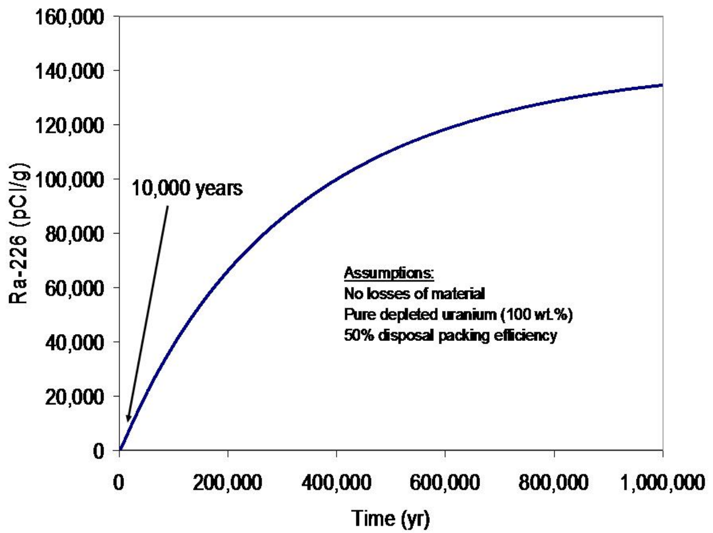
U.S.NRC United States Nuclear Regulatory Commission Protecting People and the Environment

- NUREG-2175 (Guidance for Conducting Technical Analyses for 10 CFR Part 61) provides:
  - Flowcharts, NRC staff recommendations, and examples for how licensees can develop high-quality technical analyses
  - Guidelines for what licensees or applicants should include and what regulators should review for each type of analysis
  - Suggested references, screening tools, and case studies
- DRAFT final version made publically available in ADAMS and on the public website

http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams.html

Backup

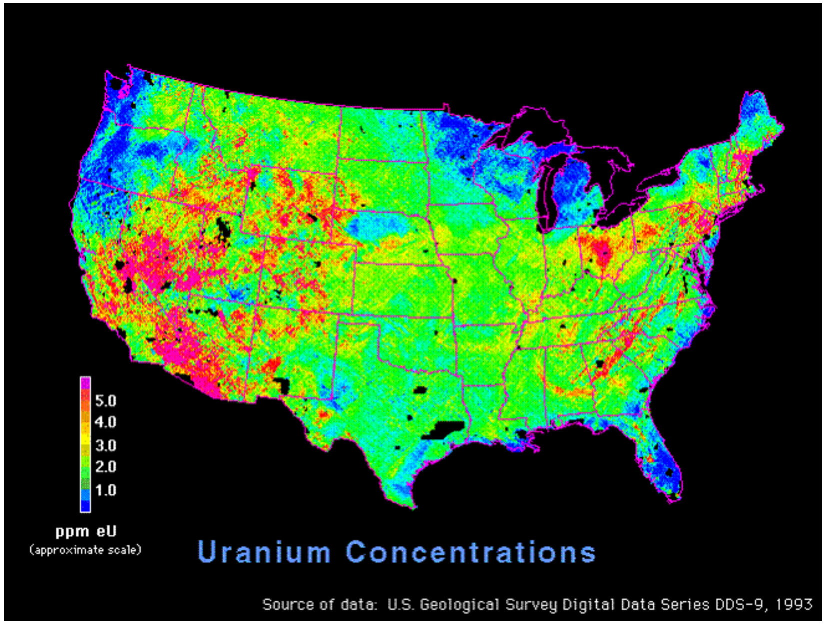
Depleted Uranium : Source Comparison



- Uranium mill tailings contain:
  - 0.004 to 0.02 weight percent U_3O_8,
  - 26 to 400 pCi/g ^{226}Ra,
  - 70 to 600 pCi/g ^{230}Th
- DU contains:
  - 99.9 weight percent uranium oxide
  - Greater than 300,000 pCi/g ^{226}Ra and ^{230}Th (one million years after disposal)
  - Time to exceed upper range of mill tailings concentrations is approximately 1400 years for ^{226}Ra and 500 years for ^{230}Th

Uranium in the Environment

- Uranium in surface soils ~ 1 to 5 ppm
- Mean atmospheric radon is ~ 0.25 pCi/L
- Indoor average radon levels ~ 1.5 to 4.2 pCi/L
- Natural radon flux levels ~ 1 to 2 pCi/m^2-s
- Radon contributes roughly 70% of the average annual dose in the United States (~250 mrem/yr)



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Protecting People and the Environment

10 CFR Part 61 “Low-level Radioactive Waste Disposal” Final Rule

Gary Comfort
Senior Project Manager
United States Nuclear Regulatory Commission

Presented to the Advisory Committee on Reactor Safeguards

November 3, 2016

Discussion Topics

- Background
  - Purpose
  - Commission Direction
  - Past ACRS Interactions
- Proposed Rule Comments
- Draft Final Rule
- Technical Elements
- Path Forward

Purpose of Rule

Problem: Ensuring safe disposal of new waste streams not analyzed as part of original 10 CFR Part 61 regulation

- Depleted uranium (DU)
- Blended wastes
- Future waste streams

Commission Direction

- SRM-SECY-08-0147
  – Rulemaking for site-specific analysis of DU disposal
- SRM-SECY-10-0043
  – Incorporate blending into rulemaking
- SRM-COMWDM-11-0002/COMGEA-11-0002
  – Use two-tired approach with compliance period covering reasonably foreseeable future and longer period of performance
- SECY-13-0075 and SRM
  – Latest rule language ACRS reviewed
  – Commission directed significant changes
  – ACRS encouraged to provide independent review

Commission Direction

Comparison of Draft Rule in SECY-13-0075 and Published Draft Rule

SECY-13-0075	Publication
Analysis Time Frames (2 – tier)	Analysis Timeframes (3 – tier)
Performance Assessment	Performance Assessment
Intruder Assessment	Intruder Assessment
	Explicit Description of Safety Case
	Defense In Depth (DID) Analysis
	Site Stability Analysis
Waste Acceptance Criteria	Waste Acceptance Criteria
Updated ICRP Dosimetry Modeling	Updated ICRP Dosimetry Modeling
Compatibility Category C	Compatibility Category B

= Minor change resulting from SRM Direction

= Major change resulting from SRM Direction

ACRS Letter Reports – Key Issues

- Risk-informed based on site-specific, realistic performance assessments with consideration for uncertainties
  - Realistic assumptions for release and fate and transport of DU
  - Realistic likelihood of intrusion
  - Range of site-specific conditions
- Use timeframes determined on a case-by-case site-specific basis rather than defining specific fixed period of performance

ACRS Letter Reports – Key Issues

- Compliance with performance objectives after institutional control period should be evaluated considering features, events, and processes for a given site for a period commensurate with the site-specific risk
- Protection of inadvertent intruder
  - Large uncertainties associated with human intrusion scenarios will not help decision making
  - Durability and stability should be sufficient
- Previously disposed wastes should not be subject to additional compliance evaluations

Rule status

- Proposed rule
  - SRM-SECY-013-0075 issued February 12, 2014
  - Published for comment on March 26, 2015 (80 FR 16081)
  - 120 day comment; reopened August 27 – September 21, 2015

- Draft final rule
  - Submitted to Commission September 15, 2016 as SECY-16-0106

Public Comments on Proposed Rule

- Received 2,401 comment letters (2,300 form)
  - Extensive public outreach
  - Six workshops and webinar
- Represented:
  - Individuals
  - Public interest groups
  - Native American Tribal Governments
  - Industry groups
  - Licensees
  - State and federal agencies
- Over 800 comments binned and responded to

Examples of Public Comments

- 3-Tier System
  - More complicated than necessary
  - 500 mrem dose goal reduces public health and safety
  - RESPONSE: Changed to new, simplified approach

- Compatibility Category
  - Reduced current health and safety provided by some States
  - Most commenters recommended "C"
  - RESPONSE: Changed compliance period definition and 61.58 to "C"

Examples of Public Comments (Cont)

- Grandfathering
  - 61.1(a) should allow existing sites to grandfather
  - Already disposed of wastes should not need to be addressed
  - RESPONSE: Staff concluded that grandfathering not appropriate and removed confusing language in 61.1(a)
- Backfit
  - Backfit analysis should be done because of impact on other licensees
  - RESPONSE: No backfit in Part 61; NRC doesn’t address passed along costs

Draft Final Rule Major Changes

The rule

- Requires a site specific analysis
- Provides a 1,000 or 10,000 year compliance period for protection of the general public
- Adds a new technical analysis for the protection of inadvertent intruders
- Adds a new post-10,000-year performance period analysis
- Adds a new requirement to update the technical analyses at site closure
- Adds a new requirement to identify defense-in-depth (DID) protections

Draft Final Rule Language –

- 61.12 Specific Technical Information
  - New DID requirement added as 61.12(o)
  - Requires identification of DID protections, including a description of the capability of each DID protection relied upon to maintain safety and a basis for the capability of each DID protection
  - Not an analysis

Draft Final Rule Language –

- 61.13 Technical Analyses

(a) Requires performance assessment for compliance period that:

- Considers features, events, and processes that represent a range of phenomena with both beneficial and adverse effects on performance
- Considers the likelihood of disruptive or other unlikely features, events, or processes
- Provides a technical basis for models used
- Evaluates contaminant transport pathways and processes in environmental media (e.g., air, soil, groundwater, surface water)
- Accounts for uncertainties and variability in the projected behavior of the disposal site and general environment and in the demographics and behaviors of human receptors
- Identifies and differentiates between the roles performed by the natural disposal site characteristics and design features in limiting releases of radioactivity to the general population

Draft Final Rule Language –

- 61.13 Technical Analyses (cont)

(b) Requires inadvertent intruder assessment for compliance period that

  - Assumes inadvertent intruder occupies the disposal site and engages in normal activities and other reasonably foreseeable pursuits that are consistent with the activities and pursuits occurring in and around the site at the time of development of the inadvertent intruder assessment.
  - Is updated prior to closure to reflect any significant changes to the activities and pursuits occurring in and around the site.
  - Identifies barriers to inadvertent intrusion that inhibit contact with the waste or limit exposure and provides a basis for the time period over which barriers are effective.
  - Accounts for uncertainties and variability in the projected behavior of the disposal site and general environment.

Draft Final Rule Language –

- 61.13 Technical Analyses (cont)

(e) Performance period analysis

- Only required if 10,000-year compliance period used
- Assess how disposal site limits the potential long-term radiological impacts during the performance period, consistent with available data and current scientific understanding.
- Must identify and describe features of the design and site characteristics relied on

Draft Final Rule Language –

- 61.41 Protection of the general population from releases of radioactivity

(a) Compliance period

- Limits annual dose to 0.25 milliSieverts (25 millirems) to any member of the public
- Demonstrated through analyses that meet the requirements specified in § 61.13(a).

(b) Performance period

- Must minimize releases of radioactivity to the general environment to the extent reasonably achievable
- Demonstrated through analyses that meet the requirements specified in § 61.13(e).

Draft Final Rule Language –

- 61.42 Protection of individuals from inadvertent intrusion.

  (a) Compliance period

  - Limits annual dose to 5 milliSieverts (500 millirems) to any inadvertent intruder
  - Demonstrated through analyses that meet the requirements specified in § 61.13(b).

  (b) Performance period

  - Must minimize exposures to any inadvertent intruder to the extent reasonably achievable
  - Demonstrated through analyses that meet the requirements specified in § 61.13(e).

Path Forward

- Commission review, including ACRS input
- If approved for publication
  - Incorporate Commission directed changes
  - Send to OMB for review (~90 days)
  - Send to *Federal Register* for publication
- Effective date: 1 year from publication
- License updates due next renewal or within 5 years of effective date
- Agreement States have 3 years from publication to implement compatible regulations

QUESTIONS?

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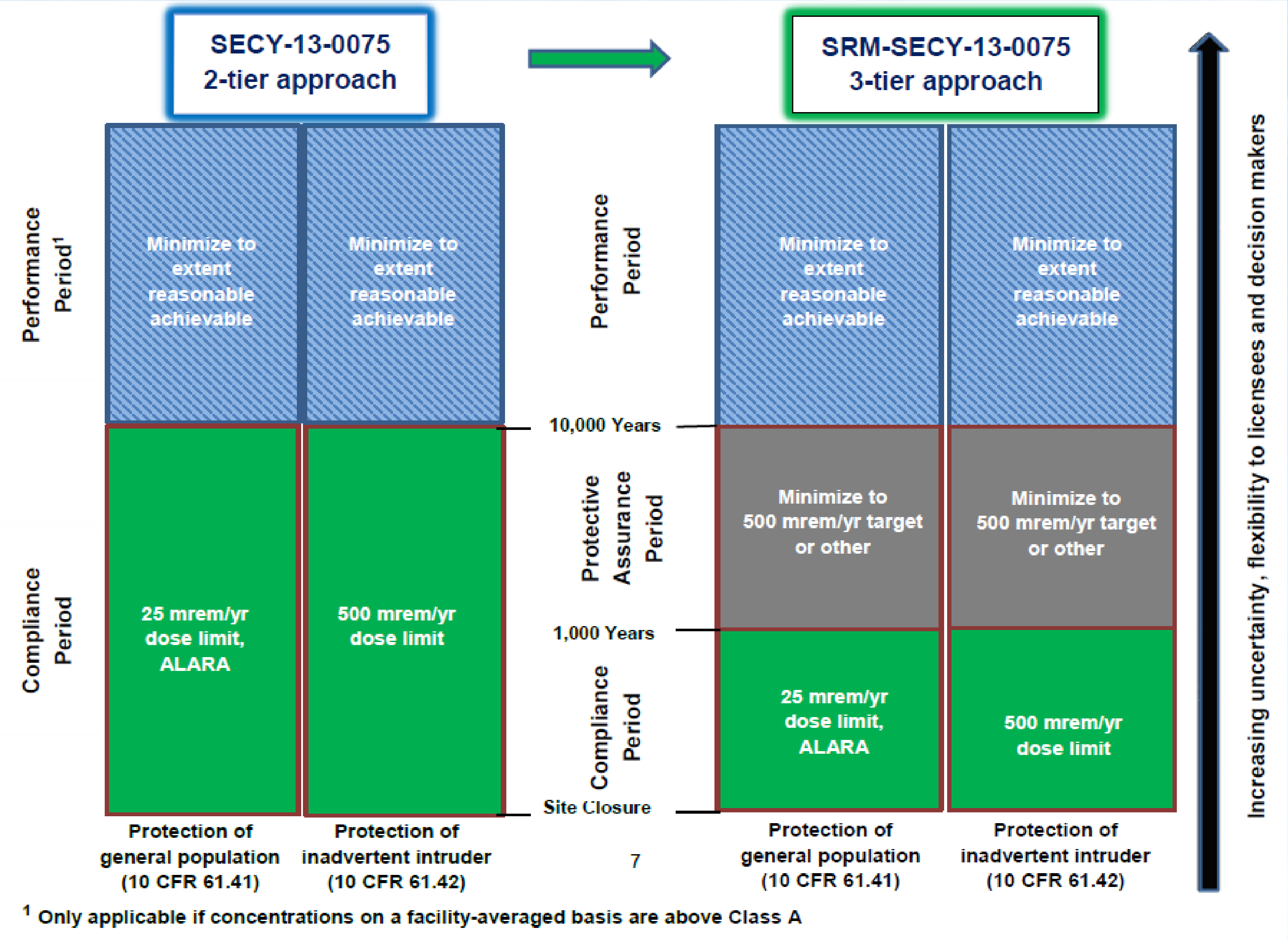
BACKUP SLIDE

Timeframe changes



Draft Final Rule Language – Definitions (61.2)

- *Compliance period*
  - Site closure to 1,000 years if no significant quantities of long-lived radionuclides.
  - Site closure to 10,000 years otherwise
- Performance period
  - timeframe established to evaluate the performance of the disposal site after the compliance period

Draft Final Rule Language – Definitions (61.2)

- *Defense-in-depth*
  - Use of multiple independent and, where possible, redundant layers of defense such that no single layer, no matter how robust, is exclusively relied upon
  - Includes, but is not limited to, the use of siting, waste forms and radionuclide content, engineered features, and natural geologic features of the disposal site to enhance the resiliency of the land disposal facility

Draft Final Rule Language – Definitions (61.2)

- *Inadvertent intruder assessment* is an analysis that:
  - Assumes inadvertent intruder occupies site and engages in normal activities and other reasonably foreseeable pursuits that are realistic and consistent with expected activities in and around the disposal site at the time of the assessment
  - Examines capabilities of intruder barriers to inhibit contact with the waste or limit exposure to radiation from the disposal unit
  - Estimates inadvertent intruder's potential annual dose considering uncertainties.

Draft Final Rule Language – Definitions (61.2)

- *Long-lived radionuclide* means radionuclides:
  - Where more than 10 percent of the initial activity of the radionuclide remains after 1,000 years
  - Where the peak activity from progeny occurs after 1,000 years; or
  - Where more than 10 percent of the peak activity of the radionuclide (including progeny) within 1,000 years remains after 1,000 years

Draft Final Rule Language – Definitions (61.2)

- *Performance assessment*
  - analysis to demonstrate compliance with the performance objectives
  - identifies the features, events, and processes that could affect the disposal site performance
  - estimates the potential dose as a result of releases caused by all significant features, events, and processes including the uncertainties

Draft Final Rule Language – Definitions (61.2)

- *Safety case*
  - Collection of information that demonstrates the assessment of the safety of a land disposal facility
  - Includes technical analyses, defense-in-depth, and supporting evidence and reasoning
  - Also includes description of the safety relevant aspects of the disposal site, the design of the facility, and the managerial control measures and regulatory controls.

Draft Final Rule Language –

- 61.58 Alternative requirements for waste classification and characteristics.
  - Specifies waste acceptance criteria
  - Requires waste certification
  - Requires annual review of content and implementation of the waste acceptance criteria, waste characterization methods, and certification program