Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
Radiation Protection and Nuclear Materials

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Tuesday, December 3, 2013

Work Order No.:NRC-472 Pages 1-489

NEAL R. GROSS AND CO., INC.
Court Reporters and Transcribers
1323 Rhode Island Avenue, N.W.
Washington, D.C. 20005
(202) 234-4433

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

+ + + + +

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

RADIATION PROTECTION AND NUCLEAR MATERIALS

SUBCOMMITTEE

+ + + + +

TUESDAY

DECEMBER 3, 2013

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:30 a.m., Michael T. Ryan, Chairman, presiding.

COMMITTEE MEMBERS:

MICHAEL T. RYAN, Subcommittee Chairman

J. SAM ARMIJO, Member

DENNIS C. BLEY, Member

CHARLES H. BROWN, JR. Member

DANA A. POWERS, Member

HAROLD B. RAY, Member

GORDON R. SKILLMAN, Member

JOHN W. STETKAR, Member

DESIGNATED FEDERAL OFFICIAL:

DEREK WIDMAYER

ALSO PRESENT:

EDWIN M. HACKETT, Executive Director, ACRS

MIKE BENJAMIN, EnergySolutions, Barnwell Facility

PAUL BLACK, Neptune and Company, Inc.

BRAD BROUSSARD, TCEQ, Texas*

BILLY COX, EPRI

BILL DORNSIFE, WCS*

LISA EDWARDS, EPRI

EARL FORDHAM, DEH, Washington*

CHRISTINE GELLES, DOE EM*

JOHN T. GREEVES, Talisman LLC

RICH JANATI, DEP, Pennsylvania*

SUSAN JENKINS, DHEC, South Carolina

SCOTT KIRK, WCS
MARVIN LEWIS*
JIM LIEBERMAN*
RUSTY LUNDBERG, DEQ, Utah
TOM MAGETTE, PWC
ARJUN MAKHIJANI, IEER
JEFF MOWBRAY, Portsmouth-Paducah Project Office*
GARY ROBERTSON
ROGER SEITZ, DOE SRNL
DAN SHRUM, EnergySolutions, Clive Facility
KEITH SPARKS, Portsmouth-Paducah Project Office*
JOHN TAUXE, Neptune and Company, Inc.
JACK ZIMMERMAN, Portsmouth-Paducah Project Office*

*Present via telephone

T-A-B-L-E O-F C-O-N-T-E-N-T-S

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

8:32 a.m.

CHAIRMAN RYAN: This is a meeting of the Advisory Committee on Reactor Safeguards Subcommittee on Radiation Protection and Nuclear Materials.

I am Dr. Michael Ryan, Chairman of the Subcommittee. ACRS members in attendance include Dick Skillman, Harold Ray, Dennis Bley, Dana Power, Sam Armijo, Charlie Brown and John Stetkar. Anybody else? No, that's it.

The purpose of this meeting is to hear presentations from and hold discussions with stakeholders and representatives on the proposed revisions to 10 C.F.R. 61. Today we have representatives from the Agreement States who license the currently operating low-level waste disposal facilities, the operators of those facilities, low-level waste generator organizations, experts in performance assessments, the Department of Energy and other stakeholders.

Subcommittee members will recall that in the Committee's last letter to the Commission on the proposed revision of Part 61 dated July 10th, 2013 the ACRS said it would conduct additional meetings on the subject to better understand the technical basis for some

of the revisions being proposed by the staff. This is our second of two Subcommittee meetings planned to collect information toward that end.

The Subcommittee met on November 19th with representatives from the Department of Energy in the first of the two Subcommittee meetings. The Subcommittee will gather information, analyze relevant issues and facts and formulate proposed positions and actions as appropriate. Then the Subcommittee plans on proposing a letter report on this matter for consideration at its February 2014 Full Committee meeting.

Today's meeting is open to the public. We have not received any requests from members of the public to provide comments, however, I understand that there are folks on the bridge line who will be listening in on today's proceedings. And opportunity will be provided at the end of the proceedings for anyone listening in to make a comment.

A transcript of the meeting is being kept. It is requested that speakers first identify themselves and speak with sufficient clarity and volume so they can be readily heard.

Derek Widmayer is the designated federal official for this meeting.

Several of our presenters today will be providing their presentations and participating in discussions via telephone. We'll be connecting with these individuals at appropriate times during the meeting, so we ask your patience while we make these connections. Thank you.

We'll now proceed with the meeting. Our first panel of speakers is from the Agreement States. I'll ask each of you to introduce yourselves when beginning your presentation.

Our first presenter is Susan Jenkins from the State of South Carolina. Susan?

MEMBER ARMIJO: Susan, just before we start, I'd just like to --

CHAIRMAN RYAN: I'm sorry.

MEMBER ARMIJO: -- make a couple of comments. Mike has provided all the necessary background, but I want to make sure that presenters understand that our focus is on hearing the views from representatives of organizations that have both extensive experience, but also responsibility for the safe disposal of low-level waste.

We've met with Department of Energy, and as Mike says, we're meeting today with Agreement State's representatives, as well as operators of facilities. In

particular we would like to hear your views on the questions of adequacy of current regulations for the disposal of low-level waste, the safety benefits of the proposed regulations and the additional burdens that may be imposed by the proposed regulations as they currently stand. And those burdens which may have some benefit, fine. Those benefits which have little or no value, we'd certainly like to hear about that.

With that, Mike?

CHAIRMAN RYAN: Thank you very much for those adding introductory comments, Mr. Chairman. We appreciate that insight.

Let me just check on the phone line. Do we have any participants on the phone line now? Please identify yourself.

MR. LEWIS: Marvin Lewis.

CHAIRMAN RYAN: Marvin? And what organization are you with, Marvin?

MR. LEWIS: Me, myself and I. Individual.

CHAIRMAN RYAN: Very good. Thank you very much.

Is there anybody else on the bridge line?

MR. LIEBERMAN: Jim Lieberman.

CHAIRMAN RYAN: And thank you, Jim. Who else?

MR. SPARKS: Keith Sparks, Portsmouth-Paducah Project Office.

CHAIRMAN RYAN: Thank you, Keith. Anyone else?

MR. JANATI: Rich Janati, Pennsylvania DEP.

CHAIRMAN RYAN: Okay. That was Rich Janati at the Pennsylvania Department of Environmental Protection.

MR. JANATI: Yes, thanks. Hello, Mike.

CHAIRMAN RYAN: Hi. Good to see you, Rich.

MR. JANATI: Thanks.

CHAIRMAN RYAN: Anybody else?

(No audible response.)

CHAIRMAN RYAN: Hearing no one, I'd ask all those participants on the bridge line to put your phones in mute mode, which helps with some of the buzzing and clicking and picking up extraneous conversations that may be occurring any one of all of your locations. So we appreciate that.

So with that, I'll turn to you, Susan. You're first on the agenda. Welcome again.

MS. JENKINS: Thank you. Again, my name is Susan Jenkins. I manage the Infectious and Radioactive Waste Management Program for South Carolina's Department

of Health and Environmental Control and I'd like to thank the members of the Subcommittee for this opportunity to present our perspective on the Part 61 proposed revisions.

I'll just start out with a brief overview of the Barnwell Low-Level Radioactive Waste Disposal Facility. The facility started operating in 1971. And here we see an aerial view of the site. This was taken in April of 2012. And as you can see, the majority of the site has been capped. One hundred twenty acres actually have been capped at this point. There are 235 acres that are used for disposal and site buildings, but not all of the 235 acres is acceptable for waste disposal.

This is a projected timeline of site operations. And the main thing that I want to point out here is that on July 1st of 2008 two very important things happened. One is that it is the date that began compact operations. So the site, as many of you know, is open to Atlantic Compact States only, and those are the states of South Carolina, Connecticut and New Jersey.

The other important thing about this date is that was the date when phase 1 closure activities began. The site is scheduled to close in two phases, and the phases are divided based on the area of the disposal site that was used for operations prior to July 1st, 2008

and post-July 1st, 2008. So we have actually completed phase 1 closure at the facility and are now in a post-closure observational period for much of the site.

And I'll just go over the status of the Barnwell site because I think it's important in terms of the proposed revisions of Part 61. As I said, the site is an Atlantic compact operations only, therefore the site is not a candidate for accepting mass quantities of depleted uranium or other long-lived radionuclides. The phase 1 closure activities are complete. In fact, 86 percent of the site is in the five-year post-closure observation period. There also is extensive documentation showing that the 16 performance objectives listed in the license have been met for that portion of the site.

MEMBER SKILLMAN: Susan, on that slide; I'm Dick Skillman, I would like to ask you what the post-closure observation activity burden is. Is that a great amount of work, or is that a small amount of work? And the reason I ask the question is when we talk about monitoring of a burial site, one of my questions is how long does one conduct that observation? And that leads to how much work is involved in doing that?

MS. JENKINS: Right. And one of the advantages of still being an operating site is that there

are employees on site that are performing the daily operations. And they go out at least on a weekly basis to survey the entire site visually, walking the caps, looking for any indications of slumping or ponding, vegetation that's growing, those types of things, the fence line, looking at the fence line for animal burrows and things such as that.

So during the five-year post-closure observation there have been several cap repairs that have been made, because in the early days of disposal, you know, obviously some of the waste has decomposed and so we've seen some effect on the caps, you know, from that. So there have been some repairs. You know, we keep looking for that. So that's kind of an ongoing process. So I think that since the majority of the site is closed and we're still there, I think that is kind of an advantage to be able to continue to take a look at what's going on. And we're learning a lot about the site, you know, and how it's performing after closure.

MEMBER SKILLMAN: Thank you. Thank you.

MS. JENKINS: This slide is just a visual illustration to show the status of the Barnwell site. The site has been operating for 42 years and we expect about 26 more years of operation. That number isn't set in stone, but that's the number that is in the current

closure plan. And if you look at it, you know, we could say that 61 percent of the operations time at the site has passed with 39 percent remaining. If we look at it in terms of disposal acreage, we see that 86 percent of the site has been used with only 14 percent available. However, thinking about it from another direction in terms of volume capacity, only three percent of the volume of the site remains, and that equates to about 1 million cubic feet.

So no matter how you look at it, the site is closure to the end of its life than it is to the beginning. And when you think about imposing new requirements, restrictions and regulations for a site like this, at first you may think that there's plenty of time for those changes to be effective, when in fact we have a very small physical area that we can impact by making changes. And of course the volume of waste that we're accepting is even smaller. So the effect of new regulations based on, you know, inventory limits and, you know, other site features would have a very limited impact, I believe.

One of the things that I wanted to point out is well is the applicability issues that we see. In 61.1 under Purpose and Scope, this is the very first paragraph of Part 61. And I'll read it out loud, if you'll bear

with me for those on the phone.

It says that "the applicability of the requirements in this part to commissioned licenses for waste disposal facilities in effect on the effective date of this rule will be determined on a case-by-case basis. And they would be implemented through terms and conditions of the license or by orders issued by the Commission."

This isn't exactly a grandfather clause, but it does allow for some case-by-case decision making for existing licenses. However, if you look at the language --

CHAIRMAN RYAN: Susan, just correct me if I'm wrong --

MS. JENKINS: I'm sorry.

CHAIRMAN RYAN: -- but if you'd back up a bit. In your case you have that authority that the Commission's talked about as an Agreement State.

MS. JENKINS: We do. We have adopted this into our regulations.

CHAIRMAN RYAN: Okay.

MS. JENKINS: And where it says "Commission," we've changed it to "Department."

CHAIRMAN RYAN: All right. And I think it's helpful to understand that the Commission would not

be taking direct action under this. That's authority that's now been, you know, given to South Carolina.

MS. JENKINS: Yes.

CHAIRMAN RYAN: Correct?

MS. JENKINS: Yes.

CHAIRMAN RYAN: Yes? Okay. Thank you.

MS. JENKINS: And more details on that --

MEMBER ARMIJO: Susan, since I've never been involved in this sort of work, this may be a dumb question, but does the Commission have oversight on your decisions? Let's say you make a case-by-case decision and someone in headquarters at NRC says, boy, that's the wrong thing to do. How is that handled?

MS. JENKINS: That would be done through an IMPEP review.

MEMBER ARMIJO: What?

MS. JENKINS: Through an IMPEP review. Every four to five years -- well four years is the standard, the NRC comes and does an audit of each Agreement State Program and they would look at all of these types of decisions. So if we were to make a decision, you know, on whether or not to apply certain parts of the regulations to our facility, we would have to of course be able to explain that to the NRC to their satisfaction, I believe.

MEMBER ARMIJO: And they retain some sort of override authority or to overrule --

CHAIRMAN RYAN: Through the Agreement State Program, yes.

MEMBER ARMIJO: -- or reverse your decision?

MS. JENKINS: I suppose they could. I think that they do have that authority, yes.

MEMBER ARMIJO: Okay.

MS. JENKINS: I think that they could deem that our program was maybe not adequate based on those decisions.

MEMBER ARMIJO: Okay.

CHAIRMAN RYAN: And I guess just to finish that thought, my recollection is that that has not happened since the inception of the program to date.

MS. JENKINS: That's correct.

MEMBER ARMIJO: Yes, I would expect there would be communications anyway before you took a position, so --

MS. JENKINS: Yes.

MEMBER ARMIJO: -- you'd know whether you were --

MS. JENKINS: That's correct.

MEMBER ARMIJO: But I just wanted to know

if you understood it that way, that there was an override authority from the NRC.

MS. JENKINS: That's the way I understand it, yes.

MEMBER ARMIJO: Okay. Is there a way we can --

CHAIRMAN RYAN: If you don't have your phone on mute and you're on the bridge line, please put your phone on mute because somebody's putting a horrible hum in the whole system here.

MEMBER ARMIJO: Thank you. Okay.

MR. LEWIS: Mike, we can barely hear the actual Committee talk on the phone.

CHAIRMAN RYAN: Okay. Well, we'll try and speak up. We have microphones at every spot on the table, so --

MEMBER ARMIJO: Susan, you can move the microphone closer to you, if you'd like.

MR. WIDMAYER: No, they can't hear you.

MEMBER STETKAR: No. No, no, no.

MEMBER ARMIJO: They can't hear us?

MEMBER STETKAR: It's because they can only pick up these two microphones and the central one, their mic. So those of you in the back of the room need to yell a little louder.

CHAIRMAN RYAN: Well, we'll do our best to raise our volume.

MEMBER ARMIJO: Okay.

MS. JENKINS: Okay. So what I wanted to point out on this slide is if you look at the new language that's proposed in 61.13, Technical Analyses, and 61.58, Waste Acceptance, the language is very similar in very both. And what it's saying here is that licensees that have licenses for land disposal facilities that are in effect on the effective date of this sub-part must submit these analyses at the next license renewal or within five years of the effective date, whichever comes first.

So this language appears to take away the case-by-case decision making that was afforded in paragraph 1 of Part 61. I don't know if that's intentional, but I will say -- and as we've discussed in -- this is the last slide -- is in South Carolina we have put a license condition into the license for the Barnwell disposal site that says that the licensee must comply with all of Part 61. When we made that decision the requirements of Part 61 it was reasonable to ask the site to comply with those. And so we did and they have.

So, you know, thinking about it in terms of -- again, I think that's where it's important that all of the sites are different. All of the sites are kind

of at a different stage. So when you're thinking about applying these to a site where most of the decisions have been made, decisions about waste acceptance, decisions about closure, there's really not a lot of value to having these requirements. And we would hope that the NRC would look at that and recognize that and somehow incorporate that into the language in the regulation, because this really is more applicable to either a new site or an existing site that is a candidate for accepting large quantities of long-lived radionuclides.

MEMBER ARMIJO: So just to make sure I understand. So the new requirements of Part 61 would really impose burdens on Barnwell, the people who operate Barnwell as well as the state. But you seen no safety benefit or just administrative burden, or what's the bottom line?

MS. JENKINS: Well, I think that in terms of -- if you think about what the options are -- and actually, if you don't mind if I go to the next slide, I may be able to answer some of that.

MEMBER ARMIJO: Sure. Go ahead.

MS. JENKINS: And then if not, I'll expound. I've borrowed one of your comments. This is a comment from a July 2013 letter to the Chairman of the Commission, and it's the comment that states that

previously disposed waste should not be subject to additional compliance evaluations as proposed by staff. And we in South Carolina tend to agree with this, because all of the disposals at the Barnwell site have been done in accordance with the regulations that were in place at the time of those disposals. And to require a performance assessment that looks at past disposals and current waste inventory is an unfair burden, I believe.

If a performance assessment was done and the results suggested that some sort of remedial action, you know, was advisable, that presented a problem because the site is essentially closed. The majority of it is essentially closed. Site stabilization is complete, as I said. Installation of the caps is complete over 86 percent of the disposal area. And if you look at the first two bullets, it's all been demonstrated and approved as part of the Phase 1 closure process. And that's been approved by the Department. So the ship has kind of sailed on that.

CHAIRMAN RYAN: Susan, isn't it true; correct me if I'm wrong, but you also have 40-plus years of environmental and on-site monitoring data of the surface system, the sub-service system, the nearby watersheds and all of that on which to base your decision making, if I'm correct.

MS. JENKINS: Yes.

CHAIRMAN RYAN: Is that right?

MS. JENKINS: Yes, we do.

CHAIRMAN RYAN: Could you talk a little bit more about how that factors in? I mean to me the fact that you have operational data and new hydrologic data and, you know, weather data and all the rest, you've got a pretty powerful database from which to make decisions about what should be done, if anything, in the future. Is that right?

MS. JENKINS: Right. We have close to 200 monitoring wells located on site and off site. Those are monitored quarterly for alpha, beta, gamma and tritium, because there's a tritium plume at the site. But we have extensive data regarding the site. And at least the groundwater plume at the site -- obviously tritium moves like water, and so we have seen tritium, you know, in the plume and down at the creek. But as far as, you know, off-site mobilization, of course we haven't seen any of the long-lived radionuclides. I mean they're going to be larger and, you know, we don't expect those to move, essentially.

Because right now our performance assessment has looked mainly at exposures to individuals at a nearby creek, which is about a half a mile away,

because that is what we see as the most likely pathway for a member of the public to receive a dose from the site. And so a lot of our focus is on the groundwater plume and the movement of that plume towards the creek. And again, we've seen tritium, very trace amounts of carbon-14. And that's what we've seen so far. But it appears as though the radionuclides based on, you know, the data that we have, it looks as though it took about 10 years for those radionuclides to travel down to the water table and then another 10 years for them to travel the half mile to the creek, to show up in the creek.

CHAIRMAN RYAN: Thank you.

MS. JENKINS: And one other I guess potentially difficult part of this, it being an older site, is estimating the source term. You know, the performance assessment of course you would -- that would be an important input parameter. And estimating the source term is a little bit complex because of record keeping, because the manifests that were used, you know, didn't always break out the various radionuclides. It would say, you know, source material, but not necessarily break it out into the individual radionuclides of uranium or thorium, or what have you.

So again, it's something that would have to be estimated. So it's not a number. You know, if you're

looking at a site that's looking to accept waste in the future, you can limit your inventory and know exactly what you have and keep track of it, whereas we have an older site. And while we've kept track of things as best we could, I mean, you know, things have certainly changed over the years.

And then of course the other issue is money. You know, there are not funds that are set aside for this. There is a long-term care fund, but that money is -- I mean the plan for it is to provide maintenance for the site, for the caps that are installed and for other site features that may need maintenance. But certainly, you know, large projects, you know, weren't anticipated.

CHAIRMAN RYAN: What's the value of the long-term care fund now?

MS. JENKINS: I'm not sure actually of the exact number.

CHAIRMAN RYAN: Maybe we can come back to that a little later in the day.

MS. JENKINS: Yes, we can.

CHAIRMAN RYAN: We could find out that. I think that would be helpful for the Committee to understand what is the magnitude of, you know, the resources ready to, you know, address any issue.

MS. JENKINS: Right.

CHAIRMAN RYAN: Thank you.

MS. JENKINS: And the Budget and Control Board did have an independent review of the long-term care fund, you know, to try to see. And it looked like the main issue with that is it really just depended on how much money that we -- what interest we were going to get off the -- from the fund. That was the biggest variable really in determining whether or not it would be enough. And but I can get back to you with those numbers.

CHAIRMAN RYAN: Okay.

MEMBER ARMIJO: Susan, I just want to make sure. Now is it your understanding that the new rule would require you to do let's say a comprehensive analysis of the material that's already been disposed of and prepare a report? Is that what you suspect?

MS. JENKINS: That is my understanding, you know, in talking with some of the NRC staff. If that's not the intention, I would like to --

MEMBER ARMIJO: Be sure. Yes.

MS. JENKINS: Yes.

MEMBER ARMIJO: Right. Well, we're not sure either, so that's one of the reasons we're asking these questions, because would there be any value from a safety perspective of redoing those analyses perhaps

to find some deficiency that could be repaired or --

MS. JENKINS: Right. I mean I think, you know, obviously there has been source material disposed on site, but what the options would be -- obviously if you perform an assessment; and I have some slides about that, too, you're kind of looking forward to limiting your inventory. That can't be done. Nobody likes the idea of digging up waste. I mean that's something that we all frown upon.

And then, you know, there's the option of possibly adding to the caps or something like that, but I don't know how we can -- especially if you're looking out for, you know, thousands of years, I don't know how that we can assure ourselves that adding soil on top of a site is really going to be helpful.

CHAIRMAN RYAN: Well, the part of that, too, I think that you have to consider is that look at the inventory radionuclide by radionuclide and ask the question what's left at 100 years, 300 years, 500 years? And when you get out past say 300, pretty much all the fission products are long gone. All the activation products have decreased substantially and you're left with a few long-lived radionuclides, some of which are a very small total quantity and some of which are larger quantities, like the uranium, for example.

MS. JENKINS: Right.

CHAIRMAN RYAN: So I think it's important in any conversation like this to understand what is the profile of the inventory radionuclide by radionuclide and what's the remaining fraction of each one, some of which will be trivially small and in essence zero. And so that to me is kind of the foundation that is important to risk assessment --

MS. JENKINS: Right.

CHAIRMAN RYAN: -- for any remaining inventory at any period of time down the line. Is that a reasonable summary from your point of view?

MS. JENKINS: Yes, I think it is.

CHAIRMAN RYAN: Okay.

MS. JENKINS: Obviously when you have waste in place it's more challenging than when you're looking to place waste.

CHAIRMAN RYAN: Yes. But by the same token if you're inventory information is pretty good, you've got kind of a leg up on making that assessment.

MS. JENKINS: Right.

CHAIRMAN RYAN: And then, you know, of course then the puzzle is can you combine that with your monitoring data to get, you know, some insight into future behavior?

MS. JENKINS: And the next couple of slides are just to show how the waste acceptance criteria and operations have evolved at the site. And you can look over those. In 1979 liquids were banned. Of course that was early on in the process. All waste was required to be containerized. Absorbents were banned in 1983. At that time also the waste classification table was included in the license. And in '85 cardboard boxes were banned as packages. 1990 is when we added the license condition to comply with all of Part 61. In 1991 we began placing enhanced caps in all of the trenches to provide some stability to the site and also it's in response to the tritium plume, because that's the year that we found tritium at the creek nearby, as I've mentioned before. And in 1995 we were required that all classes of waste be placed in vaults to promote stability of the entire site.

MEMBER BROWN: Excuse me. Was that new waste, or that didn't have anything to do with past --

MS. JENKINS: That's right. And this is all new waste. And that really is the point of these two slides is to say that, you know, the operations have evolved. I mean we look at in real time what's happening at the site and try to address those as we go along. And what all of these have in common is that they apply to

waste disposed on that date and afterwards. So, yes, we didn't go back to look at waste that was disposed in the past and put into vaults, obviously because --

MEMBER BROWN: You have to dig it up.

MS. JENKINS: That's right.

CHAIRMAN RYAN: Susan, correct me if I'm wrong, but the multilayered capping system does apply to all waste, is that correct?

MS. JENKINS: Yes, it does.

CHAIRMAN RYAN: So that's the one exception to your point, Charlie.

MEMBER BROWN: Okay. Because I was going to ask about what an enhanced cap is.

CHAIRMAN RYAN: Stopping of the infiltration applies to all waste, past, present and future. That's how that will work as I understand it.

MS. JENKINS: Right.

CHAIRMAN RYAN: Yes. Okay.

MS. JENKINS: Yes, so when I said that 86 percent of the site was capped, all of the disposal areas that were used prior to --

MEMBER BROWN: In the past.

MS. JENKINS: -- in the past have all been capped. And that started in 1991.

MEMBER BROWN: That's an enhanced cap?

What is that? I'm not --

MS. JENKINS: Okay.

MEMBER BROWN: -- an expert on any of this, so I'm asking --

MS. JENKINS: Right.

MEMBER BROWN: -- a dumb question maybe.

MS. JENKINS: No, it's not. The enhanced cap is -- the purpose of it is to prevent infiltration of rain water. That's the main purpose of it in this case.

MEMBER BROWN: More stuff on top of what you already had there?

MS. JENKINS: Yes. There is like a one-foot sand drain layer and you have like a -- there's an extra three to five feet of soil. There's a bentonite mat.

MEMBER BROWN: Okay.

MS. JENKINS: There's a polyethylene layer. So it's just a multilayered cap that's engineered to -- so when rainwater falls --

MEMBER BROWN: I've got it. Okay. That's good. I understand.

MS. JENKINS: Right. And it --

MEMBER BROWN: You can't do much about the groundwater that's already under -- but you can do the

stuff that --

MS. JENKINS: That's right.

MEMBER BROWN: You're talking about the stuff that -- the rainfall.

MS. JENKINS: It takes away the driver.

MEMBER BROWN: Yes. Okay. Thank you.

MS. JENKINS: Yes.

MEMBER POWERS: Can you give us a feeling for how much of the available volume of the site was filled at the times these various changes had occurred?

MS. JENKINS: That's a good question. I don't have an answer.

(Laughter.)

MEMBER POWERS: I only ask good questions.

(Laughter.)

MS. JENKINS: You ask very good questions.

MR. WIDMAYER: There was more in '91 than there was in --

(Laughter.)

CHAIRMAN RYAN: Yes, we got that.

MEMBER POWERS: I suspected that, but I'm gratified to have --

MS. JENKINS: Well, I will say that since -- even in the time leading up to 2008 when compact only operations began, the volumes accepted at a site were

ramped down over like a 10-year period or so. So certainly the vast majority of the volume almost disposed in the earlier year. So I would say it would be heavily weighted towards the earlier years of disposal. You know, and the fact is over time waste generators have become very good at reducing waste and reducing volumes.

MEMBER POWERS: Yes.

MS. JENKINS: And so, you know, that plays into it as well. But I can attempt to get that information for you afterwards. I'd be happy to do that.

CHAIRMAN RYAN: Well again, I think it's important to point out that all the waste disposed from day one until now still has the benefit of a very important isolation feature, which is this multilayered cap that drains water off to the sides. So that's one feature that I think applies here.

MEMBER POWERS: Well, and it also all benefits from radioactive decay.

CHAIRMAN RYAN: And from radioactive decay of course would apply to the inventory, which is substantial.

MEMBER POWERS: And I mean I think you can't neglect those. On the other hand, we have to concede that some substantial fraction of the volume is not what we would like now.

CHAIRMAN RYAN: Well it would not be acceptable now from what I think Susan has said. So, you know, that kind of early waste disposal -- again, my recollection is that in some of those earlier wastes because disposal costs were relatively cheap, there was no effort, much, to concentrate it or to compact it or to make the amount of material in one container as tight as possible. So the good news is I think that the fraction of the inventory that's in that older category is small compared to the total of the inventory. That's just my, you know, kind of a qualitative thought about it.

MS. JENKINS: Right.

MEMBER POWERS: I have to think about that, because its concentration is low, but as it escapes the containment do you have in the hydrolytic processes a reconcentration mechanism there? You know, some things bind naturally to the soil. Some things remain in solution. And so you get a reconcentration there.

CHAIRMAN RYAN: I would say the rates of release from, you know, disposable terra are relative. My own personal view is --

MEMBER POWERS: Well, you have -- because you're capped it.

CHAIRMAN RYAN: Yes.

MEMBER POWERS: And so you get less infiltration.

CHAIRMAN RYAN: And you get less infiltration. The contact time is probably not all that long and the fraction of release is probably fairly steady based on the fraction of the inventory. So if you've got lower concentrations in the waste, you probably have a little lower concentration in any --

MEMBER POWERS: That may be true. I simply don't know because I've not looked at the performance assessment on this --

MS. JENKINS: Right.

MEMBER POWERS: -- in any kind of chemical detail. And I'm willing to bet that the ground in South Carolina is a good deal wetter than it is in New Mexico.

CHAIRMAN RYAN: I would say that's a good assumption, Dr. Powers.

(Laughter.)

MS. JENKINS: But I will say that the trench standpipes that we have that are used to monitor liquids in the trenches are dry and have been for quite some time.

CHAIRMAN RYAN: Yes, and back to the cap probably doing the lion's share of that work.

MS. JENKINS: Right.

CHAIRMAN RYAN: Yes.

MS. JENKINS: And we believe that the reason that the plume -- obviously, you know, you continue to have that source term. And we believe that the groundwater is essentially rising up at times, you know, capturing some of that and then carrying it on. But we think we've eliminated the driver from the top.

And I'll just go over this quickly. In 61.7 the Concept section, just looking at the language here, particularly in 61.7.c.5 where it says that the performance period analyses are used to evaluate the suitability of long-lived waste for disposal on a case-by-case basis, and 61.7.e that says that you may want to establish a maximum disposal site inventory, again, it's just back to this whole idea that the concept section appears to have language that where we're looking forward to future disposals, because as we all know, the reason that we are looking at these proposed provisions is to find a place or a way to dispose of some known waste that's out there. But then if you look back at the language that I pointed out in 61.13 and 61.58, it's saying that existing licenses must do this. So to me there's a little bit of a contradiction there. I mean just reading it, it just doesn't seem to mesh.

And as for the period of compliance, I think

we have some of the same concerns that others do regarding the uncertainties associated with the time frame, not only those of, you know, human behavior and natural processes in the future, but also of any design features that someone would attempt to employ and whether or not those manmade elements, if that's what they are, could stand the test of time and whether or not you could show that you could be compliant for that long. And so it does seem that a time frame on the order of 1,000 years is more reasonable in that regard.

MEMBER POWERS: I mean what you're saying is it's easier to predict 1,000 years than 10,000 years.

MS. JENKINS: Right, because I mean obviously the further you go out, the more choices there are as far as what's going to happen.

MEMBER POWERS: My ability to predict 1,000 years and 10,000 years is identical. I can do neither.

MS. JENKINS: Well, I mean I just -- not that it's a great analogy, but just thinking about, you know, a cannonball coming out of a cannon, I mean obviously the closer you are to the original action, the less options there are.

CHAIRMAN RYAN: Right. If you're right in front of it, you know where it's going to land.

(Laughter.)

MS. JENKINS: That's right. So I mean 1,000 years I think has some difficulties as well, but I think it's a little more palatable than 10,000.

MEMBER ARMIJO: Well, 10,000 years, you know, we've commented on that in our letter, and that's of really no value. It's so hypothetical and there are so many uncertainties and there's no way in the world that we can assure that we'll even exist as a nation, much less as regulators. And so, you know, the idea is let's keep it safe for a reasonable time period that we have some chance of providing confidence.

MEMBER POWERS: Well, I mean shouldn't we make a distinction? We have here human behavior and natural processes. It seems the first is problematical. The second one looks more tractable to me.

CHAIRMAN RYAN: Yes, sure.

MEMBER POWERS: Certainly for 1,000 I can imagine, and I think we have proof. I hearken back to when we looked at Vogtle. There was some pretty persuasive evidence that the land in the general region of Vogtle had not changed for a substantial period of time. And so natural processes, certainly we can think about in either of these time frames. It's the human behavior that's implausible here because we don't have good models for human behavior over that time scale.

Over that time scale this particular region has gone through a very substantial change in human behavior and there's no reason to think that rate of change will continue, but it's imponderable on the human behavior. The natural processes maybe we could handle. I mean it's an analysis I'd be willing to undertake, whereas the human behavior part I'd just throw up my hands and walk away.

CHAIRMAN RYAN: Well, the other part, too, in 1,000 years is if you look at the radionuclides that have gone through 10 half lives, that's a convenient rule. It's 10 times the half-life and it's pretty much done. And it's mostly the inventory. There's a little chlorine-36, uranium, a few little odds and ends here and there, but that's it. So I think the ability to get your hands around it at that 1,000 period or something close to that, I agree with your point about 10,000.

MEMBER POWERS: Well, I mean you're exactly right that you have to look at what your source term is going to look like at that time and if your source term -- I mean I am used to treating natural uranium as a chemical hazard and not as a radiological hazard, so once you get down to that kind of level, it's difficult. I mean I live normally on a hot huge pile of natural uranium, so I --

(Laughter.)

MEMBER ARMIJO: Hasn't done you any harm.

MEMBER POWERS: Well, I don't know whether it's done me any harm or not, but --

(Laughter.)

CHAIRMAN RYAN: Okay.

MEMBER POWERS: -- not enough for me to move.

CHAIRMAN RYAN: We've got a lot of ground to cover and --

MS. JENKINS: Yes, and I'm almost --

CHAIRMAN RYAN: -- Susan's got her last slide coming up.

MS. JENKINS: Yes, I am, and I'll try to hurry this along.

Just in terms of the inadvertent intruder analyses, I just wanted to point out again in terms of the perspective of South Carolina and the site that we have there all classes of waste have been disposed in vaults since 1995. Actually it's a regulatory requirement to use engineer barriers for all classes of waste, and it's additionally in the license. I mean of course the vaults improve the ability of the site to meet the performance objectives. They enhance the site stability because they help support the caps, the

enhanced caps that we talked about. And of course they also act as intruder barriers.

So again, it just goes back to the idea that all of the sites are different. We're using intruder barriers for all classes of waste, for all future disposals, not a candidate for large quantities of depleted uranium. It would be cost-prohibitive in any way you look at it because you have to containerize it in all these vaults and it would use up a lot of volume that we were hoping to save for Subcommittee generators and the generators of Connecticut and New Jersey as well.

And I think I just had a summary slide and I don't think I need to verbalize that, especially since we're running short on time.

CHAIRMAN RYAN: I guess I'd offer a point about the inadvertent intruder. At some point an inadvertent intruder becomes an advert intruder.

MEMBER POWERS: As soon as he hits the first barrier.

(Laughter.)

CHAIRMAN RYAN: So I wrestle with how does an inadvertent intruder not ultimately at least at some point in the excavation process recognize a hazard?

MS. JENKINS: Right. And the vaults do have -- of course it's in English, but the vaults do have

a warning --

CHAIRMAN RYAN: In brass plaques.

MS. JENKINS: -- on the top.

MEMBER POWERS: The advert intruder may be after that brass.

(Laughter.)

CHAIRMAN RYAN: Could be.

MS. JENKINS: Well, actually it's stamped. There's nothing to take but the lid. You could take the whole lid.

CHAIRMAN RYAN: Susan, thank you very much for an informative update on Barnwell. We really appreciate your coming today and we appreciate your presentation.

MEMBER POWERS: Yes, that was an excellent presentation.

MEMBER ARMIJO: I'd like to just also thank you, but you know, the impression I get from your presentation is that there's a lot of uncertainty in what the rules would require from your standpoint. So they're either ambiguous or not clear. In addition there are things that you think, you believe should not even be in the rule or some clear statement that says, you know, pre-sites that have been in operation, waste that's already been disposed of is not subject to these

rules, or something that's clear and doesn't leave you hanging for the decision of some future regulator. Then you'll make a subjective decision and say, well, you ought to do that. So, you know, if that's really a good summary of your concern, let me know. If it isn't --

MS. JENKINS: It is.

MEMBER ARMIJO: Okay.

MEMBER POWERS: Don't tell us, because --

(Laughter.)

MEMBER POWERS: No, don't tell me because I don't want to --

CHAIRMAN RYAN: I think all the members understand that, you know, it's not just what's in a regulation. A regulation has to be handed from the NRC to the Agreement State and the Agreement State has to do something with the licensee. The licensee then has to develop lots of infrastructure to implement all of those requirements and you have to agree with how they're implemented. So there's a lot of language and guidance and implementation detail that can have some differences if you looked at one site versus another, because some things are more important at one site versus another. That doesn't mean they're wrong or right in either one. It means they're implemented for the circumstances that are there.

So I think there is some positive aspect to the fact that the regulations are a little bit generic but can be implemented on a site-by-site basis. So we should never lose the sight that that kind of implementation scheme has a great advantage when you're looking at dry air and eastern moisture, you know, all the other things. You can focus on what's important versus what's not. Would you agree with that?

MS. JENKINS: Yes.

CHAIRMAN RYAN: Yes. Thank you. And, Rusty, you're nodding yes.

MR. LUNDBERG: I would agree with that, too. Very much so.

CHAIRMAN RYAN: I appreciate that. And I'm reacting kind of to both Dana's comment and to Sam's comment that I think that's a very important part of what has to get done no matter what the basic one paragraph in the regulations say. You have to implement it. And there's a lot more formality in writing and in direction and, you know, agreements between regulator and licensee on how that gets done.

MEMBER ARMIJO: Yes, what I'm concerned about is ambiguity that could lead to pretty much subjective decisions that just didn't make sense.

CHAIRMAN RYAN: And what I'm saying is, you

know --

MEMBER ARMIJO: And so you want flexibility. You've got to have flexibility in this activity, but there are some things that should be clearly stated and some things that should give you flexibility. And there is no clear statement as far as I can tell about the applicability of the new Part 61 rules to a facility such as Barnwell. There's no clear statement. Either it's applicable and you'll have to do all of these things that we're proposing or it's not. And I suspect that you would prefer that it's not, but I won't put words in your mouth.

MS. JENKINS: Okay.

MEMBER POWERS: I mean it seems to me the conundrum here -- I mean there was an attempt it seems to me to impart flexibility in the language of the rule when it says case-by-case basis. And you could imagine a case that says, here, I've got a disposal facility that's some sort of a time bomb and it's just waiting to release huge clouds of plumes of noxious materials and I want to remediate that. In other places, okay, it wasn't done to today's standards, but when I take into account both the geological or hydrological properties and the decay rate, it's not. And somehow you have to make a distinction between those two. And it seems to

me that that's why the language "case-by-case" might be in there.

The problem identified by our speaker was that in subsequent paragraphs it's not entirely clear what is case by case and what is mandatory, and that needs to be clarified. Inherently I think we've got a problem that there's not a good metric on what case by case -- how you distinguish between a case I need to remediate and a case that I don't need to remediate and we end up doing very conservative kinds of analyses because we don't have good standards there.

CHAIRMAN RYAN: Well, of course then the focus then needs to turn on the performance assessment of predicted future behavior in the system, however it's cast, you know, whatever features, events and processes that define that system. And it's only through that rigor that you can get to I think a better answer.

MEMBER POWERS: Yes, and that in itself is problematical because the rigor that we demand in performance assessments today is so much greater than what was done in the past. But redoing things is itself a challenge.

CHAIRMAN RYAN: Right. Thank you.

With that, Susan, anything else, or are we good?

MS. JENKINS: No. Thank you.

CHAIRMAN RYAN: Okay. Next up is Rusty Lundberg from the Utah Division of Radiological Control.

Rusty, welcome. Thanks for being with us today.

MR. LUNDBERG: Thank you, Dr. Ryan. Again, my name is Rusty Lundberg. I'm the director of the Division of Radiation Control within the Department of Environmental Quality in the State of Utah.

And again, like Susan, I want to express my appreciation to Subcommittee members for this opportunity to share this time with my colleagues from state programs I think to provide this perspective. And I think the value that you have here on balance is is that while Susan indicated that they're long-term waste management and how they've been through the years adjusting those waste management procedures and techniques I think is reflective of what we're trying to look at in looking forward looking as well, because we are facing the decision regarding long-term disposal of large quantities of depleted uranium. So we're kind of on the other side of this. And I hope that in part you'll see some of that perspective in what I'm bringing to the table today.

I would also like to just quickly note your

discussion about regulatory oversight and the value that should be played into both balancing flexibility as well as some kind of predictability or consistency in how you not only see the regulations but implement them I think is something that we take seriously, too. It's something that's integrated throughout our entire department, not just our Radiation Control Program. So we also look at this as the importance of trying to look at predictability for those that we regulate, as well as the public, so that they understand the framework and the regulatory boundaries that we have that allow that flexibility to look at site-specific in Utah or state-specific kinds of concerns as well.

So that's why I just wanted to start out today with kind of that perspective, that over the long term we have been looking at again the value of low-level radioactive waste from the standpoint of how we classify it, looking at it both from the standpoint of long-lived and short-lived radionuclides.

So with that perspective, the bottom bullet for me is what's more important and what's on the table for our discussion today is that the game has changed somewhat from that 30-year-plus perspective and view of what was being envisioned as the potential waste streams going for long-term disposal for low-level radioactive

waste. So again, I value that the Subcommittee has an interest in this today and allowing for a real broad perspective of all stakeholders today for this.

So next slide, please. So with that I think one thing that will help you today from our standpoint is to put into perspective where we are as a state and our particular rules. We think that we have been moving forward actually somewhat in advance of the NRC just because of what's facing us and the decisions that are before us. So because of that we have our Radiation Control Board, which is a board appointed by the governor of different perspectives and interests, and they are a rulemaking authority. As an agency we don't have rulemaking authority. We rely upon the Radiation Control Board to serve as that function for us.

So in terms of the rationale, the basis, whether it be adopting NRC requirements and regulations or whether it be expanding on those to serve our interests within the state, is all vested in our Radiation Control Board. I bring that out just so that you have that perspective as an agency here.

So the first thing I want to talk about is our performance assessment rules. We see this from the standpoint of two perspectives. The first one is about

what we've done for addressing specifically large quantities of depleted uranium disposal in a shall land situation.

The next bullet is a newer rule that came into play over a year or so ago, and that is if you're not looking at depleted uranium but you also have a waste stream that again wasn't contemplated about 30 years ago when the initial view of the low-level radioactive waste construct was set up, then what happens, when do we want to evaluate the site again under performance assessments? So the Radiation Control Board undertook that initiative, identified four kind of triggers, as we call them, that would again allow us the opportunity to conduct a performance assessment.

MEMBER BLEY: And these you say are not for DU?

MR. LUNDBERG: That's correct. These are would be outside of that because we have a rule specifically addressing depleted uranium. Thank you.

Okay. Next slide, please. So with that in mind I want to just focus now on the performance assessment rule that we have in place that is directed to depleted uranium to give you that perspective. We see this as similar in nature to some of the construct and the framework that the NRC has developed as they've gone

through and looked at their proposed changes to Part 61.

We also have a two-tiered analysis as we see this. The first one is based upon doing a quantitative analysis to at least 10,000 years. And we do that primarily through computer simulation models to be able to predict some of those variables that we've already talked about, some that are a little more with certainty and some with greater uncertainty.

MEMBER RAY: Can you quantify the uncertainty?

MR. LUNDBERG: In some regard you can. When you get into some of the societal and human behavior areas you have to make certain assumptions, but some of those assumptions are fairly certain as you look at that. As you look at the time horizon that we've already been through on this planet, you know, a 10,000 year you can kind of make some judgments from past history in some regard. Moving forward it's a little more defalcate, but if you rely somewhat on your past, you can at least look at some certainty as you move forward. Obviously technological changes have a great impact on this as well --

MEMBER ARMIJO: Yes, Rusty --

MR. LUNDBERG: -- because of the acceleration as we've seen in technology.

MEMBER ARMIJO: -- the greater than 10,000, exactly when do you stop? I mean you could go to the half-life of --

MR. LUNDBERG: Of uranium?

(Laughter.)

MEMBER ARMIJO: That's a big number.

MR. LUNDBERG: That is a very large number. And the board chose as they promulgated and finalized this rule is to not set up a boundary for that. It does make it a little more difficult to -- and so that's why I'm going to talk about next here in the next slide is that that's more picked up in more of the qualitative view rather than a quantitative view. But there are some aspects in the simulation predictions that help with that.

MEMBER ARMIJO: Yes. Well, you know, the question I have is again to Mr. Ray's question about uncertainty. I'm a materials guy, so I know that you haven't got a chance of doing anything predictable for 10,000 years on materials unless you're talking about gold or copper or something like that, or ceramics. So the question is is that model subject to challenge? Has it been challenged to say, boy, you guys are just -- I mean you can't prove this or you can't prove that? You know, ultimately some of these things wind up in court

and I can't see how you can defend a model that goes out to those times and presumably is used to protect health and safety of the public. And so, that's a concern I have whether it's 1,000 years or 10,000 years, but much more for 10,000 years.

MR. LUNDBERG: Certainly I think you raise a very valid point, and that is, particularly from the public's perspective of this, as you see uncertainty and as that grows and you're less predictive of and certain in your predictions as to what can happen, the public generally views that as an opportunity to be more conservative about what you're looking at. And so I think that's the value of these predictions, at least relying upon computer models, is that it's intended to inform your decision and not have the decision just printed out on the sheet on your computer runs.

So I think you have a valid point that it does make it more difficult. It makes the decision making much more complex and to weigh this in, as well as what I'll bring up on a future slide as well. So think we see this as somewhat of an analog to the proposal as far as a compliance period for us and our rule in the State of Utah. And also the fact that it can apply to certain compliance criteria as well throughout this period.

You are bringing up about certainty and

quantitative certainty. I think we can with some of the standards and rule requirements that are in play here that you can do that.

Next slide, please. So the second tier is more of a qualitative because you factor in more uncertainty. And as you do that, even though you still have the computer model predictions to look at, you certainly look it more as, as I just stated, an opportunity to inform a decision rather than make that decision. So that's what weighs on us as we look at the long-term performance of a site.

As we look at the Clive Facility in Utah that's operated by EnergySolutions, this comes into play as we evaluate some of the long-term engineering designs, the manmade aspects and more of the natural site characteristics that are in play, not only in the short-term horizon that we can have some certainty or at least some confidence in, but as you weigh that look to a longer time horizon what happens including some of the climate aspects. So that's a real concern as we look at this as well.

Next slide, please. Moving onto the intruder aspect of this, we see that this is a positive move forward as we look at the proposed rule because it allows for analysis across the spectrum of all classes

of waste. In my initial introductory I was going to just lay out a little bit of a background on Clive itself so you have the perspective of that, and I'll just infuse that right now to help with this slide. And that is is that the Clive Facility is not the official compact site for the Northwest Compact. And so that's a unique nature of the facility. Also unique to the site is that there's a state law that prohibits the disposal of greater than Class A waste, received and disposed of at the site. So those two -- and there are other unique characteristics about it as well, but those two are primary as far as some of our view of this as a regulatory agency.

So as we look at the ability for an intruder analysis to not just be exclusive to say a Class C waste situation and being broader in its perspective, we see that that's a positive step.

The other part to this is that it does factor again; and I think this is a thread that will be integrated throughout the discussions today, is how do you really address the uncertainties even though you see value in looking at intruder analyses? How do you account for that?

Now for us, one of the major concerns here, or at least points of focus for us, is about the significant in-growth that occurs for depleted uranium.

To me that is one of the more salient points in the discussion. And I'll move that even to more of a technical evaluation even. I think that covers both the aspects of long-term concerns and public perceptions when you have to account for significant in-growth, progeny in-growth, and as you look at the technical aspects of that.

Dr. Ryan?

CHAIRMAN RYAN: Rusty, you in Utah have uranium deposits.

MR. LUNDBERG: Correct.

CHAIRMAN RYAN: Naturally occurring uranium deposits.

MR. LUNDBERG: Correct, we do.

CHAIRMAN RYAN: Have you taken any insights from fully equilibrated uranium deposits and kind of said, well, what's different about fully equilibrated uranium deposits versus the disposal that we want to make of depleted uranium?

MR. LUNDBERG: I wouldn't say directly at this point, but those are parts of the analyses that may have some bearing and interest as we look at that and broaden our view and our performance assessment. Because I think you're right. Right now we're primarily focused on the changes that would occur to get back to

equilibrium, so to speak, as you have the change --

CHAIRMAN RYAN: And you've got that schoolhouse already and other deposits around the state. Why not go to school there?

(Laughter.)

MR. LUNDBERG: It does make sense to do that. You're right.

CHAIRMAN RYAN: Okay. Thanks.

MR. LUNDBERG: Thank you. So again in terms of intruder objectives and the analyses associated with that, we do see some steps moving forward in the proposed Part 61 changes that are positive in nature.

Next slide, please. So one of the benefits here is that we're moving away from the general view of a humid, and in the next slide, versus the arid aspect of a generic view of what's at play here. And I think that we always have seen the site-specific nature and evaluations as being a real step moving forward with this whole effort.

Next slide. Another aspect, and again this is unique because of our state law prohibiting disposal of greater than Class A and --

(Voice coming over bridge line.)

CHAIRMAN RYAN: Could you guys put your phones on mute who are in the bridge line, please? Thank

you.

MR. LUNDBERG: Anyways, I just wanted to draw the association of our perspective on this somewhat as it relates to the waste acceptance criteria and how that's moving into the proposal for this as well. It is important from our perspective and we don't see that this is necessarily changing by the proposed changes, but we want to offer the opportunity to preserve the value of waste classification, because again for us that is what we depend on as far as what's allowed for disposal at the Clive Facility.

So the next slide, I just want to further elaborate on that is that it is important for that classification to preserve that kind of structure in its concept, but also; and this was brought up earlier as far as what are the added burdens, as you move towards waste acceptance criteria, perhaps the basis to make decisions regarding acceptability of disposal of low-level radioactive waste, what you also do in turn is move the burden or shift that burden verifying that that can happen, whatever waste.

We see this just shifting a little bit of the burden and responsibility of waste generators to our agency as the oversight or regulatory agency of the disposal facility. They're going to be less inclined to

be maybe attentive about what they're putting in their packages if they're just basing it upon waste acceptance criteria. In other words, they're going to leave it up to the facilities to make sure that it meets their criteria, whether it be Utah, whether it be Texas or some other facility.

So by default we see somewhat of a shift in burden and responsibility, not that that's necessarily a negative for us, but we just want to note that we see this as an opportunity for us to make sure that we fulfill our responsibilities to validate, verify and to serve in that regulatory capacity
that's --

CHAIRMAN RYAN: Can't you counter that concern, which I appreciate., by things like split sampling or, you know, on-site inspection or other, you know, activities on your side to gain higher confidence that what you're expecting is what you're getting?

MR. LUNDBERG: You're very right. And we're trying to move more into that direction, and I think that there is some value in seeing that. We are limited obviously if we go out of state to conduct an on-site inspection as to what we're there for in terms of our jurisdictional role, but we recognize that. We've made that statement of commitment to the NRC that we're not

going to try to move beyond that or usurp an Agreement State or even the NRC in terms of their jurisdictional role of a given facility or a generator site. But we do see this as an opportunity. And what I'm saying here is that we also have to evaluate what are the financial or other resources that would be necessary to accommodate that also? So we're kind of in the early stages of this adjustment for us and we think that we're moving forward in a positive direction to help address this.

CHAIRMAN RYAN: It sounds like you've got all the variables at least well lined up.

MR. LUNDBERG: Yes, we do.

CHAIRMAN RYAN: Yes. Okay.

MR. LUNDBERG: We kind of know the landscape and what we're facing.

CHAIRMAN RYAN: Yes. Great. Thank you.

MR. LUNDBERG: All right. And of course the last part of this as far as waste acceptance criteria, and we move towards that. That is the functioning or driving factor here is that we still want to coordinate with what we are limited in the State of Utah in terms of Class A limits.

Next slide. The last part of this is I want to just address compatibility. You had an interest in this somewhat. We've always, and I think collectively

some of the other Agreement States have asked for flexibility. I think it goes hand-in-hand and fully integrates with the concept of site-specific analyses. We also understand; and this goes to my earlier statements about predictability and consistency, you also want to be able to balance that. So how do you do that if you're asking for flexibility? Can you preserve and really provide some kind of level of predictability and consistency?

We think you can, particularly as it relates to just what you've seen between South Carolina and Utah. There is no likelihood of long-term disposal of large quantities of depleted uranium, where in Utah we have and faced that. So I think that just with those kinds of differences that that's where flexibility comes into play. But where you might have the floor of consistency come in is what kind of standards and criteria would help you get there regardless of whether a state is considering or not considering? So I think that that plays to both.

CHAIRMAN RYAN: Rusty, you haven't mentioned this yet, but have you taken any guidance or insights from uranium mill tailing disposal, which has been on the ground and covered by a thin layer and then vegetated and that's it?

MR. LUNDBERG: Right. And we do have that because we have a facility in Utah. In fact, we have the only operational conventional mill in the United States with the State of Utah. So we do have that direct association and experience and expertise that we can draw on as well. Again, what we see the difference here in this discussion particularly is about the long-term disposal of depleted uranium. We think that that's a different need and different perspective. And I think that you would agree with that. So we're not trying to -- Susan brought out in her presentation, we're not trying to tip everything over just at the expense of depleted uranium. We think we're just wanting to add to that and not be limited by the current construct that we're under and allow that responsibility to account for long-term concerns.

MEMBER ARMIJO: Well, you know, I've been worried about that since we've started reviewing this Part 61, that depleted uranium concerns seem to drive the whole issue and would there be value in having just a separate rule for the disposal of large quantities of depleted uranium? You know, if you didn't have large quantities of depleted uranium, you're not subject to the rule. You don't have to document and write reports and have inspections on your conventional waste. And I

don't know if the staff would even entertain such a thought, but it seems that this issue of the very life of depleted uranium is really distorting the language in the rule. And I'd like your comments on that.

CHAIRMAN RYAN: And in addition, Sam, I think it's important that the mill tailings has its own regulation.

MR. LUNDBERG: It does.

CHAIRMAN RYAN: And it's completely separate in just exactly the way you've described.

MEMBER ARMIJO: Somewhere. Maybe we ought to put the depleted uranium under a mill tails regulation as opposed to -- or some other rule that says, hey, look, we're going to treat it differently, we're going to bury it deep or whatever it is, but we're not going to confuse the conventional low-level waste, if you can use the term, Part 61, by stuffing in all of this stuff and really distorting the whole regulation.

MR. LUNDBERG: And I think that's a very valid point. I believe that that was one of the drivers for our Radiation Control Board to move forward with developing a separate rule that would trigger performance assessments specific to depleted uranium. And I think that that's what we've done in the State of Utah is we have established that. Again, as you pointed

out, there are some aspects of that that still are largely subjective. The qualitative versus the quantitative kinds of periods. At what point do you cease one and begin another? It's not a clear bright line by any means.

So because of that lack of having some certainty in terms of establishing when you start one and end another I think does add to the complexities, but at the same time underscores the unique nature of it. And I believe that's why we've moved forward in the State of Utah as we have.

MEMBER ARMIJO: You're contemplating or are disposing of large quantities of DU right now?

MR. LUNDBERG: Correct.

MEMBER ARMIJO: Is it always in the form let's say of an oxide, a uranium oxide or metal? Or what's the form that you're --

MR. LUNDBERG: That's the primary form right now. I would imagine as you look towards -- that's the legacy stockpile, so as you look to other future opportunities, it may expand beyond what we see now as that legacy waste form and construct. So right now that's our focus in terms of the performance assessment, because that's at the doorstep, so to speak. The to-be-generated or currently under the commercial

enrichment facility and maybe future facilities certainly bears out future discussions if that changes.

MEMBER ARMIJO: You wouldn't be accepting anything like UF6 or anything like that?

MR. LUNDBERG: I think we're relying upon the conversion of that. A de-conversion, I should say and then -- yes.

MEMBER ARMIJO: Yes. And do you have requirements that are different? Let's say shallow disposal is unacceptable. It's got to be deep disposal. Or is there something that says, okay, in order to reduce uncertainty I want to treat this material differently? I'm going to bury it deeper or I'm going to contain it differently. What does the State of Utah require?

MR. LUNDBERG: Well, one way we're looking at that in part is is that we are bounded by some of the natural characteristics or physical characteristics of the site there at the Clive Facility. One of those is the shallow groundwater. It's highly saline, so it's non-potable, but even in light of its high salinity, we are still looking at it as a source of groundwater that's worth protection. And so we rely upon our groundwater protection standards in part to address that. So looking at the boundary of a shallow groundwater condition, we are somewhat limited in terms of how deep

or how shallow, depending on your point of view as to what we're bounded by.

But, yes, as you look at performance assessment you can look to certain aspects of requirements. If it's fully above grade or below grade, what are results of that assessment?

MEMBER ARMIJO: Okay. Thank you.

MR. LUNDBERG: I would just -- there's one other slide about compatibility is all, and that is the fact that we are in progress of a performance assessment. So if you look at some of the changes in Part 61, not only is flexibility important is that we need to assure that we're not going to have to do a restart as we go through our performance assessment and complete that out.

CHAIRMAN RYAN: Great. Thank you, sir.

MR. LUNDBERG: I think at pretty much summarizes everything that I have.

CHAIRMAN RYAN: Thank you, Rusty. Appreciate that.

MEMBER ARMIJO: One last quick question. If in the course of the rulemaking process the Commission decides that a compliance period of 1,000 years is adequate, would that give the State of Utah heartache?

MR. LUNDBERG: Well, I think the value -- and this goes at the heart of compatibility. If it's

a compatibility like a Level C, we would have the flexibility to be able to maintain our 10,000-year time frame. If it's a B, then we'd lose that flexibility. So that's why from one perspective flexibility for compatibility purposes is very important for us so that we can maintain -- as we've discussed here, the longer term time horizon is so critical to the discussion on depleted uranium you really can't short-side that by simply staying with the 1,000-year period. I mean it's helpful, but it's certainly not going to be one that will gain public confidence if you limit yourself that way.

MEMBER ARMIJO: Okay. Thank you.

That's all I have, Mike.

CHAIRMAN RYAN: Okay. Great. Any other questions from members at this point?

(No audible response.)

CHAIRMAN RYAN: We have two participants on the phone. Brad Broussard from TCEQ in Texas. Brad, are you with us?

MR. BROUSSARD: Yes, I am. Good morning.

CHAIRMAN RYAN: Good morning. You have the floor.

MR. BROUSSARD: Okay. Thank you. Can everyone hear me okay?

CHAIRMAN RYAN: Just fine.

MR. BROUSSARD: Okay. Well again, I'm Brad Broussard, a representative from the State of Texas and I'm a technical specialist and health physicist for the Radioactive Materials Division of the Texas Commission on Environmental Quality. I'd like to thank the Committee for allowing states to provide perspective on the proposed revisions.

What I'll try to do is talk about a couple of things, the time of compliance, performance period, the 500-millirem intruder dose, compatibility and maybe touch a little bit on waste acceptance if we have enough time.

PARTICIPANT: Okay. First of all, what was the appointment for?

CHAIRMAN RYAN: Hello?

MR. BROUSSARD: Pardon?

CHAIRMAN RYAN: That was not us talking. There's somebody else on the phone lines has their microphone open. Please close it at this time.

PARTICIPANT: Okay.

CHAIRMAN RYAN: Brad, go ahead.

PARTICIPANT: He said that --

CHAIRMAN RYAN: I'm sorry, your microphone is still coming through.

PARTICIPANT: I'm sorry, Bruce. Excuse

me.

CHAIRMAN RYAN: Whoever is speaking other than Brad, your microphone is coming through.

MEMBER BLEY: It think you got it.

CHAIRMAN RYAN: Okay. Back to you, Brad.

PARTICIPANT: We just spoke with GE yesterday and --

CHAIRMAN RYAN: I'm sorry, we're going to have to stop talking.

MEMBER STETKAR: Who is speaking about GE? Whoever is speaking about GE, either stop speaking or turn your microphone off.

PARTICIPANT: So we're going to --

MEMBER BLEY: He's not listening to the phone.

MEMBER POWERS: He's turned off his receiver.

PARTICIPANT: I don't need to lose board time.

CHAIRMAN RYAN: Brad, let's try it. You're going to have to just raise your voice a bit to overpower the person that's challenged by the phone.

MR. BROUSSARD: Okay. To reiterate what I was saying, I'm going to try to go over time and compliance, performance period, the intruder dose,

compatibility.

MEMBER ARMIJO: Maybe we want to take a 10-minute break so we can --

CHAIRMAN RYAN: Yes, that's a great idea.

MEMBER ARMIJO: We've got to fix this problem. We can't have a presentation.

MR. BROUSSARD: I'm saying the performance that we have regarding --

MEMBER ARMIJO: Tell Brad.

MR. BROUSSARD: -- performance and --

CHAIRMAN RYAN: Brad?

MR. BROUSSARD: -- compliance period.

CHAIRMAN RYAN: Brad? Brad? Brad?

MR. BROUSSARD: The performance period either needs --

CHAIRMAN RYAN: Hey, Brad?

MR. BROUSSARD: -- to be better defined --

CHAIRMAN RYAN: Brad? Brad, hold on.

MR. BROUSSARD: -- as far as --

MEMBER ARMIJO: He's not hearing us.

MR. BROUSSARD: -- because the way that it's stated now is just --

CHAIRMAN RYAN: Brad?

MR. BROUSSARD: -- the time after compliance period.

CHAIRMAN RYAN: Excuse me, Brad?

MR. BROUSSARD: Yes?

CHAIRMAN RYAN: We're going to hold your presentation until we can get the other party to mute their phone or stop talking or something.

MR. BROUSSARD: Okay.

CHAIRMAN RYAN: So what we'll do is we will probably disconnect you and ask you to call back in at say 10:00. All right?

MR. BROUSSARD: Okay.

CHAIRMAN RYAN: I thank you for your patience. So sorry for the trouble. All right.

MEMBER ARMIJO: Somehow we either got to get that guy off the phone or hang him up or do something so that he stops talking.

(Whereupon, at 9:51 a.m. off the record until 10:05 a.m.)

CHAIRMAN RYAN: All right. Let me make one mention. I worked with low-level waste at Barnwell for about 12 years in the late '70s and '80s. So I just want to let everybody know I used to work there, but I haven't and have no interest in it.

MEMBER POWERS: Does this explain the various peculiarities of your personality and decorum?

CHAIRMAN RYAN: If you say so, Dr. Powers.

I'll accept that diagnosis.

(Laughter.)

CHAIRMAN RYAN: Yes, otherwise I'm okay.

With that, I think we have Brad Broussard from Texas CEQ. Brad?

MR. BROUSSARD: Yes, I'm here.

CHAIRMAN RYAN: Congratulations. Welcome aboard and the floor's all yours.

MR. BROUSSARD: Thank you. Okay. We'll try this again.

Again, I'm Brad Broussard, a representative from the State of Texas.

What I'll do is -- I apologize for not having slides. We've got a lot going on here and didn't have any time to pull it together.

CHAIRMAN RYAN: That's fine.

MR. BROUSSARD: Well, what I'm trying to do is go through some of the main proposed provisions in a somewhat orderly fashion.

The first is the time of compliance of compliance period and the performance period. Next I'll try to talk a little bit about intruder dose and compatibility issues.

Here in Texas we have a similar rule requirement to what's being proposed, but it's not

exactly the same. Our rules require that analyses be conducted for a minimum of 1,000 years or out to the time frame when the peak dose occurs. And that was one of our comments on the proposed definition of performance period is that it may be helpful to either -- to expand that definition to include maybe some things like when the peak dose occurs, you know, which uncertainty in the model renders the results meaningless, you know, or cost-benefit analysis shows that there's no further benefit?

As far as compliance period goes, what we did here in Texas during our review of the license application was we determined the compliance period from our modeling. The compliance period we chose 50,000 years. And during that time we started to see some in-growth and some other factors, site-specific things affecting dose. So that's where we decided to say, okay, evaluate out to 50,000 years as the compliance period.

CHAIRMAN RYAN: Brad, just a quick question. You say at 50,000 you saw a lot of things coming in. Well, radioactive decay is taking things out. What was making things increase?

MR. BROUSSARD: Well, there were some other -- you know, site -- and it will be different for each site, but an example would be erosion. Because erosion

is very hard to model long term, we decided to just cut it off right there and put certain provisions in the license to require a revised performance assessment with a more sophisticated model before waste acceptance took place. In addition to that we also require an annual performance assessment update, you know, to account for any changes over time in waste received, additional site-specific information, or any other changes; regulatory, you know, environmental, those times of things that could affect waste receipt.

CHAIRMAN RYAN: So in short, you're trying to keep your performance assessment updated to all things it can impact?

MR. BROUSSARD: That's correct.

CHAIRMAN RYAN: Okay.

MR. BROUSSARD: We determined to use the 50,000, or decided to use 50,000 years as a compliance period. And since that time we worked with the licensee to have them develop a more, I guess, robust sophisticated model to look at some of the more long-lived radionuclides such as depleted uranium and we're currently in the process of that right now.

And as far as the intruder performance objective, the 500-millirem, from our perspective I think the State of Texas is okay with it. I mean

historically all analyses have used the 500-millirem. You know, because it's in guidance, you still have to demonstrate meeting the performance objective. So the 500-millirem to me is acceptable, whether it's in rule or whether it's in guidance.

CHAIRMAN RYAN: Okay.

MR. BROUSSARD: One of the other things that we've done, which is somewhat consistent with what's being proposed in the revisions, is developed waste acceptance criteria. I believe a lot of the sites do this. Some are more extensive than others. But we looked at what all the other -- the sited states have done as far as waste acceptance. We used some of the information that was gathered from the performance assessment and also some of the existing guidance like the BTPM concentration averaging to develop the waste acceptance criteria that we've actually put in the license.

One of the comments that we had also as far as waste acceptance goes is that in some regards it seems that what the NRC is moving towards is allowing for waste acceptance to be based solely on performance assessment, which I'm not sure that that's really a good idea. I do believe that it could be very helpful, but I do think that for the purposes of maintaining doses that the waste

classification table should be retained. There should be some option, and I believe there is, to look at one or the other. Unfortunately we did not have a chance to review the supporting technical guidance for the proposed revisions. The document was voluminous. We didn't have enough time to do it. So I believe some of the comments and some of these issues may be addressed in that document.

MEMBER ARMIJO: You meant --

MR. BROUSSARD: One thing I'm going to talk about is compatibility. And we really had no comment. The State of Texas had no comments on proposed compatibility issues. I think one of the areas that would be a concern to some stakeholders would be the changes to 61.13 that would go from a health and safety category to category C. You know, for the most part I believe what -- even if the proposed regulations had been promulgated 10 years ago, the State of Texas would still be compatible, because the time of compliance that we used was 50,000 years and the 61.13 proposed requirements are for 10,000 years. So either way it would have been okay from our perspective. So that's really the reason that we didn't have any comments regarding compatibility.

And that's really about all I have. I'll

answer any questions, if you have any.

CHAIRMAN RYAN: Okay. Any questions for Brad?

MEMBER ARMIJO: I've got a couple of questions.

MEMBER BLEY: Okay. Sam, you need to use the microphone here or there.

MEMBER ARMIJO: Okay.

MEMBER BLEY: These are the only ones that pick you up.

MEMBER ARMIJO: Okay.

MR. BROUSSARD: I'm sorry, like all the Committee members, we're having a -- I don't know if we're all having this problem, but I can barely hear you.

CHAIRMAN RYAN: We'll raise our voices. Thank you. We were just told --

MEMBER BLEY: Project toward that microphone.

MEMBER ARMIJO: I'll try and speak as loud as I can because the microphone's quite a way from me.

MR. BROUSSARD: Okay.

MEMBER ARMIJO: The State of Texas uses a compliance period of 50,000 years, is that correct?

MR. BROUSSARD: Yes.

MEMBER ARMIJO: Now, you know, we've talked

about the uncertainties in that kind of a long-term analysis to justify such a compliance period. Have you ever been challenged either in court in members of the public or other organizations about the technical adequacy of an analysis that says you are assuring health and safety out to 50,000 years?

MR. BROUSSARD: Actually we haven't. And I believe the reason is because we don't have -- the compliance period is not anything that's specifically stated in our rules. Our rule requirement is a minimum of 1,000 years or when the peak dose occurs. So we started to see doses -- and that could have been considered peak doses around 10,000 years, but as we went out further we were starting to see other things happening like the previous example I gave, like from erosion and some in-growth starting to take place.

Now that being said, the applicant during their initial analysis went out to 100,000 years. And so they felt that that captured all of the peak doses from everything except the long-lived, specifically depleted uranium in which they -- they had initially asked for I think about 10,000 cubic meters in the initial application. But because the models that we were using weren't as sophisticated as they needed to be, we put a prohibition in the license for the short term until the

applicant or licensee could develop a more sophisticated model to account for some of, you know, the things that happen over the longer tie frames.

MEMBER ARMIJO: Okay. I just want to make sure I've got it clear. Your rule requires, the regulation in the State of Texas is 1,000 years for compliance, is that correct? But you require licensees or applicant for analyze for 50,000 years or perhaps even longer as part of your licensing process?

MR. BROUSSARD: That's correct.

MEMBER ARMIJO: Okay.

MR. BROUSSARD: The regulatory requirements are a minimum of 1,000 years or to the time when peak dose occurs.

MEMBER ARMIJO: Yes, and that's the second question I had is since we know peak doses can be extremely long, you capped that time somehow?

MR. BROUSSARD: Right, we capped it based on the simple model we were using and the proposed inventory in the license application excluding depleted uranium.

MEMBER ARMIJO: Okay. I think I understand that. Thank you.

MR. BROUSSARD: Okay. Any other questions?

CHAIRMAN RYAN: Any other questions for Brad?

(No audible response.)

CHAIRMAN RYAN: Brad, thank you very much. We appreciate your time.

MEMBER ARMIJO: I'm sorry, Mike, I had just one more just to make sure I had my notes right.

CHAIRMAN RYAN: Okay.

MEMBER ARMIJO: You seem to be requesting that the rules should retain the waste classification as well to permit, you know, use of waste acceptance criteria. Is there anything in the rule that suggests that that would not happen?

MR. BROUSSARD: Well, you know, in my reading of it some of the language, it seemed to indicate that a site-specific analysis could determine waste acceptance. And I think that because there's so much uncertainty associated with, you know, these types of modeling exercises that there needs to be something, you know, either between the licensee or applicant and regulator where, you know, everyone's in agreement, or strong agreement that, you know, okay, hey, this is something that's defendable. It's great. You know, we all agree and we can move forward with it. But as some of you are aware, that's not always the case. And that's

okay. It's going to happen. But, you know, for some of the other radionuclides beside -- you know, instead of depleted uranium I think the waste classification tables are very important.

MEMBER ARMIJO: Okay. Thank you.

CHAIRMAN RYAN: All set? Next on the agenda we have Earl Fordham from DEH in Washington State.

Earl, you with us?

MR. FORDHAM: Yes, I am. How are you all doing back there?

CHAIRMAN RYAN: We're doing fine, and yourself?

MR. FORDHAM: Not too bad. We got our first initial snowfall here today.

CHAIRMAN RYAN: Well, hopefully we will not.

(Laughter.)

CHAIRMAN RYAN: All right. The floor is yours, Earl. Thanks for joining us. We appreciate your time.

MR. FORDHAM: Good morning, all. Again, my name is Earl Fordham and I want to thank the Committee for inviting me to address you today.

I have a lot of firsthand experience at the Washington facility and I think I actually met your chair

there, Dr. Ryan, back when I was a resident inspector and making some trips out to South Carolina. I was the resident at the Washington facility for 12 years and supervised the Waste Management Group for the last 6 or 7 years. So during that time in the last 20 years Washington as an existing facility when Part 61 came out, so we were grandfathered in, but one of our goals has been is to become fully compliant and to no longer need that grandfather clause that was in there before. And we have completed an Environmental Impact Statement back about almost 10 years ago and had opportunities to update it.

Washington's facility is closer to the phase of life of that Susan mentioned for South Carolina, and that's not necessarily because of the land use or, you know, volume available for us, as we've only used approximately I'd say half the facility acreage. The issue for us is the Northwest Compact basically used its exclusive right to restrict access to itself and the Rocky Mountain Compact back in 1992. As a result we are now only getting, you know, a mere pittance of what we got back in the '80s and '90s. Our volume is down around 20,000 cubic feet a year, whereas before back in the '80s it was over a million.

I take it somebody's there to turn slides.

CHAIRMAN RYAN: Yes, we're on the aerial

view of the site.

MR. FORDHAM: Ah, thank you. Thank you. That's perfect. What I want to do is, you know, bring to your attention there is you are looking north and the buildings in the upper right are part of the Department of Energy's Hanford facility. So you can see we are in very close proximity to acreage controlled by the Department of Energy. In fact, the site is on a 100-year lease from the AEC, now the Department of Energy and is subleased by our Department of Ecology to the site operator, U.S. Ecology. There are burial grounds that the Department of Energy uses all around us. Perhaps one of the bigger ones is the Environmental Restoration Disposal Facility, also known as ERDF, off to the left originally on the acreage that was leased to the State of Washington and then returned back to the Department of Energy in the mid-'90s for their use in constructing ERDF. Again, please note that proximity of those Department of Energy buildings.

And if you'd go ahead and move the slide. I'm trying to take this presentation along the lines of the way it was asked for questions to be answered in the *Federal Register* notice on Part 61. So we'll talk a little bit about the two-tier approach, you know, compliance and a performance period appropriate. The

State of Washington agrees with that. Primarily back in the late '90s when we were getting our draft Environmental Impact Statement together we were talking to the NRC folks in the Low-Level Waste Program nearly every week. And so we had kind of come up with an idea of what were we use for evaluation purposes and then go beyond that to find peak dose.

I think you've heard a lot about modeling already. I won't spend a lot of time expressing our concern over the uncertainties. We are a little concerned perhaps to get beyond 10,000 years because we have a hard time going beyond 10,000 years our self. We would treat 10,000 years as a maximum and kind of wonder why not just use up to 1,000 years?

CHAIRMAN RYAN: Okay.

MR. FORDHAM: Move onto the fourth slide. Should there be a dose limit other than the quarter of a million sievert, 25 millirems? No. Twenty-five has worked really well. I'm not sure if they were hinting about this going down to what EPA at one time talked about, 15 millirem. That's always an issue out here at Hanford because they try to clean Hanford up to 15 millirem and we are 100 acres of different light. Using 25 millirem per year is out standard. And a lot of our doses, and perhaps I have not heard it in other

discussions, our linked to some of the modeling assumptions that you use.

And in our particular case, being a desert environment only getting between six-and-a-half and seven inches of rain a year on average, you know, our infiltration and our primary driver and the Kd's that are used in the modeling become very critical.

CHAIRMAN RYAN: Earl, could you refresh my memory and tell me what the net efflux is of evaporation versus infiltration at the State of Washington site?

MR. FORDHAM: With or without a cover? Without a cover of any type we lose probably five inches of it at a max through the waste strata, and it's 300 feet to groundwater. With a cover or a proposed cover our Phase 1 is basically a -- I call it a raincoat. It's going to be dirt, HDPE 60 to 80 mL and then dirt on top of it to protect the HDPE from UV.

CHAIRMAN RYAN: So we're going from a smaller fraction of your annual rainfall down to your new cap, essentially no infiltration?

MR. FORDHAM: Correct. The Phase 2 when we get it fully designed and we'll hopefully -- no, this one's conceptual -- will be an ET cover.

CHAIRMAN RYAN: Yes.

MR. FORDHAM: So we'll have a silt-loam

percentage in the top meter. We are using as kind of a model the -- back in the '90s, I believe it was Battelle was contracted to install a cover over the B pond out here, 14 layers, very expensive beyond what we could hope to do here or Department of Energy can do on their waste site. But we are basically using the top meter of that B pond cover, which is a silt-loam and vegetated having a small percentage of pea gravel mixed in for erosion control.

CHAIRMAN RYAN: Thank you.

MR. FORDHAM: Continue on to the next slide.

MEMBER ARMIJO: I have a quick question for your slide 4.

MR. FORDHAM: Okay. Back to slide 4.

MEMBER ARMIJO: Yes, I'm not familiar with the Kd's. What are Kd'ses?

MR. FORDHAM: It's basically how fast the radioisotopes will move through the vadose zone. The closer to zero, the faster they move. Water is zero in essence. So if you get a Kd value, you can model it conservatively and then in reality Mother Nature is going to have a different Kd. So your model may not necessarily be validated by reality. But you try to be conservative. And then you go back to your modeling and

adjust Kd's or you establish mobile fractions for your isotopes depending on what further sampling and analysis bring.

MEMBER ARMIJO: Okay.

MR. FORDHAM: The Hanford Facility has had the opportunity to have several rounds of analysis. Being an existing facility plant now, RCRA came into being, we had accepted mixed waste, what is now mixed waste, wasn't mixed waste back in '85, and thus our Department of Ecology is very interested in looking at the facility from a chemical point of view also. You know, we have issues with a few chemicals here.

MEMBER ARMIJO: Okay. I understand the concept. I don't know the units or whether it's a dimensionless parameter or it's feet per year or inches per century or what it --

MR. FORDHAM: I believe it's like milligrams per liter.

MEMBER ARMIJO: Milligrams per liter?

MR. FORDHAM: But I could be mistaken there. I'd have to get back to you exactly.

MEMBER ARMIJO: Yes. Okay. My colleagues can educate me later. I just wanted to know what that was.

MR. FORDHAM: Okay. Onto the next one. I

talked a little bit about the 10,000 years, and I'm pretty sure you've heard the other previous speakers that 10,000 years -- we definitely don't want to see it any further out. We kind of wonder if it shouldn't be even shorter.

MEMBER ARMIJO: Well, I've got to ask this question again, because the way I interpret a compliance period is that a licensee must prove to the regulator that their site meets the regulation for the period of 10,000 years and they do it by analyses, and those analyses are subject to review and approval and challenge. Personally I believe that there is no analysis for 10,000 years that would survive a rigorous technical challenge, but that's me.

MR. FORDHAM: I'm on the same boat as you are.

MEMBER ARMIJO: Okay. Well, then why is it okay? You know, why does the State of Washington say, well, I guess it's okay for analysis? But there's an analysis period. You can do anything you want. It's just paper. If you make a mistake, you just erase it and redo the calculation. But if you have to comply physically by the design or the maintenance of the low-level waste facility, that's a different story. So I'm just confused of the interpretation of compliance period. Is it really hard compliance or is it 1,000

years real physical compliance and 10,000 years of just a calculation? Can you try and help me out here?

MR. FORDHAM: It's rather difficult with the uncertainties involved, especially with infiltration rates and what the actual mobile fractions for various isotopes are and, you know, the soil permeability, the Kd's involved. In the discussions that we had with the NRC back in the late '90s when we were wrestling with this question we asked why is 1,000 years good enough for uranium metals, but we need to go out beyond? I'm sure you're aware that some of the initial discussions with Part 61 were influenced by the high-level waste --

MEMBER ARMIJO: Yes.

MR. FORDHAM: -- group at the NRC. And they were looking at 20,000 years. And we went like, no, in our initial set of comments were is that our error bars get really bad just in that last 10,000 years. So I think there was some compromise looked at. Ten thousand years does have a degree of uncertainty. Twenty thousand years has a, you know, much greater degree in our calculations. A thousand years, you know, as I told our Commissioner, I basically said for Washington it's a maximum 10,000 years, and we would prefer 1,000.

MEMBER ARMIJO: Okay.

MEMBER RAY: Let me add. Sometimes I've seen here in this discussion the 1,000 quantitative, in quotes. I think that was on one of the slides earlier. And the 10,000 qualitative. Now, in your question, Sam, I thought it sounded like you were assuming they were both quantitative. I don't know the difference between quantitative and qualitative, but --

MEMBER ARMIJO: I think they're both semi-quantitative because they're calculations, right? And but the credibility of the calculation is only defensible up to a reasonable time, maybe up to --

MEMBER RAY: Well, yes, but I mean at least there's an effort to distinguish between the two in the way that I've said in some of the presentations.

CHAIRMAN RYAN: I think Harold's onto something that's absolutely useful. If you can identify things that you really want to be quantitative versus qualitative, you've really added some value to the discussion because, you know, you can't calculate things with certainty to 10 or 20,000 years. You can probably reach with something shorter, on the order of 1,000 years, in terms of a future event or process in the natural environment. So I mean that's a point I think we need to all think about.

MEMBER RAY: And I think some of us are

concerned about challenges in a legalistic sense. And it does make a difference if you're challenging, whether you're challenging a qualitative assessment or a quantitative calculation.

MEMBER ARMIJO: Exactly.

CHAIRMAN RYAN: And that's why I think when the tools are defined as, you know, what kind of calculation you're going to make and what a performance period ought to be for this, that or the other thing, you need to be pretty precise, and I'm not sure we've been as precise as we might could be to get at the question you're raising, Harold. So that's a good point. Thank you.

Earl?

MR. FORDHAM: Continuing on, a little bit more on the compliance period of 10,000 years. Going back to that picture of the facility from the introduction --

CHAIRMAN RYAN: Yes.

MR. FORDHAM: -- and how at a close proximity to our facility the Department of Energy disposal sites are, there are several Hanford disposal facilities nearby. Some of them have been used for years. ERDFs are to the west. It's been operational since '96. There's another constructed ready to go for

the waste treatment plan about a mile or so from me, or these. The idea is we ran our analysis very conservatively trying to accomplish political needs that we have in this area, but at the same time realizing that the Department of Energy is going to use the land at the disposal site as part of an industrial complex. And they use an industrial scenario for theirs, which would make the doses even lower than what we had predicted.

And the NRC held a kind of a meeting I want to say two or three years ago now where the Department of Energy representative talked about the WIPP Facility and then the -- you know, I can't remember what they call the Nevada Test Site now, but, yes, they talked about the land being withdrawn and thus the probably of intrusion was no longer equal to one. It's something in that regard may be appropriate for the Hanford sites, too, because I can't envision the Department of Energy releasing its disposal areas back to public domain for thousands of years.

Moving onto --

MEMBER ARMIJO: Earl, I just want to comment on that. The built-in assumption in that argument is that the Department of Energy will be around to control the property thousands of years in the future. And that's just -- history has shown us that that's highly

unlikely that any current organization will still be in place that far into the future, which makes this whole issue of regulating for periods thousands and thousands of years into the future -- well, my opinion, almost silly, you know?

MR. FORDHAM: I run into, talk to stakeholders here in Washington. You know, we operate on the assumption of institutional controls that are going to last 100 years. And here out at Hanford the assumption is more like 30 to 50.

MEMBER ARMIJO: Yes. Well, a colleague of mine has just pointed out that one church has been existing for 2,000 years as an organization, but I challenge anybody to show me a government that's existed for that length of time.

So, you know, I think our assumption is that there is a big difference between government control. And private sector control is really just an assumption when you're talking periods that far into the future. So if we're going to regulate for one type of organization or be more restrictive because they're so-called private sector and less restrictive because the government will exist forever, I just don't think that makes -- I find that hard to defend, but I'll leave it at that.

MR. FORDHAM: I'll go ahead and move on

to --

MEMBER ARMIJO: Please do, Earl.

MR. FORDHAM: -- a question and the answer. Dose limit associated with a performance period analysis. So what should the dose limit be? I think we've kind of talked about this already, you know, qualitative versus quantitative. In the performance period we don't believe that there should be a limit. State of Washington when it did its analysis for CIS did go out to peak dose and a little bit beyond. Our modeling went out 100,000 years and our error bars are huge. So to try to put a limit on it and it just doesn't make a lot of sense for us.

CHAIRMAN RYAN: Earl, did you wrestle with the question of how do you know it's the peak when you picked one?

MR. FORDHAM: Oh, yes. Oh, yes. And I'm not sure if my colleague -- you know, I think, Mike, you might know him, Drew Thatcher, if you actually had Monte Carlo loaded or not. But he did 500 realizations of the model. And that's how we came up with the numbers. So it wasn't just a single run and come up with a number or a year. It was a lot of effort to try to vary what we could as far as establishing a band for parameters and --

CHAIRMAN RYAN: Can you assign some distributions of that selection --

MR. FORDHAM: Yes.

CHAIRMAN RYAN: -- you know, calculation all that usual way? Okay. Thanks. That's helpful.

MR. FORDHAM: So next, slide 7. Should there be a dose limit associated with the inadvertent intruder analysis? If so, what should it be? We do support the 500 millirem for the uncertain intruder. We are well below it. But again, that was, you know, a healthy discussion between our staff and the NRC back in the late '90s as 500 millirem was guidance at the time and we were quizzing them on were they looking at something different. They said, no, we weren't, so we went with 500. Obviously with the inadvertent intruder versus an on-site resident, it's two different scenarios as far as how long it lasts. So we believe 500 is appropriate.

And then kind of the all the others issues slide, slide No. 8. Cost-benefit analysis is the really interesting new topic. Definitely plays into the assumption about, you know, future generations and their values. Land use. Remember that picture that I showed you at the beginning. Year 2063 my 100 acres will be shut down, covered and all above-ground facilities will be

demolished and the land will revert back to daily operating report or its successor.

I envision it turning back over to the same group that looks at the uranium mills, the legacy management group for monitoring well into the future. How far that future is, I think we can acknowledge that's up for discussion.

Moving on, we agree with the NRC on using the most up-to-date ICRP recommendations for the states being allowed to develop their own waste acceptance criteria. It is kind of interesting. Department of Energy has done a performance assessment on its ERDF facility. What I would have to bury in a package as Class B cesium they can, you know, bury in their cells just a couple of miles to the west of me un-packaged, un-stabilized. That's the benefit right there of a site-specific performance assessment.

Finally, I'd like to chat just a little bit on compatibility. Generally I agree with Rusty. There are areas where they need to be compatibility A and B. Everything else the states always want flexibility. We didn't comment on that when we delivered our comments to the NRC back last spring and so we are always striving for flexibility but understand the need for someone that's at 25 millirems to 500 millirems.

And the final picture was taken last year. You can see at the bottom of the picture the effects of the fire of 2006 at Hanford there where the sagebrush is missing. It is restoring and it's a great tool on saying how fast the site will be reclaimed by Mother Nature. Do I believe it's going to look like the center picture forever? No, I don't, because Hanford does heal and sagebrush does return.

CHAIRMAN RYAN: Any other questions for Earl?

MEMBER ARMIJO: Yes, just on your slide 8 you used the words "tread carefully." Could you expand on that?

(Laughter.)

MR. FORDHAM: The idea here is that you're making assumptions about the values of future inhabitants. We have values today. Are they going to be the same values? For instance, here at Hanford the Columbia River is a primary value of the stakeholders. They don't want to see their use of it, whether it be for a water source or recreation jeopardized in any way, shape or form. A hundred years ago what did people think about the Columbia River? You talk to the Native Americans and it was sacred to them back then. But I have a belief that you could probably make an assumption that

100 years from now the river will be, you know, a critical component for this area, but other parts of our environment out here may not be. So we try to put values on future generations, we get into a quagmire. You know, are they our values, personal values or are they truly the collective community values?

MEMBER ARMIJO: Okay. Thank you.

CHAIRMAN RYAN: Any other questions from members?

(No audible response.)

CHAIRMAN RYAN: Okay. With that, we appreciate everybody's presentations in this session. it's been very helpful and informative.

MEMBER POWERS: They have been outstanding presentations.

CHAIRMAN RYAN: Yes, every one. They've been all very informative and to the point, which we appreciate.

MEMBER POWERS: Very, very focused and --

CHAIRMAN RYAN: Thank you, Dr. Powers.

With that, we are scheduled for a 15-minute break, which we'll maybe kind of cut it a minute or two short. Come back a couple minutes after 12:00 if we can, we'd appreciate that.

MEMBER BLEY: Eleven.

CHAIRMAN RYAN: I'm sorry, 11:00.

(Laughter.)

CHAIRMAN RYAN: So, let's get our schedule back a little bit. So thanks. We'll reconvene at let's say five after 11:00.

(Whereupon, at 10:48 a.m. off the record until 11:06 a.m.)

CHAIRMAN RYAN: All righty. We have two more speakers before our lunch break, and first up is Scott Kirk from Waste Control Specialists.

Scott, welcome and thanks for being with us today.

MR. KIRK: Thank you very much. And, yes, I am Scott Kirk and I work for Waste Control Specialists. I'm a health physicist. I'm vice-president of licensing and corporate compliance and I'm also the site's corporate radiation safety officer. I'm here today to share, you know, some of the perspectives that WCS has, you know, acquired over licensing a new facility.

You know, a lot has happened over the last 40 years, a lot of advancements in waste management practices, but there's really been only one facility license which is operating. The Ward Valley Facility was licensed, but it's not operating. But in 2009 WCS did acquire a low-level waste license. We're

authorizing to dispose of Class A, B and C waste. This is first the facility, you know, like I said, that's operated since 1980. We're authorized to dispose of waste within the Texas Compact, but also outside of it. But we have two facilities. We also have a federal waste disposal facility that was envisioned by the state legislature as well.

With that said, we're allowed to import waste from non-regional generators, which I think has really benefitted the nation since the closure of the Barnwell Facility to non-regional disposal facilities. You know, the Texas legislature is, you know, as well behind the facility. You know, they've authorized the importation of up to 275,000 curies per year of waste materials.

The facility is located in West Texas. It's a very arid remote portion of the United States. It borders Lea County, New Mexico. We're located probably about 70 miles east of the Wood Facility, but the facility is also located within the Permian Basin. And that's very important to also recognize that the primary industry out there is oil and gas. They're very familiar with risk. They're very familiar with geology, drilling, those sorts of things because oil and gas is the bloodline to that area of the country.

MEMBER ARMIJO: Just a quick question.

MR. KIRK: Yes.

MEMBER ARMIJO: When did the facility actually receive its license and start operating?

MR. KIRK: 2009 is when we received our license. We had a variety of pre-construction license requirements like we had to do some additional characterization and other sorts of things. And I think we took our first waste in 2011 for the compact facility. And for the federal facility we opened it up and took the first waste in June of last year, or this year.

This sort of gives you an aerial view of the facility. The LSA pad, you know, we stored some of the Department of Energy's Fernald Silos 11(d)(2) byproduct materials at the LSA pad. We also constructed a byproduct facility, which is for 11(d)(2) materials. There's a lot of radium in that waste materials, which is now disposed of in Andrews County. We also have a RCRA Subtitle C landfill that's permitted. We have facilities which are admin buildings, but we also have a treatment storage and disposal facility as well where we can treat waste.

In the center you'll see the federal facility. It's much larger. You see the one area that has been developed. You know, we can expand that further

to the west, which is on the left-hand side of the screen. The smaller facility, which is the compact facility, the Texas Compact facility, it's also dead center, which you'll see, but it's a much smaller facility. That's Phase 1 that we have undergone, you know, that's already operational, but we've already submitted a major amendment request to expand it towards the east. So there are abilities to expand the capacity of it.

You also see what we call -- there's evaporation and sedimentation ponds that we do collect leachate. We treat it. We pump it into the sedimentation and evaporation ponds.

MEMBER ARMIJO: Where is that on the picture?

MR. KIRK: The evaporation ponds? There's two of them, one for the federal facility and one for the compact facility.

MEMBER ARMIJO: Okay.

MR. KIRK: And it's really designed as a zero discharge facility. And what you'll see is -- and this is really a vision of the Texas legislature. They were willing to sign up allowing a private entity to license a new facility and also to have one that would service the Department of Energy. But they had certain visions that they wanted to have in place. And it far

surpasses, you know, past disposal practices and disposal concepts. One thing that they wanted to ensure was is that the federal facility and the compact facility were separate. But they did not want to have commingling of radionuclides between the two facilities, so they're physically separate. They have a fence between the two. They have separate, you know, entrance and egress pathways. So that's what you also see and that's why they are separated.

MEMBER ARMIJO: Okay. I'm going to ask a bunch of questions --

MR. KIRK: Oh, please do.

MEMBER ARMIJO: -- that are just for familiarize with this. The federal facility, this is all private land or is it federal facility on government land?

MR. KIRK: It's private land, but that's a very good point, and I'll get to that later in the presentation.

MEMBER ARMIJO: Okay.

MR. KIRK: But I'll answer your question. The legislature required us to have a memorandum of agreement with the Federal Government and that agreement stipulates that at the end of plant life that the Federal Government will own all the buildings, all the land into

perpetuity. In essence it's institutional controls into perpetuity --

MEMBER ARMIJO: That's correct. Yes.

MR. KIRK: -- so it was federal land. And that's that memorandum of agreement that has been signed between the Department of Energy and Texas.

MEMBER ARMIJO: Okay.

MR. KIRK: Now the Texas facility also has stipulations. They own the facility today. I mean we own the facility. We license it. But part of that licensing process was that we had to transfer title of that facility prior to start-up. So when we receive waste -- we have two resident inspectors. They evaluate the manifest. They sign the documents. Once they sign it, they own that waste before it gets placed into the hole.

MEMBER ARMIJO: Okay. And the last question is what is the LSA pad?

MR. KIRK: That stands for low-specific activity. It's just a name that it's been called. It's a storage pad, but we do work up at that LSA pad. And what I mean, when we do work there, we have a irradiated hardware transfer system. Only it might be 300,000 pounds. The transfer belt is about 10 inches thick. But in the older disposal facilities they use like a slit

trench design to off-load irradiated hardware. The design of our facility doesn't allow that. All of our waste has to be placed in what's called modular concrete canisters. So we have to do vertical lifts. So we had to come with a state-of-the art transfer system so that we could off-load sources that are, you know, very highly radioactive. The sources -- the design bases were to off-load a source of 30,000 R per hour on contact. And we've done about 18 of those.

MEMBER ARMIJO: So is the LSA pad just an interim location where you do some packaging and preparation for disposal?

MR. KIRK: We do preparations. We off-load the containers there. We also have used that as a storage pad for ion exchange resins and other things like that prior to the time that we opened our facility. But primarily we don't do storage there. We do some de-watering of resins there. It's really just a isolated facility that's remote, but we use it for those type of activities.

MEMBER ARMIJO: Okay. Thanks, Scott.

MR. KIRK: You're welcome.

MEMBER ARMIJO: That helps.

MR. KIRK: You know, as I'd mentioned, to answer a question, the Texas legislature, you know,

required transfer of the land to the State of Texas, but prior to waste receipt. We were authorized under or license to receive up to 2.3 million cubic feet of waste materials and 3.89 million curies, but for the curies were allowed to decay correct at. You know, we provide to the Texas Compact Commission really about on a monthly basis. We have license requirements that we provide updated inventories where it's decay-corrected, where we demonstrate compliance, but also for the capacity. And the important part here is is that the compact facility serves Texas and Vermont as the compact and the Texas legislature and the Texas Compact Commission wanted to ensure that the Texas Compact is also protected as far as available capacity for volume and for number of curies.

And as I mentioned, Texas takes title to the waste prior to waste receipt, but a really important part of this is, too, there are fees collected for waste that's imported into the State of Texas. You know, Texas agreed that they would help serve in a lot of the nation's waste disposal needs since Barnwell closed, but a percentage of those fees go to Andrews County where they build recreational facilities and other things like that that services the local constituency. But a large portion of that also goes to the Texas coffers as well, the state

treasury.

MEMBER SKILLMAN: Who are the contributors to your waste streams? Where is the waste really coming from?

MR. KIRK: It's coming from the majority of nuclear power plants across the country. We've received some silt sources. We've received medical waste like -- and also American Airlines. They send us a lot of tritium exit signs. I think they had like, I don't know, 20,000 curies of tritium in these exit signs. But we take, you know, research waste as well, though some facilities have not been able to take like pathological waste, like animal carcasses. But we don't have that prohibition, so we also support the research community and the University of Texas and other universities.

MEMBER SKILLMAN: Okay. Thank you.

MR. KIRK: For the federal waste disposal facility, you know, what Texas was grappling with really was the failure of licensing the facility at Sierra Blanca, which was down by El Paso. And what they said is that a private entity -- and they passed a law -- a private entity could submit a license amendment request to support the Texas Compact, but they recognized that there wasn't large volumes of Class B and C waste. And to ensure that facility would be economically viable,

they also agreed that they would allow another facility to be built that would service the Department of Energy. So that framework was established. It was a law passed in about 2003.

Now as I had mentioned before, there was a requirement by the legislature that a memorandum of understanding had to be in place before we received waste at the federal facility. And that agreement was with the State of Texas and the Department of Energy, and that has been signed and is in place. And such, the Department of Energy has agreed to assume ownership of the federal waste disposal facility into perpetuity upon closure. For the federal waste facility it's much larger. We're authorized to dispose of up to 26 million cubic feet or 5.6 million curies. And again we decay correct the source terms. WCS' perspective with regard to Part 61. You heard a little bit from Brad Broussard, so some of my information will be repetitive from what he has, but I think it really puts a lot of light on the licensing of the new disposal facility.

You know, from the outset, you know, we have supported a 10,000-year period of compliance. And what we believe is and what we've learned by licensing our facility it really allows a true evaluation of the long-term environmental performance of a waste disposal

facility. What it really allows you to do is to, you know, evaluate or test the engineered barriers that you build. It allows you to evaluate the significant exposure pathways and it also allows you to or indicates if you need additional characterization. Especially like for updates to a performance assessment, it really allows us to do that so that -- you know, on a 1,000-year time period you wouldn't be able to test these kind of features.

We think that our site is, you know, very well suited, you know, for unique waste streams such as depleted uranium. And by the sheer fact that we've licensed our facility for -- it has a period of compliance of 1,000 years or peak dose, whichever is longer. You know, we think that the fact that we've licensed one, that's not an insurmountable task, especially if it's for a well-sited facility. And I'll get into that more. And what I'm getting at is if you have a very robust facility and the water table is far removed from the site, it's arid, it's remote, you don't have lots of rainfall, we do not find that to be overly problematic to demonstrate compliance with a standard, you know, that's more restrictive than what the NRC, you know, may or may not be proposing.

MEMBER RAY: Well, what do you assume; just

to take rainfall as an example, the rainfall will be in 10,000 years?

MR. KIRK: Well, you know, we also looked at climate changes. You know, the site itself really is not subject to erosion. We have what's called a gradation. The Mescalero Sands to the west will grade over the site. We've looked at, you know, very sophisticated computer modeling of the site. What we had assumed for the future climate change, we don't have like glaciation in West Texas, but what we did is we assumed that we would have much wetter conditions. You know, we doubled the rainfall up to 30 inches. It's usually about 16 inches, but we doubled that for prolong periods of time.

And really what we found out from our site is is that when you saturate the soils with large volumes of water, what happens is it pushes those radionuclides down, you know, further towards the water table. But, you know, our water table is about 600 feet below grade. The soils are very impermeable. And on natural conditions, that's really more bounding. The natural tendency of those radionuclides would be to diffuse upwards. But when we looked at, you know, wetter climates, what that showed is is that that's not the bounding scenario. And if we would not have really

looked at, you know, peaks longer than 1,000 years, we never would have had that realization.

MEMBER RAY: So you did make a conservative -- or I assume you'd consider it conservative assumption about future changes on climate, as you called it?

MR. KIRK: Yes, unrelated to manmade activities. We just assumed based on the last Ice Age that, you know, it was wetter conditions in West Texas. And so, you know, the original study we had used was from Wichita, Kansas. You know, we questioned whether that was really applicable, but that was the study that was most germane to the topic. And so, you know, we used those rainfalls and also looked for, you know, historical records. We thought a doubling of the rainfall would be appropriate.

MEMBER ARMIJO: But that's pretty arbitrary. It could have been if someone said, hey, I think it should have been 10 times just to be sure. Ten thousand years is a long time.

MR. KIRK: But it would be --

MEMBER ARMIJO: How would --

MR. KIRK: Okay. I'm sorry.

MEMBER ARMIJO: How would you respond to that? You say, hey, look, we've gone back in historical records, geology or something, that says this has been

arid for 100,000 years and it's likely to be arid for another 10,000? You know, how do you do this? It sounds to me like it's very qualitative.

MR. KIRK: It is qualitative and you have to use reasonableness, you know, and there's a reasonable assurance provision in the Texas statute and in the regulations. But the point I was trying to make is the more rainfall that you have, it really causes you to have lesser doses. I mean the bounding case is that you have zero rainfall. And what happens then is that the radionuclides over time migrate to the surface where you could have crops and those sorts of things that would update those radionuclides and could be consumed in foodstuff.

MEMBER ARMIJO: Okay. But you know that from time zero then that the bounding case is zero rainfall?

MR. KIRK: We know that. Exactly. But my point here though is is that if you don't look at a time period past 1,000 years, like 10,000 years, you'll never come to that realization. Now I think that's a very fundamental understanding that one needs to know when you're licensing a facility. You need to know how it's going to behave and perform.

MEMBER ARMIJO: Yes, I understand that.

MEMBER RAY: "Know" is maybe not the right word you want to use, but estimate or --

MR. KIRK: Oh, it's an estimate. Oh, no, absolutely it's an estimate.

You know, and as we said before and as Brad Broussard at TCEQ had mentioned, that period of compliance is 1,000 years or peak dose, whichever is longer. In our initial license applications we did look at time periods over 50,000 years. But we have submitted a major amendment request. We've altered those. And I'll get into that as well.

We believe that the NRC's rulemaking should be forward thinking and we think it should really reflect some of the waste management advancements that have been made over the past several decades that's exemplified by the successful licensing of the WCS facilities.

For intruder protection, you know, I think the key here is is that -- at least at our facility, is the barriers that you need. Our facility; and I'll show you in a second, is highly engineered. You know, we do have multiple intrusion barriers, but we believe that it's a longstanding fundamental design requirement and a performance objective that's in Texas regulations. And we think that that needs to stay, but we also, you know, recognize that you need to have reasonable and

likely intruder scenarios.

For example, depleted uranium; and I'll get to this later, you know, we assumed that intruder would be there for our major amendment, which is about 400,000 cubic meters of depleted uranium. We assumed that a resident would be there a million years from now. You know, you could come with estimates of those sorts of things. Obviously they're not precise estimates, but what it really tells you is, you know, the site really suitable? Does it degrade? Is it stable over time periods?

For the intruder scenario that we really used for someone, you know, drilling was for oil, but we assumed that time period was going to be about 500 or 600 years into the future, because we assume at some point in time that oil is going to be depleted in the United States. Now and how long would that be? Would it be 500 years? Six hundred years? A thousand years into the future?

Now we modeled that scenario and, you know, I think that we drew up for the compact facility -- we stack our MCCs high, about four. And for the federal facilities we stack them high, about six. Each of these MCCs; and you'll see pictures of them, they're about 10 feet high. You know, we assume that a driller would

drill into it, bring the materials to the surface and we still pass the 500 millirem intruder pathway at about 500 or 600 years. And we assume that was bounding because that includes the fission products and activation products, the more shorter-lived radionuclides. But for depleted uranium large periods of time, no, I think you need to apply reasonableness to intruders.

MEMBER ARMIJO: And that reasonableness standard is in the State of Texas regulations?

MR. KIRK: Yes, the dose standard -- what it's called out for -- and when the rule was passed, or when the legislation was passed in 2003, TCEQ then embarked on a rulemaking effort. And what they did is they -- you know, they establish regulations for the 1,000-year time period and peak dose, whichever is longer. And in response to comments there's a lot of good information in that. And what they said is they didn't anticipate someone would model out into infinity. The standard really applies to the reasonably maximumly exposed individual.

CHAIRMAN RYAN: Scott, have you ever looked at or had any experience with chemical waste disposal which is for all practical purposes infinitely live? I mean I struggle with the fact that we have RCRA requirements that have fairly shortened the horizon, for

years, things like that, we see.

MR. KIRK: But those heavy metals will be there for a long time.

CHAIRMAN RYAN: Forever.

MR. KIRK: Yes, that's a fact. I think it's well understood, but that's the construct of the regulatory environment in which we live. The EPA regulates the hazardous portion of these sorts of things whereas, you know --

CHAIRMAN RYAN: That's not my question. I mean my question is we've got two kind of modes of operation: One is where essentially infinitely-lived material -- there's some consideration given to that. The other is a class of other infinitely long-lived hazardous materials where we don't consider. How do we get around that? I mean how do we get a coherent system someday?

MEMBER ARMIJO: It isn't.

MR. KIRK: Well, you know, a lot of people propose having a generic risk-based system where you look at risk of hazardous materials and you juxtapose that, similar to how we handle radioactive materials. And I know NCRP has come out with reports like that as to how we move forward. But you know, it's a good question, but I don't have an answer for you.

CHAIRMAN RYAN: Well, I mean we're talking about it and it sort of struck me we keep talking about basically something that's going to be here for the life of the planet.

MR. KIRK: Absolutely.

CHAIRMAN RYAN: And, you know, half-life doesn't mean much when you're in that time frame.

MR. KIRK: No, I agree with you completely.

CHAIRMAN RYAN: Thanks.

MR. KIRK: You know, we think that 10,000-year period of compliance, it provides regulatory and public confidence in the long-term performance of the site.

MEMBER ARMIJO: You know, I guess where I really struggle -- and these presentations have helped a great deal. To me compliance is a tough standard. You comply. And what you talked about, when you talk 10,000 years, you're talking really an analysis, qualitative, semi-quantitative analysis. But then when you actually want to comply in a physical way, you talk in terms of 1,000 years. And the term "compliance" is used in both cases. And that's confusing to me, that you can analyze until you're blue in the face, but it doesn't matter as long as you aren't obligated by law to demonstrate that you meet the standard in a hard sense.

And so do you think of the 10,000 years period of compliance as an analysis, an evaluation, but not a requirement?

MR. KIRK: It was a requirement. It was a quantitative requirement.

MEMBER ARMIJO: A quantitative requirement to do the analysis, but is it a quantitative requirement that you have to prove that you protect the public for 10,000 years into the future?

MR. KIRK: We do. We did have to.

MEMBER RAY: Can I ask it a different way, Sam?

Do you have to meet a threshold of let's call it probability that no one would be exposed to greater than the standard of compliance, that the probability of that happening is less than 10 to the minus 6th or whatever you --

MR. KIRK: No. This issue goes back into reasonableness.

MEMBER RAY: No, wait.

MR. KIRK: I'm sorry.

MEMBER RAY: What was your answer?

MR. KIRK: It's reasonable. I mean --

MEMBER RAY: No, your answer was no, I think, wasn't it? You don't have to show that it's less

than 10 to the minus 6th?

MR. KIRK: No, we don't use probability estimates.

MEMBER RAY: Okay.

MR. KIRK: It's part of the regulation.

MEMBER RAY: That's the difference that we're talking about.

MR. KIRK: Yes.

MEMBER RAY: In some things we have to do that. Okay? The probability of something bad happening is less than 10 to the minus 6th, or 10 to the minus 5th, or whatever. That's not the methodology you're using here?

MR. KIRK: No, nobody for low-level waste disposal uses --

MEMBER RAY: I understand, but I'm just trying to make that distinction so that we don't apply the same protocol to this in our thinking that we do in other things that come before us here.

MR. KIRK: I would completely agree with you. I don't know how you put probability estimates on things in such large time frames.

MEMBER RAY: Well, that's what we're trying to figure out.

MR. KIRK: I don't think it's possible to

do that.

CHAIRMAN RYAN: Well, because it begs the question then, Scott, what use is a deterministic analysis for the same time period? You're picking one number and that's it.

MR. KIRK: Yes, I think what you do is you define your assumptions to the parameters in which you're calculations are defined. You defend those. You do your calculations. When your calculations -- they come up with a point estimate. Sometimes they're probabilistically driven. I mean we did -- and our dose assessments are probabilistic analysis. You come up with a numerical value and you compare it to a dose standard.

CHAIRMAN RYAN: Well, but you're still kind of in the place where, you know, your beta calculation, you've made some variations of that calculation. But, you know, I always kind of wondered about, well, am I SCUBA diving in oatmeal and I don't know which way the bubbles are going or have I hit the target in the center? I don't know which field I'm. How do I know that I'm representing reality with some degree of certainty?

MR. KIRK: Well, I think you struggle with that. You do. And so and I mean I understand your point. A thousand years is shorter than a ten thousand

year period, or for peak dose, which is, you know, way into the future.

CHAIRMAN RYAN: Yes.

MR. KIRK: So how do you make sense of that? And I think the thought is, and at least the way I look at it is, the numerical number that you're coming up with that demonstrates compliance with that dose standard is one issue. But the other issue about site suitably, like stability and those sorts of things is another issue. And Texas grappled with that as well and their logic and their rationale for coming forward to the point that they did is well documented.

CHAIRMAN RYAN: We've had some good discussions with the state representatives today about their strategies and, you know, background thinking on how they approach that. So that's helpful that we know that.

MR. KIRK: You know, our concept was you shouldn't regulate for peak dose because that's potentially into infinity. The point should be 10,000 years, which was consistent with NRC guidance at the time. And their response was, no, we can look at periods much greater than that. And the key part is to look at site suitability, was the response in response to comments to rulemaking.

MEMBER BLEY: You know, we've heard this from a number of folks today. Those calculations can be helpful if they point out some holes in the system that you weren't aware of, but the way the thing is written, it sounds as if we're trying to prove that it will be maintained properly for that period of time, which is nonsense.

MEMBER POWERS: It strains credulity.

MEMBER BLEY: It does more than strain it.

(Laughter.)

MEMBER BLEY: Well, like I said, there's a problem in the way this stuff is written for me. Now, you know, doing that analysis I can see benefit as long as you don't pretend that all these systems that you assume will be there, socioeconomic and governmental systems. As long as you aren't relying on that for such long periods of time.

CHAIRMAN RYAN: Dennis, I think that's a key point that ought to be made in our letter. You know, there's a difference between gaining insights into something and saying the numerical value is 1.6328.

MEMBER BLEY: Exactly. Yes.

CHAIRMAN RYAN: You know, so I think we need --

MEMBER ARMIJO: Qualitative compliance is

the standard as opposed to quantitative compliance. And I understand it. I understand that, hey, these guys aren't trying to prove to -- to meet a standard, a numerical standard, you know, whether it's peak clad temperature of things that we worry about. It's a qualitative assessment.

MEMBER BLEY: And you're making assumptions that some of the institutions will be there, but that's an assumption that --

MEMBER ARMIJO: Sure. And people can argue until -- but the real effective control in, at least in Texas is a reasonableness standard that will accept qualitative arguments for these long periods of time. And even then it only has to be for 1,000 years. It doesn't have to be for 10,000, if that's correct.

MR. KIRK: Well, the reasonableness argument went beyond 1,000 years during our licensing process.

MEMBER ARMIJO: Okay.

CHAIRMAN RYAN: I'm going to suggest we move on because we've got one more speaker.

MEMBER STETKAR: Well, I have a question actually. Since you've done the 10,000-year analysis, right, for your facility have you made any changes in the way that you designed your facility or requirements for

package of waste as a result of looking at 10,000 years versus 1,000 years, for example?

MR. KIRK: Well, I could tell you that it required us especially for some of the mobile long-lived radionuclides like technetium-99. You know, one of the things in our major license amendment that we have submitted and what we are defending is, you know, being able for tech-99 to take -- you know, to be able to take much larger inventories of it.

MEMBER STETKAR: Yes.

MR. KIRK: And one of the things that we came to understand pretty quickly is that the volume of concrete in our facility is instrumental in impeding the mobility of technetium-99. Because what happens is that concrete will degrade over time. There's a buffering effect. The pH will rise. And as a result, you know, we adjusted our Kd's for tech-99. So we showed, you know, based on that construction feature that, you know, the math of the tech-99 will be sort of held up in that matrix, you know, well over a 100,000-year time period.

So, you know, we already had the requirement to have all the concrete, but it --

MEMBER STETKAR: Yes, that's --

MR. KIRK: -- required us to go back and re-look at things.

MEMBER ARMIJO: But did the analysis help you discover another advantage of what you'd already decided to do?

MEMBER STETKAR: Yes, what I was asking was --

MEMBER ARMIJO: Yes.

MEMBER STETKAR: I mean that's confirming that the design you already had can satisfy the requirement. I was asking whether the comparison of 1,000 versus 10,000 versus -- pick any other number, actually gave you some insights such that you said, oh, gee, we should actually put some more concrete in.

MR. KIRK: No, we didn't do that. No.

MEMBER STETKAR: Okay. Thanks.

MR. KIRK: We did not.

MEMBER STETKAR: That's what I was looking for. Thanks.

CHAIRMAN RYAN: Okay. Scott, we're getting a little bit tight on time, so if you could -- we're asking a lot of questions, so it's not your fault, but I want to make sure we don't shortchange Dan. We'll go a little bit over 12:00.

MR. KIRK: Okay. I'll can do the best I can.

CHAIRMAN RYAN: I'm speaking to my

colleagues through you, I think.

(Laughter.)

MR. KIRK: You know, we think our success though is really rooted with the tremendous support that we've gotten from the state and our region and our local communities. They've been very supportive of the WCS facility. And without them we would not have a licensed facility today.

Our local community, you know, they agreed from the outset that they would host the disposal facility, but only if it was backed by good science technology as well as being regulated with proper regulatory oversight.

You know, Texas' vision of a modern low-level waste disposal facility. You know, one of the key things that they recognized was is that the -- they thought more stringent requirements may be needed. And one of the key parts of that is, you know, they adopted this sort of philosophy about isolated assurance, monitor retrievable storage and the overall design concepts of our facility, but they mandated that we us modular concrete canisters which have reinforced concrete in them. All of the waste has to be placed in those for the compact facility. They're stacked four high. At the federal facility they're stacked six high.

Again, we're located in a very arid remote part of Western Texas where the average rainfall is less than about 16 inches and it's far removed from any water table. The water table, which is non-potable, that resides underneath the site is about 600 feet below grade.

As we mentioned before, the standard of 1,000-year or peak dose, that's really a quantitative standard that we were held to. And as I have said before that, you know, we had proposed a 10,000-year period of compliance as being, you know, the maximum bound, but you know, Texas wanted us to look at the more mobile radionuclides, and so that's why they imposed, you know, a peak dose standard. But they also said that it demonstrates a relationship between site suitability to the performance objectives specified in the rule itself.

This is really just an overview of the design itself. The first layer that you is really an evaporation of cover itself. We have multiple intruder barriers which are large concrete and boulders. The reason that you see this portion, the arched portion of that performance cover is what happens is, or what it's designed for is when rainfall does come, if it infiltrates to the site, it won't intrude into the waste itself. And again those are multiple layers. The liner

system at the bottom is about seven feet thick of reinforced concrete, sand, rebar. And again, we pump any leachate that we have off to evaporation ponds.

The hydraulic conductivity of the clays themselves, it's about 600 feet thick. Now, those are more impermeable than concrete themselves. The hydraulic conductivity is 1 times 10 to the minus 9 centimeters per second. Again, they're about 600 feet thick of these red bad clays. The facilities are designed precisely at the ridge of where the Dockum Formation is, which is where these red bed clays are.

We do have a sandstone lens about 125 feet below grade. We've age dated that water. It age dated about 16,000 years. The reason we age dated it was to show the stability of the site and the fact that that water doesn't move. We took over about 600 borings in order to best characterize the site.

This is a picture of the compact facility. We think this is a new industry standard. As you can see the hole itself, the disposal facility -- when it's all said and done it's going to be 100 feet from ground surface down to the bottom of the disposal facility. So again, it's very deep. The cover system varies anywhere from 25 to 40 feet. And again, you can see concrete all around it. You know, there's concrete up the sides of

the wall of the disposal facility. Again, the liner is seven feet thick and each of these concrete containers when they're full they'll weigh about 90,000 pounds. We place like ion exchanges resins in them. We grout them in place.

CHAIRMAN RYAN: Just to calibrate my eye, how many cubic feet of waste will that disposal unit hold?

MR. KIRK: The unit? The disposal unit?

CHAIRMAN RYAN: That I'm looking at, yes. This one hole.

MR. KIRK: To that hole? That's Phase 1. I could come back and give you some specifications on that.

CHAIRMAN RYAN: Okay. That would be great.

MR. KIRK: This is a picture, an aerial view of the federal waste disposal facility. You can see it's much larger. And again, for the federal waste disposal facility we can stack, you know, MCC six high.

The older facilities. You know, the Clive Facility is a great facility for Class A waste, but they use impoundments. But it's nowhere near the type of features that we have. And again, it's our legislature that helped mandate some of these requirements. And for the Barnwell Facility, just in oversight -- you know, and

I just have to commend the Barnwell Facility. It's really helped, you know, support the generators across the country for many, many years, but the design of it is not anywhere near the WCS facility because our facility is modern and it's forward thinking.

We have updated our performance assessment. You know, we submitted a major amendment request where we can take up to 400,000 cubic meters of depleted uranium. We submitted that in August of 2013. You know, as I had mentioned before, the maximum doses to an intruder is really limited to the reasonably maximum exposed individual. It was also well below the regulatory limits.

You know, when we were looking at peaks, we spoke to our regulators as to what they wanted us to see. In the original application it was 50,000 years. To take waste up to the Class C limit, you know, we looked a peaks from 100,000 years up to 1 million years time period. And what it really show you -- I would agree it tells you nothing about the precision of the dose estimate, but it should tell you that you should have confidence in the performance of your site.

CHAIRMAN RYAN: I got to tell you I struggle with a million years, because that's probably a range of probability where the U.S. could get whacked up pretty

good by a meteor strike. I mean I just don't have any confidence whatsoever that --

MR. KIRK: We didn't look at meteor strikes.

(Laughter.)

MR. KIRK: We do not look at meteor strikes or the probability.

CHAIRMAN RYAN: Listen, a million years for anything in a model of surface behavior is silly. I mean how can you say there's any certainty in what you end up with as the answer?

MR. KIRK: Well, you know, people look at the geological record. You know, they look at that and they make judgments on faults and those sorts of things for much longer periods than a million years.

CHAIRMAN RYAN: I'm not asking what people do. I'm asking how you did it. With what certainty are you making estimates over that time period?

MEMBER ARMIJO: Well, the impression I get is you can do these calculations and there's really no standard against what somebody can judge whether you're right or wrong. There's a lot of opinion, there's a lot of assumptions and you do your best and you're in an environment where the legislature says, okay, you've satisfied us. And but as far as really believing it, you

know, as long as you don't have to comply in a hard sense to meet a -- then I think I understand what you're doing.

MR. KIRK: Well, you know, the effort that we had in front of us, we had a regulation which is 1,000 years or peak dose. We used the best tools that are available today to estimate, you know, environmental performance of the site. The model showed that the site's going to perform for, you know, well past 10,000 years.

CHAIRMAN RYAN: I'm not arguing with your modeling. Not at all. I mean I understand how you did it, what you did, what you calculated, but when you get into time periods of say 500 or 1,000 or 10,000 kinds of numbers and get to a million years, then lots of features, events and processes that weren't in play in your performance assessment come into play.

MR. KIRK: I agree with you.

CHAIRMAN RYAN: Yes, okay. All right. That's fine. I understand.

MR. KIRK: You know, as I mentioned before, we did look at climate change where we doubled the annual rainfall.

CHAIRMAN RYAN: Scott, I'm going to have to ask you to wrap up because we do have another -- you know, Dan yet to speak and we're running short on time.

MR. SHRUM: With your permission should Mike Benjamin and I switch, because he said he's is shorter.

CHAIRMAN RYAN: No, it's not a matter of --

MR. SHRUM: Okay.

CHAIRMAN RYAN: -- time. It's a matter of, you know, getting --

MR. SHRUM: Understood. Okay.

CHAIRMAN RYAN: We'll be a little late going to lunch, but that's okay.

MR. KIRK: So you want to hear the conclusions?

CHAIRMAN RYAN: Sure.

MEMBER ARMIJO: Yes, just keep going.

MR. KIRK: Much has changed in the manner in which radioactive waste materials are being managed since Part 61 was promulgated over 40 years ago.

Our site is the only site that's been licensed since the Low-Level Waste Policy Act was enacted in 1980.

We believe that safety has assumed a leadership role in helping site a new facility and developing a 21st Century state-of-the-art disposal facility.

The NRC's guidance developed with the support of Agreement States hosting a disposal facility have recognized the need for a period of compliance of 10,000 years.

A 1,000-year period of compliance is not sufficient to evaluate the long-term environmental performance of a disposal facility, especially for long-lived radionuclides.

Building community support is essential to the development of new sites.

Communities willing to host a license facility should expect a modern state-of-the-art facility built on the best science and technologies that are available that are really depended upon to protest public health long into future.

The length of time for a period of compliance is more of a policy issue than a technical decision.

Demonstrated compliance for a well-sited and designed facility for 10,000 years is not unsurmountable as evidenced by the successful licensing of the WCS facility. Thank you very much.

CHAIRMAN RYAN: Scott, thanks very much for your presentation.

Any questions or comments for Scott?

MEMBER ARMIJO: One quick question. Now, first of all, thank you for a very good presentation and obviously a very modern facility. There's no question about that. But the question I have is this facility was designed and licensed to the current regulations of Part 61 and those additional requirements from the State of Texas. So if that's the case, and you believe this would comply with a new Part 61, then does Part 61 do anything for you, the proposed regulations? Does it help you? Does it bother you?

MR. KIRK: Yes, and that's a very good question. I think the part that helps is it's recognized, at least in my opinion, that you need to demonstrate whatever waste streams that you put into that disposal facility are safe. But the classification tables, you know, licensees can use those or they can do a site-specific analysis. So for depleted uranium I think that really helps us because we demonstrated the safety case. If later if the NRC came back and said, hey, DU is not Class A waste, it's Class B or C, we'd be able to take it. But if they say that it's greater than Class C waste, we'd -- I think it demonstrates that for a modern disposal facility it's very helpful in that regard, especially when it comes to depleted uranium.

MEMBER ARMIJO: Okay. Thanks, Scott.

Appreciate that.

MR. KIRK: Thanks very much for your time.

CHAIRMAN RYAN: Scott, appreciate it. Thank you for being here.

MR. KIRK: Thank you.

MR. WIDMAYER: Can you do it, or you want me to do it?

MR. SHRUM: I don't know. It's pretty high-tech here.

MR. WIDMAYER: Oh, come on.

(Laughter.)

MR. WIDMAYER: See Shrum?

MR. SHRUM: Got it.

MEMBER STETKAR: Welcome to our world.

MR. SHRUM: Here we go. Hey, that wasn't bad, was it?

CHAIRMAN RYAN: Perfect. Very good. Thank you very much for being with us. Dan Shrum from EnergySolutions.

MR. SHRUM: Very much appreciate the opportunity. I do have a disclaimer that when Part 61 was first being contemplated, these changes, I had a full head of hair and --

(Laughter.)

MR. SHRUM: -- I can only imagine what I'm

going to look like when it's done.

MEMBER POWERS: Just remember there are only a few perfect heads in this world. The rest of them are covered with hair.

(Laughter.)

MEMBER BROWN: Wise words.

MR. SHRUM: I've got some slides in here for some context. You know, the NRC is proposing these new regulations for waste streams that are significantly different than what was considered when Part 61 was originally developed. Originally the rule was going to require new and revised site-specific technical analysis. The rule was going to say exposure limits for intruders, a developed criteria for the acceptability of low-level radioactive waste. And the rule also identified that Part 20 would also have to be amended.

Then in January 2012 the Commission redirected staff and asked them to evaluate to following; and that is, would you consider accepting and adopting new ICRP standards? Would you consider or possibly look at a two-tiered approach for the period of compliance or -- and the compliance period? Would you consider a WAC? And what kind of compatibility? What when these rules are sent out -- what are the states going to have do? So those things were asked by the Commission in January of

2012.

So the fundamental requirement of the rules is to require performance assessment. There are four commercial disposal facilities in the United States, and all four have done technical analysis to -- and they are different. And that's one of the things that ought to be considered or ought to be looked at is do they need to be the same? I don't have the answer to that. But they're all different. I know that our facility has a different exposure requirement. Ours is a little more stringent than the other facilities. Is that right? Is that wrong? You know, that's what we're here to talk about. All four of them have WACs also. All of the facilities have waste acceptance criteria.

On the two-tiered approach, the word "reasonably." Now I've been taught to be very careful when I write things like "significant" and "reasonably," and that's been a point of discussion. And I'm going to not shy away from it. We're going to discuss that word once again.

To me reasonably foreseeable does not mean you can run the model. The model is simple. It runs simple. You know, we've got people that have helped us develop these models.

Okay. I'm sorry, John, the model is not

simple. It's very complex.

(Laughter.)

MR. SHRUM: But adding time to it is pretty simple, isn't it?

But there's more to the model than just plugging in the numbers. All the facilities are aware that there has to be more than just increasing the time frames. You have to look at durability of cover components. You have to look at the durability of waste forms. You have to look at the HIC durability. That's what a lot of the waste gets disposed of. How about the drainage systems that are either manmade constructed? How long do those last? You know, will those continue to flow over time? Concrete, rebar and those types of things, those are other durability issues that have to be looked at.

So, you know, I'm a geologist in training. I like to look at longer time frames. But typically we have not been doing that. We try to look at things about 300 years out. Steel, concrete, things like that. So how do we extend those time frames out to 10,000 and make it meaningful? That's the concern.

So to me reasonably foreseeable is closer to 1,000 years. And the reason for that is it captures most of the low-level waste that's being disposed of in the United

States.

Now 1,000 years doesn't capture depleted uranium, but neither does 10,000 or 20,000. Depleted uranium doesn't really start going until the time period after that. Ten thousand years, you know, threw this in there. It's also what was mostly contemplated for high-level waste. Now 1,000 years is consistent with other regulated low-level facilities such as what the Department of Energy has. Now again, we haven't looked at components out for 1,000 years, but we can kind of extrapolate out a little easier from 300 to 1,000 as opposed to 300 to 10,000.

Yes, sir?

MEMBER POWERS: That's what bothers me a little bit. Your first line, you had me in your hand when you said you'd like to think of 300 and then you went to 1,000. I mean 300 seems plausible for things.

MR. SHRUM: And why did I say 1,000?

MEMBER POWERS: Yes, then you went wimp on me.

(Laughter.)

MR. SHRUM: One, two, three, four, five, six. The sixth bullet. You're absolutely right. A thousand is tough. When you start looking at components of a system, of an engineered system, 1,000 is tough.

MEMBER POWERS: We were having troubles getting from 60 to 80 on components.

MEMBER ARMIJO: Well, you know, I got to step in at least from a metallurgist's standpoint. You know, if you go down to the museums here in Washington, you go and see the ancient Chinese bronzes, 2,000, 3,000 years old, cast bronzes in beautiful condition, buried in the ground for thousands of years. There was a finding in Scotland several years back of buried iron spikes that the Romans buried.

MR. SHRUM: Yes.

MEMBER ARMIJO: Buried for almost 1,500, 1,800 years in pretty nasty soggy Scottish soil without any engineered barriers. When they were discovered and found, they were still -- yes, they had rust on them, but they hadn't dissolved away. They still were sharp, pointed and functional. So, you know, metals -- you know, I don't know concrete. Concrete could be a tougher problem. So things don't degrade. You have that much. So 1,000 is not an extraordinary challenge, I don't think, but it will be costly to prove it with experiments. But I think --

(Laughter.)

MEMBER POWERS: I want to do those experiments.

MEMBER ARMIJO: No, they've already been done.

(Laughter.)

MEMBER ARMIJO: Archeology will tell you it's there hopefully, you know?

MEMBER POWERS: Sam, for every case that you find a nail that lasted 1,000 years, I can find cases of nails that didn't last 5.

MEMBER ARMIJO: Well, you've had different --

(Laughter.)

MEMBER ARMIJO: I'm just saying that there are lots and lots of archaeological findings to demonstrate materials last quite a long time.

CHAIRMAN RYAN: If you take a look at it from the other side of the coin and say what radionuclides are left at time A, B, C and D down the timeline, you'll find very quickly that your down to a very small number of radioactive materials with long half-lives and very low inventories in an inventory that's a big inventory. Chlorine-36 and a little bit of this and a little bit of that and, you know, that's it.

MEMBER POWERS: I mean that seems to me that's really where you get to is what will I have left that I have to worry about?

CHAIRMAN RYAN: And I think at some point when you look at failure barriers or containers or whatever it might be, you've got to also kind of line up with what fraction of the radioactive material inventory is still around. Two-thirds of the inventory is cobalt-60.

(Laughter.)

CHAIRMAN RYAN: You know, and 300 years, cesium and strontium. I mean not -- you know, 30-year. Three hundred years that's gone, and lots of other stuff is gone with it. So I struggle with the fact that we talk about paying 20,000 years, like other DU what's going to be left? Not much.

MEMBER BLEY: Well, I think, you know, I mean his third bullet is kind of where we started on this at our first meeting some long, long time ago.

CHAIRMAN RYAN: Yes.

MEMBER BLEY: You know, except for DU you're probably all right at much less than that.

CHAIRMAN RYAN: Right.

MEMBER BLEY: And going to 10 or 20 doesn't get you any closer to the --

(Laughter.)

MEMBER POWERS: Not much.

MEMBER ARMIJO: But, you know, I think

Dana's point is that, you know, if you were talking about 300 years, 500 years, you address the problem of low-level waste, but you don't address DU.

MR. SHRUM: That was my point.

MEMBER ARMIJO: Yes.

MEMBER POWERS: And you never address DU.

MEMBER ARMIJO: And you never will.

MR. SHRUM: You never will address DU.

MEMBER ARMIJO: And so --

MR. SHRUM: I agree with that.

MEMBER ARMIJO: Okay.

MR. SHRUM: Okay. Thank you. Okay. So 1,000, this gets to your point. It's still a long time.

(Laughter.)

MR. SHRUM: I am well aware of that. But you get closer to trying to manage the uncertainty of 1,000 better than you can with other time frames. I believe it does give confidence to other stakeholders. Other stakeholders may believe that we have to model with certainty out to 2 million years or don't take it. We need to change and work on changing that expectation and through education through that. And it's also a number that won't cause unintended consequences for some of the existing facilities.

So performance period. So the first one

was reasonably foreseeable compliance period. The second tier is performance period. And that's used to capture longer-lived isotopes. And I believe, it's my opinion that they need to be looking more to catastrophic effect, not 25 millirem, not even 500 millirem to the inadvertent intruder which is being proposed, but into the 1 to 10 rem range. And the reason for that is it's speculative anyway. People live -- I mean we're allowed to give our employee five rem a year. That's allowed. And, you know, that's a known thing that we can do. And so as we project these things into the future, increasing the threshold might be a reasonable way to handle that.

We also believe that as you get into the performance period you start to focus more on the site location as opposed to engineering features. Now the facility that I represent, the Clive Facility, we're all natural materials. We take no credit for any engineered features other than, you know, how long will rock last, and rock is -- rock's been around for quite awhile.

So anyway, and then you start to capture what happens with DU, and I'm not saying specifically you capture, but you start to understand some of the dynamics of what will happen with depleted uranium.

MEMBER ARMIJO: Well, just on that point, I raised this question before, and wouldn't this whole

regulatory process be much cleaner if DU was just regulated separately? Take it out of the low-level waste thing and have a separate regulation that addresses DU and its disposal and not bury it -- and not confuse the -- or add burden to what I consider really low-level waste. It just seems to me that when you stick DU into this regulation, large quantities, it becomes a driver of the regulation, and it shouldn't.

MR. SHRUM: I believe that it has conflated two very different things that we've had to deal with, normal low-level waste and the potential of the facility for depleted uranium. However, I do believe that properly worded we can capture both. And I'm going to get some slides later why I think that's important to keep it as one just because of I'm more of a pragmatist on that type of thing. It will be tough to --

MEMBER ARMIJO: Okay.

MR. SHRUM: Okay.

CHAIRMAN RYAN: And you mean keeping it as one in the same regulation and keeping one use the same facility?

MR. SHRUM: Yes, one regulation, potential of using one facility. Or not just one facility. I don't mean our facility.

CHAIRMAN RYAN: Collocated?

MR. SHRUM: It could be collocated, that's right.

MEMBER ARMIJO: But distinct requirements. You can't have the same requirements for something that has a 30-year half-life and then the same --

MR. SHRUM: I don't disagree with that. Yes, something has to change when you start to evaluate the --

MEMBER ARMIJO: There has to be a boundary between so that the requirements don't drift over and you're applying DU thinking to short half-life.

MR. SHRUM: That I agree with, yes.

It's also been proposed -- you know, the Clive Facility did not evaluate an inadvertent intruder for some specific reasons that I'll get into. Right now it's being proposed that it would be a 500 millirem per year standard. The NRC has also discussed in their recent -- in the July 2013 proposed rule to change the definition of the inadvertent intruder to limit scenarios to reasonably foreseeable activities.

Now this is what we are experiencing and I'm going to give you an example of what we are experiencing with what's happening.

So we believe we're on the bleeding edge of what's going on with Part 61. The State of Utah has

adopted some rules and we're trying to implement those rules and our regulators are trying to implement those rules. And as they implement those rules without clear guidance we are having some unforeseen situations happen. And that's what's happened here.

The Clive Facility. This isn't a commercial for the Clive Facility. This is to tell you what we experienced. So it's inhospitable to human health. You cannot live out there. It's very salty. It's doesn't support life in this area. Our regulators concluded that it's unrealistic to assume residential or agricultural intruders. The NRC in their order for the LES said significant intruder exposures at a site like Envirocare; that's the old name, are unrealistic. It could be licensed under Part 61 regardless of the time frame. Okay. This was back in 2006. I'm not going to read all that one, but it says it's a good site.

Okay. So as Rusty mentioned earlier, we're doing other licensing things and the state has tried to look at inadvertent and intruder analyses at our facility. And that's gone from in 2006 from what could happen to now we've got a resident that lives, farms and mines at the facility, pumps the water; the water's twice as salty as the ocean, treats the water for consumption and irrigation. They can grow crops at our facility and

there's a potential to receive dose from the filter cake.

The only reason I'm bringing these up is if we're going to have to look at these time frames, we need a better understanding from the NRC of what is an inadvertent intruder. Is it anybody? Are we going to play the what-if game? Because the what-if game take a long time. You know, so these are some of the things that we were dealing with.

So one of the things that they stated was lack of historical habitation doesn't preclude future residence patterns. So they're trying to implement what they believe is going to be coming down the pipeline.

I didn't realize that there's a potential to grow algae for food source in high-saline waters, and we're being asked to evaluate that.

So when I was a kid, I thought we were all going to be flying around in cars. And we're not yet. I understand that we have to look out into the future. That's the purpose of performance assessments, but we need to be careful on how we do that and we need to be able to be reasonable in doing so.

WAC. I think the WAC is a good idea. It's consistent with what DOE does. It's also --

MEMBER ARMIJO: Dan, I'm sorry to --

MR. SHRUM: Oh, I'm sorry.

MEMBER ARMIJO: -- interrupt you. Getting back to the current issues related to the inadvertent intruder, is this strictly somebody saying, okay, given all these what-ifs, run your model and you'll get some answers, but you don't have to do anything about it?

MR. SHRUM: Oh, no, we have to do things about it.

MEMBER ARMIJO: What would you have to do?

MR. SHRUM: I don't know.

MEMBER ARMIJO: That's the problem then. If it was just running your model for all of these what-ifs, you know, people play around with that until they're broke or satisfied, but as long as you don't have to physically do anything other than run the model --

MR. SHRUM: Now, I have been informed that performance assessments are a good tool to help with your decision process.

MEMBER ARMIJO: This isn't.

MR. SHRUM: We have been in a deterministic -- the way we have done our models in the past. And so actually the performance assessment is the answer and we're working with the new models that have been done and saying that it helps inform the decision. But to date it's been that the decision -- and John's nodding his head -- John Tauxe with Neptune -- that's the world right now.

It is the decision. Okay? Any other questions?

MEMBER ARMIJO: So it's becoming the basis for decision as opposed to just information?

MR. SHRUM: Correct. I know that might be a little too bold, but that's the reality.

MEMBER ARMIJO: Oh, that's what we have to be careful about, that if that's not the intent of the regulations, we shouldn't make sure that it's worded so it doesn't become the basis.

MR. SHRUM: We're very supportive of this WAC idea, because all of the facilities currently have waste acceptance criteria. It's used throughout DOE. I believe that a properly written WAC criteria would end the need for further rulemaking because you could have the table or you could use through analysis waste acceptance criteria and you could inform the decision either way. And we believe that that's important for moving on and we believe it's important to move on.

For example, we had a moratorium placed in the State of Utah in the disposal of the depleted uranium in June of 2010. We submitted our performance assessment on June 1st of 2011. The state has begun their performance -- the review of our PA. But this has been one of the policy issues that has come up. And I want to be very clear on this. I don't disagree with what

the state is saying, but further Part 61 rulemaking is a significant policy issue to be resolved. And they will wait until this is done. And I don't know that I blame them for that, but it's a real challenge for us. You know, they will wait. They don't know what will happen. And what will happen -- and will depleted uranium be reclassified or something like that? So that's a concern.

And so when you ask me about two rules and things like that, it needs to come to a conclusion.

MEMBER ARMIJO: So there's a lot of regulatory uncertainty right now and the state has chosen let's put everything on hold until we're --

MR. SHRUM: Well, we're doing it right now, and that's good. And we're supportive of that, but we won't probably won't receive a decision until Part 61 is completed.

CHAIRMAN RYAN: You mean, just to be clear, until the Part 61 update that's currently in process, or soon to be in process here?

MR. SHRUM: And there's discussion that it will be opened back up again. That's discussed very, you know, candidly with NRC.

CHAIRMAN RYAN: Okay.

MR. SHRUM: And we may open it back up

again. And that's tough. That's tough to be a regulated entity when -- you know, it's not that we want absolute certainty, but if it's being openly discussed that Part 61 may be opened up again, that's a concern for us. It's a concern for other stakeholders also.

Compatibility. A lot of these are just my opinion. If this was so important, I thought the compatibility categories would be quite high. Right now there's a lot of overlapping. It's not clear to me exactly where the compatibility is going to come down. I think further discussion on that. I don't know that we have to have absolute consistent standards through all the states, but many of the issues of, you know, requiring a performance assessment and probably dose standards, as well as what the inadvertent intruder scenarios are going to look like would be important to have that consistent. But there will be some -- states absolutely have the right to either require some things or suggest some things and move into that direction. Okay?

That's all I have. Thank you very much for your time. And any other questions?

(No audible response.)

MR. SHRUM: Always good to go right before lunch.

(Laughter.)

CHAIRMAN RYAN: Any questions from members?

(No audible response.)

CHAIRMAN RYAN: Any other comments or questions for anybody in the room, speakers past or --

(No audible response.)

CHAIRMAN RYAN: Hearing none, Mr. Chairman, we'll convene until -- how about we make it 1:10?

MEMBER ARMIJO: 1:10. Okay. We'll have a full hour?

CHAIRMAN RYAN: Yes.

MEMBER ARMIJO: Okay. Thank you, sir.

CHAIRMAN RYAN: Thank you. We'll convene until 1:10.

(Whereupon, the hearing was recessed at 12:11 p.m. to reconvene at 1:10 p.m. this same day.)

CHAIRMAN RYAN: And I appreciate everybody coming back after lunch. The next speaker is Mike Benjamin who will talk about the disposal facility in Barnwell, South Carolina, operated by EnergySolutions. Mike, welcome and thanks for being with us.

MR. BENJAMIN: Thank you, Mike, and thanks to the ACRS for allowing me to spend a few minutes talking about Barnwell. My name is Mike Benjamin. I'm the

general manager for the disposal operations for the EnergySolutions Barnwell Disposal Facility.

Contrary to some belief, Barnwell is not closed. Barnwell, we work every day, year around, and we are providing a very necessary service to the Atlanta Compact states providing them a low-level radioactive waste disposal service.

We've been in business since 1971. As Susan Jenkins' slides showed we've used about 86 percent of the land surface as completed and have enhanced caps. Enhanced caps are a multilayer, low permeability soil, bentonite mat, a high density polyethylene umbrella on top of that with a sand layer, top soil and vegetation.

I think there was a question about the efforts taken for the long-term care. Taking care of that vegetative cover ensuring that tall trees or long-rooted species do not have a chance to grow means that -- our cutting season, or our growing season in South Carolina runs from May to October so it's almost a constant grass-cutting challenge. And then adding 200 wells for sampling analysis and reporting keeps a number of folks fairly busy.

As the host for the Atlantic Compact or the disposal site for the Atlantic Compact, we expect to be in business until about 2038, allowing us to continue

receiving about 7,000 to 11,000 cubic feet of waste per year, and allowing near the end of that time frame some additional disposal space for decommissioned reactor facilities.

CHAIRMAN RYAN: What kind of components would go into the space for decommissioning reactors?

MR. BENJAMIN: It's hard to say. The dynamics of the low-level waste industry, I think, have changed a little bit with Clive and Barnwell being restricted to the three states, so probably the irradiated components.

CHAIRMAN RYAN: But nothing fuel bearing or anything like that.

MR. BENJAMIN: No fuel bearing. We've never received any fuel bearing materials. Everything is strictly low-level radioactive waste.

CHAIRMAN RYAN: Thank you.

MR. BENJAMIN: We agree with the conclusions and the recommendations that the ACRS provided to the NRC chair dated July 22nd in their memo revisions to the low-level radioactive waste disposal requirements, 10 CFR Part 61.

The Barnwell Disposal Facility has disposed of low-level radioactive waste for longer than 40 years in compliance with all the regulations at any given time.

The radiological performance of the BDF is addressed by the acceptance of waste according to our waste acceptance criteria, regulations, direct measurements and model.

As an operating facility, we believe the additional imposed requirements are a risk because we would have to demonstrate compliance for an operating facility for 10,000 years as well as protection of inadvertent intruder for that period.

We do not believe there is justification for the selection of this time period. We believe forecasting human activities and natural processes over 10,000 years has not progressed to be a reliable science.

(Crosstalk)

MR. BENJAMIN: As nice as I can be.

MEMBER POWERS: A little bit understated there.

MR. BENJAMIN: The proposal to change the regulations to also be applicable to previously disposed waste will cause unnecessary burden to the BDF.

I think Susan Jenkins talked about our extended care fund. Today our extended care fund consists of about $144 million where we are withdrawing about $2.2 million per year for what is considered institutional activities.

And those are those activities that manage

and maintain and monitor the closed portion of the site, and the proposed changes will not affect the performance of the facility for waste that's already disposed of.

CHAIRMAN RYAN: Just to clarify a point here. Also receiving institutional control money with currently received waste, correct?

MR. BENJAMIN: Yes.

CHAIRMAN RYAN: Yes, so what's the net -- and I understand. What's the net to the bottom line? Are you still gaining in funds or are you spending more money than what you're adding?

MR. BENJAMIN: Still gaining in funds.

CHAIRMAN RYAN: Oh, so the fund is still growing in spite of the fact you're using some of that revenue for ongoing.

MR. BENJAMIN: Right.

CHAIRMAN RYAN: Okay, thanks.

MEMBER SKILLMAN: Mike, let me ask this. I'd asked Susan about the activities to maintain the facility and she mentioned inspections, looking for burrowing, looking for intrusion, kind of walking the fence line.

You just communicated that the growing season as it is in South Carolina, you've got quite a few people tied up cutting grass and keeping the fauna and

flora from going through the HDPE. I think that's what you were meaning when you said that.

MR. BENJAMIN: Yes.

MEMBER SKILLMAN: Please tell us what that support will look like after 2038.

MR. BENJAMIN: As far as manpower-wise or --

MEMBER SKILLMAN: Yes. Is there going to be an army of grass cutters and security with arms and patrolling the perimeter? What's it going to look like after 2038 as we consider control period?

MR. BENJAMIN: I think my opinion will be, is what I will express. At that time the site would be under full control of the South Carolina Department of Health and Environmental Control. We would have terminated our license.

If they chose to retain the company EnergySolutions at that time to do those managing and monitoring efforts, two or three people to maintain and manage the physical portion of the facility -- cutting grass, maintaining the equipment, walking the site on a regular basis looking for signs of disturbance or subsidence. Another small handful of environmental samplers, analysts and recordkeeping processes.

So right now we're spending about $2.2

million a year on that. Things come up. We've had two cap repairs over the last couple of years. They were small, so the cost to repair was minimal. We have brought in subcontractors to help support that but you've still got to have local people or people on the payroll to support the subcontractors.

MEMBER SKILLMAN: So you would see that continuing after 2038 whether EnergySolutions is doing it or the state is doing it?

MR. BENJAMIN: Yes. I believe it would continue at least for a five-year period, and then could be reduced for the next 100-year period, post closure period.

MEMBER ARMIJO: Now the state has control of those funds.

MR. BENJAMIN: Yes.

MEMBER ARMIJO: So they could either keep you folks running --

MR. BENJAMIN: Yes.

MEMBER SKILLMAN: -- post closure or get someone else. And it would really be their decision on whether something needed to be done, let's say another repair or something like that or would their contractor --

MR. BENJAMIN: Well, the process right now

is we, or the department recognize the need for an effort. We gather the facts and make a proposal to South Carolina Department of Health and Environmental Control.

If they approve or agree, we send a communication to South Carolina, the Budget and Control. We have a Budget and Control Board that oversees disbursement of funds. We would make a request to that Budget and Control Board to spend those monies contingent upon approval from the Department of Health and Environmental Control.

MEMBER SKILLMAN: Okay. Thank you.

MR. BENJAMIN: You're welcome.

CHAIRMAN RYAN: With that any other questions for Mike?

MEMBER ARMIJO: Mike, before you go, let's assume that the regulations, proposed regulations are implemented as written. Have you estimated what the cost burden would be to do the various analyses that would be required?

MR. BENJAMIN: No, we have not. And I think a modeling run is probably a million dollars.

MEMBER ARMIJO: Everything costs a million.

MR. BENJAMIN: Remediation. You know, if there was remediation required it would be very, very

difficult to quantify that without some type of target to look for.

MEMBER ARMIJO: Okay. But it wouldn't be a small amount of money even if you didn't have to remediate.

MR. BENJAMIN: Yes.

MEMBER ARMIJO: So you would just run some models, and are there specific models that are approved for use in this kind of work or is it just --

MR. BENJAMIN: I'm not a modeler so it would be hard to answer that.

MEMBER ARMIJO: Okay. I'll ask someone else. Thank you.

MEMBER RAY: It's somewhat on the same point, but I'm just struggling with the last paragraph in your letter here. "The proposal that changes regulations to also be applicable to previously disposed waste will cause unnecessary burden on the BDF." I think I understand that, sort of what you were just talking about.

The second sentence though is the one I don't understand. "The proposed changes will not affect the performance of the BDF for waste already disposed." What's the basis -- first of all, tell me if I understand that to mean there's an unnecessary burden but it

wouldn't be excessive to the point of affecting performance.

MR. BENJAMIN: For previously disposed waste it's at where it's going to be. In my opinion it would be very non-ALARA to try to exhume that waste, repackage and rebury it.

MEMBER RAY: Sure.

MR. BENJAMIN: So given all those factors, previously disposed waste, it is what it is.

MEMBER RAY: Well, I know. But what do you mean by will not affect the performance?

MR. BENJAMIN: What's going to perform, and the site's going to perform in that general area of the site as it will with a 10,000-year PA, or without a 10,000-year PA.

MEMBER RAY: Okay. I'm trying to just compare the unnecessary burden to the will not affect the performance. Those two things don't seem --

CHAIRMAN RYAN: There may be a point I can make that will help.

MEMBER RAY: Go ahead.

CHAIRMAN RYAN: I think, Mike, the point is what would affect buried waste? Well, infiltration from the top, of water, is the principle issue in my book because the water's got to rise up into the waste.

MR. BENJAMIN: I think in the long term it's more erosion of the top.

CHAIRMAN RYAN: Well, whatever happens to the top to improve water getting down into the waste though is a negative. So all the capping is designed to preventing that so maintaining the cap is really kind of the key thing to keep that from being a risk. Water coming up from below is very unlikely because the water table would take tremendous amounts of water to raise that aquifer up any appreciable amount from its, you know, current very small oscillations.

MR. BENJAMIN: And I think our idea is that if we ran a 10,000-year PA and we were over 25 millirem per year at some point, we can't wait for 5,000 years to do a remediation. We would have to develop and implement activity or action now, or at that time of finding we would exceed a target which what we feel would be an unnecessary burden.

MEMBER RAY: Right. Again I'm still just struggling with the last sentence, what it means. "Proposed changes will not affect the performance of the BDF."

MEMBER BROWN: Well, they seem inconsistent. Is that --

MR. WIDMAYER: Well, I understand it to say

that he thinks that South Carolina DHEC is not going to make them do anything. So the waste that's there is going to perform the way it's going to perform. So even if they spend a million dollars doing modeling, South Carolina DHEC's not going to --

MEMBER RAY: We've spent too much time on this. I should just give up. But the first sentence seems to say you should not make these changes because of the unnecessary burden. The second sentence says, but it won't make any difference.

MEMBER BROWN: And what we often do is to take this comment and say if they do the analyses and the analyses also but nobody makes them do anything with it, then it changes nothing. But if somebody made them --

(Crosstalk)

MR. WIDMAYER: The regulation will make them do the analyses or else they have to close.

MEMBER ARMIJO: Right. But also if the analysis shows that there is no need for changing anything, you'll have just have proved that you spent a lot of money where no safety benefit. If the analysis shows that your caps are going to be eroding badly in 5,000 or 10,000 years, then you would have to spend money to re-cap assuming that the state made you do that.

The question is will these calculations

yield a safety benefit for this particular site, and I'm getting the impression you're saying it's just a waste of money. That's my impression.

(Crosstalk)

MEMBER RAY: I can read lots of things into it, but I'm just trying to understand what was intended by the second sentence.

MEMBER ARMIJO: Well, you can try one more time, Mike, because we all three have different --

MR. BENJAMIN: We're talking specifically about previously disposed waste. So we've already placed the waste in the ground and it's met all of our regulatory requirements.

MEMBER BLEY: When you placed it.

MR. BENJAMIN: When we placed it. So making a new rule today that affects previously disposed waste, we feel, places unnecessary burden on the disposal operator.

MEMBER RAY: I understand that.

MR. BENJAMIN: That rulemaking doesn't change the overall performance of the disposal methodology. But for those wastes that are already in the ground it's there. The engineering barriers are there, the natural barriers are there, and they're not going to change over time.

MEMBER RAY: Okay.

MEMBER STETKAR: But if the analysis said you ought to exhume that and put in better barriers or just move it out that would affect you.

MR. BENJAMIN: Sure. That would greatly affect.

MEMBER STETKAR: You bet.

MEMBER ARMIJO: And it would affect your performance --

(Crosstalk)

MEMBER ARMIJO: It would have an effect if it led to physical changes in what you do.

MR. BENJAMIN: Yes, maybe we overlooked that kind of an extreme activity.

CHAIRMAN RYAN: One thing that comes to my mind is from my own history, is that I think it's very important to understand what's around at that period of time. The radionuclides that would be around at that kind of 300-year period would be nickel-62, uranium-238, which is there forever, carbon 14, I-129 and tech-99. That's it. That's all that's left.

MEMBER POWERS: There's a certain amount of 235.

CHAIRMAN RYAN: 235, 238, yes. I'd say that's uranium.

MEMBER BLEY: And the implication of that is it's very unlikely that a future analysis would show that you needed to do anything.

CHAIRMAN RYAN: Bingo. Thank you.

MEMBER ARMIJO: So even if your caps were eroding and all that?

CHAIRMAN RYAN: Well, 1.1 million curies of cobalt-60 will receive and irradiate hardware. The five-year half-life, that's long since out the window.

(Crosstalk)

CHAIRMAN RYAN: The only radionuclides that are out there are the ones that remain. There's one, two, three, four and five.

MEMBER POWERS: And those radionuclides remain because they decay every alternate leap year.

CHAIRMAN RYAN: Yes, or somewhere around that roughly. So I think it's very important to keep in perspective that as time marches on the problem gets smaller and smaller.

MEMBER POWERS: I think that's a very, very important perspective that it is, there's a tendency to say 1,000 is good then 10,000 must be better. But you have to understand it's the product of time and what you're specific dose rate is. And in fact that number is falling off at fairly dramatic --

CHAIRMAN RYAN: 9.76 curies of I-129 distributed in how many acres, Mike?

MR. BENJAMIN: 235.

CHAIRMAN RYAN: 235 acres doesn't necessarily give me a huge amount of trouble.

MEMBER ARMIJO: But you already knew that.

(Crosstalk)

MEMBER POWERS: Iodine-129 anywhere for any purpose doesn't give me a lot of trouble.

MEMBER ARMIJO: Okay, so we've proved that we know all of these things already. It's probably in your existing performance model, and repeating that model if required by Part 61 rulemaking would cost money and unlikely to require physical changes, so why are we doing it? I guess that's your point.

CHAIRMAN RYAN: No, I think what Mike's saying is he doesn't see any value in going in and disturbing all of that. Did I catch you right?

MR. BENJAMIN: Right.

MEMBER POWERS: Well, I mean the fact is that exhuming waste and doing something else with it actually incurs hazard.

CHAIRMAN RYAN: Yes, an operational hazard and all that --

MEMBER POWERS: If you're precluding

speculated hazard by imposing demonstrable hazard doesn't seem like a good tradeoff to me.

MEMBER RAY: Yes, but what you're referring to is, okay, the legacy stuff that's certainly true about and therefore almost grandfathers it in whatever circumstance it's in. I'm not sure that it speaks to any other aspect of the proposed changes here.

MEMBER POWERS: But wasn't trying to either.

MEMBER ARMIJO: We're just talking about already disposed stuff.

CHAIRMAN RYAN: Okay, any other questions for Mike?

MEMBER BLEY: Yes. Just as a devil's advocate from what the staff presented us at various times in the past, the impression I got from the last subcommittee meeting when they presented what the analysis requirements were was that if you could do a simplified performance analysis along the lines we were just talking and show that given what's left it really doesn't matter, that that would be sufficient and you wouldn't have to do that very elaborate analysis. Now I don't know if that's true or not, but that was what the claim was.

CHAIRMAN RYAN: Well, I think that gets

back to the kind of operational profile that a site has at any given time where they're brand new and receiving lots of waste --

MEMBER BLEY: But I was talking about this case we were just talking to.

CHAIRMAN RYAN: Okay.

MR. BENJAMIN: And, you know, who makes the decision that the model inputs, especially the societal and natural processes, are correct or agreeable, acceptable?

MEMBER POWERS: Well, I think that's where you get the real problem, because I guarantee you that whatever assumption you made there's somebody that thinks that's the worst assumption that ever crossed human mind and that some alternate assumption is demonstrably better.

And so without agreements on not only what the assumptions are but what constitutes an acceptable analysis these things are, I mean they just escalate.

MR. BENJAMIN: And those assumptions are very site-specific.

CHAIRMAN RYAN: Yes, and I think the fact that, you know, there's site-specific assumptions, there's a history of modeling and monitoring that goes back decades at all these sites, and then there's, okay,

what do we do with this mass of information in terms of looking forward?

Well, are we looking forward with a big, robust input of new waste, are we looking forward with a very modest amount of new waste that's very well characterized or are there new and unique things? So it really has to be a story that goes from start to finish for the whole system of this site before it can really make, well, the path going forward should go down this road.

So I appreciate Dennis' question, but that's kind of, it's got to be almost case specific to whatever, you know, scenario you're outlining for that site to move forward.

MEMBER BLEY: That's true.

MR. BENJAMIN: Thank you all.

CHAIRMAN RYAN: Thanks, Mike.

(Off the record comments)

CHAIRMAN RYAN: Next up on our agenda is Lisa Edwards from EPRI. Lisa, welcome, and thank you for being with us today.

MS. EDWARDS: All right. Thank you very much for the invitation and I appreciate the opportunity to talk to you about this topic in particular. I'm going to talk about the time of compliance. So Slide 2.

(Off the record comments)

MS. EDWARDS: All right, so my name is Lisa Edwards. I'm the senior program manager at EPRI. My programs include the chemistry program, low-level waste radiation management, ground water protection in decommissioning areas. Before I came to EPRI I worked for about 20 years in nuclear power plants and that kind of forms my background for this presentation.

So before I start, I just want to give you a high-level view of EPRI. We are a nonprofit research organization, but our mission is to conduct research and demonstrations on key issues that face the electric sector on behalf of our members.

You can't hear me?

(Off the record comments)

MS. EDWARDS: Can you hear me now? Okay. So EPRI is the Electric Power Research Institute. We're a nonprofit organization and we conduct research, development and demonstrations on key issues that face the electric sector. We do that on behalf of our members which is generally electric producers, but also on behalf of the public and we consider the public sector and society our ultimate stakeholder. And I point this out just because I noticed on the agenda that we're listed as industry, and although we do get funding from

the industry we are not part of industry. They fund our research but they don't dictate the results or how we report it or, you know, anything --

CHAIRMAN RYAN: For our purposes you're part of industry.

(Laughter)

MS. EDWARDS: Okay, so at EPRI in the low-level waste area we have three focus areas. The first is waste minimization which is basically don't generate the waste. So in this area we conduct research and give the plants tools to minimize waste.

In the '90s that was seen in Class A volume reduction, more recently in the Class B and C volume reduction effort. So it's been ongoing. The second prong is safe storage.

So that's really focusing on plants that have orphaned waste streams, have lost access to disposal as many of the plants did when environmental closed to out of compact waste, and just to make sure that the plants have the research and the design information they need to build and operate storage facilities in an event-free manner.

And then finally, disposal flexibility. So disposal flexibility is about developing the technical basis to help risk inform the regulatory

process when revisions to regulatory guidance and rules are going on.

So before we get into the details, I kind of just wanted to do just a high level look at some of the discussion topics that I think relate to what I'm going to talk about today. They're a little bit varied, but I think you have to consider all of them together in order to get a complete picture.

So the first is related to the near surface disposal versus geologic disposal and the reasonably foreseeable future. I think the thing to keep in mind is that any manmade engineered barriers that are implemented as part of 61 disposal facility will never reasonably afford the longevity provided by a geological disposal site nor do they need to because the decay of low-level of rad waste hazard doesn't warrant it.

The shallow land disposal facilities are constructed using materials like concrete and clay and manmade membranes. All things that are going to be expected to erode far more quickly than any geological formation. So the reasonably foreseeable future in terms of shallow land disposal is different than what it is for geological land disposal.

In terms of calculations for compliance with a limit that they should have reasonable accuracy

in the results, I think to do otherwise, to simply, I think, as someone else pointed out is we can run the miles and produce a number, but the number may have such high levels of uncertainty but it's still a number we can put a value, I think that that maybe could even be considered misinformation. Because when you put a number in print, particularly when you put it in print as a way of satisfying your regulatory requirement, public consumption of that is that that is real number.

And generally, our interaction with the public has shown me that the understanding of levels of uncertainty are confidence levels and a number is not generally well accepted. If it's there in writing then that's a real number and it should be able to withstand challenges. And yet we know from a science basis that numbers with high levels of uncertainty are going to have a very difficult time withstanding challenges.

MEMBER STETKAR: Lisa, have you tried in your interactions with the public explaining and quantifying and showing the public those uncertainties?

MS. EDWARDS: No.

MEMBER STETKAR: Okay, thank you. Well, it's been my experience that members of the public do understand uncertainties when you present them, get uncertainties. They may disagree with your

characterization but they understand uncertainty.

MS. EDWARDS: Okay.

MEMBER RAY: And so your point is simply in disagreement with those who have said earlier that the insights that they get are worth the potential misunderstanding because they have looked beyond 1,000 years and have felt that they benefited from doing so. But you would think that's not a good idea.

MS. EDWARDS: Well, I think that my point is on whether you assess it as a qualitative number or quantitative number.

MEMBER RAY: We made that distinction. If we said it was qualitative then what would your answer be?

MS. EDWARDS: I'd be more comfortable with that. If it was qualitative and you had the ability to express uncertainty with it and effectively communicate that, that seems more reasonable to me. However, if you say it's quantitative and I give you a limit of 500 millirem or 25 millirem or 50 millirem and I say I've done a calculation and I can prove to you that I will be less than 25 millirem a million years from now or 10,000 years from now or, you know, 5,000 years from now, I think that is a different story.

MEMBER RAY: Well, then it depends then on

how -- excuse me, Dana. It depends on how it's characterized whether or not it's objectionable. Go ahead.

MEMBER POWERS: Well, I don't want to --

MEMBER RAY: No, I'm done.

MEMBER POWERS: When you say the public has troubles with this uncertainty, I don't disagree with you by the way. In contrast to John, I find even trained engineers don't really understand uncertainty especially if they're on the ACRS.

(Crosstalk)

MEMBER STETKAR: Fortunately I've never been trained so --

MEMBER POWERS: You're not even housebroken sometimes.

(Off the record comments)

MEMBER POWERS: Is the difficulty the public have with the uncertainties is that they ask you, I mean they can't go out a million years and say, see, you were wrong, it came in too high. They physically can't do that.

So is the challenge they say, ask you, well, did you consider X? And you did not because it has a probability of some vanishing small, and they say, okay, your number is wrong. And true enough, it is, but by such

a minuscule amount that you think you're still comfortable with it. Is that where they have challenges?

MS. EDWARDS: I guess the scenario I kind of had in mind when we were preparing these slides is that when you run a calculation like this there's going to be a number of places where you have to make a decision point. That the assumption that you're going to include in your modeling could be somewhere between this number or this number, or that the human activity is going to follow this path or this path.

MEMBER POWERS: I see what you're saying. Yes. Yes.

MS. EDWARDS: So when you do a calculation like that if at every point, every decision point you go way to the very most conservative, the one that can't be challenged by anyone, you're going to end up with a very good, very big number that cannot easily be challenged in a public forum but will have no meaning.

So if the same people decide to take a middle of the road number or make their assumptions balance, kind of not one extreme or the other, in a public forum with a potential audience that believes you are intentionally trying to mislead them, they can say well, you use this number here, but isn't it true that maybe

the real number is something out here? And then you look like you're misleading or, you know, stacking the deck.

MEMBER POWERS: But you also get into traps of where you're trying to honestly get a balanced view, so you make one kind of assumption here and you make the opposite kind of assumption over here to kind of get a balance, then they say, well, you're inconsistent. I know whereof you speak.

MS. EDWARDS: There is a need for DU disposal and I think that's a problem faced in our society where obviously we generate DU and we need to be responsible about how we handle it. But DU is a unique hazard separate and different than the vast majority of the low-level rad waste that's disposed of.

And it appears that trying to address the unique characteristics of DU is leading to a one-size-fits-all approach at least in terms of quantitative time of compliance for Part 61 disposal site. It isn't actually, or may not be warranted for low-level rad waste absent DU.

And finally, I guess if you think about what is at risk from the actual low-level rad waste stream itself, which we know far more about now than we did when Part 61 was actually developed, we can assess what those risks are. And that is part of what I'll do in the

upcoming slides is take a look at some analysis of the behavior of the actual hazards over time.

So when preparing for this discussion specifically related to the time of compliance for low-level rad waste -- I'm going to the chart so which is the stuff that EPRI maybe some excels at in a few slides.

But really, in reality, the first thing we did is say who else has considered this question? And we looked at both within the United States and outside the United States and two from outside the United States are the ICRP and the IAEA. I'm not going to read these quotes to you, I think everybody can kind of do that on your own.

But in summary there's two concepts that emerge. And the first is that uncertainties increase perhaps even unacceptably as one moves further into the future. And the second is that there's a recognition that the duration for meaningful accuracy in dose calculations increases with the robustness of the disposal methodology.

So your ability to predict the behavior of the disposal site, the more highly engineered it is and the more robust the site is, that can increase your confidence in the accuracy of the numbers that you might

produce further out than if you had, say, just kick and roll and, you know, throw a little dirt over the top, because you've got a better engineering that you can predict over time. Maybe not in geological time, but in hundreds of years' time.

So inside the United States, NAPA prepared an analysis. Dennis, a question?

MEMBER BLEY: No, no.

MS. EDWARDS: NAPA prepared an analysis for the DOE on this same subject and concluded that the near future was two to four generations and that distant future was 500 to 1,000 years.

This same report acknowledged four related principles. Two that are designed to protect future generations and two that recognize that there will be an awareness and a responsibility of hazards that is passed along to future generations and that that awareness can be protected.

Another concept that's recognized in this report was one where near-term hazards have a priority over long-term hazards that are less certain. And I think that's a pretty comparable metaphor for the difference between the low-level rad waste minus DU and the characteristics of DU itself.

I will acknowledge up front that EPRI

understands that the staff, the NRC staff, considered this same report and analysis of this question, but I think that they reached different conclusions from their analysis of the report than the summary that I just provided.

Another source that we came across in our kind of hunting through how other people answered this question is from CEQ, the Council on Environmental Quality. This approach is used for oil and gas activities on federal lands and is used by the EPA, and there's a whole list of them here. USDI, Bureau of Land Management, National Park Service, Forest Service, Fish and Wildlife Service, et cetera. It's all about oil and gas activities. And basically, the center line here --

(Off the record comments)

MS. EDWARDS: So basically there's a cumulative effect and a significance threshold here, so you define some level that's acceptable from a risk standpoint and then you analyze the risk over time and find where the peak is, basically. This proximate cause test is what it's called, tends to eliminate scenarios that are remote, speculative or outside of the realm of reasonable probability.

In this chart from the CEQ, the significance threshold is some form of safe limit in what would be

equated to an acceptable intruder dose at probably 100 years in our scenario. So the point here is not to use the time frame that's actually up on the screen. It was just to look to see how another agency addressed this same kind of question of how far out do we look.

CHAIRMAN RYAN: I guess the practical reality is that it will be halfway through its institutional control period required by regulation and law at the end of your craft.

MS. EDWARDS: Say that again.

CHAIRMAN RYAN: Any, say, license number 61 will only be halfway through its required institutional control period at 50 years.

MS. EDWARDS: So the years here, this is just a graph that is showing it in how they use it with oil and gas.

CHAIRMAN RYAN: Oh, so that doesn't have anything to do with low-level waste. My mistake.

MS. EDWARDS: But the approach, the concept is what we're trying to reference here not the specific application of it. We haven't tried to take this and specifically apply it to low-level rad waste, but it could be. But here is an organization that tried to tackle this same problem and the approach that they used to do it.

So if you look at the last bullet, you know, some level of acceptable risk is where that significance threshold is, and if you liken this peak to a point where postulated low-level rad waste intruder dose is known to be the highest that would probably be at about 100 years, because in effect the low-level rad waste significance threshold -- sorry, then diminishing the hazard from cesium-137.

So what's trying to be pointed out in that last bullet without me trying to read pieces and parts at a single time is your cesium-137 and nickel-63 are probably going to be highest in terms of your dose at that 100 or so year mark, not at the 10,000-year mark.

MEMBER POWERS: This kind of an approach allows you to take into account your inventory effects. And I would not be surprised if in fact it did peak out at about 50 years, just because you'd be starting to deplete heavily anything that has, you know, ten or 15-year half-lives.

CHAIRMAN RYAN: Yes, a lot of stuff would begin, but the cesium and the strontium should be there too.

(Crosstalk)

MS. EDWARDS: I have some graphs to that effect.

MEMBER POWERS: But recognize that yes, it's half as much as it started after 30 years --

CHAIRMAN RYAN: Sure, yes.

MEMBER POWERS: -- and by the time you hit 100 years you're now down to what, 127. And this allows you to take that into account.

CHAIRMAN RYAN: You bet.

MEMBER POWERS: And then you'll get this interesting phenomena where the inventory kind of flattens out but your time keeps going on, so you're going to get an interesting plot. It's going to be almost, the risk is going to fall like it's stung, but the integrative cumulative list is going to be flat as a pancake.

MS. EDWARDS: I agree. So kind of the first step was how did other people answer this question? And just in summary, the ICRP said several hundred years with any level of certainty. The IAEA says several hundred years, but that could go up to a few thousand years if you had a robust enough facility.

NAPA was 500 to 1,000 years, and that was what they called the distant future not the near future. RCRA site says, I think Dr. Ryan mentioned earlier is 30 years. CEQ, which was the site we were just talking about, usually comes out at the 35 to 55-plus years. It's only when you get to the geological disposal and

high-level waste that you see anybody who's remotely trying to approach the kinds of time frames that are being discussed for the regulation. So what we said is in our analysis we found the discussion from the IAEA, the ICRP and NAPA to be the most compelling. And given that even from an ICRP to the IAEA and NAPA you still range from several hundred to maybe a couple thousand years, we decided to look at the actual behavior of the hazard over time to see if conclusions could be drawn about the life of the hazard that would be pertinent to the discussion to see where in that time frame a good place would be to fall.

So you've got to stay with me on this slide. There's a lot of information here. There's actually going to be three slides, and we worked on these slides specifically designing them to portray one view of the current risk of low-level as it relates to dose with decay.

All of these graphs are based on the actual low-level rad waste radionuclide mix published by EPRI in 2007 taken from four years of utility waste data and not the disposal cell mix that was used to develop Part 61.

This is important because there's far more certainty about the composition of the radionuclide mix

today from what we've actually disposed of than what we knew when Part 61 was being developed. And we don't expect that mix to change dramatically or significantly because fuel fission yields and materials of constructions don't and haven't changed significantly.

Before I get into this first chart, I'll note that we only use the utility waste on this chart because that's where we have the level of detail and it is only used --

CHAIRMAN RYAN: A quick question, if I may. Sorry to interrupt, Lisa, but I'm intrigued by your materials statement. Is there anything in new reactors or new construction of reactors that has different materials, different alloys that would introduce a different radionuclide? Has anybody taken that step to look forward to those materials?

MS. EDWARDS: We haven't actually done that analysis, but if you want kind of a gut level reaction, most of the material changes are focused on reduced corrosion rates. Most of the activity that we find in our waste is a result of cleaning up the corrosion that is taking place.

So kind of my gut-level reaction would be the less corrosion you have, the more corrosion resistant materials you have, probably your inventory will go down.

(Crosstalk)

MS. EDWARDS: And how it will affect the specific radioisotopic mix, there might be a --

(Crosstalk)

MS. EDWARDS: -- but I don't think it's going to be --

CHAIRMAN RYAN: Okay, I was just curious.

MS. EDWARDS: But I haven't done the numbers.

CHAIRMAN RYAN: Okay. No, that's fair enough.

MEMBER POWERS: How would that be? If I go to more corrosion resistant materials that nearly always means I'm putting more nickel into the system.

MS. EDWARDS: I can't hear you.

MEMBER POWERS: Nearly all my metals that are more corrosion resistant are richer in nickel.

MS. EDWARDS: You know, there's some truth in that because we see steam generator replacements followed by a nickel-63 spike.

MEMBER POWERS: It's hard to get more nickel than Inconel.

(Crosstalk)

MEMBER POWERS: Yes, but it's more widespread use, it's not more concentration. And so

it's just not obvious to me that -- but what is absolutely true is that modern plants, we've gotten the cobalt out of them.

MS. EDWARDS: Yes.

MEMBER POWERS: Okay, that's true, but it's not obvious to me that the corrosion resistance is leading us to less easily activated materials.

MS. EDWARDS: So I'm going to go back to where I should have stopped in the first place. I haven't run those numbers.

MEMBER ARMIJO: You're the chemistry person also at EPRI, right? Water chemistry. And people have been deliberately adding, let's say, noble metals and zinc to a control dose and to reduce stress corrosion cracking potential in the core internals. Are those, produce high activity waste streams or in filters or --

MS. EDWARDS: That's not just an easy question to answer because there's not a single answer that's going to fit all behaviors that we see in a plant. So --

MEMBER ARMIJO: I'm just guessing it would be a small amount but, you know, I --

MS. EDWARDS: We don't see a significant impact to the low-level rad waste streams after zinc

injection.

MEMBER ARMIJO: Okay.

MS. EDWARDS: You won't see a big change in the classification of the waste or anything like that.

Okay, so I'm going to go back to this chart. Okay, here is the chart, what it's made of. We used the EPRI database which was four years of shipping records from commercial nuclear power plants and we developed an isotopic mix from that.

We took all of the Class A, B, and C waste from utility only, not non-utility. From utility only, what's been generated up to the current point out 48 years through decommissioning. So very large inventory.

(Off the record comments)

MS. EDWARDS: So we took that Class A, B, and C -- go ahead, Billy.

MR. COX: Okay, what you're looking at here is, this is the four years of rad waste data from utilities, all Classes A, B, and C minus activated metal. And what we did was we made the assumption that the classification limits in the existing Part 61 represent an acceptable level of risk when they set the unity.

So what we did here was we took all the waste and its volume, so we determined its concentrations and we divided it by the Class A limit in the existing Part

61, then we normalized them to 100 percent. So what you're actually looking at here is decay of risk as it's related to the existing Part 61 concentration limits which represents some risk. And what you can see is that at 100 years which would be institutional controls would stop, the risk is 22 percent of what it was when it was first disposed of. And at 500 years the radiological risk is 2.6 percent.

So there's a factor of 10 drop just between 100 years and 500 years. And beyond that it really doesn't change a lot. Pretty much the only thing that's left is carbon-14.

The tech-99 isn't charting here only because it's primarily reported on manifests as a detection limit value and we know it's not present at the concentrations that have been reported on manifests. But what we're really trying to show here is what the decayed risk is.

MS. EDWARDS: So we have our total activity that's A, B, and C combined together. We divided by the volume of the waste, and we come up with a concentration and we divided that by the Class A concentration limit. And that is a way of equating the inventory to a risk.

We tried to be conservative which is why we put A, B, and C together so we had all of the activity,

and we used just the Class A concentration limit and applied it to that summation of total activity.

And we say that at year one all that is 100 percent of whatever that risk is. And if you accept that Part 61 Class A concentration limits represents some acceptable risk or some level of risk, that's 100 percent on year one. And then we just simply decay that through time and you can see at the 100-year mark we're actually 22 percent of what it would have been at year one.

And Billy's point, which I think he made very well, is that by the time you get to 300 years and 500 years you're at a small fraction of where you started. You can do this same thing with activity, but I think what made this especially interesting is using the Class A concentration limits to provide kind of an anchor or a viewpoint of how that activity relates to some perceived or measured risk.

And I'm going to go to the next slide if there's not more questions either from what Billy said or what I said.

MEMBER POWERS: I guess what you're saying is that you started off and you said, gee, this is totally acceptable now, and so if nothing happens to this repository your risk goes down because of decay.

MS. EDWARDS: Yes.

MEMBER POWERS: And that's comforting but not really illuminating. I'm worried about if something happens to your repository because you're assuming that that repository is as it was because you didn't allow it to change over this period of time.

MS. EDWARDS: In my mind, that's where the Class A concentration limits come in. If I only showed you the chart and showed you the decay over time simply on radioactive decay, there's no kind of taking that back to a risk.

The presumption in this particular graph is that the Class A concentration limits were analyzed as Part 61 and derived based upon the fact that those concentration limits represented some acceptable level of risk.

CHAIRMAN RYAN: Lisa, I'm thinking about the fact that the 61 analysis really is kind of aimed at the material in a reactor and then something happens to the material in the reactor and it gets out or doesn't get out.

But 61 is based on two things. One is an intruder analysis which means that human being comes in contact externally or internally with the radionuclide. I'm a little nervous that some of those radionuclides that are on the list that we all work with in that area

are much more important either as an internal exposure hazard or an external exposure hazard.

So the scenario of exposure here is probably a little different. I'm trying to figure out how I translate this into something for, say, an environmental case of the long-term performance of the disposal site. So it's a very interesting analysis, but it will be helpful to try and put what's the scenario of exposure here that gets somebody exposed from this system versus kind of it's a site and you walk on it or dig in it or, you know, go hunting for gold doubloons in it which is an intruder scenario and all that stuff.

So can you help me with that a little bit or --

MS. EDWARDS: There is no modeling done --

CHAIRMAN RYAN: On that, okay.

MS. EDWARDS: -- with this graph. This is strictly a look at the activity, how it changes over time relative to the risk that was assigned to that activity based upon the Class A concentration limits from the Part 61 tables.

CHAIRMAN RYAN: So that's apples and oranges. I mean I don't know how you can assign a risk in the 61 analysis scenario and then look at strictly a risk from the standpoint of, you know, what you're

presenting in the graph. I'm struggling with it.

MEMBER ARMIJO: I see this chart as saying these things are safe the day we disposed of them. I mean it's 100 percent of the risk is taken into account, and as long as my disposal site does not degrade this is what your risk will be as a function of time. And within the period of performance you're actually managing that. You're inspecting and repairing and whatever.

After that you have to prove to yourself that the facility will not degrade to change the risk model. So those are much easier time frames to analyze what's going to happen to the materials, to the caps, to the -- so to me it argues. It says hey, 500 years would probably be plenty.

CHAIRMAN RYAN: I really like the way that you've presented it. But when I look at it I think about, well, let's take the top 20 radionuclides by inventory and say, okay, here's where we are times zero, and then decay them down radiologically in that soil, and then independent of those decay curves let's make up three or four or five or how ever many scenarios you want that expose people under various conditions to this set at this point in time. And then you get some relative idea over time what that profile of radionuclide risk might be. Does that make sense?

MS. EDWARDS: I hear what you're saying and it does make sense, but then I wouldn't divide by the Class A concentration limits.

CHAIRMAN RYAN: Forget the Class A concentrations. I'm holding that kind of separate for the moment. This is just the look at what's happening and I'm sure this is reactor-informed, you know, in terms of the numbers and the radionuclides you've chosen, which is great.

But just do that independent and then interpret it separately as a separate matter might really help clarify it a little bit. Just a thought.

MS. EDWARDS: I don't have that data, and Billy's yelling at me quietly from the back of the room again --

CHAIRMAN RYAN: That's all right.

MS. EDWARDS: -- to tell me that we do have that data. I don't have that data up here with me.

CHAIRMAN RYAN: That's fine. That's fine. I'm not saying we need an answer today. I'm just thinking out loud with it. That might be a way to, you know, further inform the kind of analysis you're presenting.

MS. EDWARDS: I don't want to beat a dead horse here because I agree with what you're saying and

I'm actually kind of now interested in going back to that number. The reason we picked this chart is short of doing a site-specific performance assessment, which I don't have the data to perform on the individual sites, and short of a graph that I'm going to show you two graphs from now that looks at a generic site, I wanted a way to conservatively take the inventory that exists today as we know it in the isotopic mix and add in A, B, and C together over many years and still relate it somehow to risk. Put all of that waste into kind of a single package that's related to risk without performing those calculations.

The best methodology we could come up is say the Class A concentration limits weren't pulled out of the air. They were derived saying if we keep our waste at this concentration or less in a disposal environment, whatever may happen to that disposal environment that concentration represents a hazard that's acceptable. Otherwise the concentration limits would have been lowered or raised if there was more wiggle room, I guess.

CHAIRMAN RYAN: It might be helpful to go back to the 61 technical basis documents and make sure that you're using it in a way that comports with the way it was developed. You know, I guess I can't say I completely agree with the analogy that --

MEMBER POWERS: The division is suspect but the chart is good, because it just communicates the same thing you're saying except they don't have technetium-99 on it for reasons they didn't explain. And nor do they have the depleted uranium on because they've got a good sense.

MS. EDWARDS: Oh, and I should have said that up front is that part of this analysis is to look at what does the hazard look like without DU, and is there an obvious time of compliance for the waste without the DU being incorporated into the waste.

CHAIRMAN RYAN: That's a terrific goal. That's an excellent goal to, you know, begin to put this in kind of a perspective.

MEMBER POWERS: Yes, I mean gives it to you without looking at dose effectiveness kinds of numbers, which is fine. What's intriguing about it is that from a risk analyst's point of view you have to come up with risk enhancements in the period between the 1,000 and 10,000 that have to exceed something on the order of the factor of 50 to compensate for the decay, and that's hard to do that because it has to be a factor of 50 over what you've got during this 100 to 1,000-year period and I don't see easy routes to that.

MEMBER SKILLMAN: Lisa, let me ask you this

question please. You said this is four years of shipping records. How thorough are those records?

MS. EDWARDS: I believe what we did is go to some of the people who do the electronic preparation of shipping records and then we went to the utilities and requested them to send us their shipping records for a four-year period. And out of the 104 or so utilities I think we've got all the shipping records from 67 of them. Is that about right?

MR. COX: Sixty five.

MS. EDWARDS: Sixty five.

MR. COX: Ten thousand records and we vetted them all and we came up with 8,500 of them that were shipped. The ones that weren't indicated as shipped in the rad mean database we didn't use. Just the ones that were shipped. So 8,500 records over four years.

MEMBER SKILLMAN: So 60-some sites or 60-some plants?

MR. COX: No 65 units.

CHAIRMAN RYAN: What's a unit?

(Crosstalk)

CHAIRMAN RYAN: Just want to make sure.

MS. EDWARDS: So out of the 100 and some that could have sent us the records, at the time there

was 104 plants, we got 60-some that responded with their database.

MEMBER SKILLMAN: And did you adjust these upward for the difference between the 65 and the 104?

MS. EDWARDS: Okay, so the isotopic distribution we assumed was representative regardless of the number of plants.

MEMBER SKILLMAN: I understand, okay. Now I do. Thank you.

MEMBER POWERS: What's surprising is how low the cobalt-60 is that might not be the case if you were looking at decommissioning shipment.

MS. EDWARDS: I think that the thing to take away from this, each one of these graphs we can go into a great deal of detail. And actually at the back of this package there's a series of slides that give you assumptions and that the processes that were used to develop these graphs individually.

The point being that I take away from this is that at 300 years you're pretty much on your TRU and carbon-14 line where your total is starting to be almost entirely composed of that. By 500 years your total is just barely above the carbon-14 line, meaning that all these other nuclides have decayed away and this is where your hazard is centered.

And whether you look at the hazard, if you assume all barriers have broken down and no longer exist, you assume they're all gone by 1,000 years, you're not going to get a dramatically different effect further out. That a 1,000 year look may be from this viewpoint adequate.

(Crosstalk)

MEMBER RAY: Point then that drives the concern beyond 1,000 years?

MS. EDWARDS: I didn't, that's not my viewpoint so I can't say --

MEMBER RAY: Understand, but you're not aware of what, you don't know what it is?

MS. EDWARDS: Well, I think part of it is the DU.

MEMBER RAY: Okay, anything else that comes to mind?

MS. EDWARDS: No, I don't want to, I guess, speculate.

CHAIRMAN RYAN: Chlorine-36 and some of these other --

(Crosstalk)

CHAIRMAN RYAN: I'm just thinking out loud and just thinking --

MEMBER SKILLMAN: I think what's going on

here is the shipping records do not represent plants that have clad failure. And as long as you don't have clad failure, I think that's the fingerprints. And if you have clad failure you have a whole different set of isotopes, and as long as the clad's intact you really come down to the carbon-14.

MS. EDWARDS: Well, I think it's a mixture. I mean almost every plant has had at least some pen leaks.

(Crosstalk)

MEMBER ARMIJO: Clinton has never had a fuel leak but for -- there's tramp uranium in the crud and all that sort of stuff, but that's not included --

MEMBER SKILLMAN: If you've had clad failure you've got some other longer life isotopes that are going to show but they're not predominant and they're not great numbers.

MS. EDWARDS: Just to be clear, we did not segregate records out based upon whether a plant had experienced any fuel leaks or not, and simply put the request for the information out to the industry and we took all of the information that was released to us. And having worked at some of those plants I know that they had fuel leaks at the time, and that is included in the data along with the plants that had fuel without any leaks.

MEMBER STETKAR: And Lisa, you said this is just a four-year snapshot.

MS. EDWARDS: For the isotopic mix.

MEMBER STETKAR: For the isotopic mix.

MS. EDWARDS: That is correct.

CHAIRMAN RYAN: Just looking ahead here a little bit, we're scheduled for a break relatively soon at 3:15, and I want to make sure we leave Roger enough time. Roger, how are you doing on your time?

MR. SEITZ: We've got about 20 slides.

CHAIRMAN RYAN: Okay.

MS. EDWARDS: Okay, risk versus decay. That last graph didn't look at irradiated metal, so it did not include activated metal so we wanted to take a look at activated metal. And this graph simply does a comparison between a Class C source, this is what's approved for a Class C source, in red, 130 curies. And we set that equal to that's 100 percent.

Dose rate at three centimeters is 100 percent, and we show how that models and decays over time from a dose rate. In this case it's an intruder scenario. It's about a carry away piecemeal type of thing. And we compared that to the model dose from a piece of stainless steel. I think it's 0.01 inches and a Class C filter from a PWR and a Class C filter from a

BWR.

But we didn't use just the filter and the actual activity that was typical. We took an average of the Class C filters and then we went to ten times that. So we said, if this is the actual activity, we're going to scale that activity up so it's ten times the Class C limit. Because the BTP allows for the ten times --

CHAIRMAN RYAN: What's carry away setup? What's the -- I take it and put it in my pocket and leave?

MS. EDWARDS: Put it on your mantelpiece.

MALE PARTICIPANT: What's the mantelpiece one?

CHAIRMAN RYAN: Okay, if you had it in your pocket awhile the mantel part won't matter.

MS. EDWARDS: That could be true. So this is the Class C source. We also put in a couple of reference points here to show the Class A source and the Class B source, both at 100 years and 300 years. And basically we've just decayed these over time and showed how their dose rate at the three centimeter, how it compared to the Class C. And you can see by the time you get out to 500 years they're below that.

And in fact at the 100 and 300 years they're within a factor of 10 of actually the Class A and B source limits. And this is just an impact of a mix of radionuclides

instead of having a single monoisotopic source. Next slide.

This was done for both a wet site and dry site. So basically we took all the waste, utility and non-utility, and we put all of it into a single disposal site instead of dividing it between sites. And then we said, what are the dose rates if we model the site according to the descriptions that are in the NUREG, if we model the site what kind of dose performance do we get out of it?

So there's four different cases here in blue. You will see that it still meets the 500 millirem criteria even at year 100 very close to the site closure, but that base case assumes no cap and just two meters of cover.

So there's no waste form kind of enhancements or capping over the disposal site. The red line you put a barrier in place. That's the trench cap to keep water from infiltrating and then we ran RESRAD and did the dose projections out again. And again you can see by the time you get, no matter which scenario you use, by the time you get to 500, 600 years kind of all in the same place.

Green looks at waste form, and purple which is the best case looks at both the combination of waste

form using those concrete overpacks, high integrity containers, et cetera, that limits the mobility of the radionuclides for a certain period of time where it can decay combined with the cap.

And in all cases you meet the millirem requirement. This is on a wet waste site. We did the same thing on a dry site, on a western, arid site, and the graph's a lot less interesting because it's all way down in the dirt.

MEMBER ARMIJO: Lisa, could you explain the red curve? I don't understand why it peaks, goes down and then peaks. Is that --

MALE PARTICIPANT: The barrier fails.

MEMBER ARMIJO: The barrier fails at 200 years more or less, is that --

MS. EDWARDS: And then you get your infiltration.

MEMBER ARMIJO: Is that just an arbitrary assumption or is that a --

MS. EDWARDS: I'd have to dig back in the report, but I think that actually came from assumption. I'd have to dig back in the report.

CHAIRMAN RYAN: I'm going to guess that up to about 200 years you're assuming some corrosion failure of containers, stainless steel and other, you know,

robust matters. That's where we get out to the 300 to 500 period and then, you know, kind of migrate --

(Crosstalk)

CHAIRMAN RYAN: And so I'm guessing that there's a change in container robustness from --

MEMBER ARMIJO: It's basically degradation of barriers that caught at that point that's peaked out.

MS. EDWARDS: In the red case we're not looking at any waste forms. We're not looking at the containers or, the red case is simply looking at the, the difference between the red case and the blue case is the introduction of the cap.

CHAIRMAN RYAN: Yes.

MS. EDWARDS: The green case has both the cap and the waste form, so the concrete containers are high integrity containers.

CHAIRMAN RYAN: Got you.

MEMBER ARMIJO: So the green case you could lose the cap entirely and you'd still, the concrete boxes they put things in --

MS. EDWARDS: Overpacks in the high integrity container. Okay, so those were the three charts. I'm going to just quickly go back to the concept that there are uncertainties in performance assessments.

And there are a number of people who have

considered this topic and under IAEA might point out in particular that if you misuse these results from overly conservative representations of the disposal system can lead to poor decision making that's based on results that bear little resemblance to the actual performance of the facility.

So I just go back to that. Those are not my words. Those are words from the IAEA, another agency that has looked at this type of thing. I think it's important, because once 10,000 years is introduced as the time of compliance it's very difficult for someone later to say I need to pull that back to a more reasonable time frame.

So once you ring that bell that's kind of where the mark is then in the sand and it would be very difficult to pull it back. And I think it's a new precedence that moves a perception that low-level rad waste represents the same kind of risk that high-level waste does and that you're moving it into a geological time frame.

CHAIRMAN RYAN: Well, that's something that the waste part of this industry has struggled with, low-level waste and high-level waste, as far as trying to get into the let's make a bunch of conservative assumptions or assumptions we think are conservative

and, you know, run with that. And we don't disconfirm it very well.

Well, we know the intruder at 100 years plus zero is going to dig into the waste and conduct his entire life right there in the Class C disposal cell.

MS. EDWARDS: At the worst possible spot.

CHAIRMAN RYAN: Yes.

MS. EDWARDS: At the very first opportunity --

(Crosstalk)

CHAIRMAN RYAN: I guess it would be interesting to hear your comment on do you think this should be risk informed in the way that probabilistic risk assessments are done for other issues that have complex problems like this or not?

I'm not looking for an answer this second, but I'm thinking that if it was something that got a little bit leaning toward don't make a bunch of very conservative assumptions that compound on each other so you don't even know what reality is, but to do some kind of systematic risk insights analysis so you could come up with something that was a little bit more representative of the realities, many of them which are in a PRA -- dare I say it -- to think it through.

MS. EDWARDS: I think there's a place for

probabilistic risk assessment and the management of disposal of radioactive waste. I think there is another place where you can take a deterministic view but inform it with reasonable rather than overly conservative assumptions and maybe get to a framework that's usable and easily usable. I'd have to look at the details of both to really understand where I fall on which one I think is better.

CHAIRMAN RYAN: I hear you. You know, one's easy to explain but may not be as accurate representing reality. One's tougher to explain but it might give you the options to really understand the system behavior. So the devil you know and the devil you don't want to know.

MS. EDWARDS: Exactly.

CHAIRMAN RYAN: So I'm kind of waiting for Mr. Stetkar to say something but he's not going to.

MEMBER ARMIJO: Well, your chart argues for a different criteria for time of compliance or even assessment for low-level waste that it's not DU, you know, to separate the two things, and you'd have a totally different issue on the table.

MS. EDWARDS: That's on the third bullet on this slide. So the unique hazard from land disposal of DU should not dictate a generic time of compliance for

low-level rad waste sites that don't accept DU.

I think the behavior and the characteristics of this hazard are so different and atypical of the rest of the low-level waste that the one-size-fits-all approach is going to drive us to an assessment that communicate to the public that communicates a hazard that's not actually there.

MEMBER ARMIJO: I think that's a very important point. I talk to different groups of people, and it's incredible when instead of giving them assurance that they're being protected by when we say, oh, we're designing this for 1,000 years or 10,000 years, instead of saying, gee, that's great, they conclude that if it's that dangerous that you have to worry about it for 10,000 years, what in the world is happening today? And so it backfires.

As engineers we see conservatism in one way but the general public sees our conservatism as treating something that's incredibly dangerous, and that's misinformation. It creates anxiety and it's not true.

MS. EDWARDS: I couldn't agree with you more.

MEMBER ARMIJO: I think this is a very valuable piece of work. Have you published this in a report?

MS. EDWARDS: Many reports. And I think there is a slide --

MEMBER ARMIJO: Okay.

MS. EDWARDS: -- in the back of the slides. This is not a last slide, but in the backup slide there is a list of references.

CHAIRMAN RYAN: That would be great. I think it adds to it. Well, it strikes me that one thing that's come out of this discussion is something like, you know, maybe we ought to think about that we treat DU as a special case since it's hazardous chemical not radiological, and deal with it in some other way than trying to squeeze it into radiological.

MEMBER RAY: Well, it changes the picture dramatically when you include --

CHAIRMAN RYAN: That's what I'm saying, Hal. I mean we've been kind of chasing it --

MEMBER ARMIJO: We're distorting the picture.

CHAIRMAN RYAN: Maybe this is something that we ought to think about. I just throw that out to think about --

MEMBER RAY: No, I've been thinking about it. I don't know that it distorts the picture, Sam, if you allow the things to be combined.

CHAIRMAN RYAN: That could be co-located but the basis of regulating it might not be the same.

MS. EDWARDS: Well, you know, my perspective, and I might have a few of the facts, they get a little blurry over time. But I thought we were going to do a comprehensive review of Part 61 and we were going to do kind of a broad look at it.

But the DU thing came up and there was a limited rulemaking that was supposed to be designed specifically to look at DU. I think somewhere along the line the staff got the direction to combine the concept of blended and unique waste streams in with DU and the whole picture got bigger faster.

MEMBER POWERS: And this is surprise to you how? Okay.

MS. EDWARDS: That's it.

CHAIRMAN RYAN: Yes, that's great. Thanks very much.

(Off the record comments)

CHAIRMAN RYAN: Thanks for having this up, Roger, and we appreciate your patience.

MR. SEITZ: I think Christine should be on the phone.

CHAIRMAN RYAN: Okay.

MS. GELLES: I am. Can you hear me okay?

CHAIRMAN RYAN: We can hear you just fine, Christine.

MS. GELLES: Are we ready to begin?

CHAIRMAN RYAN: Yes, please. I'm sorry. Yes, we're ready to go. Thank you.

MS. GELLES: Okay, so I first want to begin by thanking you for allowing us to return and providing the committee with some additional information about DOE's proposal plans and our analysis.

This time we're going to specifically focus on depleted uranium which has received so much attention here, I think, in your dialogue even today. I'm very sorry that I can't be there in person and I want to thank you for accommodating me while I'm on travel.

Roger Sietz, who you met several weeks ago, is going to share this presentation with me, and I also want to mention that we have several technical experts from the Portsmouth-Paducah Project who can answer any detailed technical questions you might have on our conversion technology or again, really detailed questions on our waste form.

And that's Jack Zimmerman, our federal project director, and I believe he has several others also on the line, Keith Sparks and Jeff Mowbray among them.

CHAIRMAN RYAN: Thank you for the staff who is participating and we're waiting for Christine to call on her as needed, all right?

MS. GELLES: Thank you.

CHAIRMAN RYAN: All right.

MS. GELLES: Okay, so Roger if you could pass through right to our discussion topics. In talking to Derek, we tried to construct a deck of slides that provides enough background on our history of managing our depleted uranium hexafluoride inventory and how we came to the decision on waste form selection.

And it's a somewhat detailed history so we're not going into it in great detail, but we wanted to summarize it. So if the members are interested in looking at some of our new documents about the context which do that.

And then we'll close with Roger reviewing some of the, more details of our defense-in-depth disposal systems as applicable to our analyses related to depleted uranium. Slide 3. The next three slides are really good pictures. We'll go through them very quickly. Slide 3 is a composite showing both one of our cylinder yards where our several decades of cylinder generation is stored. There's a close-up of some of the refurbished cylinders where we painted them

to deal with some deterioration that's occurred over time.

CHAIRMAN RYAN: Are these full or empty cylinders?

MR. WIDMAYER: Full. Can you hear, Christine? Mike asked if they're full or empty cylinders.

MS. GELLES: These are full cylinders.

CHAIRMAN RYAN: Full of UF6?

MS. GELLES: Yes, sir.

MR. SPARKS: There are some partials in there, Christine.

MS. GELLES: Thank you.

CHAIRMAN RYAN: Due to the number on the screen I didn't see it. That might be eventually what I think.

MALE PARTICIPANT: Well, it goes on to the horizon.

(Crosstalk)

MS. GELLES: We've got two of those. And I should mention that although there are the three gaseous diffusion sites, the entire inventory of cylinders from Oak Ridge were relocated to the Portsmouth facility. Is that correct, guys?

MR. SPARKS: Yes.

CHAIRMAN RYAN: Okay, thank you.

MS. GELLES: You can see the relative size of these cylinders with one of our workers standing next to it. This is a picture of how we move the cylinders around. And Slide 5 is another picture, alternative mechanism for moving the cylinders. And you can see again some similar workers standing next to the cylinders that have been in storage for some time.

You can see we stack them two-high, so although that yard looks long it's actually, you know, the inventory's twice because it's stacked two deep.

CHAIRMAN RYAN: Dana has a question on it. Dana?

MEMBER POWERS: No, I was just going to point out the hazard to the public from those yards lies in the HF and not anything to do with the uranium. The opportunity presented to those of a terrorist bent is the HF.

MR. SPARKS: On the phone we couldn't hear that question, if you could repeat it.

CHAIRMAN RYAN: It was a comment. And that Dr. Powers made the comment that most of the hazard from the public standpoint is the HF rather than anything else.

MR. SPARKS: Yes, that would be correct.

MS. GELLES: And we'll talk to that because that was also a consideration in the selection of the waste form.

Okay, if you could go to Slide 6, and please, because it is a little bit hard to pick up every speaker around the table, if I'm not hearing you when you have questions just forcefully interrupt me, all right?

CHAIRMAN RYAN: Okay, thank you for that Christine. If I've got a question on this I might just jump in and help facilitate a little bit. So thank you for that.

MS. GELLES: I appreciate that Mike.

CHAIRMAN RYAN: Yes.

MS. GELLES: Okay, so on Slide 6 this is a busy slide. I apologize for so many words but we'll spend a few moments on it. So we think inventory of our DUF6 is a legacy of our enrichment activities. Not just the Department of Energy but also the United States Enrichment Corporation, or USEC after the privatization.

And we did look exhaustively at options for how to manage this inventory, and there have been several really significant analyses that have helped formulate the framework of our, the patchwork of our decision making for moving forward.

Most significant, I guess, is the

foundational documents, would be the 1999 Programmatic Environmental Impact Statement on Alternative Strategies, and the document number's there, it's available electronically if folks want to read it. I'm going to just summarize it here a bit.

The alternatives we evaluated were no action, long-term storage as DUF6 but in a, with perhaps making new storage yards, maybe enhanced storage capabilities. Long-term storage as an oxide, reused as a uranium oxide, reused as a uranium metal and disposal as a uranium oxide.

And in '99 we published our Record Of Decision, and that Record Of Decision indicated that we wanted to quickly, expeditiously with conversion of the entire inventory to an oxide or a depleted uranium metal or a combination of both.

But I want to note that our original preferred alternative was disposal as an oxide, conversion for disposal as an oxide. But based on some comments we received from industry who had indicated that there were technologies for potential reuse of a metal form, we allowed in our preferred alternative that we'd be open to continued discussions about a metal form, because we did not think it would be appropriate for conversion to metal unless there was a use documented as

part of the analysis.

MEMBER POWERS: I have a question. A question I'd like to ask is, when you considered conversion of the oxide was there a consideration of converting that to a form that is less water soluble such as a phosphate or a silicate?

MS. GELLES: I'm going to summarize one of our scientific studies that evaluated waste forms, and I hope it's responsive, but I think it's going to result in a negative answer of the two forms that you just described were not specifically analyzed. But Jack or Keith, do you guys have an answer to that immediately or should we defer that until we get to Slide 8 or 9?

MR. ZIMMERMAN: I don't have a specific answer. I'm unaware of the phosphate form being looked at, but I know all the documentation points to the uranium oxide as being stable in the environment as well as what's molded in other forms. So I don't really know if the phosphate is also a stable, environmentally stable form or not.

MEMBER POWERS: Well, the silicate is extraordinarily stable and that's why uranium miners don't like the silicate because it's hard to refine.

MS. GELLES: I'm going to keep that question here in the margin of my notes, and we'll revisit

it after we talk about the Oak Ridge National Laboratory's assessment of the various waste forms and maybe we can talk about that in a little more detail. Okay?

MEMBER POWERS: Sure.

MS. GELLES: The other thing about our EIS in the evaluation of the alternative for disposal, it was a generic assessment of disposal in a wet environment as well as a dry environment, and the dry environment was defined as that the ground water being 500 feet. And we evaluated both the grouted oxide form and ungrouted oxide form.

But ultimately after the issue of the ROD we initiated a competitive acquisition for the construction of the conversion facilities at the two gaseous diffusion sites and that's Ports and Pad because we had relocated the Oak Ridge cylinders.

And in 2002 the first contract was awarded to Uranium Disposition Services and they began development of the facility. And so the selection of UBS was also the ultimate selection of the waste form, and the conversion technology and what they had proposed and ultimately technology that produced the triuranium octoxide of a U308 waste form.

And since that was consistent with our

previous analyses we were comfortable with moving forward with that. We did need to do some site specific NEPA evaluation related to the actual construction operation of the conversion facilities, and we developed that document between 2002 and 2004. And again just to circle back. And NEPA analyses in the ROD that indicated a preference for conversion to the uranium oxide or metal that opened the question, and as we went through that solicitation we allowed in the RFP, the Request For Proposal that the comment to that could propose an alternative waste forms but also is the one we selected was consistent with the NEPA analysis.

Slide 7 please. So in June of 2004 we issued the two site-specific EISs on the construction and operation of the conversion facilities, and in the ROD for these facilities we reconfirmed that we would be converting our inventory to the U308 form and also producing the hydrogen fluoride, the HF product, where the aqueous HF would be sold for reuse in a commercial application and that is in fact happening.

And the depleted uranium oxide conversion product would be reused if there was a, to the extent that it could be, and we tried multiple times to provide it for the industry, and there have been no respondents. So we are preparing for storage, or we're providing for

its storage until we're able to settle on the final disposal location. And although the site-specific EISs included specific consideration of disposal at two sites, the Nevada Test Site, which now is the Nevada National Security Site, and Envirocare which of course became EnergySolutions' facility, as the destinations for the conversion product, but we did not decide through the instruments of those Records of Decision and I'll explain why in a few moments.

MEMBER ARMIJO: Christine, I had a quick question. On the conversion process you use, you say you're going to produce a small amount of calcium fluoride. And I'm familiar with a wet conversion process at a commercial fuel factory, and we produced mountains of calcium fluoride, and that ultimately converted to a dry process where we didn't produce any.

So when I saw this yard full of all those cylinders I nearly fell out of my chair. So I don't know how, if you've demonstrated that you produce very little calcium fluoride but you might have another waste stream, big waste stream.

MR. ZIMMERMAN: Yes, this is Jack Zimmerman. No, the calcium fluoride is just solely a secondary waste stream. It really comes from regenerating some of our off-gas scrubbers.

MEMBER ARMIJO: Okay.

MR. ZIMMERMAN: So other than that we don't have a calcium fluoride waste stream.

MEMBER ARMIJO: Okay, great.

MR. ZIMMERMAN: It's uranium oxide and hydrofluoric acid. And that's, I mean, well, we've been in operation for over two years now.

MEMBER ARMIJO: Okay, great.

MS. GELLES: Thank you. Slide 8. These are pictures of our facilities. And a quick summary of the respective scale of them. They're practically identical except for the different number of processing lines.

At the Ohio facility we have three processing lines. Construction occurred between 2002 and 2008. Hot functional testing began in June of 2010. And we're protecting not only 18 years of operation to address the near quarter million metric tons of depleted uranium hexafluoride we have there, and 24,000 metric tons roughly correlates to about 21,000 cylinders.

At Paducah where we have a larger inventory, we have four processing lines and a longer operational period projected. Same construction period. Hot functional testing at Paducah occurred a little bit later in 2010. And you can see over half a million metric tons

of depleted uranium hexafluoride stored there and that correlates to about 45,000 cylinders.

Slide 9, I think, Roger. This is just a diagram of our DUF6 conversion process and I'll summarize it, and if you have any specific questions I'm most confident that Jack can answer that. So to start with the UF6 cylinder there sort of in the bottom left, it's placed into an autoclave and heated to liquefy the DUF6 which is set into the conversion unit.

DUF6 is mixed with steam and hydrogen in the fluidized bed conversion unit to create a uranium oxide, primarily the U308 and the HF product that we also discussed. The HF is condensed and transferred for sale and reuse, and then the uranium oxide is transferred pneumatically to a hopper and loaded into one of the empty cylinders.

And we want to make note that we stabilize any heel quantity that remained in the cylinders when we sent them into the process, and it's stored in those reused cylinders at the storage yard there at the site, pending the availability and selection of a disposal facility or facilities.

Are there any questions on that? Or Jack, would you like to amplify that?

MR. ZIMMERMAN: No, I think you've got the

basics covered.

MEMBER POWERS: And when you reload the cylinders do you wash them?

MR. ZIMMERMAN: I only heard the first part of the question.

MEMBER POWERS: The cylinders that you reload with this uranium oxide product there is presumably some fluoride absorbed on the surfaces. Do you take that off?

MR. ZIMMERMAN: We basically get, potassium hydroxide is injected into the cylinder. It's a neutralizer that will remain in heel contents and it's basically put on rotation. We basically have a system that rotates the cylinder and basically spins it, so basically neutralizing any material on the sides.

MEMBER POWERS: Good, thank you.

MR. ZIMMERMAN: Also, as they check the pH to make sure it's neutralized and within the right ranges and confirm there's no hydrogen germination as well.

MEMBER ARMIJO: Is it then drained or do you just put the powder right in afterwards?

MR. ZIMMERMAN: No, we put the powder in over the top. The heel quantity is, probably it's less than 20 kilograms in basically a 14-ton cylinder. So it's stabilized with whatever the calculated amount

that's basically chapter 18. The proper amount of care is to neutralize the remaining contents.

MS. GELLES: Thank you. Could you go to Slide 10 please. This is just a little bit of a status of where we are. Following construction of the facilities, DOE decided to compete in commissioning and operations of the two facilities and in 2010 we awarded that contract to Babcock & Wilcox Conversion Services, called BWCS.

As I noted before, hot functional testing began in 2010 and operations began in 2011. But due to the first-of-kind nature of these facilities, a major focus on our path to stable and sustainable conversion operation to this point has been determining the maximum possible throughputs based on actual experience and empirical data and working to refine the systems to achieve that output.

We have been focusing on ramping up to full conversion operation. Again I mentioned the essential need to upgrade aspects of the system to achieve that higher throughput and we've been very successful.

So whereas in fiscal year '11 we converted 270 metric tons, in our second year of operations we converted over 6,100, almost 6,200 metric tons, and in fiscal year '13 we surpassed our goal of 12,600 and

actually converted 13,679 metric tons. So we've realized a really steady increase in our production capability.

MEMBER POWERS: I hope that you will have an opportunity at some point to document this first-of-a-kind engineering because it sounds like a major success to me. And those are rare enough in first-of-a-kind engineering undertakings.

MS. GELLES: Yes, and Jack can comment on this if he likes, but we recognize and were caching very carefully the lessons learned we've encountered here during the commissioning of these facilities. And then we have several other first-of-kind treatment facilities that also stumbled during parts of commissioning --

So we have a little community of federal project directors like Jack who are sharing lessons learned on commissioning. Thanks for the comments.

Page 11. These are excerpts from, and it's not a comprehensive excerpt. I sort of take the appropriate relevant sections here, from the USEC Privatization Act Section 3113, the low-level waste paragraph that clarifies DOE's statutory responsibilities related to commercial depleted uranium as well.

So I won't read it to you, but some of the

high points. The Secretary, at the request of the generator, must accept disposal of low-level waste including depleted uranium if it's ultimately determined to be low-level waste if it's generated by, the corporation here refers to USEC, or any persons licensed by the NRC to operate an uranium enrichment facility recognizing that there are other plants and commercial enrichers in development.

It also notes that the generator, in this case it could be USEC again or another commercial enricher, could also enter into agreements for disposal with persons other than the Department. So it's not mandatory that they come to DOE.

And it acknowledges in Paragraph C that no state or interstate compact shall be liable for the treatment, storage and disposal that a low-level waste including DU that's attributable to commercial enrichment.

Now if the generator were to request DOE to accept their waste, including the depleted uranium for disposal, they need to reimburse us for full costs including a prorated share of any capital costs that we develop.

And, you know, while I think you've heard Waste Control Specialists, you recognize that we could

provide for a federal disposal at a DOE site, we could also provide for access to the federal disposal facility and Waste Control Specialists in that this Privatization Act effectively adds commercial DU to the definition of federal waste for which the Secretary of Energy is responsible.

Are there any questions on that slide?

MEMBER SKILLMAN: Yes, this is Dick Skillman, Christine. I assume that what you're referring to in the last two minutes of your discussion would be LES and others such as LES that are producing this waste form.

MS. GELLES: Yes.

MEMBER SKILLMAN: How many other private producers are out there? You've given us the total cylinder count at Paducah and Portsmouth. The backyard of Hobbs looks approximately the same as what you've shown in your slide. So my question is how many other generators are out there?

MS. GELLES: There are no others that I'm aware of. There are others planned. For instance, we're aware of other commercial companies who are pursuing licenses to form domestic enrichment activities here in the United States, but to date nobody else has a facility that is currently generating commercial

product. There are, through USEC's research and development related to their centrifuge technology they are generating some low-level waste stream that meets this definition, but they're not depleted uranium hexafluoride cylinders.

MEMBER SKILLMAN: Thank you, Christine.

MS. GELLES: Okay, Slide 12. The next three slides are summarizing, I'm sorry, four slides are summarizing the Oak Ridge National Laboratory report, and the title of these slides is the actual title of the report, Assessment of Preferred Depleted Uranium Disposal Forms.

It was developed by the chemical technology division of ORNL in 2000. It is in support of our planning for the two conversion facilities and the site-specific EISs. There are other studies that have been done, but this is the significant one and the most relevant, I thought, to the committee's interest in waste form selection.

And so the following slides are going to summarize the evaluations that are contained in that report, and this report is electronically available. If you haven't found it we'll be happy to provide it to you. And following the discussion I'll take a look at the introduction of the report and see if it answers the

question of why we selected just these four forms for evaluation.

So the forms we considered were depleted uranium metal. I'm sorry, Slide 13, please Roger. Depleted uranium metal, and we're noting here that it's insoluble in water but we're also noting that it reacts slowly with moisture to form oxides in the presence of oxygen; condensed moisture promotes the generation of hydrogen; and reactions may form a pyrophoric surface in the absence of oxygen.

So it presents a pyrophoric concern if it were going to be stored for a prolonged period of time, and that's one of the reasons why in our programmatic EIS we indicated our preference against generation of a metal form in that they would have re-used metal.

Next slide. The uranium tetrafluoride form is very slightly soluble in water. We know it reacts slowly with moisture to form the uranium dioxide and hydrogen fluoride which of course is a concern as we noted before, and eventually other oxides and minerals.

Uranium dioxide, insoluble but we note that the powder, if it's still in a powder form it prevents a pyrophoricity concern when it comes in contact with air. Reacts slowly with oxygenated groundwater to yield more stable oxides and minerals. And Slide 15,

our preferred form because it projects the lowest uncertainty and our greatest confidence in performance. The triuranium octoxide insoluble in water, reacts very slowly to a more stable uranium mineral and the product tends to be a fine particulate or powder in which we can address in our modeling as a reliable waste form in our disposal system.

Slide 16. We've aggregated a few comments that we've received from the NRC over the years that are relevant to waste forms, and I want to acknowledge that these letters that are cited here actually address a broader set of aspects related to the management of depleted uranium hexafluoride inventory, but we've highlighted the excerpts that were, and specific to the waste form discussion.

So in '92 we heard from the NRC staff about a preference for the U308 as the chemical form for final disposition, and that letter also acknowledged that the uranium tetrafluoride form for final disposition would not be acceptable because of its physiochemical and long-term stability being incompatible with the analyses of 10 CFR Part 61.

In '95, we again heard in a letter that the DUF6 will likely require conversion to a more stable physiochemical form. In mentioning the triuranium

octoxide, the staff recommended the U308 which is thermodynamically stable and relatively unsoluble as a likely form for disposal.

And then in 1998, the NRC again expressed a preference for uranium oxides over metal and this was provided to us in comments on our draft programmatic EIS that we were discussing before.

So we considered these comments when we went for evaluations and we view them as relatively consistent on the support of our waste form selections.

Slide 17, please. This is my final slide before I turn it over to Roger. It gets back to answering the question of the additional analyses that we need to do before we ultimately select disposal sites for the depleted uranium conversion product that we're currently producing at the two facilities.

So we've committed to conduct additional analyses on the transportation and disposal of the conversion product. And the reason we did this is in 2004, DOE unfortunately had an oversight and we did not adequately serve two of four states, the host states of Envirocare and NTS or Tribes and NNSS now, when the EISs were published.

And to remedy that oversight we committed to do additional NEPA documentation to confirm the

adequacy of the EISs prior to issuing any Records of Decision. So we've remedied that oversight and provide, you know, update and appropriate service of the EISs and we've been in discussion.

And in March of 2007 we took the first step for satisfying the commitment for the additional NEPA analyses by publishing a draft supplement analysis on locations for disposal of the depleted uranium conversion product. We analyzed in this document all of the previous studies including the analyses in the programmatic and the site specific EIS's. We summarized the state of play regulatorily and for both Clive and from the standpoint for Nevada.

But we chose to not finalize that document for selected disposal locations in light of the NRC's initiation of the limited rulemaking on uniquely streamed and depleted uranium, which of course is more akin to the site-specific performance assessment that my colleague needs to describe.

So we have it out there as a future action for us to undertake. Originally we wanted to finalize all of this analysis prior to the startup of the two conversion facilities so that we could be ensured that we would have the disposal locations for the waste that we would be generating.

DOE's waste management policy has a very strong bias against generating waste which they cannot currently be disposed, but we worked through in our startup analysis the appropriate evaluation to ensure that we could provide for safe storage pending some future completion of this document.

We have been, as you know, closely monitoring with the NRC staff that they're working on and we're very pleased that we can interact with the committee on these important issues. And we remain uncertain exactly when we're going to resume that additional NEPA analysis and conclude and then show Record of Decision.

I'll also note in the last bullet that what we're evaluating is potential sale of a portion of the depleted uranium hexafluoride inventory for reuse, reenrichment specifically. And right before the holiday last week we announced our intent to enter into negotiations with a private company for sale of a portion of the higher assay tails for cylinders for reenrichment.

Ultimately -- yes, any questions?

CHAIRMAN RYAN: No.

MS. GELLES: Okay, sorry. Ultimately, you know, because of the Privatization Act the cylinders produced for those enrichment activities will come back

to us, so it's a temporary potential change to the inventory of cylinders that are in the yard awaiting conversion, but ultimately it's quite possible that the tails will be returned to us for future conversion and disposition.

CHAIRMAN RYAN: Okay.

MS. GELLES: I'm going to turn it over to Roger now, and Roger's going to summarize the more recent analyses again in context of our defense-in-depth results that we presented to you a few weeks ago.

CHAIRMAN RYAN: I'll just mention that after Roger's presentation we'll take a short break and then we'll come back and see if there are any final questions and then we'll roll into the last session of the day.

MR. SEITZ: Okay, and my part is very short. It's just a couple slides to provoke some thoughts.

When you think about disposal of depleted uranium, I think everyone realizes that near surface disposal is a challenge because of the long-lived nature of it. But we believe that there are viable options in the United States. And performance assessments that have been conducted in some of these NEPA analyses that we've heard about to date do support the idea that it can be safely disposed at favorable locations.

Three, and I think just a little bit of a repeat of what Christine mentioned, but there's three locations that are currently considered options for near surface disposal -- Nevada, EnergySolutions in Utah, and Waste Control Specialists.

DOE has oversight of the Nevada disposal facility and has disposed of depleted uranium in that facility, and the site-specific performance assessments do support those disposals.

Moving forward, there's also been evaluations for the larger inventories expected in the future, and I know that EnergySolutions and Waste Control Specialists are both also pursuing the regulatory approvals that they need for disposal at their sites.

MEMBER POWERS: Put it in WIPP.

MR. SEITZ: That's a bigger change.

MEMBER POWERS: Yes, but I mean if I was going to put it anyplace I'd put it out in the mines in grants. But I mean that's where it came from and it'll move out of there. But given that that might pose some political challenges why not WIPP?

MR. SEITZ: It's something to be considered. One concern just off the top of my head, one concern with WIPP is if this is determined to be a resource in the future it may preclude --

MEMBER POWERS: No, you can recover it.

MR. SEITZ: Out of WIPP?

MS. GELLES: If I could interject as well, I mean when we were doing our NEPA evaluations on disposal we conducted those within the context of current policy. And we evaluated and given that depleted uranium is by default Class A waste under the Department of Energy classification scheme, we knew that we needed to appropriately evaluate low-level waste alternatives.

And our analysis was limited to low-level waste alternatives although we looked at surface facilities, salts and a mine facility, a geological depository, but we ultimately concluded for ourselves that near surface disposal could be protective and for that reason did not see reason to consider WIPP a reasonable alternative given the statutory prohibition against --

(Crosstalk)

MS. GELLES: -- definition of true waste going there.

MEMBER POWERS: Statutes can be changed and they just get you out of all these low-level waste headaches. It's not going to contribute to the heat load, and an inert oxide and an inert salt sounds like a good combination to me.

MEMBER ARMIJO: It would have to be a pretty big facility.

MEMBER POWERS: It is a big facility. It's huge.

MEMBER ARMIJO: For all of those tanks that we saw in the picture?

MEMBER POWERS: Well, I understand though is tanks can dip down to about this much oxide.

(Crosstalk)

MEMBER ARMIJO: Okay, got it. I have no questions.

MR. SEITZ: Yes, at this point we're focusing on the near surface option that's been identified. So I'll bring up the figure that we used in the presentation a couple weeks ago, just the idea that I like people to think in terms of disposal and get beyond just this focus on numerical calculations and think of disposal as a full total systems concept.

And I think especially when you think of things that are long-lived like depleted uranium it becomes a much more focus on the site. You're looking for good locations. And if you remember the Nevada slide, those that were here, the Nevada slide has an exaggerated size for the site part of this bullet. And I think that highlights the benefit of Nevada is it is a very good

location for disposal of waste. It's remote, low rainfall, no residents to speak of, and even historically no residents to speak of.

So you've got your site characteristics. We have any facility design. That by choosing the good sites you've reduced the reliance on the design factors. which become less important over time unless you're making copper cannisters or something.

And also the administrative and technical controls. Things like, you heard this morning that Waste Control Specialists has the agreement for federal ownership. I understand that's also being considered for the Clive facility.

So that adds confidence, the federal ownership aspect. The site-specific analysis certainly was part of it and that is part of the work that's been done to support near surface disposal. A lot of it comes down to the radon. For example, at Nevada it's management of the radon. And you can deal with that with depth.

And essentially what the results show, the longer time frame that you choose, you go a little bit deeper and that helps to buffer that radon concern.

MEMBER POWERS: Go to deep borehole.

(Crosstalk)

MR. SEITZ: And I do want to remind people there are in these analyses, and I think this came up, there is a tendency towards conservative bias. And those become more pronounced the longer you go out in the future because you have trouble defending assumptions farther out in the future. And so that's built into these calculations as well.

CHAIRMAN RYAN: Okay, terrific. Thank you very much. We are scheduled for a 15-minute break which will begin now and we'll come back at 25 after 3:00.

(Whereupon, the foregoing matter went off the record at 3:10 p.m. and went back on the record at 3:31 p.m.)

Other Stakeholders

CHAIRMAN RYAN: We have three speakers in the afternoon session.

MR. WIDMAYER: He wants -- he wants to wait there.

CHAIRMAN RYAN: Huh?

MR. WIDMAYER: He wants to wait there.

CHAIRMAN RYAN: Okay. If you want to wait there, that's fine, either way. Okay, okay. Suit yourself. Up first is John Greeves from Talisman, LLC. John, nice to se you.

MR. GREEVES: Good to be here, Dr. Ryan.

Thanks for inviting me. Just a little background on myself. I actually joined the NRC Waste Program in 1980, when Part 61 was being developed. I worked with the authors of Part 61, and the then-affected Agreement States.

It helps give you a context of how things were, as Dr. Ryan said, in the old days. He too shared the experience, maybe from a different position.

But subsequently, I was also responsible for managing the staff that developed the guidance for, for example, engineered barriers under the Low Level Waste Amendments Act in 1985. So that was a good experience, and although the NRC staff really didn't license low level waste facilities, they did invoke the performance objectives of Part 61 on a number of occasions.

One example was the West Valley Demonstration Act, the Commission Policy Statement on the West Valley Demonstration Act, to write out the performance objectives. So the then-staff had to implement those performance objectives.

Then subsequently the National Defense Authorization Act of 2004, which addresses tank waste disposal around the weapons complex also incorporated the performance objectives of Part 61, and while I was

on staff we had to implement that.

So that body of experience is there, and I retired from NRC as Director of Waste Management in 2004. Since the last ten years, I've had an opportunity to work with the Department of Energy.

I understand there was a briefing on the 19th. I was unable to monitor that, and I had an opportunity to work with the Department on their implementation of the Order 435.1, and it taught me a lot.

My experience base grew significantly by seeing things from a different angle. So I just thought I would share that backdrop with you. I tried to keep my presentation material relatively simple, to just try and hit the key points, and the experience that I have indicates that the regulatory standards should best follow what I call four principles: Adequate protection, travel in the international community and these are the kinds of things you'll run into regardless of what you're regulating.

We have the ICRP recommendations to look to and international experiences, which I have some international experience working with other countries.

Simple standards. The regulation is not a place to put how to language. It's a place to put clear, simple statements of what the requirements are, and it

really should avoid complex how to language.

Further, the conversation we've had here this morning. The existing Part 61 and certainly the proposed Part 61 is going to have some clarity issues for all stakeholders. The last one, implementable.

Any standard needs to be reasonably implemented and to me, a new standard ought to run this test when you put it down there. Can you make an honest statement that I've met these principles?

MEMBER RAY: Let me ask you a question here. Isn't there, maybe implicit in what you've listed there, the idea that a standard should apply to something that's relatively consistent? It seems as if there's low level waste that is separable or is separated now, and which we're having to treat as if it were subject to the standard, whereas it wouldn't necessary need to be?

MR. GREEVES: That is a concern. You've heard views around the table about shouldn't there be a separate standard for DU. I've thought about this a lot, and I'm going to articulate what I think is an approach that provides these things, adequate protection, simple, clear and implementable in one standard.

After we're done, we can come back to this question. But I understand the question, because I've wrestled with it too, and I've seen others also. I don't

subscribe to splitting off some new standard for DU, and hopefully after I'm finished you'll see how I think we need to account for long-lived radionuclides, including.

So just a little background. I don't think everybody's in the room's familiar with this, but there were actually six sites back in the time frame on Part 61 in '82 as being promulgated, and then three of them actually had to close because of poor performance.

I would assert that Part 61 has been a gold standard for low level waste disposal. It's also been adopted in legislation that I identified earlier, and it's been recognized by the international community. DOE's taken Part 61 performance objectives and pulled it into its Order 435.

So it's been to me a gold standard. It's done a very good job, and what it did in large part was it cured a lot of the poor disposal practices of the day, and Dr. Ryan said in many meetings that it cut worker doses by factors. So it's really done a wonderful job, and the authors have a lot to be proud of. It's done would it could over these decades.

The second point here is performance objectives are primary requirements. The Commission, for example in the West Valley Demonstration Act, and legislation in the so-called WIR, Waste Incidental

Reprocessing legislation in 2005 or 2004, pointed out you've got to meet the performance objectives. They are primary.

So the technical requirements in Part 61 at the time were and are prescriptive as written. Over time, the Commission migrated to risk-informed performance-based regulation. It came at a later time. We've grown. We've learned since 1982. But the performance objectives stand the test of time, and this regulation has been successfully implemented by Agreement States.

So it served well. Does it need to be updated? You'll see later I say yes. Over the years, there's been advances in computational capability, and these have pretty much been implemented through guidance and policy statements, through more than by the way just low level waste disposal activities.

The emerging waste streams, as recognized by the staff, they've done a good job, require an updating of Part 61, in my view.

Just a little bit more on the background. To me, Part 61 as written combines deterministic and performance-based approaches. It's easy to point to the classification tables. They're really a generic set of criteria that were created with the technology and

calculational capability available in the late 70's, and it's very prescriptive.

The performance objectives can be used to evaluate what we call now performance assessment techniques, and I would point to the language that's now in 61.13. It calls for a technical analysis. That particular statement can be used to invoke risk-informed performance-based processes, and frankly everybody's been doing that for the last decade.

You've heard here that all of the sites do a waste acceptance criteria. How do they do a waste acceptance criteria? It's informed by performance assessment activities. So effectively people have been doing this, and a reading of 61.13, I think, you could potentially come to that conclusion, that that's what's needed.

It's not clear enough, so and the last point here is that the staff, I think, has done a good job identifying the gaps. The DU issue, you've heard a lot about it today. It really is a gap in the thinking that's contained within the confines of the existing Part 61.

All of that were what are called blending issues. There's been meetings on that. I'm not going to go into that. But evaluating of long-lived radionuclides needs an adequate protection standard, and

so I think that's fundamentally why we're here.

I have a bit of preliminary thoughts. The reason I'm saying that is that I'm waiting to see what the Commission has to say with the SRM. The Commission has this material. I'm given to understand the votes are in, and their due process has come out with a staff requirements memo and some follow-up action.

So I fondly hoped I would have that, and be able to articulate my views as to okay, where are we going to go from here? We don't have that. So that -- I actually concluded some time ago that Part 61 needs an update in a few areas.

It needs to clarify that site-specific performance assessment of all, underline all, all waste streams needs to be done. The way it's being interpreted now is you don't have to do waste site-specific performance assessment for Class A waste, for example. So hey, if that's not the way to interpret 61.13, then fix 61.13 and say it's all waste streams, not just selective ones.

The intruder standard. Listening to people here throughout my career, the royal "we" have always used 500 millirem as a standard to evaluate intruder protection, whether it was in the rule or not.

By the way, you'll find that number in the

statement, the work that went into the thought process of the people in 1980, that they were looking at the 500 millirem standard.

It just didn't end up in the rule. So I think an update needs to include an explicit statement about the 500 millirem standard. I think there's a consensus to use ICRP modern dose methodology. I'm not going to dwell on that, but that's one of the things that should be updated, and a key is the Advisory Committee on Nuclear Waste and others recognized the need for a two-tier standard, years ago. I think there's a consensus that we need to have a two-tiered standard.

My view is that the first tier, 1,000 year period, as implemented by the Department of Energy, which I spent basically the better part of the last ten years getting insight on, has proven to be effective without using a very prescriptive classification table.

They don't have -- they don't use classification tables, and they are able to do performance assessments, and they look at compliance for 1,000 years. I think it's a good first tier number, and the thing you have to do is to look at it as the two tiers, and what is the definition of the second tier?

To me, the Commission really regulates by dose. So I think it has to have some dose component and

how far to go, peak, impact peak, dose. Some people talk about impact; others talk about dose out to the peak is a defensible way to look for adequate protection for long-lived radionuclides.

The art here is combining the two tiers. I've heard some people say well 1,000 years is not safe, it's not adequate. Well, by itself it's not. You have to look at it as a construct. It's a two-tier construct.

The table you looked at earlier shows you boy, we've got a lot of stuff we've got to watch for the first 1,000 years. So that's the 1,000 year compliance approach. There are long-lived radionuclides DU actually grows, that I think call for an adequate protection standard to have a second tier to it, and you don't really need any more than that. The two of them together will provide adequate protection and fill what really now is a regulatory gap.

So to me, these two tiers work in combination. We've got camps of people who want the first one. We've got camps of people who want you actually need both of them for adequate protection.

MEMBER RAY: You're using the words "address for 1,000 years" and "evaluate for longer periods." I keep looking at the differences in the way these tiers are described, the verbs, adjectives and so

on.

MR. GREEVES: Well, my advice is keep the rulemaking language pretty simple, but we could probably spend a session talking about okay, how do you do analysis for the first thousand years, and how do you do analyses throughout the time frame.

You know to me, lots of speakers already before me feel comfortable with the calculation that they can make out to 1,000 years, and some people aren't even comfortable going that far, by the way. But I think the consensus is we have some comfort, confidence in our ability to understand the uncertainty and the issues involved out to 1,000 years. So that's what I'll call Tier 1.

Then you've got a Tier 2, and you might listen to some of these speakers and it sounds like they don't think we need a Tier 2. We need a Tier 2. You cannot point to stakeholders and say okay, how are you -- if you're going to consider these long-lived nuclides in this first term, how are you going to protect me? So you'll need a Tier 2.

How you frame that Tier 2, how you analyze it, it's subject to discussion and what is not negotiable is that you have to make a decision. So as you'll see later, I subscribe to setting a quantitative criteria for

Tier 2, evaluate it and I want that analysis and that uncertainty, and I think informed decision-makers will be able to deal with that.

What they have to do is they have to make a decision, and what I cannot conceive of is how am I going to make a decision with terms that say minimize releases? I don't know what minimize releases means, by the way. That's not helping me. So but let me get through my slides and we can come back.

MEMBER RAY: John, before you do that, in the original -- in the Part 61, the 1982 version, how was the idea of a Tier 2 treated? Was it implicit in the -- or was it --

MR. GREEVES: Let me -- you know, my friends will talk to me about this stuff. They didn't look at a Tier 2, because you see things depleted uranium, were not on the plate at the time. So they -- you can look at the EIS, and the EIS actually did calculations out in time, certainly to 10,000 years.

MEMBER RAY: So but then what I'm trying to get at is if -- is Tier 2, from your view, a necessity for short-lived?

MR. GREEVES: No.

MEMBER RAY: Not, okay. So you don't need it for short-lived. You only need it for DU and stuff

like DU?

MR. GREEVES: I subscribe to adequate protection for service disposal, you need a second tier if you are contemplating long-lived. And oh by the way, a very large fraction of the long-lived material is actually in A waste.

I think, I'm pretty sure that line -- if the other stuff goes away, but there's, you know, Gary Lowells pointed this out early on, that you know, the real enemy here is the long-lived waste in the Class A fraction, and you can't ignore it. You need a two-tiered system, and you know, I think the DU and the blending issue sort of lifted this issue, and Part 61 was ripe for an update, so let's get it done in one spot, not two.

So okay. I'm on -- so did I go through all of these?

MR. WIDMAYER: You're good.

MR. GREEVES: Okay.

MR. WIDMAYER: You want to do Slide 6.

MR. GREEVES: All right. I'm up to 6 then. There's one missing then, because I thought about these quite a bit. To me, the performance objectives are the gold standard. I've said this before, that they've been recognized by the Commission in the West Policy Demonstration Act.

They are in legislation. The National Defense Authorization Act that NRC, by the way, has a role of doing an evaluation of those tanks around the weapons complex, and they both recognized it's the performance objectives.

The problem we've got is this proposal is messing with the performance objectives, and it's actually stringing them back to, for example ,61.30 -- 13, which didn't happen in the past. So these proposed additional requirements in the two performance objectives we mostly talk about, 41 and 42, the public does --

Intruder actually now have provisions that reach back to 61.13(e). I think this is a problem. It's going to cause a question with this legislation, and implementing that, with all the new language in 61.13, is something we need to think long and hard about. So I'll look forward to the Commission SRM and probably have some comments about that at a later time.

But the legislation recognized the need for clear standards, and the new 61.13 language is very prescriptive. It's really "how to" language, and once this comes out for comment, I would think about commenting, take a lot of that language and put it in.

It reads like, it feels like guidance. Put

it into guidance, because you put all that into a standard, and it's going to create opportunity and mischief for interpretation.

CHAIRMAN RYAN: John, we're running a little bit tight on time.

MR. GREEVES: Okay, so I'll speed up. The second tier, I spoke earlier and questioned, needs a quantitative metric. I don't know how to regulate minimizing releases, which is the language that's in there now, and it could be interpreted differently.

The key with the second tier is avoiding catastrophic consequences, and the other thing that really caused me to want to move away from this, dig this up and so what's a metric for that? Others have put numbers out there. One rem; maybe it's 500 millirem.

I don't know. But to make a decision, I need a figure of merit that I can do my uncertainties around, and so I think you need a figure of merit to make that decision.

The long-term analysis concepts in Section 61.7, which is the concept Section 13, which is technical analysis and 58, become quite complicated and again, it feels like guidance to me. To me, it loses the context intended originally by the authors.

This is going to be implemented by multiple

Agreement States, and finally, I think, the site-specific waste acceptance criteria approach, as shown by DOE, is effective and protective, and we need to be able to just build that in, in a way that allows that to move forward.

I'm just trying to speed this up. Performance objectives have and should have the highest level of compatibility. One of the things you started this meeting, there's just not time to do it --

MEMBER BROWN: Flip your slide so everybody can see it. He flipped the slide. He was on Slide 7.

MR. GREEVES: Oh, yeah. I went to Slide 7. The performance -- the compatibility is an issue, and it's probably worth a meeting of its own. There's very few people who actually understand that compatibility status issue. But the performance objectives to me need to have the highest level of Agreement State compatibility.

Grandfathering was discussed this morning. I think there needs to be a clear grandfather. It can't be "I wonder," it can't be "I doubt or wonder about it." It needs a grandfathering provision to -- these people work on these sites for decades, and now a new set of standards is going to confront them. It's got to be some room for grandfathering.

Not to kind of dwell on it, point of compliance, I think, is an important issue. The buffer zone concept is in Part 61. I think it needs to stay there just the way it is, and then last, as I've talked about, site-specific performance assessment, I think, will resolve a lot of the issues that revolve around the outdated classification tables.

MEMBER ARMIJO: You would retire the classification tables?

MR. GREEVES: No. I subscribe to that. Well first, the classification tables are in legislation.

MEMBER ARMIJO: So you can't retire them.

MR. GREEVES: You can't retire them. Now enlightened people know that all the legislation did was use them as a marker for separating state and federal. So they exist, and they're not going to go away.

I know the Agreement States like the classification tables. I don't want to go there. I don't want change those classification -- they're just fine. What they do for me are generic screening values that are dated in the 70's, early 80's.

Let them sit there and then move towards waste acceptance, site-specific performance assessment approach, and allow that to do what effectively is being

done. All these Agreement States, all the licensees are using performance assessment techniques to come up with a waste acceptance criteria that's risk-informed, performance-based, and it to me tells you where you really are, versus some screening table that was developed --

CHAIRMAN RYAN: The Agreement States have all the authority they need, because they can write site-specific license conditions and take care of all of this, John, and they do.

MR. GREEVES: Mike, I think that there's a very simple rule that they could invoke, clarifying the need for site-specific performance assessment, provide for a waste acceptance criteria, get the dose limit for the intruder at 500, and invoke a two-tiered approach. It's not that hard.

MEMBER ARMIJO: I guess I'm just thinking about, you know, how much of that's already been done.

MR. GREEVES: Well, it's not in regulation. There's no two-tiered approach in the regulation. There's no --

MEMBER ARMIJO: It's been done.

MR. GREEVES: Oh, it's been done, yes.

MEMBER ARMIJO: Licensees invoke it all the time. But I just want to -- it's something to think

about.

MR. GREEVES: Yeah. But I don't think you could get through a hearing, a licensing activity without a new rule if you were contemplating DU or some of the other voice forums --

CHAIRMAN RYAN: Okay. Well, the clock's ticking, so must we. John --

MEMBER ARMIJO: I had just one question. On Chart 6, you talk about a quantitative metric of 1R should be considered, one rem, I mean, for the -- and that would be a --

MR. GREEVES: It's just a metric. The high level waste standard has a metric. If I'm a decision-maker, I do not want to be left with John, minimized releases. I don't know what "minimized releases" means. I need some kind of an anchor to be able to defend my decision that -- short of that, you're going to have a bunch of people making it up as they go. It's going to be freestyle, and you'll have a decision in this state that's different from that state, and you might throw away a perfectly suitable --

CHAIRMAN RYAN: John, I understand what you're saying, but on the face of it, minimizing releases to the public would be difficult to implement. 1R should be considered. I guess I understand that, but one rem

to who? One person, everybody?

MR. GREEVES: It would be to the critical group. I subscribe to it --

CHAIRMAN RYAN: What's critical group?

MR. GREEVES: Whatever the critical group is.

CHAIRMAN RYAN: Well --

MR. GREEVES: Out at this time frame, you know, it could be stylized approach like they did for --

CHAIRMAN RYAN: Right. So a lot of thought would have to go into making that --

MR. GREEVES: Absolutely, you know. These are preliminary thoughts.

MEMBER ARMIJO: Okay, great.

MR. GREEVES: I don't see how you can do it without a metric.

CHAIRMAN RYAN: Okay, and that's a good point too. I understand.

MALE PARTICIPANT: I guess we switch.

CHAIRMAN RYAN: Thank you, John. I appreciate you being here.

MR. GREEVES: Okay.

CHAIRMAN RYAN: Well you both have microphones. You really, you don't need -- oh yeah. You've got to operate the slides. And just a caution.

Don't whack the microphones too hard. Our recorders get a big bang in his ear if you do.

MEMBER POWERS: But it is kind of fun to watch when it happens.

(Off record discussion.)

CHAIRMAN RYAN: Go ahead, please.

DR. TAUXE: John Tauxe with Neptune and Company. I'm here with my colleague, Paul Black, who's in the audience, one of the founders of Neptune and Company, and I'd like to thank the Committee for inviting us to offer our opinions here.

My slides are oriented towards my understanding of what the questions before us were, to address some specific issues and then other issues too, and I have a lot of slides for ten minutes, so I'm going to just start going through.

First about site-specific performance assessment. I have an awful lot to say about performance assessment, because that's my bread and butter, and but that's --

I'm not going to have that the focus of this discussion, except to say that the way we view performance assessment, especially site-specific PA is to help in decision-making at even a most basic level, just to show differences between sites and get away from

this idea of cookie-cutter analyses and assessments that are often applied, and yet don't provide as much information and utility in decision-making as site-specific PA would do.

Now Mike Ryan had brought this -- he's mentioned this a couple times this meeting, is features of instant processes, and that's what we feel is the fundamental place to start in doing PA.

You have to identify what features, events, processes and I would enhance that to include exposure scenarios are important in any particular given site, and for any particular waste form or waste type, radioactive waste type.

So you know, considering the standard steps as we call them, I'll use that acronym, these physical, chemical types of things that can happen at the site, that at least should be considered. A lot of them will be dismissed, not --

I don't think any U.S. sites are going to be targets of tsunami, but a lot of these others would apply in different ways to different sites. It's important to pick those that apply to a given site, and not pick those that don't apply, so that you're not spending time, wasting time evaluating FEPs that don't matter for a particular site.

And I would expand this to include exposure scenarios. So I'll call it FEPses or something like that. I don't know, but in the same vein, there are exposure scenarios that apply at a particular site, and certainly don't apply at a particular site.

We've heard examples, and I could go on and on about examples of different PAs that I've worked on, and this really helps discriminate one site from another. It's very useful, very important, and again, only some of these apply to some sites.

As an example, here are five real sites, V, W, X and Z, and the different site-specific exposure scenarios that would apply to these sites, as everybody turns their head sideways to read the headings.

So as an example, this Site V here has a lot of exposure scenarios that really can matter and awful lot. Fishing, water well drilling, on-site resident and that sort of thing, and if you compare that to Site X, there's a lot of scenarios that just simply don't apply there.

Does that make it a better site or not? Not necessarily. You've got to do the performance assessment to find out. But there's no point at Site X in doing oil and gas well drilling that might be applicable at Site Y, but not Z or V or W.

So there's no point in going there, and it's important to get the FEPs agreed upon ahead of time with the regulator, with the licensee in this case, with stakeholders, so that everybody starts on the same page, and say okay, this is -- this makes sense.

This is what we're going to do for this site, and then you do the analysis, and the way I say it is then let the chips fall where they may, and then we see --

MEMBER SKILLMAN: Please go back.

DR. TAUXE: Yes, certainly.

MEMBER SKILLMAN: Why do all of the sites have hunting and recreation?

DR. TAUXE: Yeah. All five of these sites are on lands that are currently hunted, and all five of these sites could involve recreation in the future, recreational user. A hiker, someone in a vehicle driving around, these sorts of things.

MEMBER BLEY: These are dual sites. These are -- these are the X's just hiding what they are.

DR. TAUXE: Dual sites.

MEMBER BLEY: These are the X's just hiding.

DR. TAUXE: Yeah. I mean I can tell you.

MEMBER BLEY: No, that's all right.

DR. TAUXE: It's no secret.

MEMBER ARMIJO: But these are transient groups, people.

DR. TAUXE: Well, the on-site resident --

MEMBER ARMIJO: No. I'm talking about for the hunting and --

DR. TAUXE: The hunting and the recreation, yes. Those are short-term exposures.

MEMBER ARMIJO: And so why is that important?

DR. TAUXE: Because those things can happen, and it very well could be. It's not safe to presume that they couldn't be the controlling factor in determining the highest dose, for example. Those particular scenarios could.

So the idea with FEPs is you screen out things that couldn't happen like tsunami. Those things that could happen, you need to analyze before you dismiss them, unless there's some extremely low probability like meteorite impact or something like that.

But hunting occurs at all these sites now. So hunters are part of an exposed group. We don't know until we run the analysis how exposed they are. Are they going to get higher doses than an on-site resident? It's possible.

MEMBER ARMIJO: I don't think so. It's a

real stretch.

DR. TAUXE: They're not there to presume, I would say.

MEMBER ARMIJO: Well, you can presume. You can put everything under this thing. I just wonder --

DR. TAUXE: Well, no. You'd screen it out, and this, you know, you talk with people who live there. You talk with BLM. You talk with DOE. You talk with whoever owns the site.

MEMBER POWERS: I'm wondering how do you screen out, for instance, gas well drilling?

DR. TAUXE: How do you screen out gas well drilling?

MEMBER POWERS: Yeah. I can pick places. I'm thinking off-hand of Great Britain. There are locations there that nobody for the last 200 years thought they would ever drill a gas well. They're not contemplating drilling gas wells. But how I go about doing this screening when confronted with that example?

DR. TAUXE: Umm, well you use your best knowledge. The best knowledge may be incomplete. We all know that our best knowledge today is incomplete, and this is part of the problem, but it's something that you try to account for here. I would say that, you know,

depending on the geology. In Britain there might be places where gas was found that they hadn't expected to.

But I would posit that gas and oil well drilling is not going to happen in Los Alamos, for example.

MEMBER POWERS: But they're very, very likely to drill for geo energy there.

DR. TAUXE: Up in the Caldera. Geothermal. There's a good one. We should add that to the FEPs list. See, so this is why we have this discussion, see geothermal exploration as a perfectly reasonable thing to come up with, and say well geothermal would be good here. It wouldn't make much sense at Clive.

But it might make a lot of sense at Los Alamos. That's good. So geothermal exploration should be on the list of FEPs, should be examined as a scenario. And then -- or people may argue to dismiss it. But it's something that should be discussed and evaluated.

I like the geothermal exploration. Actually, that is on most FEPs lists, but not every site goes through FEPs. I think every site should go through FEPs. It sort of levels the playing field for everybody. But it's not a requirement. I think it's sort of a prerequisite, to make sure that all your thinking is

even.

Intruder assessment. There was a question about whether we should do intruder assessments. And we, meaning we at Neptune, we don't really see the value. I don't see the value of separating inadvertent human intruders from your standard member of the public, and in fact there are a lot --

There are examples where it's very fuzzy and difficult to separate them. I'll bring one up soon, but just go through all those scenarios that we just talked about, and if someone, you want to call them an intruder, you want to call them member of the public. Everybody's sort of a member of the public.

You determine who's there, what they're doing, what sort of risk is posed for them, and go from there. The utility of the intruder assessment in setting up Part 61 is recognized, but I'm not sure that it is still necessary.

But if you're going to do an intruder assessment, it needs to be site-specific intruders. Here, we might have someone drilling for water. Here, we might have someone drilling for oil. Here, we might have a resident. Here, we might have a hunter. We're not going to have a fisherman in Nevada, and you're not going to have one at Clive for a while.

So also what makes an intruder not so clear. So here's an example. Let's say one person comes along to the site. They do something to disturb the site, that doesn't actually expose them to waste. They leave. What they've done to the site ends up exposing waste.

Someone else comes along, is exposed to that waste. Who's the intruder? Neither is a classic intruder, but this is a real scenario, and it falls through the cracks as an intruder scenario versus member of the public, and it muddies it all up.

Federal versus commercial facilities. Well first, there's no difference. Why should they be evaluated separately? It's waste X, waste Y going into site A or B or W. Why would they -- why would we evaluate that differently if -- you know, federal versus commercial facilities, if you're talking DOE versus NRC, should be the same.

If it's federal and commercial facilities at site like WCS where they're missed together, they should be the same analysis. And we've done our best at Neptune, having worked on both DOE and commercial facilities, to follow the same basic principles. The performance metrics might be different, but that's not really part of the PA in a way.

You do the analysis and then you can measure

it against whatever a decision-maker wants to measure it against.

Other issues. Now I will say that there are those in the room who told me I should, you know, keep my nose out of policy. But I was asked to come here, and I'm sticking my nose in policy because as a practitioner, I have a very practical interest in the policy.

If it's vague, if it's difficult to implement, that's a problem for me in writing a performance assessment model. If I have to ask a lot of questions about well, what do you mean by "commingle"? What do you mean about "associated waste," what do you mean by this or that, what do you even mean by "the site," basic things like that.

You know, we have to make our best guess and see if it's defensible. That's the situation we're in now. So vague and inconsistent language, even in 61 Section 41. It's called "Protection of the General Population." In that, the text is to protect any member of the public.

Well, which is it, because those are different assessments. One is a population assessment; one is an assessment of an individual. It's different, different approaches, different math that goes into it. You can't combine them. You can do a whole bunch of

positive individuals and combine them to make a population dose assessment, which we have done in the past.

But the language is inconsistent. It causes a problem for me. Inadequate definitions of "person" and "occupy." If you look, and these words are used throughout the proposed rule, and it's -- there's some clarification needed, and if you're interested in the particulars of it, we did make comments this last January on the rule. I got about 27 pages of comments about things like this.

I know it gets overly-detailed and nit-picky it seems, but these are things that pain me.

MEMBER ARMIJO: John, you raised the issue on your first bullet, about vague and inconsistent language.

DR. TAUXE: Yeah.

MEMBER ARMIJO: In that same, almost the same sentence, after "any member of the public," it says "for all time into the future -- at any time in the future," which is rather open-ended.

DR. TAUXE: Rather.

MEMBER ARMIJO: And so, you know, I appreciate that you're bringing this up, because I think the regulation should be very, very clear and specific

and limited, so that you can -- you don't have these open-ended infinite time, infinite populations, where everybody's guessing. If you have to do performance assessments, you need some guidelines that are clear and --

DR. TAUXE: Well and actually, you know, both are laudable goals. General population under some kind of a LARA assessment, and how do we reduce doses to everybody, and any member of the public. Do we want to protect the dirt, the child who eats a lot of dirt and lives as a resident on the site, maybe the most exposed person?

Do we have to protect him? Is it going to be show-stopper for the site? Those are decision questions. But any member of the public tells me, you know, you pick your worse person and do that. Is that really where we want to go? I mean we could. We could at least do the analysis and then let the decision-maker decide if that's worthwhile.

But the language, at least in guidance, somewhere the language could be -- I think it should be a little more specific in the rule.

Stability. The definition of the current one is "stability means structural stability." Well, it's tautological. It doesn't -- that's not a helpful

definition to just say "structural stability." For how long? What kind of stability? Stability that exposes waste or something like that.

CHAIRMAN RYAN: Forgive me John, but time is running out.

DR. TAUXE: Okay, and this one. There are places in there that say well, to see if it's a significant dose, we'd have to do an assessment. Or if it's a significant hazard, an assessment should be done. But how can you know if it's significant or not until you've done the assessment side? So either way, an assessment must be done.

And correct me if I'm wrong, but the way I read 61.7(e)(3) is that depleted uranium would be a Class E waste, because it says "any waste with a hazard of more than 500 millirem in a year is a Class E waste."

So there might be some language cleanup that is desired there, but the way I read that is do you use now Class C? Well then, you know, there are other places where it says it isn't, so --

CHAIRMAN RYAN: I'm not sure that's right. I won't -- I'll just make a comment like that.

(Simultaneous speaking.)

CHAIRMAN RYAN: I don't think you're looking at the body of definition in its totality. So

I disagree with your assessment.

DR. TAUXE: Okay. Well, all right. Maybe it could be clarified. Environmental impacts are brought up, but there's very rare -- there's no ecorisk assessment. There's no environmental assessment. It's all human oriented. If we want to get into environmental assessment, I'd love to help do ecological risk assessment.

And dose is still used as a proxy for risk. I think risk is where it's at, and dose is part of the risk, but as we saw before, uranium toxicity is part of the risk. We did at the Clive DU PA. We included uranium toxicity.

How long is dose relevant? Well, I'm going to go through this very quickly. You can read. But the problem with deep time, I like the two-thirds system. I think when you get way out in time, geologic things can happen, and at some sites, it's obvious what's going to happen.

And where that is, I think that should go into some decision-making. Los Alamos, where I live, my house is, you know, the property I'm on is going to be washed into the Rio Grande within 100,000 years, and all the waste that's disposed of there. So future risk.

The time of compliance is this arbitrary

line there. It has no basis. Even Chairman McFarland has said there's no technical basis for any kind of number like 1,000 or 10,000 years. It's because we have ten fingers is where that comes from.

And if you just impose that line on the first stage of the two-stage idea, then you get something like this. So risk has gone up, and often it's still increasing at that point, and then boom. You decide okay, we're not going to -- we're going to discount risks after that make it zero. Full burdens on the current generation are on the next few.

MEMBER ARMIJO: Why isn't the risk going down with time?

DR. TAUXE: Why isn't it?

MEMBER ARMIJO: Yeah --

DR. TAUXE: Because despite what you've seen, at a low level waste performance assessments, we find the risk continues to rise for quite some time after 1,000 or even 10,000 years, generally due to radionuclides that I've heard dismissed here like Iodine-129, Tech-99.

These actually do have some serious impacts, not so much for the intruder necessarily, but I can show you some performance assessments where those are the driving risk factors.

MEMBER ARMIJO: Well, that certainly looks different than the EPRI curves, and I just --

DR. TAUXE: Yes, it does.

CHAIRMAN RYAN: And is this published and you have any kind of document that we could read?

DR. TAUXE: The performance assessments are. This is -- and we presented this at Waste Management.

CHAIRMAN RYAN: Is this a performance assessment of a specific site?

DR. TAUXE: No. This is a generic look.

CHAIRMAN RYAN: A generic look at what?

DR. TAUXE: At risk over time. We often see the risk still increasing.

CHAIRMAN RYAN: This is just a construct.

DR. TAUXE: Yeah, but it's valid. I mean if I plotted all the performance assessments we've done on top of this, they would, you know. Depending on which end point you're looking at. Are we looking at -- well, performance assessments have a lot of end points.

There's a member of the public. There's groundwater protection limits. There's a lot of different end points that have to be met for risk or other things. I could just say "end point" there.

But often things, you know, one thing that

got me excited when I first started this was seeing a performance assessment done at the Savannah River site, when they had stopped at 10,000 years. Then I saw another graph later on down in the performance assessment, where the dose, the peak dose that they had calculated some time later was 18 orders of magnitude higher than the 10,000 year dose. I thought well, that's why you don't not do that.

MEMBER POWERS: But the base of the dose is 10 to the minus 36. I don't care.

DR. TAUXE: The actual doses are not 10 to the minus 36. They're, you know, 21 out of 25 is considered passing, and there's a cutoff. Without the cutoff, it would be different.

So what's happening here is we're imposing this discounting. Up until that time the compliance we're considering the calculations with a value of one, and afterwards we're giving it zero.

So we're convolving the risk plot there with this discounting plot, and cutting it off. Here's another idea. An idea. Discounting in human society -- human society seems to value -- I'm not saying they should, but they seem to value the distant figure much less than the current and near future. We just heard that two weeks ago in front of this Committee.

CHAIRMAN RYAN: Again, I want to remind you, Dr. Makhijani's been patiently waiting and been around --

DR. TAUXE: Where this goes, though, is this figure on the right, which obviates the whole question of when is the right time to look. It shows you the right time to look.

MEMBER BLEY: John, following up on Sam's question. Are there any of the assessments that you've been involved in, that showed the kind of behavior with things going up well out in time, that are public documents that we could see?

DR. TAUXE: All these PAs are public documents.

MEMBER BLEY: Are they? Okay.

DR. TAUXE: Yeah. So I'm done.

MEMBER ARMIJO: Okay. I'd just like to mention that at one point you brought up that I, you know, I haven't heard much from anyone else in all of this, is that a great deal of what's in the draft regulation could well be or should be guidance rather than regulation.

That's similar to what we see for reactors for those same kind of things, for risk assessment, and that might really help avoid some of these definitional things that will get anchored in rule, that could lead

to a cookie cutter kind of analysis, where we're doing a lot more than we need to.

The basic idea that you start qualitative as complete as you can, sure fits with the regime we proposed. But can you -- I'm just curious why we haven't heard that idea much more than we have, that a lot of this ought to be guidance, so that it's easier to deal with in the future, when you get disagreements from regulation changes?

MEMBER RAY: Well, people want regulatory certainty though too. I mean if they develop an application, invest in it, they want to have some --

MEMBER BLEY: Yeah, but if your certainty is overload.

MEMBER RAY: I understand that. I've been there. I'm just telling you that there's a downside to just saying well, bring it in and we'll let you know.

MEMBER BLEY: We'll take a look. Well have guidance is different from that.

MALE PARTICIPANT: Maybe.

MEMBER RAY: Yeah. It might well be that people would take the heavy burden, knowing what it's going to be in reference. Okay.

MEMBER ARMIJO: Okay. Arjun.

DR. MAKHIJANI: Well, thank you very much.

I really appreciate being asked to come before you. I believe it's the first time I've been in this forum. Your water fountain is to be felicitated. The best water fountain ever.

In a way, my Institute started this whole depleted uranium debate during the LES hearings in the 1990s. We pointed out that DU in large amounts was not covered by the low level waste regulation explicitly. It was dropped between the draft and the final EIS.

It was considered in the draft EIS, but it was dropped in the final because it was not considered waste and wasn't anticipate to be a waste. Then 2004, the NRC acknowledged that asked the staff to develop a regulation about it.

So we've done a lot of -- the point of saying that is not to take ownership of it, but to say that we've done a lot of analysis of this question and I'll give you some examples. But before I launch into that, I do want to agree with some of the things that were said earlier, and disagree with a couple of them.

I agree with the sense that I've heard from the members of the Committee that it's not reasonable to think of long time frames in the sense of physical compliance, but that we may learn something by doing a calculation and that ought to inform how we think about,

in this case, depleted uranium.

But if we are not comfortable with waste for which compliance in the physical sense would be required for very long periods of time, in this case hundreds of thousands of years, millions of years, as John has just pointed out, then we ought to think of some other way of managing it, because we're not protecting future generations.

This concept of discounting really came from economists who think about putting in the money. So future money is less valuable than today's money. And from King, a famous economist, did say that in the long run we're all dead.

But this was a very peculiar idea I thought, because in the long run we're dead as individuals, and there's a difference between dead as individuals and being dead as a society.

In the long run, you want society to go on. In my view -- so that's a profoundly wrong idea to think about in the long run we're all dead, and therefore on social things we ought to be imposing some kind of discounting.

On the other hand, I think morality for a very long time has required that we treated future generations at least as well as we do ourselves,

especially as in this case we're getting all the benefits and we're dumping all the waste and risk into the future.

That's very important. If anything, we ought to be protecting future generations more than we are today. So this idea that we ought to have a separate higher dose for the intruder of 500 millirem, when intruder actually, as John has said, and as you yourselves remarked, ceases to have any meaning after you've lost institutional control.

It's just people, and if people go there, and whatever, hunters or residents or whatever, then they ought to be protected to the same extent that we want to protect ourselves today. I think the idea of a separate intruder dose, just because we have a harder time calculating it or uncertainties, this is our problem.

You know, if we can't manage to keep the risks to future generations within bounds, maybe you ought to be doing something else. Maybe solar energy might be a good idea. That's a different debate.

MEMBER ARMIJO: I don't understand your thinking. Future generations have no responsibility to protect themselves. That's what I'm hearing from you, that all the burden is placed on the present generations, not matter what it costs, in order to protect his

hypothetical population that somehow will be unable or unwilling to protect itself.

I just don't see that as an issue, as anything that makes sense to me. So maybe that's an issue of your morality versus mine, but the real issue is, based on history, each generation has become a little more knowledgeable, adept, capable than previous generations.

So there's a rolling ability to protect yourself as you move forward, unless there's some massive gap where knowledge is lost, society crumbles, and then the future generations are unable to protect themselves. They're just wandering around finding, looking for something to eat. So I don't understand, you know.

DR. MAKHIJANI: Okay. Let me respond.

MEMBER ARMIJO: I don't, you know, I understand what you're saying, but I just can't buy it, which is --

DR. MAKHIJANI: And maybe it is different morality. Maybe it's a different way of thinking about it, rather that morality. I think that to the extent possible, we ought to take -- not be imposing risks from our activities on future generations. We've talked about inadvertent intruders all day. So future generations won't be able to protect themselves if they

don't know there's a risk.

That is a large part of the problem that we've been talking. We're talking about creating risks where future generations won't even know the risks are there, because there will be this inadvertent intruder. That is a very large part of the problem.

Future generations certainly we hope will be able to protect themselves, and they should protect themselves from the risks they create, not from the risks that we're dumping on them, as a general idea. At least that is my frame of reference. You can take it or leave it. Obviously, you leave it.

But I think that it's something that should be considered, in the sense of how you set -- and my statement is very specific, that we should not be setting a separate dose standard from our activities. I'm not saying we should reduce the risk of future to zero.

That is not possible for any generation. What I'm saying is it is hypocritical to say that we should protect future generations at 500 millirem, and we should protect ourselves to 25 millirem. The cancer risk is not going to change unless our biology changes.

Why should we be imposing a cancer risk that is bigger on our children and grandchildren and great grandchildren than we are ready to suffer ourselves, from

our own activities? That's what I say is immoral. So I believe that this proposal is immoral.

I also believe that the issue of large amounts of depleted uranium is driving this debate, and there was some sentiment that there should be a separate rule, perhaps, for depleted uranium. I would suggest to you that this rule already actually exists. It's called 40 C.F.R. 191.

If you look at 10 C.F.R. 61, Table 1, it has that one line item for transuranic alpha-emitting waste greater than five years, limited to 100 nanocuries per gram. Well, the word "transuranic" is entirely arbitrary. The characteristics of depleted uranium in every way, as the National Research Council has remarked, not only me, but I have remarked this at great length in official testimony, repeated times, over more than a decade now, are identical in every essential respect to transuranic waste.

400 nanocuries per gram is long-lived with alpha-emitting waste. It has the same radiological characteristics, and it is an accident or basically a characteristic of the time that radionuclides like radium, thorium-232, thorium-230 and the uranium were not in Table 1.

It would not be hard to fix. It is really

greater than Class C waste. I don't see what this -- it is not Class C waste, not Class A and not Class B, and we shouldn't be getting rid of those tables. We shouldn't be going from, you know, essentially even though you can't rid of them, but transitioning by going around the law and saying we're going to some waste acceptance criteria.

Let me give you an example of what waste acceptance criteria have meant in practice, in terms of one of the companies that testified before you. In one of the early versions of the license application of Waste Control Specialists to the Texas authorities, they said that they were going to receive 30,000 curies of uranium-235 as waste from the Department of Energy.

They also had a corresponding number for U2-34 and U2-38. The isotopic ratios were physically impossible. The amount of uranium-235 stated 31,000 curies, was much larger the amount than the amount of uranium-235 than the country has ever possessed, much less in any waste stream.

I'm talking about the total quantity that it has ever possessed. Apparently, there was nobody qualified within the company at that time. For me it took five seconds to know it was completely wrong. But there was nobody qualified in proofreading that

application that was submitted. It was corrected after I made this question public, to the best of my knowledge.

I'll give you another example from the Clive site. One of the -- one of the technical documents that led to the license had some performance assessment calculation that said, I don't know, 10 to the 37 picocuries per gram of uranium-238 would be a suitable concentration for upper limit for disposal at Clive.

Well, it turns out that that's more than the weight of the earth, per gram of Utah soil. I pointed this out after an NRC staff person had testified under oath that that was a scientifically suitable appropriate document.

The error has never been corrected. I even protested to the Chairman of the NRC, the new one, who I've known for quite a long time. When I met with her last November, November of last year, that it was absurd that this error had never been corrected, even though I testified under oath. I protested in public and in private, including the Utah Division of Radiation Control, and the reply I got back was simply that this is no longer a valid document.

How the error came about is that faulty computer -- there's a faulty computer program somewhere. They were had chose to divide by zero probably somewhere.

Is that still in use? I think it is still in use, because I see the thing popping up in many different places.

But the NRC -- neither the NRC nor the company, nor the Division of Radiation Control in Utah has had -- we can't go to a system of waste acceptance criteria alone. This thing has to be bounded pretty carefully. I think clearly the rule is insufficient. Clearly depleted uranium is a problem. I think there is a solution that is staring us in the face.

We ought to treat it like transuranic waste. It has come up that, you know, why not the repository. Well, the repository is bounded by law, and whether we can change that law or not -- or whether it would be a good thing for the federal government to go back on one more commitment to the people of New Mexico.

But certainly we have advocated that a repository, deep geologic disposal for depleted uranium would be a good idea, and that it ought to be treated as greater than Class C waste. It's not a complicated problem. We have a solution staring us in the face, and I believe the reason we're not accepting it is the industry is probably unwilling to accept the cost of that, because there may be an order of magnitude higher than shallow land disposal.

I think there are other wastes that are

GTCCs-like that the DOE is considering. We haven't seen a final EIS out of the DOE for greater than Class C waste, but this problem is clearly related to that. There also ought to be curie limits.

This idea that we're going to blend down and indefinitely increase the number of curies is a little ridiculous because it should have been discredited. The dilution to the solution is the solution to pollution.

And I'm glad that we seem to be on the road to ruling it out at least more or less, but it should be ruled out out of hand. It has no place in waste management, and the way to rule it out is to put curie limits.

Actually, on depleted uranium, the draft EIS to the low level waste rule had 50 nanocuries per gram as a limit, and I was consulting with Dr. Esch earlier on, and he affirmed my memory that it said 17 curies as a total limit.

I believe that they should be total curie limit, especially on long-lived radionuclides. I agree with the sentiments that, you know, 100 years, 300 years, we can think about them. We know enough to do reasonable performance assessments.

Beyond that, when the curie amounts and concentration amounts are large enough, we ought to think

about properly engineered deep geologic disposal.

A couple of other things. The analysis of where's there is a comparison made on page 14 of the Notice, it's ML-13291A262. The table that compares the present rule with the proposed rule is very misleading in how it presents its doses.

It says that the current -- it misrepresents the current rule. It says the current rule performances, .25 millisieverts annual whole body dose. But it does not mention that the current rule also has organ dose limits. I have pointed this out a number of times.

I am shocked that an official document does not even represent the content of the existing rule properly, because it has proposed to drop the organ dose limits. The practical effect of dropping the organ dose limits would be thorium-232 to relax the allowable concentration by more than two orders of magnitude, because in the case of thorium-232, bone surface dose would be the controlling dose, and its dose conversion factor is more than two orders of magnitude greater than the whole body dose.

In the case of other actinides it will be the same. Strontium-90 would be an order of magnitude. So this is a real problem. Not representing the current

regulation, misinforming the public and then quietly dropping the organ dose limits, which would allow a very serious relaxation of the rule.

I think the organ dose limits are more fundamental, because in going from organ doses to whole body effective dose equivalents, you're using weighting factors and today is breast is one weighting factor, tomorrow it's another. You know, it depends on whether feminism or masculism is dominant in society or something.

But I've seen that, you know, if you look at how the weighting factors have changed, they're actually not changed in one direction but actually oscillated. So they're clearly fairly arbitrary, and organ doses should be the controlling doses. In the compensation program that the government is carrying out, the cancer risk are calculated -- the doses are calculated according to organ doses, and that's how the cancer probability is calculated.

We don't get cancer on the whole body, except when it spreads. We get cancer in particular parts of the body.

CHAIRMAN RYAN: While I appreciate your comments, we're kind of drifting off of our topic.

DR. MAKHIJANI: Well, it is part of the

proposed regulation, and I found it egregious that the public is not even being properly informed of the content of the existing regulation.

CHAIRMAN RYAN: No, I'm not criticizing. I'm simply saying our time's running short, and I want you to make sure if you had other points you'd like to make, we'd like to hear them.

DR. MAKHIJANI: Let me look over my other points. I did -- we don't have a good definition of members of the public. I have asked for a long time that members of the public be explicitly defined to include children and women, because risks to women are much higher than risks to males, radiation risks, and risks to children are much higher. There's also an executive order about it, Executive Order 13045, which is being ignored here.

A couple of things I did not agree with some Commission members about. DU is not like mill tailings. Mill tailings are in the nanocuries per gram. DU is in the hundreds of nanocuries per gram. You're impaling radioactivity overall, a long period of time thorium-230 controlling declines over time. DU radioactivity increasing over time, because not equilibrium to start with.

I also disagree that a depleted uranium

remain is essentially a chemical toxin. Depleted uranium is really like radioactive lead. At the amount at which it is chemically toxic, it is also radiologically significant. Perhaps I pointed out to Dr. Ryan that the most recent research from the Armed Forces Radiobiological Research Institute will illuminate this.

We've looked at it with some considerable care. I do not believe that the radiation aspects of uranium should be ignored, especially as you -- you have the ingrowth of the daughter products over time. We did some calculations about depleted uranium at a site like Utah, although not the physical configuration of the Utah site.

But burial, shallow land burial. We also did an explicit calculation on a Texas site when we were looking into depleted uranium during the LES licensing hearing.

Our generic site analysis for a dry site like the site at Utah for shallow land burial resulted in doses that were between 179 rem per year and 795 rem per year, with peak doses being in the 10-20 thousand year range.

This is one of those heuristic calculations. You don't necessarily believe those

numbers, but it tells you something. I'm not talking millirem; I'm talking rem. We're talking multiple sieverts of dose per year.

In the Waste Control site, the idea was that -- the conversion factor is clearly erosion. The company said the site's actually going to build up because erosion is less than deposition, and so we don't have worry about that.

Of course, there's more than one opinion than what was in the company's application. We actually hired an independent -- not hired. He actually gave us free advice, because he didn't want to be paid for it or any impression that we were paying for his advice.

And then among the range of erosion estimates that out there from experts, we find that with most erosion estimates you're going to wind up with doses in the tens of rem per year at the Waste Control Specialist site at long periods of time.

So clearly, we are with the material that at long periods of time has the potential in wet sites to screw up your water and give you high doses via water, and in dry sites, to uncover the waste by erosion and give you high doses by external dose and inhalation dose.

This is not suitable material for disposal and so we have to -- we have to -- so for, I think 500

years is not a bad limit for time frame, but only if we adopt total curie limits, and only if we rule out large quantities of long-lived radioactive --

CHAIRMAN RYAN: Dr. Makhijani, let me just take a minute and see if there's anybody else on the bridge line, because we are over time, and if there is somebody there, I'd like to give them an opportunity to speak as well. Is anybody on the bridge line at this point? Is it open?

MR. WIDMAYER: I believe it's open.

CHAIRMAN RYAN: Okay. I wonder if there's anybody on it.

MALE PARTICIPANT: It seems to be open.

CHAIRMAN RYAN: We'll just check. Sure, thank you.

(Pause.)

MEMBER POWERS: Let me ask one question. I actually have several, but one question on this 500 millirem standard for an intruder.

Public Comments

MR. DORNSIFE: Hello?

CHAIRMAN RYAN: Yes.

MR. DORNSIFE: Hello?

CHAIRMAN RYAN: You don't need to yell.

MR. DORNSIFE: Well, you weren't

answering.

CHAIRMAN RYAN: Well, that's because it just came on.

MR. DORNSIFE: Okay. This is Bill Dornsife. I'm Executive VP for Licensing.

CHAIRMAN RYAN: Bill, Bill, Bill. Excuse me, Bill. You're blowing out the room here. Either we've got to turn down the microphone or turn down your microphone.

MR. DORNSIFE: All right. I'll get a little bit further away.

CHAIRMAN RYAN: There we go. That's much better.

MR. DORNSIFE: Okay. I have a couple of brief comments concerning some of the questions that the Committee had. First of all, I don't think anybody mentioned that the PA is not the ultimate yardstick for compliance. It's just a tool.

MR. JANATI: Hello Mike?

CHAIRMAN RYAN: I'm sorry. Somebody just added to the bridge line and --

MR. JANATI: Mike Rich Janati here.

CHAIRMAN RYAN: Dornsife is speaking at the moment. Would you stand by?

MR. JANATI: Oh, I'm sorry. Go ahead.

CHAIRMAN RYAN: Okay.

MR. DORNSIFE: So in order -- because of that, we typically look at a number of different scenarios in our site-specific performance assessment. For example, we do a probabilistic analysis, which includes distributions for the various hydrogeological factors and infiltration and other things, and we also look at the probability of an intruder inhabiting the site, based on history of ranches in the area and also, you know, the probability of being on the disposal site the entire, entire ranch, and that turns out to be about sub 5 times 3 to the minus 5 here.

We also do a most likely case, which turns off the driller and residents, because they are very low probability events based on those parameters. We also do what we call a deterministic analysis, which looks -- which assumes the intruder is there, probability of one.

Then finally, we do a climate analysis, which shows the impact of greater rainfall that Scott cited. So you know, those things hopefully will help the regulator make an informed decision on reasonable assurance.

Also, based on my modeling experience, there are really two categories of radionuclides that cause dose to the public. There's radionuclides that

come out in the form of gases, and they typically have an impact very early in time, prior to 1,000 years. And of course depending upon what engineering barriers you have.

The other category is the long-lived mobile radionuclides that really don't show up for a very long time typically, and 1,000 years may not capture the impact of those. The primary pathway for those are either diffusion to the surface or ground water.

I would suggest that ground water, there isn't a lot of uncertainty in the hydrogeological characteristics under the site, and ground water is always going to be a very important commodity, a resource. So again, 1,000 year compliance period may not capture that impact of ground water.

CHAIRMAN RYAN: Thank you, Bill. We have one other new speaker on the bridge line, and I'd like to ask that speaker to make his or her comment now.

MR. JANATI: Mike Rich Janati, Pennsylvania.

CHAIRMAN RYAN: Hi Rich, nice to talk to you.

MR. JANATI: Just a couple of comments. I'll try to make it as quickly as possible. Can you hear me?

CHAIRMAN RYAN: Yes. We can hear you fine.

MR. JANATI: First of all, I mean a couple of general comments. First of all --

CHAIRMAN RYAN: In fact, you could even lower your voice a notch, and it will be okay.

MR. JANATI: All right. Is it better?

CHAIRMAN RYAN: Just pretend we're in the room talking to you. You don't have to holler.

MR. JANATI: First of all, I think there needs to be a distinction between unique wavestreams, in this case depleted uranium, and routine low level waste from commercial facilities, due to the differences in the toxicity of the two, and mainly by toxicity, I mean chemical and physical form of the inertial property.

CHAIRMAN RYAN: Rich, Rich, Rich, Rich. We're really having a hard time hearing you. You've got to lower the volume of your voice.

MR. JANATI: Okay. Can you hear me now?

CHAIRMAN RYAN: That's a little better.

MR. JANATI: Is it better?

CHAIRMAN RYAN: Yes.

MALE PARTICIPANT: Keep going.

CHAIRMAN RYAN: Keep hitting the button. It will be even better yet.

MR. JANATI: Is it better now?

CHAIRMAN RYAN: Yeah. Just hold the phone --

MR. JANATI: Because I don't hear you very well. But if you hear me, that's fine.

CHAIRMAN RYAN: Yep.

MR. JANATI: So what I think the issue is, you know, there has to be a distinction between unique wave streams, and in this case, depleted uranium, and routine low level waste from commercial facilities. That's mainly due to the difference in the toxicity of these two, and by toxicity, I mean chemical, physical form of the inertial property.

Now I believe a more efficient and effective approach for NRC would have been to address the disposal of DU separately. Do a separate rulemaking, or do a separate regulatory document. Now as far as health and safety point of view, I don't believe the NRC proposed changes will result in any additional health and safety benefits for the disposal facilities that accept routine low level waste only.

Now to give you an example, you know, in Pennsylvania, and (name) knows this. He was very much involved in this. We went through a very extensive public involvement process, to develop our low level waste regulation. Some of key provisions of our

regulations are facility surface design, above ground, three layers of protection, overpacked disposal module, engineered solid.

We have a zero release goal. We have an intruder dose limit of 25 millirems a year. The regulations specifically said that the facility design shall, to the extent practical, limit the radiation exposure to a 25 millirem per year limit. We will not accept depleted uranium. I don't think we would accept any, and unfortunately, this is not an Agreement State and because of compatibility purposes, we might have to end up opening up the (inaudible) and that's going to be very controversial.

I can tell you, it's not going to -- absolutely not going to benefit us at all, from a health and safety point of view. Looking at performance time frames, my view on that is that it has to be done on a case-by-case basis, and it has to be decided by Agreement States, by looking at, you know, projected waste streams, site-specific characteristics, and waste acceptance criteria.

A 10,000 year compliance period, I think for a facility that accepts routine waste streams, and all the services associated with it, is going to make the licensing process very difficult and complicated. We

modeled as a worse case scenario for Pennsylvania waste, that was for 2007, thousands of curies of related components, (inaudible), DAW that was shipped to Barnwell prior to the Barnwell being -- not being available to us in 2008.

So we started with 70,000 curies, and we ended up with 60 curies after 1,000 years, mainly nickel-59 and nickel-62. So now looking at, you know, the development started at a specific (inaudible). I don't understand why that would require a change to Part 61. Why couldn't they have gone to regulatory documents, have you looked at 61.58?

And the other thing I wanted to point out is that the Nuclear Regulatory Commission, NRC implemented a new reactor oversight process, which is a much better system than the old process, without changing regulations at all. They did it through guidance and procedures.

The new reactor oversight process, as I recall, did not require any changes to the regulations. So the bottom line is that I believe that it has to be a separate rulemaking, a separate process for depleted uranium.

I think it's going to be an unnecessary burden on the Agreement States like us, Pennsylvania, who

will have to go through the process again, opening up a regulatory low level waste regulation, and it would create issues and concerns and problems for us.

If you want to proceed with this rulemaking, let's go after the disposal facilities, make exempt facilities that are not going to take unique waste streams or depleted uranium. Also just one other thing. Lisa Edwards, as I recall, I was on the bridge and I was listening throughout the process.

She mentioned that this is not a comprehensive change. This is not a comprehensive change at all, which means at some point in the future, we're probably going to have to go back and visit the process and visit Part 61 again.

So I don't -- I personally don't believe that -- and this relates to Pennsylvania -- I don't believe this rulemaking going to have any benefit to health and safety, health and safety benefit, at least not in our case. Thank you, Mike.

CHAIRMAN RYAN: All right, Rich. Thank you for your comments. We appreciate you being on the line and being patient with us. Is there any other speakers on the line?

MR. DORNSIFE: Hey Mike?

CHAIRMAN RYAN: Yes.

MR. DORNSIFE: I just have one other really short comment.

CHAIRMAN RYAN: Bill Dornsife again. We'll just confirm that for the record, please.

MR. DORNSIFE: Right. I just want to note that two Agreement States use compliance periods that are longer than 1,000 years. Obviously, Waste Control and Utah for the depleted uranium, and most of the waste goes to those states. I think lowering or mandatory lowering of the compliance period in those states will have a real impact on public confidence.

CHAIRMAN RYAN: Okay. You cut out, Bill.

MEMBER POWERS: Must have lost him.

MR. DORNSIFE: Well no. I'm still here.

CHAIRMAN RYAN: Oh, okay. Oh, you're there. Okay. Very good. Now we are at the appointed -- I'm sorry. One more comment. I'm sorry, excuse me.

MR. MAGETTE: May I comment?

CHAIRMAN RYAN: You may, now.

MR. MAGETTE: My name's Tom Magette. I'm with PriceWaterhouseCoopers, and I would just like to make two comments.

First of all, I would like to address the question of whether or not uranium or depleted uranium could be appropriately addressed in this rulemaking

regarding Part 61, and secondly, I'd like just to talk a little bit about the need for another rulemaking.

I would say it is entirely appropriate to address uranium in this rulemaking. It can be done without compromising or complicating the current regulatory regime for the disposal of unknown commercial waste streams.

Secondly, I would suggest that once you finish this rulemaking as it's constituted, then you can be done. There is nothing that needs to be done to further improve Part 61. The beauty of the language that the staff sent to the Commission for the site-specific rulemaking is twofold.

First, the two tier approach, and secondly, the use of a waste acceptance criteria from a site-specific performance assessment.

The two-tier approach with a reasonable compliance period, which I don't think can be more than 1,000 years, allows you to have essentially a status quo for regulating the commercial waste, the non-uranium, the non-long-lived waste, and it allows for a performance period to look at long-lived waste.

The reasonableness of that is that you simply cannot create an effective, quantitative standard out many, many thousands of years. It doesn't matter

what regime you're looking at, whether it's low level waste, surface disposal, it doesn't matter.

You cannot with confidence come up with a quantitative standard. You can create a reasonable, quantitative standard that you have to demonstrate compliance with at 1,000 years or less, so you have addressed both parties of the problem.

The beauty of the WAC is that it creates a much more accurate and precise way to regulate the waste that we're already regulating. There was a comment made this morning that the WAC would never be equivalent to or as good as the tables, because the WAC just comes from a model.

Well, the numbers in the tables in 6155 also come from models that are based on generic sites, disposal technologies that aren't used at any sites in the country, and other old methodologies, including a generic assumed waste stream that we also don't dispose of.

Yet Lisa was able to present a more accurate reflection of the waste stream today. We know we have better data. So you can significantly improve upon that, and a site-specific PA-driven WAC will be far more accurate than what's in the tables, and it will be something that you can also respond to, if there are

changes in things like organ weighting factors in the future.

So ultimately, there's a common notion that it's harder to regulate. I don't understand how that can be either. If I simply take one number and replace it with another number, I haven't really changed anything about the regulatory process.

Generators and processors are today required to certify that their shipping waste is in compliance both with the regulations and the WAC for any given site that they're shipping to. Merely changing a number doesn't affect that process. It doesn't impose any new burden on a state, on a disposal site operator or a generator or a processor or a shipper.

So by virtue of implementing a WAC in lieu of the tables, you have in fact, I believe, implemented what constitutes a gold standard. You could have another rule, but what would you do that would be more effective than a site-specific analysis. You simply cannot put in a rule, in new Part 61 tables, something that is more effective and does a better job of defining what can safely be disposed of at any given site. Thank you.

CHAIRMAN RYAN: Thank you, Tom. I appreciate your comment. Let's see.

DR. MAKHIJANI: Can I have a moment of your time?

CHAIRMAN RYAN: We've kind of -- we've got one more speaker here, so we did kind of interrupt your flow. So why don't you finish up, and then we'll let this gentleman finish.

Other Stakeholders (continued)

DR. MAKHIJANI: I just want to give you one important example of why curie limits are important. Today, the graphite blocks at Hanford from the Manhattan project reactors would be considered as Class C waste. They're about 85 percent of the Class C limit, by my calculation.

And the Department of Energy proposes to dispose of them off in the plateau there at Hanford in shallow land burial. But by their own calculation, the drinking water limits would be exceeded by hundreds of times from disposal of Class C waste. We clearly need curie limits, and I believe these graphic blocks actually belong in deep disposal.

We're often admiring the French when it comes to their nuclear reactors. I've been involved in the French nuclear waste discussion officially, and I know French, I write in French, speak in French and have done so. We're not paying attention to the fact that

they actually do have something called medium activity long-lived waste that they plan to co-locate in the same repository that they're planning in the east of France.

It's a separate section of that repository. The Swedes also have deep disposal of the same kind of waste, intermediate level long-lived waste, and they have a deep repository, but they have a separate one. I don't really care whether we adopt a separate one or the same one.

A separate one is probably cheaper, but we should have deep disposal of a much larger set of waste than we currently plan, or that are even currently indicated by greater than Class C, or at least greater than Class C.

Finally, I would just say that the definition of "long-lived" in the proposed rule of 10,000 years and ten percent and all that, all of three alternatives, is a little ridiculous. It's far too long.

Long-lived should be linked to institutional controls. By that definition, anything with a half life of more than ten years, so gone in 100 years, should be defined as long-lived.

Maybe, you know, cesium and strontium I

would agree. You can deal with the kind of performance calculations that you're talking about. That's an intermediate half life. But certainly 10,000 years at ten percent, which means a half life of about 3,000 years, by my calculation, is far too long. I mean it does -- in the spirit of some of what you've been talking about.

CHAIRMAN RYAN: Well, I think quite frankly that a short time and intermediate time and a longer time, maybe it's three instead of just --

DR. MAKHIJANI: It might be three. I would agree that some 30 and more than 30. It would be not unreasonable.

CHAIRMAN RYAN: Well, I might not agree with 30, but you know --

(Simultaneous speaking.)

DR. MAKHIJANI: --with strontium and cesium, and there's a cutoff with strontium and cesium because above that --

CHAIRMAN RYAN: No, I understand.

DR. MAKHIJANI: --the next one, the next most important one you are running into nickel.

CHAIRMAN RYAN: Food for thought for another day.

DR. MAKHIJANI: Yes.

CHAIRMAN RYAN: One last comment from

another new speaker, and thank you for your patience.

DR. MAKHIJANI: Sure, no problem.

MR. ROBERTSON: My name is Gary Robertson, and in the past, I was in charge of regulating the Hanford low level waste site for U.S. Ecology, and I was the director of the State of Washington, and went through the whole process and evolution.

I can say NRC did a good job and it is the gold standard what they came up with in Part 61. Today, we're looking at new waste streams, and I actually have said this several times. There is a problem about consistency within the NRC regulatory framework, and I'll give you a couple of examples.

I'm sure it's not going to get addressed, but if you look at the uranium mill regulations, you're able to not just go to 100 years but to perpetuity to protect the sites. I think somebody has to address that, either you adopt 100 years or you change the low level waste so it's protected for perpetuity.

Now with depleted uranium and the problems associated with it, it seems like adoption or at least looking at the uranium mill standards for a compliance period would be the way to go. For example, the uranium mill regs say you can go out to 1,000 years, but no less than 250.

I think they acknowledged the qualitative versus quantitative nature there. I'd recommend the 250 years, and then out to 1,000. Then if you want to go off for peak doses to look at things that aren't very realistic, to go on out to that, the sited states have a problem, I believe, with compatibility.

Here's the issue. If you change that to compatibility C, I see at least one problem with, for example, the state of Washington and South Carolina, who have adopted a time period. If you end up setting it at 10,000 years, even though they're allowed to be flexible, they're really going to get a push from the public to do the 10,000 years.

I think this group can push back and look at what's realistic, and that's no more than 1,000. If a state cannot defend properly the 1,000 years, then roll it back to 250.

CHAIRMAN RYAN: Thank you very much for your comment. Any other commenters?

(No response.)

Subcommittee Discussion

CHAIRMAN RYAN: Hearing none, I want to thank all the participants, the staff speakers and our members of various interest groups who have come today. We really appreciate your input. It's been, I think, a

very lively and fruitful discussion all day, and you've all given of your time and your talents and I appreciate that very much.

With that, Mr. Chairman, I'll turn the meeting back to you for a close out.

MEMBER ARMIJO: Well, I would like to add my thanks to all the presenters. Even though our questions may have seemed a little bit --

CHAIRMAN RYAN: Pointed.

MEMBER ARMIJO: Pointed, I was going to say "aggressive," please take it as an intention to get more information. The presentations were excellent. The comments and the discussion was very good. It's exactly what we were looking for. Together with the previous input from the prior meetings, the Committee will hear --

The full Committee will hear from the Subcommittee, and we expect the -- depending on the decision, the full Committee is likely to be writing a letter to the Commission based on this input. So again, thank you very much, and I'll turn it back to you, Mike.

CHAIRMAN RYAN: Again, I'll add my thanks to the Chairman's thanks, and we had a good meeting with lots of very, very good input all day, and I wish the staff from this morning were all here. Some of you are here.

Thank you again for your time and talents, and with that, Mr. Chairman, we'll adjourn the meeting. Thank you very much.

(Whereupon, at 5:09 p.m., the meeting was adjourned.)

DHEC

PROMOTE PROTECT PROSPER

South Carolina Perspective on Part 61 Proposed Revisions

Prepared for the ACRS Radiation Protection and Nuclear Materials Subcommittee Meeting

December 3, 2013

South Carolina Department of Health and Environmental Control

Promoting and Protecting the Health of the Public and the Environment

D H E C
PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control
Promoting and Protecting the Health of the Public and the Environment

Barnwell LLRW Disposal Facility

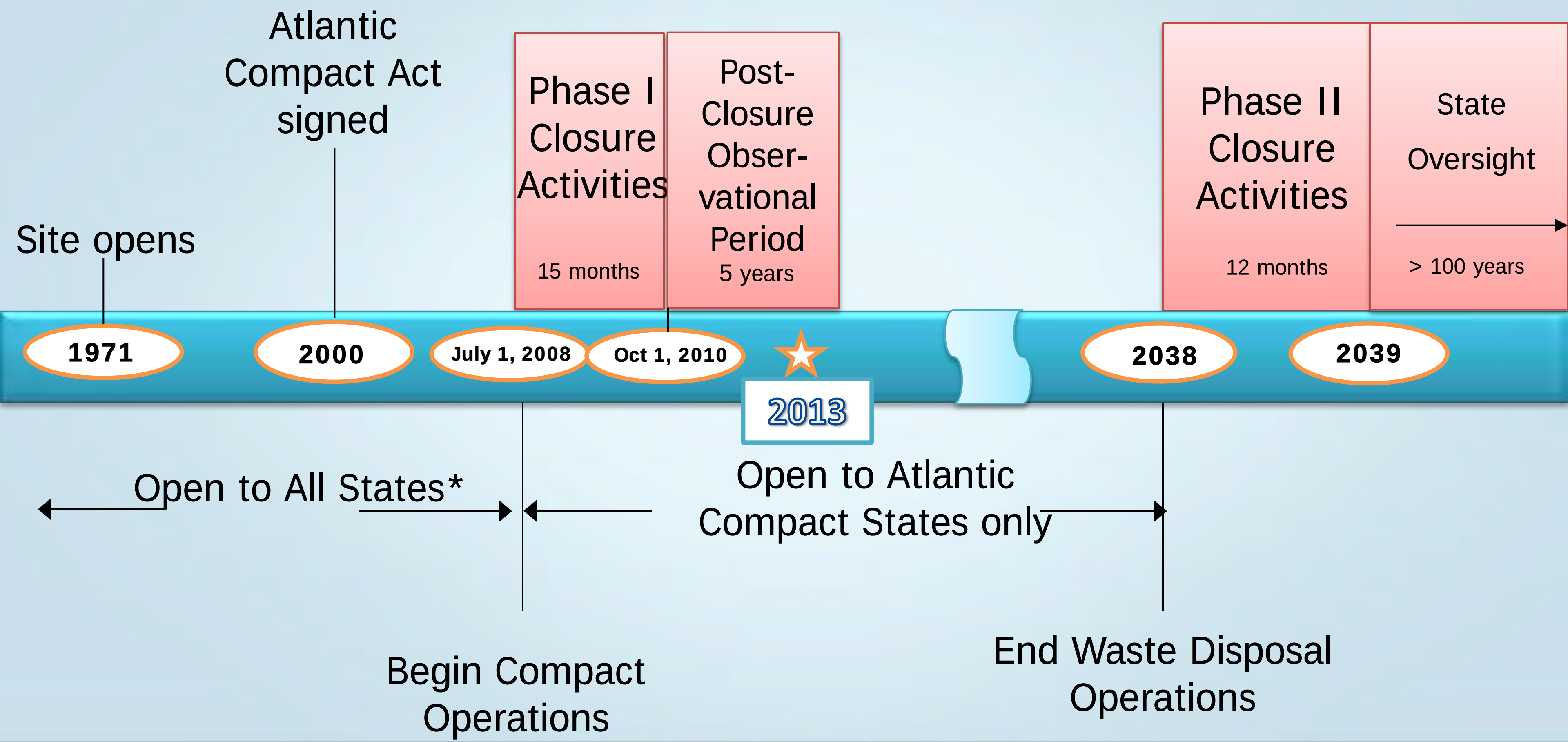
Started operating in 1971

120 acres capped

235 acres used for disposal and site buildings

South Carolina Department of Health and Environmental Control
Promoting and Protecting the Health of the Public and the Environment

Projected Timeline



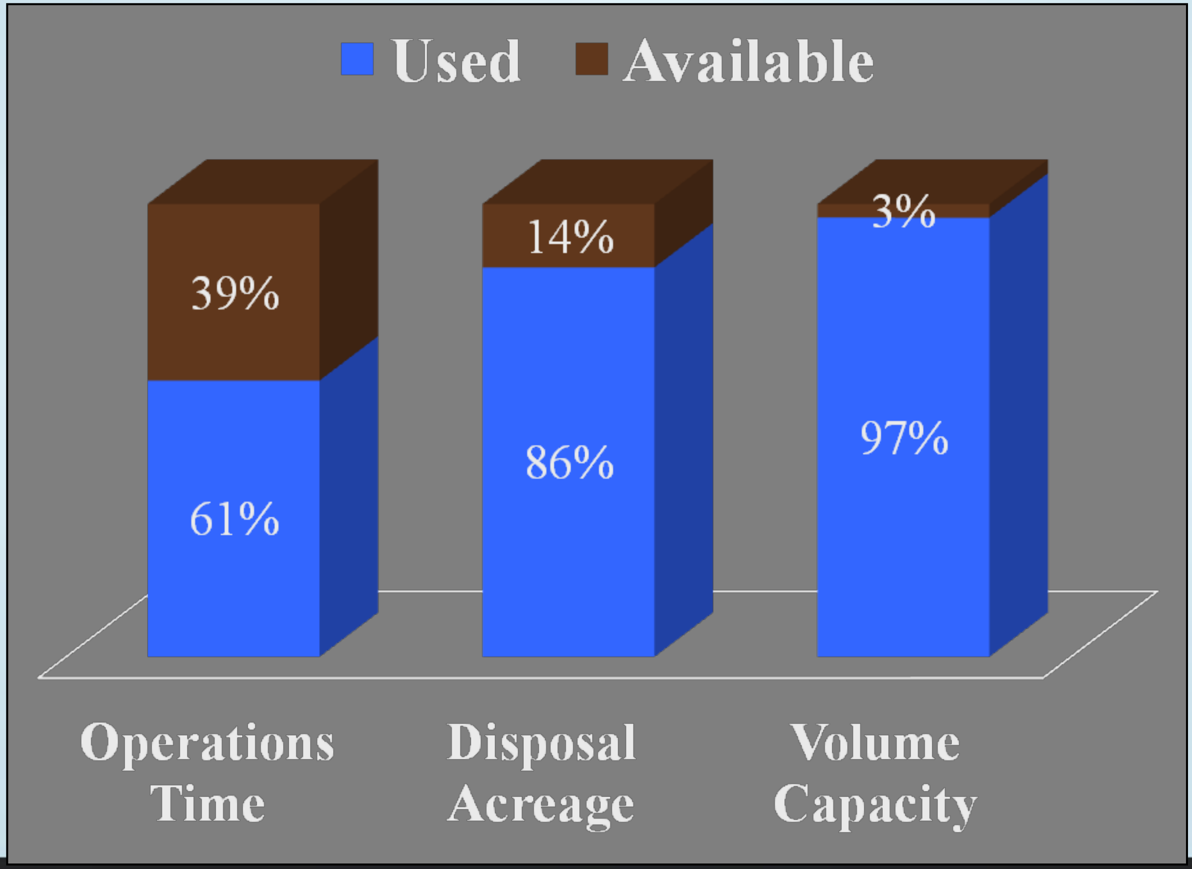
*NC was banned in 1995

Status of Barnwell Site

- Atlantic Compact Operations only
- Phase I closure activities are complete
- 86% of site is in 5-year postclosure observation period
- Extensive documentation showing 16 performance objectives listed in the license have been met



Status of Barnwell Site



Applicability Issues

61.1 Purpose and Scope

"Applicability of the requirements in this part to Commission licenses for waste disposal facilities in effect on the effective date of this rule will be determined on a case-by-case basis and implemented through terms and conditions of the license or by orders issued by the Commission."

Applicability Issues (cont.)

61.13 Technical Analyses (long-term analyses)

"Licensees with licenses for land disposal facilities in effect on the effective date of this subpart must submit these analyses at the next license renewal or within 5 years of the effective date of this Subpart, whichever comes first."

61.58 Waste Acceptance

"Licensees with licenses for land disposal facilities in effect on the effective date of this subpart shall comply with the requirements of paragraphs (b) and (c) of this section at the next license renewal or within 5 years of the effective date of this subpart, whichever comes first."

ACRS Comment

"Previously disposed waste should not be subject to additional compliance evaluations as proposed by staff"

- All disposals at the Barnwell site have been in accordance with the regulatory requirements in place at the time of those disposals
- Site stabilization including installation of caps is complete for 86% of disposal area
- Demonstrated and approved as part of Phase I Closure
- Estimating source term is complex due to recordkeeping
- There are no funds set aside to potentially remediate the site based on new requirements for past disposals

Waste Acceptance Criteria and Operations Evolved

- 1979 - Liquids banned (scintillation liquids and hazardous chemicals)
- 1979 - All waste containerized
- 1983 - Absorbents banned
    - allowed for incidental liquids only
- 1983 – Waste classification table included in license

Waste Acceptance Criteria and Operations Evolved

- 1985 – Cardboard boxes banned as packages
- 1990 - License condition to comply with all of Part 61
- 1991 – Enhanced caps on all trenches
- 1995 - All classes of waste in vaults to promote stability of entire site

61.7 Concepts

- 61.7.c.5
  - "The performance period analyses are used to evaluate the suitability of [long-lived] waste for disposal on a case-by-case basis."
- 61.7.e
  - "For long-lived waste and certain radionuclides prone to migration, a maximum disposal site inventory based on the characteristics of the disposal site may be established."

Period of Compliance

- 10,000 years
  - Concern about uncertainties associated with this timeframe
    - Human behavior and natural processes
    - Design features
- Timeframe on the order of 1,000 years - more reasonable

Inadvertent Intruder Analyses

- All classes of waste (A,B and C) disposed in vaults at Barnwell Site since 1995.
- Vaults improve ability of the site to meet the performance objectives
  - enhance site stability
  - act as intruder barriers

Summary

- Applying new requirements to existing licenses and existing waste should remain case-by-case
- Some concepts and associated requirements of Proposed Part 61 appear contradictory
- Compliance period on the order of 1000 years
- Majority of Barnwell Site is closed, future waste volumes will be low, not candidate for future DU

South Carolina Department of Health and Environmental Control
Promoting and Protecting the Health of the Public and the Environment

CONTACT US

www.scdhec.gov (803) 898-DHEC (3432)

Follow us on Twitter. @scdhec

Like us on Facebook. www.fb.com/scdhec

Check us out on YouTube. www.youtube.com/scdhec

Susan Jenkins, Manager
Infectious and Radioactive Waste Management Section
803-898-0377
jenkinse@dhec.sc.gov

Advisory Committee on Reactor Safeguards Radiation Protection and Nuclear Materials Subcommittee

Rockville, MD

December 3, 2013

Rusty Lundberg

Utah Division of Radiation Control

Considerations

- **1981 NRC DEIS (NUREG–0782):**
  - **Short-Lived Isotopes (e.g., $T_{1/2}$ < 50 yrs, e.g. Cs-137)**
    - **In abundant quantities**
  - **Long-Lived Isotopes (w/ decreased progeny risk)**
    - **$T_{1/2} \geq 50$ yrs. (e.g. C-14, Tc-99, etc)**
    - **In limited quantities**
  - **DU – *only in very small quantities***
    - **Weapons / power DU by-product = Federal ownership**
- **NOW: private sector disposal → DU in large quantity**
  - *Increased* progeny risk (significant)

Utah – Performance Assessment Rules

- **Current Utah Rule: UAC R313-25-8**
  - **Promulgated: June 2, 2010**
- **4 Regulatory "Triggers" for new PA Analysis**
  - **1) Waste not considered in 1981 NRC DEIS**
  - **2) Waste that will result in > 10% dose increase @ time of peak dose**
  - **3) Waste > 10% of approved total site inventory**
  - **4) Waste that would result in an unanalyzed condition, not considered in R313-25 (10 CFR 61).**

Utah – Performance Assessments

- 2-Tiered PA Analysis:
  - Tier 1 - “Quantitative” ≥ 10,000 years (required)
    - Computer model predictions
    - Analog to NRC “Compliance Period”
    - Compliance criteria applied - examples include:
      - Points of Compliance
      - Dose limit, all pathways: 25/75/25 mR/yr

Utah – Performance Assessments

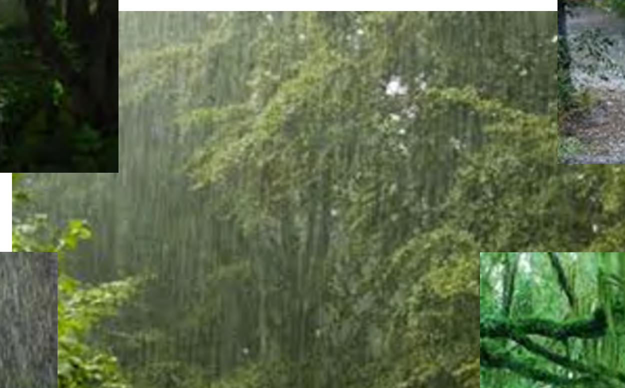
- Tier 2: "Qualitative" Analysis – to peak dose
  - Time period beyond "Quantitative"
  - Analog to NRC "Performance Period"
  - Computer model predictions – needed to:
    - Inform regulatory decision
    - Provide ability to evaluate long-term engineering designs / site characteristics

Intruder Performance Objectives

- Considerations for proposed changes to 10 CFR 61
  - Intruder analysis for all LLRW waste classes
  - How to address uncertainties for very long time periods for radionuclides with significant progeny in growth

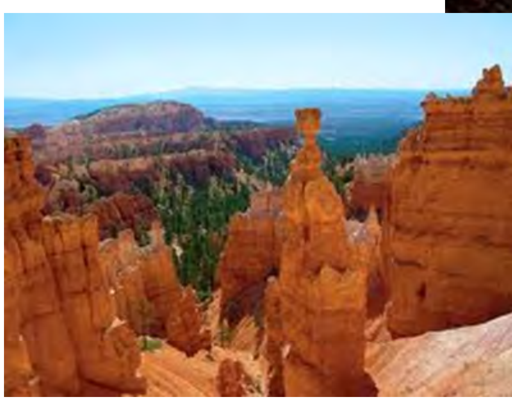
Other Utah Concerns

Humid vs.



Other Utah Concerns

Arid



Other Utah Concerns:
WAC & Waste Classification

"This proposed revision must not either explicitly or by interpretation be a means to by-pass the existing waste classification requirements of Subpart 61.55."

"It is vital to Utah's Class B and Class C prohibition that the existing classification system of low-level radioactive waste remain in place, with the ability of a state, such as Utah, to enforce state prohibitions on wastes with higher radioactive levels."

-- Gov. Gary R. Herbert

(77FR72997)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

STATE OF UTAH
OFFICE OF THE GOVERNOR
SALT LAKE CITY, UTAH
84114-2220

GARY R. HERBERT
GOVERNOR

GREG BELL
LIEUTENANT GOVERNOR

January 4, 2013

Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
ATTN: Rulemakings and Adjudications Staff

RE: Utah Comments on the Proposed Rule Changes to 10 CFR Part 61, Licensing Requirements for Land Disposal of Radioactive Waste
Docket ID: NRC-2011-0012

On behalf of the State of Utah, I appreciate this opportunity to comment on the above referenced rulemaking proposal. I commend the Nuclear Regulatory Commission (NRC) staff, who I understand have worked closely with the Agreement States, the Low-Level Waste Forum, and other interested stakeholders throughout this rule development process. I have been informed that this level of stakeholder engagement has enhanced the dialogue associated with the proposed rule changes.

As you know, Utah has demonstrated a vital leadership role with respect to the key issues related to the management and disposal of low-level radioactive waste. This letter serves as an affirmation of my ongoing commitment to protect the health and safety of the residents of Utah and to offer comments to the NRC regarding some basic, yet vitally important principles that the Commission needs to follow when considering revisions to 10 CFR Part 61.

For a number of years, Utah has, by state statute, explicitly prohibited the management and disposal of Class B and Class C radioactive wastes inside the state. This statutory prohibition is important to the people of Utah, as well as top government officials because it serves to limit Utah's role in the overall national framework for low-level radioactive waste. Given the importance of our state law, it is vital that the NRC maintain the waste classification system in order to preserve the integrity of Utah's regulatory framework. In any proposed revision, NRC should preserve the regulatory flexibility necessary for an Agreement State, particularly a sited state such as Utah, to institute and address state-specific conditions and requirements, so that Utah may continue to prevent the disposal of radioactive wastes with radioactivity levels greater than Class A limits within its borders.

Other Utah Concerns:
Waste Acceptance Criteria (WAC)

- **Site-specific WACs**
  - **Preserve LLRW Classification System**
  - **Adds confirmation burden to Host States**
  - **Coordination with Class A waste limits**

Other Utah Concerns: Compatibility

"NRC should preserve the regulatory flexibility necessary for an Agreement State, particularly a sited state such as Utah, to institute and address state-specific conditions and requirements, so that Utah may continue to prevent the disposal of radioactive wastes with radioactivity levels greater than Class A limits within its borders."

-- Gov. Gary R. Herbert

(77FR72997)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

STATE OF UTAH
OFFICE OF THE GOVERNOR
SALT LAKE CITY, UTAH
84114-2220

GARY R. HERBERT
GOVERNOR

GREG BELL
LIEUTENANT GOVERNOR

January 4, 2013

Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
ATTN: Rulemakings and Adjudications Staff

RE: Utah Comments on the Proposed Rule Changes to 10 CFR Part 61, Licensing Requirements for Land Disposal of Radioactive Waste
Docket ID: NRC-2011-0012

On behalf of the State of Utah, I appreciate this opportunity to comment on the above referenced rulemaking proposal. I commend the Nuclear Regulatory Commission (NRC) staff, who I understand have worked closely with the Agreement States, the Low-Level Waste Forum, and other interested stakeholders throughout this rule development process. I have been informed that this level of stakeholder engagement has enhanced the dialogue associated with the proposed rule changes.

As you know, Utah has demonstrated a vital leadership role with respect to the key issues related to the management and disposal of low-level radioactive waste. This letter serves as an affirmation of my ongoing commitment to protect the health and safety of the residents of Utah and to offer comments to the NRC regarding some basic, yet vitally important principles that the Commission needs to follow when considering revisions to 10 CFR Part 61.

For a number of years, Utah has, by state statute, explicitly prohibited the management and disposal of Class B and Class C radioactive wastes inside the state. This statutory prohibition is important to the people of Utah, as well as top government officials because it serves to limit Utah's role in the overall national framework for low-level radioactive waste. Given the importance of our state law, it is vital that the NRC maintain the waste classification system in order to preserve the integrity of Utah's regulatory framework. In any proposed revision, NRC should preserve the regulatory flexibility necessary for an Agreement State, particularly a sited state such as Utah, to institute and address state-specific conditions and requirements, so that Utah may continue to prevent the disposal of radioactive wastes with radioactivity levels greater than Class A limits within its borders.

Other Utah Concerns:
Compatibility

- Flexibility for Host States
  - State waste classification requirements
  - Performance assessments (DU)
    - In progress

(77FR72997)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

STATE OF UTAH
OFFICE OF THE GOVERNOR
SALT LAKE CITY, UTAH
84114-2220

GARY R. HERBERT
GOVERNOR

GREG BELL
LIEUTENANT GOVERNOR

January 4, 2013

Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
ATTN: Rulemakings and Adjudications Staff

RE: Utah Comments on the Proposed Rule Changes to 10 CFR Part 61, Licensing Requirements for Land Disposal of Radioactive Waste
Docket ID: NRC-2011-0012

On behalf of the State of Utah, I appreciate this opportunity to comment on the above referenced rulemaking proposal. I commend the Nuclear Regulatory Commission (NRC) staff, who I understand have worked closely with the Agreement States, the Low-Level Waste Forum, and other interested stakeholders throughout this rule development process. I have been informed that this level of stakeholder engagement has enhanced the dialogue associated with the proposed rule changes.

As you know, Utah has demonstrated a vital leadership role with respect to the key issues related to the management and disposal of low-level radioactive waste. This letter serves as an affirmation of my ongoing commitment to protect the health and safety of the residents of Utah and to offer comments to the NRC regarding some basic, yet vitally important principles that the Commission needs to follow when considering revisions to 10 CFR Part 61.

For a number of years, Utah has, by state statute, explicitly prohibited the management and disposal of Class B and Class C radioactive wastes inside the state. This statutory prohibition is important to the people of Utah, as well as top government officials because it serves to limit Utah's role in the overall national framework for low-level radioactive waste. Given the importance of our state law, it is vital that the NRC maintain the waste classification system in order to preserve the integrity of Utah's regulatory framework. In any proposed revision, NRC should preserve the regulatory flexibility necessary for an Agreement State, particularly a sited state such as Utah, to institute and address state-specific conditions and requirements, so that Utah may continue to prevent the disposal of radioactive wastes with radioactivity levels greater than Class A limits within its borders.

Contact Information

Rusty Lundberg
Director
Utah Division of Radiation Control
Utah Department of Environmental Quality

(801) 536-4257
rlundberg@utah.gov

PR 10 CFR Part 61
(77FR72997)

DOCKETED
USNRC

January 7, 2013 (5:57 PM)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

8

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

January 7, 2013

Secretary, U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Attn: Rulemakings and Adjudications Staff.

Re: Docket ID NRC-2011-0012

Dear Sir or Madam:

The Texas Commission on Environmental Quality (TCEQ) appreciates the opportunity to respond to the United States Nuclear Regulatory Commission's (NRC) proposed revisions to 10 CFR Part 61 published in the December 7, 2012, edition of the *Federal Register* entitled: "Site-Specific Analyses for Demonstrating Compliance With Subpart C Performance Objectives."

Enclosed please find the TCEQ's detailed comments relating to the NRC's proposed revisions referenced above. If you have any questions concerning the enclosed comments, please contact Mr. Brad Broussard, Radioactive Materials Division, Office of Waste, (512) 239-6380, or at brad.broussard@tceq.texas.gov.

Sincerely,

Zak Covar
Executive Director

Enclosure

Template = SECY-067

DS10

Texas Commission on Environmental Quality Comments on Revisions to 10 CFR Part 61: Licensing Requirements for Land Disposal of Radioactive Waste

Waste Acceptance Criteria

Proposed 61.7 Concepts

(d) Waste acceptance. Demonstrating compliance with the performance objectives also requires a determination of criteria for the acceptance of waste. The criteria can be determined from the results of the site-specific analyses that demonstrate compliance with the performance objectives for any land disposal facility or, for a near-surface disposal facility, the waste classification requirements of Subpart D of this part.

Comment: This proposed provision seems to allow waste acceptance criteria to be established from the results of a site-specific analysis for any "land disposal facility." In addition, it appears that in the context of this revision a "near-surface disposal facility" is different than a land disposal facility. This implies that waste acceptance criteria established from a site-specific analysis is the only approach that has to be taken for meeting the performance objectives. However, Section 5.2.7 of the Part 61 Regulatory Basis document states the NRC is proposing Option 3 - *Generic Waste Classification or Site-Specific Waste Acceptance* where a hybrid approach is taken that would allow licensees to use *either* the results of the site-specific technical analyses set forth in 10 CFR 61.13 *or* the waste classification requirements in 10 CFR 61.55.

The proposed language in 61.7(d) should be clarified in guidance or expanded in rule to indicate that this hybrid approach should incorporate both the waste classification tables and an approved site-specific analysis in determining waste acceptance criteria.

Period of Performance

Proposed 61.2 Definitions

Performance period is the time after the compliance period for disposal facilities during which the performance objectives specified in §§ 61.41(b) and 61.42(b) must be met.

Part 61 Regulatory Basis Document, Section 5.1.7, *Options Considered* states that:

"The analyses for the second tier would use: (a) a screening process to identify if long-term analyses are necessary, and if applicable, (b) long-term, site-specific analyses to peak dose (limited to 1 million years). The performance requirement for the long-term analyses would be to maintain effects to the public ALARA (as low as reasonably

achievable). The analyses that could be used for the second tier would be described in guidance, not in regulations. The regulations would only describe the analyses at a high level. Appropriate technical analyses for each would be described in guidance. The screening analysis would be based on a conservative approach (e.g., peak ingrowth of daughter isotopes, assume no retardation during transport, defined scenarios) to manage long-term uncertainties and ensure that public health and safety is protected. If the screening analysis results show the performance objectives will not be met, then inventory limits could be established based on the screening analysis or long-term, site-specific analyses could be performed to demonstrate that public health and safety will be protected. Using this framework, the analyses can be risk-informed. The standard for considering if the effects from the second tier are acceptable would be to maintain doses to the public ALARA."

Comment: The new proposed definition of performance period indicates that the performance objectives of §§61.41(b) and 61.42(b) must be met. The standard that has to be met for the second tier analysis is still too subjective. Guidance developed that provides instruction on conducting a second tier analysis should state how the ALARA analysis is demonstrated. This may provide better direction for regulators as to how to implement the proposed definition and the proposed §61.41(b) and §61.42(b) revisions.

Compatibility

Section 5.4 of the Part 61 Regulatory Basis document provides limited discussion on compatibility categories for new provisions relating to *performance period, compliance period, intruder assessment, long-lived waste, performance assessment,* and waste acceptance criteria. It only states that compatibility designations be assigned that ". . . ensure alignment between the States and Federal government on safety fundamentals, while providing the States with the flexibility to determine how to implement these safety requirements. . . ."

Comment: The current compatibility category for §61.41 is category A. If the NRC chooses to maintain this category with the new revisions to §61.41, specifically performance period analyses demonstrating ALARA, the NRC should provide direction in the Part 61 supporting guidance for conducting an ALARA analysis that meets the proposed requirements in §61.41(b).

The current compatibility category for the waste classification tables in §61.55 is category B. If site-specific analysis is used to determine waste acceptance criteria, the NRC should maintain the same compatibility category.

The current compatibility category for §61.2 relating to definitions is category B. However, §61.7 has no compatibility category but the proposed revisions address conducting a performance assessment, an intruder assessment, site-specific analyses for long-lived waste, and in developing waste acceptance criteria. Careful consideration should be given to the compatibility category for §61.7. Stakeholders should be provided

the opportunity to provide input on compatibility categories as they are determined by the NRC Standing Committee on Compatibility.

RulemakingComments Resource

From: Melanie Aldana [melanie.aldana@tceq.texas.gov]
Sent: Monday, January 07, 2013 5:57 PM
To: RulemakingComments Resource
Cc: Carrera, Andrew; Melanie Aldana
Subject: Docket ID NRC-2011-0012
Attachments: signed letter & comments.pdf

Hello -

Attached please find the Texas Commission on Environmental Quality's comments regarding the United States Nuclear Regulatory Commission's (NRC) proposed revisions to 10 CFR Part 61.

These comments were also submitted by mail and via the Federal eRulemaking Portal.

If you require assistance with this electronic transmission or if you have need additional information, please contact me by return e-mail or by phone at (512) 239-1622.

TCEQ appreciates the opportunity to comment on this issue.

Thank you.

Melanie Aldana
Texas Commission on Environmental Quality
Chief Engineer's Office- Executive Assistant
512-239-1622

PUBLIC HEALTH
ALWAYS WORKING FOR A SAFER AND HEALTHIER WASHINGTON

The state of Washington's View on the Regulatory Path Forward

December 3, 2013

Earl Fordham, Deputy Director, Office of Radiation Protection

Washington State Department of Health

Is the proposed two-tiered approach (compliance and performance periods) appropriate?

Yes

- Large uncertainties associated with these timeframes
- Wide variety of existing timeframes versus predicted earthly events. Beyond 1000 years, impacts are only estimates.

PUBLIC HEALTH
ALWAYS WORKING FOR A SAFER AND HEALTHIER WASHINGTON

Washington State Department of Health

Should a dose limit other than 0.25 mSv (25 mrem) be applied to a performance assessment?

No:

- Future dose is linked to site performance assessment assumptions (e.g., K_d's).
- Uncertainties become too large beyond a few thousand years.
- With large uncertainties, relevant scenario selection is critical. Is rural residential proper everywhere?

PUBLIC HEALTH
ALWAYS WORKING FOR A SAFER AND HEALTHIER WASHINGTON

Is the compliance period of 10,000 years appropriate for long-lived LLRW?

For the foreseeable events in Washington, we believe the 10,000 year compliance period is sufficient for analysis.

Washington's LLRW disposal site is located within a region of Hanford containing several disposal sites and most likely will never be released for public use.

Washington State Department of Health

Should there be a dose limit associated with the performance period analysis, and if so, what should that dose limit be?

No dose limit should be applied if for no other reason that this timeframe will coincide with another glaciation period which could last for thousands of years.

PUBLIC HEALTH
ALWAYS WORKING FOR A SAFER AND HEALTHIER WASHINGTON

Washington State Department of Health

Should there be a dose limit associated with the inadvertent intruder analysis, and if so, what should that dose limit be?

Yes, Washington support the NRC staff's choice of 500 mrem/year for the inadvertent intruder.

With the relative shortness of the intruder exposure, a higher dose rate is appropriate.

PUBLIC HEALTH
ALWAYS WORKING FOR A SAFER AND HEALTHIER WASHINGTON

Washington State Department of Health

Other Issues

- Cost-benefit analysis: brings into play the assumptions about future inhabitants, land use (remember the picture), and scenarios.

  Tread carefully!!
- We agree with the NRC on using the most up-to-date ICRP recommendations.
- We support allowing states to develop their own waste acceptance criteria. No two sites are the same.

PUBLIC HEALTH
ALWAYS WORKING FOR A SAFER AND HEALTHIER WASHINGTON


N
© 2012 Google
Google earth
Imagery Date: 8/7/2011
46°32'15.03" N 119°33'31.85" W elev 726 ft
Eye alt 3909 ft

Questions?

PUBLIC HEALTH
ALWAYS WORKING FOR A SAFER AND HEALTHIER WASHINGTON

Earl Fordham
509-946-0234
Earl.Fordham@doh.wa.gov
Website: http://www.doh.wa.gov

ANDREWS, TEXAS

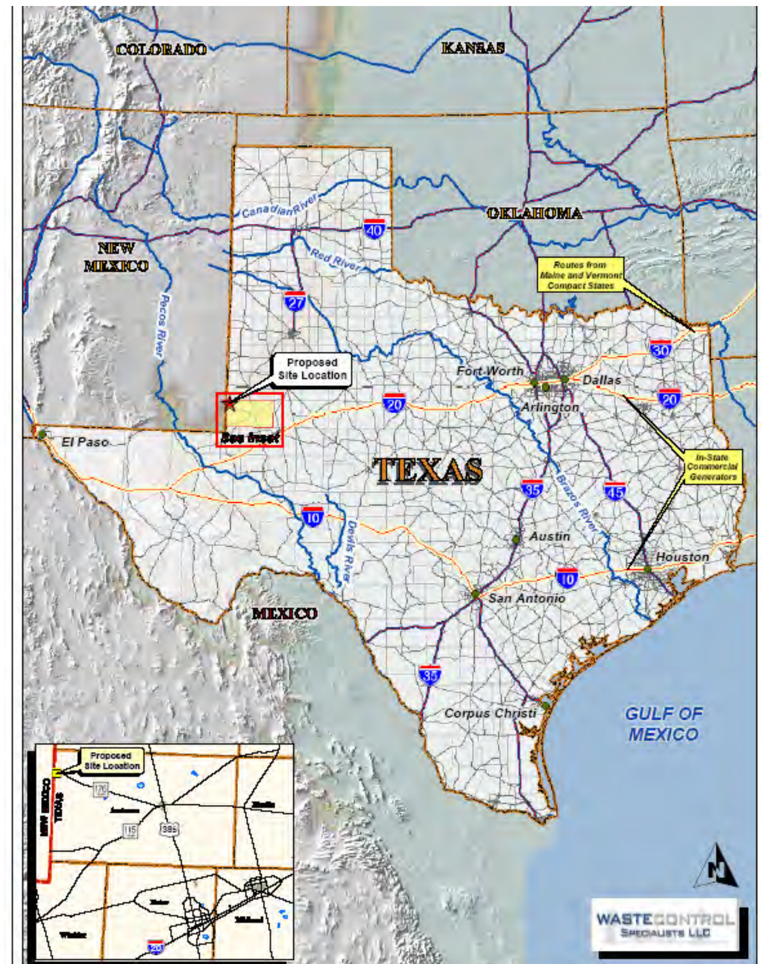
Advisory Committee on Reactor Safeguards
Technical Basis - 10 CFR Part 61 Low-Level Waste Site-Specific Analysis Rulemaking

December 3, 2013

J. Scott Kirk, CHP

First Operating Facility in Over 40 Years

- WCS is the first operating facility licensed to dispose of Class A, B and C LLW under the LLWPA of 1980 (as amended in 1985).
  - Disposal authorized in the Texas Compact Waste Disposal and Federal Waste Disposal Facilities
  - Importation of LLW by non-regional waste generators authorized by Texas Legislature (275,000 Ci)
- Located in Andrews County, Texas and borders Lea County, New Mexico.



LLW Transportation Routes

WCS
ANDREWS, TEXAS

WCS Current Facilities

LLW Facilities

Texas Compact Waste Disposal Facility (CWF)

- Texas Legislature required transfer of land to State of Texas prior to receipt of waste.
- Authorized to dispose of 2,310,000 ft^3 or 3,890,000 Ci (decay corrected).
- Texas takes title of waste prior to disposal.
- Portion of fees collected provided to Texas and Andrews County.

Federal Waste Disposal Facility (FWF)

- Texas Legislature created the framework allowing disposal of federal waste.
- Texas Legislature required a Memorandum of Agreement with the Department of Energy before receipt of waste.
- DOE agreed to assume ownership of the FWF into perpetuity upon closure.
- Authorized to dispose of 26,000,000 ft^3 or 5,600,000 Ci (decay corrected).

WCS' Perspectives Regarding Revisions to 10 CFR Part 61

- WCS supports a 10,000 year Period of Compliance.
  - Allows for an evaluation of the long-term environmental performance of a waste disposal facility.
    - Tests engineered barriers, determines significant exposure pathways, and indicates need for additional site characterization.
  - Well suited for regulating Unique Waste Streams such as DU.
  - Demonstrating compliance with a 10,000 Period of Compliance is not insurmountable for a well-sited disposal facility.
  - Texas regulations requires a Period of Compliance of 1,000 years of peak dose whichever is longer.
    - Effectively required evaluation of over 50,000 years .

WCS’ Perspectives Regarding Revisions to 10 CFR Part 61 (Cont.)

- NRC’ rulemaking should reflect waste management advancements made over the past several decades as exemplified by the successful licensing of the WCS facilities in Texas.
- Intruder protection as been a long-standing, fundamental design requirement and performance objective for disposal facilities. However, the NRC should consider reasonable/likely intruder scenarios in the decision making process.
- 10,000 year Period of Compliance provides regulatory and public confidence in the long-term performance of the site.
- WCS’ success rooted in strong support from the State, region and local communities from the outset.
- Community agreed to host a disposal facility only if backed by good science and technology, as well as regulated by proper regulatory oversight.

Texas' Vision of a Modern LLW Disposal Facility

- Created framework for licensing a 21st Century waste disposal facilities recognizing that:
  - More stringent standards may be needed to protect public health and the environment.
    - Use of Modular Concrete Canisters (MCCs) to remove radioactive materials from the biosphere.
  - Concept based on assured isolation and monitored, retrievable storage.
  - Located in an arid and remote region of western Texas with less than an average annual rainfall of less than 16 inches.
  - Located in an area far removed from any water table.

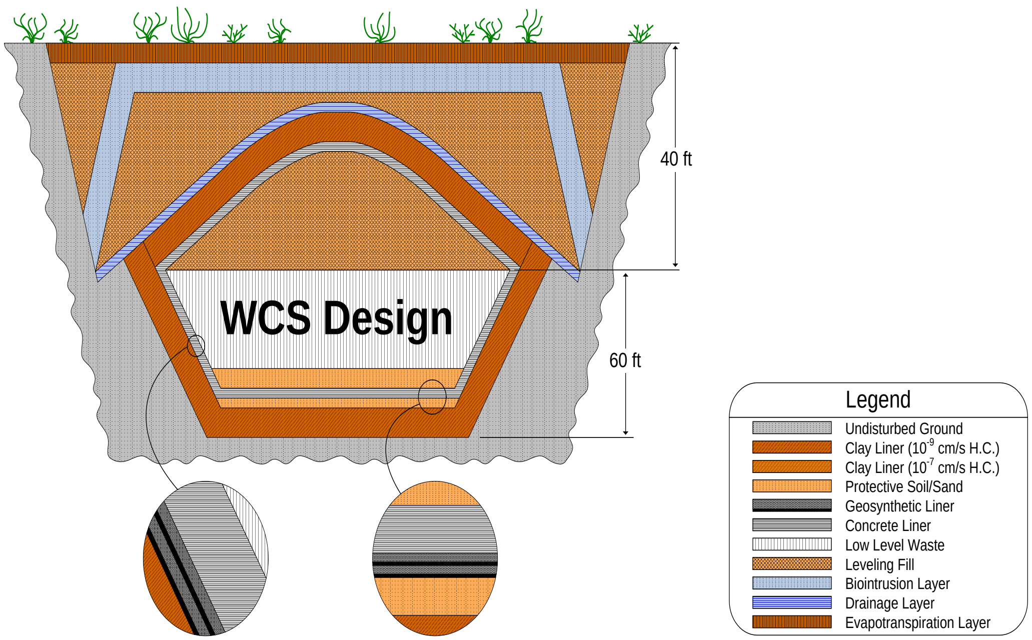
Texas' Vision of a Modern LLW Disposal Facility (Cont.)

- A Period of Compliance of 1,000 years or peak dose, which ever is longer is stipulated in Texas regulations .
  - Includes a <u>quantitative</u> public health standard to a reasonably maximum exposed individual of 25 mrem/y.
- Rulemaking considered a 10,000 Period of Compliance consistent with NRC guidance, but chose a more restrictive standard to:
  - Capture the peak dose from the more mobile long-lived radionuclides, and
  - Demonstrate the relationship of site suitability to the performance objectives specified in the rule.

WCS Site Design

ANDREWS, TEXAS

WCS Landfill Liner Design



- Multi-layered cover system that is 25 – 45 feet thick
- Depth to waste is at least 25 feet below surface
- Natural red bed clay is less permeable to water than concrete
- Hydraulic conductivity of clays are ~1E-9 cm/sec
- Red bed clays more than ~600 ft thick below landfill.
- Confined water 125 ft below landfill age dated at ~16,000 years.
- Extensive hydrogeological investigation – over 600 boreholes.

Compact Waste Facility (New Industry Standard)

Federal Waste Facility (New Industry Standard)

WCS

ANDREWS, TEXAS

Clive Facility
(Previous Industry Standard for Class A)

WCS
ANDREWS, TEXAS

Barnwell Facility
(Previous Industry Standard for Class B/C)

WCS' Updated Performance Assessment

- WCS submitted a major license amendment to accept all Class C LLW and 400,000 m^3 of Depleted Uranium (DU) in August 2013.
- The maximum doses to an intruder or "reasonably maximum exposed individual" well below the regulatory limits.
- Model estimated peak doses for DU at ~1 million years in to the future.
- Analysis included the effects of future climate changes (i.e., wetter climates) by doubling average rainfall.

WCS' Updated Performance Assessment (Cont.)

- Use of large volumes of concrete very effective at impeding the mobility of certain radionuclides (i.e., ^{14}C, ^{99}Tc and ^{129}I) for long period into the future.
- Disposal at depth with a robust cover system is a fundamental necessity for ensuring the safe disposal of DU.
- Disposal at depth, coupled with intrusion barriers, are reasonable design features needed to demonstrate compliance with performance objectives.
- Analysis clearly demonstrated the suitability of the site to isolate radioactive materials from the biosphere well past at 10,000 year Period of Compliance, especially for Unique Waste Streams.
- Technical review of the major amendment is nearing completion.

Conclusions

- Much has changed in the manner in which radioactive materials have been managed since 10 CFR 61 was promulgated over 40 years ago.
- Only one site has successfully been licensed and currently in operations since Congress passed the LLWPA in 1980.
- Texas has assumed a leadership role in establishing requirements needed site and develop a 21st century, state-of-the art disposal facility.
- NRC guidance developed with the support of Agreement States hosting a disposal facility have recognized the need for a Period of Compliance of 10,000 years.

WCS
ANDREWS, TEXAS

Conclusions (Cont.)

- A 1,000 year period of compliance is not sufficient to evaluate the long-term environmental performance of a disposal facility, especially for long-lived radionuclides.
- Building community support is essential to the development of new sites.
- Communities willing to host a disposal facility should expect use of modern, state-of-the art science and technologies in the siting and design of a facility to ensure long-term protection of public health and the environment.
- The length of time selected for Period of Compliance is more of a policy decision rather than a technical decision.
- Demonstrating compliance for a well-sited and designed facility for 10,000 years is not insurmountable as evidenced by the successful licensing of WCS.

ACRS – 10 CFR Part 61 Technical Basis
Site Specific Analysis Rulemaking

Daniel B. Shrum

December 3, 2013

10 CFR Part 61

ENERGYSOLUTIONS

Objective as stated from NRC RIN 3150-A192 July 2013 Proposed Rule for Part 20 and 61, Page 13

"The NRC is proposing to modify the current regulations to ensure that LLRW streams that are significantly different than those considered in the development of the existing 10 CFR Part 61 are adequately considered during the licensing of LLRW disposal facilities and to ensure that the 10 CFR Part 61 performance objectives will be met for disposal of those LLRW streams"

10 CFR Part 61

ENERGYSOLUTIONS

Proposed Rule will require Part 61 facilities to:

Prepare New and Revised Site-Specific technical analyses

"Proposed rule would affect existing and future LLRW disposal facilities that are regulated by NRC or an Agreement State"

Set exposure limits for intruders

Current rule has no long term exposure standards for inadvertent intruder

Develop criteria for the acceptability of LLRW for disposal

Allows facilities to "account for facility design, disposal practices, and site characteristics to determine criteria for the acceptability of LLRW for disposal"

Part 20

NRC will Amend Part 20 to "conform to the proposed requirements of LLRW acceptance"

10 CFR Part 61

ENERGYSOLUTIONS

January 2012 COMWDM-11-0002/COMGEA-11-0002

ICRP Standards

- Allow flexibility to use current ICRP dose methodologies in SSPA

Two-tiered approach

- Compliance Period that covers the reasonably foreseeable future
- Period of Performance that is not a priori

Waste Acceptance Criteria (WAC)

- Flexibility for disposal sites to establish site-specific waste acceptance criteria based on PA results

Compatibility

- Establish requirements for SSPA
- Develop site-specific waste acceptance criteria
- Ensure alignment between States and Federal government

Site Specific Technical Analyses

Fundamental Requirement of new rule

Four Current Commercial Part 61 disposal facilities:

US Ecology – Hanford Complex, Washington

WCS – Andrews County, Texas

Barnwell Facility – Barnwell, South Carolina

Clive Facility – Clive Utah

All four facilities have current PAs – with different exposure limits

Two-tier approach

“A two tiered approach that establishes a compliance period that covers the reasonably foreseeable future and a longer period of performance that is not a priori and is established to evaluate the performance of the site over longer timeframes. The period of performance is developed based on the candidate site characteristics (waste package, waste form, disposal technology, cover technology and geo-hydrology) and the peak dose to a designated receptor.”

Reasonably Foreseeable

ENERGYSOLUTIONS

- Reasonably Foreseeable ≠ You can run the model
- More to a model than plugging in numbers – analyses and evaluations have been conducted on components for LLRW facilities, but for more reasonable time frames. For example:

  Durability of cover components

  Durability of waste forms

  HIC durability

  Drainage durability/fouling

  Rebar strength and durability
- Many components of engineered systems have not been evaluated for timeframes much longer than 300 years therefore 10,000 year timeframes are less meaningful

Reasonably Foreseeable

- Reasonably Foreseeable = 1,000 years
- Captures most of LLW disposed of in US
- Doesn’t capture DU, but neither does 10,000 or 20,000
- 10,000 year same value used for high level waste
- Consistent with other regulated LLW facilities
- Component performance can be reasonably extrapolated
- Still a really long time
- Manages uncertainty without undue speculation
- A number that would provide confidence to the general public and practicality for regulated community
- Won’t cause unintended consequences for existing facilities

Performance Period

EnergySolutions

- Will capture longer lived isotopes to evaluate catastrophic effects
- Allows for flexibility as the error terms grow larger
- Should allow for a higher threshold – 1 to 10 rem as contemplated by the IAEA
- Moves focus to site location as opposed to engineering features
- Captures DU – which was the original purpose of the rule

Inadvertent Intruder

ENERGYSOLUTIONS

- Proposed: 10 CFR 61.42 would require an intruder assessment
- Proposed: 500 mrem/year standard
- “Given the uncertainty in predicting human behavior into the distant future and to limit associated speculation, the NRC is proposing to change the definition of the inadvertent intruder to limit scenarios to reasonably forseeable activities.” (NRC RIN 3150-A192 July 2013 Proposed Rule for Part 20 and 61, page 26)

Inadvertent Intruder

Clive specific example

- Site inhospitable to human habitation
- Inherently protective against intruder scenarios
- Utah DRC conclusion
  - "…unrealistic to assume residential or agricultural intruders.[1]"
- From the Nuclear Regulatory Commission's Order
  - "…significant intruder exposures at a site like [Envirocare] are unrealistic.[1]"
  - "…could be licensed under 10 CFR 61 regardless of the time frame you looked at.[1]"

[1]Memorandum and Order in the Matter of Louisiana Energy Services, L.P., CLI-06-15, June 2, 2006

Inadvertent Intruder

ENERGYSOLUTIONS

Clive specific example

Also From the Nuclear Regulatory Commission’s Order

> “If, as here, extensive speculation is required to find significant long-term adverse impacts at [Envirocare], by the same token one could assume – perhaps even more readily – that technological improvements over upcoming centuries (or millennia) will provide more erosion-resistant disposal unit covers, or will otherwise alleviate concerns about the impact of depleted uranium disposal.”

Inadvertent Intruder

EnergySolutions

From DRC June 7, 2013 responses to Energy*Solutions* PA for SEMPRASAFE waste:

- Resident lives, farms, and mines on the Clive facility (page 134)
- Pumps water from high TDS (65,000 mg/l)/low yield (gallons per day) aquifer (Page 132)
- Treats water for consumption and irrigation (page 136)
- Ability to grow crops in high saline soils (page 137)
- Receive dose from filter cake (page 136)

Inadvertent Intruder

ENERGYSOLUTIONS

- Require a different analysis for blended vs bulk waste (page 127)
- Lack of historical habitation doesn't preclude future residence patterns (Page 143)
- Grows algae for food source in high saline waters (page 137)

"Currently, it is anticipated that commercial biofuel production from algae is several decades away; however, the expectation is that algae will provide much in the way of biofood and fuel in the future"

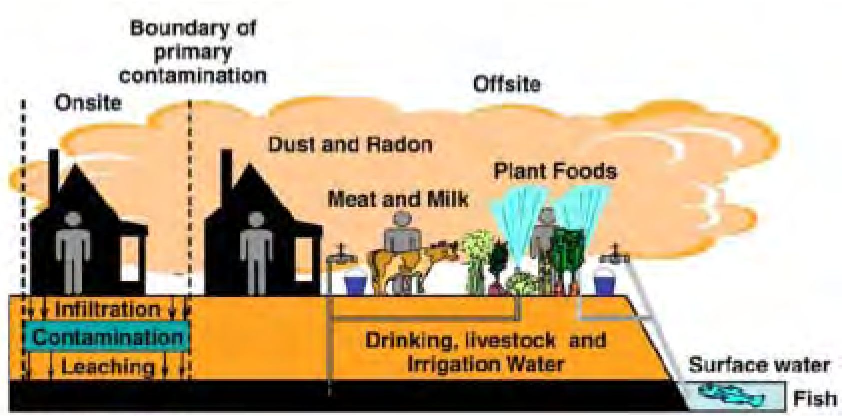
Waste Acceptance Criteria

ENERGYSOLUTIONS

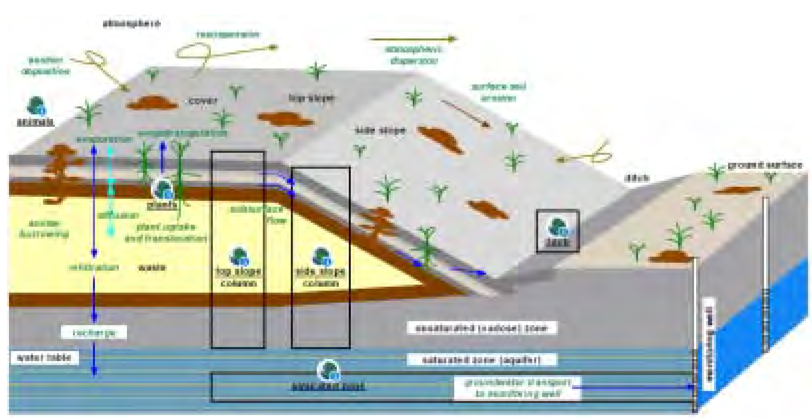
- All four commercial disposal facilities currently use WAC to enforce critical and limiting assumptions of an approved site-specific performance assessment
- Effectively applied throughout DOE complex
- PA-derived WAC would end need for further rulemaking
    - Establishes risk-informed performance-based standard
    - Consistent with NRC Principles of Good Regulation
    - Continued rulemaking will result in status quo until end of second rulemaking

Depleted Uranium Status

- Moratorium effective June 1, 2010
- May not receive or dispose of significant quantities of concentrated DU until PA approved
- PA submitted June 1, 2011
- Utah DRC began the review September 2013
- Further Part 61 rulemaking is a significant policy issue to be resolved



From NUREG/CR-6937, Fig. 1.1



Compatibility

ENERGYSOLUTIONS

- Definitions are ambiguous and overlap
- Confusion of various categories
- H&S basis of Performance Objectives
- Consistent implementation of Part 61 across the Agreement States is critical
- Transboundary implications for waste generators as well as disposal facilities
- Consistent standards nationwide

EnergySolutions

ENERGYSOLUTIONS

December 3, 2013

Barnwell Disposal Facility Comments on the Proposed Rulemaking to revise 10 CFR Part 61

We agree with the Conclusions and Recommendations of the ACRS to the NRC Chair, Allison Macfarlane dated July 22, 2013, "REVISIONS TO LOW-LEVEL RADIOACTIVE WASTE DISPOSAL REQUIREMENTS (10 CFR PART 61)".

The Barnwell Disposal Facility (BDF) has disposed of low-level radioactive waste for longer than 40 years in compliance with the regulations. The radiological performance of the BDF is addressed by the acceptance of waste according to the Waste Acceptance Criteria of the BDF, regulations, and by direct measurements and modeling.

As an operating facility, we believe the additional proposed requirements are a risk because we would have to demonstrate compliance for an operating facility for 10,000 years as well as the protection of an inadvertent intruder for that period. We do not believe there is justification for the selection of this time period. We believe forecasting human activities and natural processes over 10,000 years have not progressed to be a reliable science.

The proposal to change the regulations to also be applicable to previously disposed waste will cause unnecessary burden on the BDF. The proposed changes will not affect the performance of the BDF for waste already disposed.

Respectfully submitted,

Michael J. Benjamin
General Manager, Disposal Operations

740 Osborn Road • Barnwell, South Carolina 29812
803.259.1781 • Fax 803.259.1477

ELECTRIC POWER RESEARCH INSTITUTE

LLRW Time of Compliance in 10 CFR Part 61

Lisa Edwards
Sr. Program Manager

USNRC ACRS

Radiation Protection and Nuclear Materials Sub-Committee
December 3, 2013

Together…Shaping the Future of Electricity

EPRI's Mission

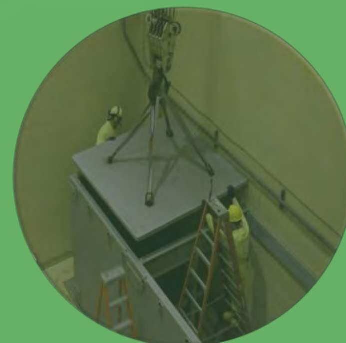
To conduct research, development and demonstration on key issues facing the electricity sector on behalf of our members, energy stakeholders, and society

ELECTRIC POWER RESEARCH INSTITUTE

EPRI LLRW Focus Areas

Waste Minimization

- Reducing Generation Reduces Need for Disposal or Storage



Safe Storage

- If Storage is the Only Option – Store Waste Safely
- No Events

Disposal Flexibility

- Technical Bases to Risk Inform the Regulatory Process

EPRI LLRW Research Portfolio

Part 61 Discussion Topics

- LLRW near surface versus geologic disposal
- What is the reasonably foreseeable future in terms of a shallow land disposal site?
- Calculations for compliance with a limit should have reasonable accuracy in the results
- A need for depleted uranium (DU) disposal
- Potential impacts on existing disposal options
- What is the risk from LLRW absent DU

ELECTRIC POWER RESEARCH INSTITUTE

Quantitative Time of Compliance for LLRW

International Guidance

- ICRP 81 (1998): "…*doses and risks, as measures of health detriment, cannot be forecast with any certainty for periods beyond around several hundreds of years into the future*."
- IAEA SSG-23 (2012): "…*engineered near surface disposal facilities, which are subject to processes that may affect their integrity (e.g. erosion, human intrusion) … modeling periods of a few thousand years may still be reasonable.*

  For deeper facilities, such as geological disposal facilities for high level waste, modeling for periods of tens of thousands of years and beyond may still result in meaningful estimates of upper bounds of possible radiation doses."

Balancing Risks Fairly Across Generations
National Academy of Public Administration (NAPA)

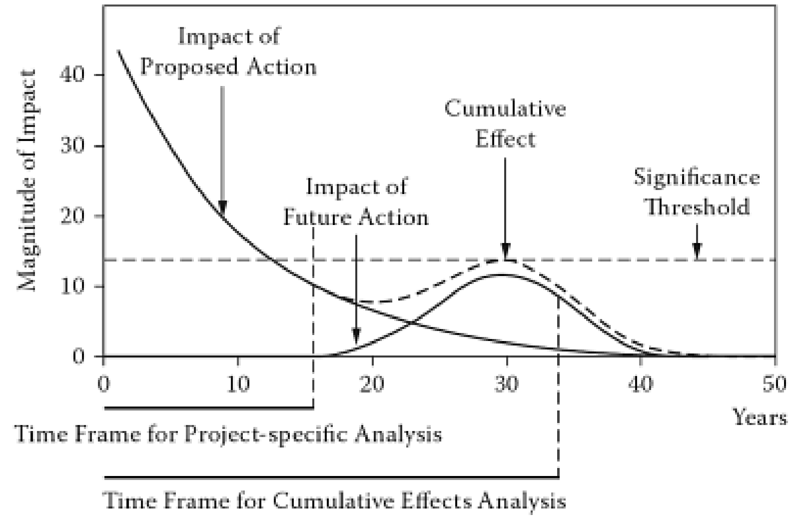
- In a 1997 report titled "*Deciding for the Future: Balancing Risks, Costs, and Benefits Fairly Across Generations*"[6] , for DOE, the NAPA acknowledged:
  - The "near future" to be 2 to 4 generations, and
  - The "distant future" to be 500 to 1,000 years.
- The present generation carries forward an "trustee responsibility" for maintaining an awareness of longer term hazards to future generations.
- Proposed a philosophical concept of a "chain of obligation" between generations, and recognizes that there may be circumstances where near-term hazards have priority over long-term hazards that are less certain.

ELECTRIC POWER RESEARCH INSTITUTE

Time Frames for Environmental Assessments

Council on Environmental Quality Guidance

- The Council on Environmental Quality in their 1997 Handbook “Considering Cumulative Effects Under the National Environmental Quality Act”[8] provides a chart for evaluating time scales used in environmental assessments (EA).



- To determine the time frame used in an EA, a “proximate cause test” is often used to “...determine if a reasonably close relationship exists, as opposed to some remote or speculative causation. …the test determines [if an] action would reasonably and foreseeably cause a measureable or important impact on a resource of concern and limits an agency’s analysis to those resources thus affected.”[9]
- In this chart from CEQ, the significance threshold represents some level of acceptable risk. Likening this peak to a point where postulated LLRW intruder dose is known to be highest, near year 100, in effect the LLRW significance threshold, then the diminishing hazard from Cs-137 and Ni-63 decay should dictate the duration of the LLRW x-axis.

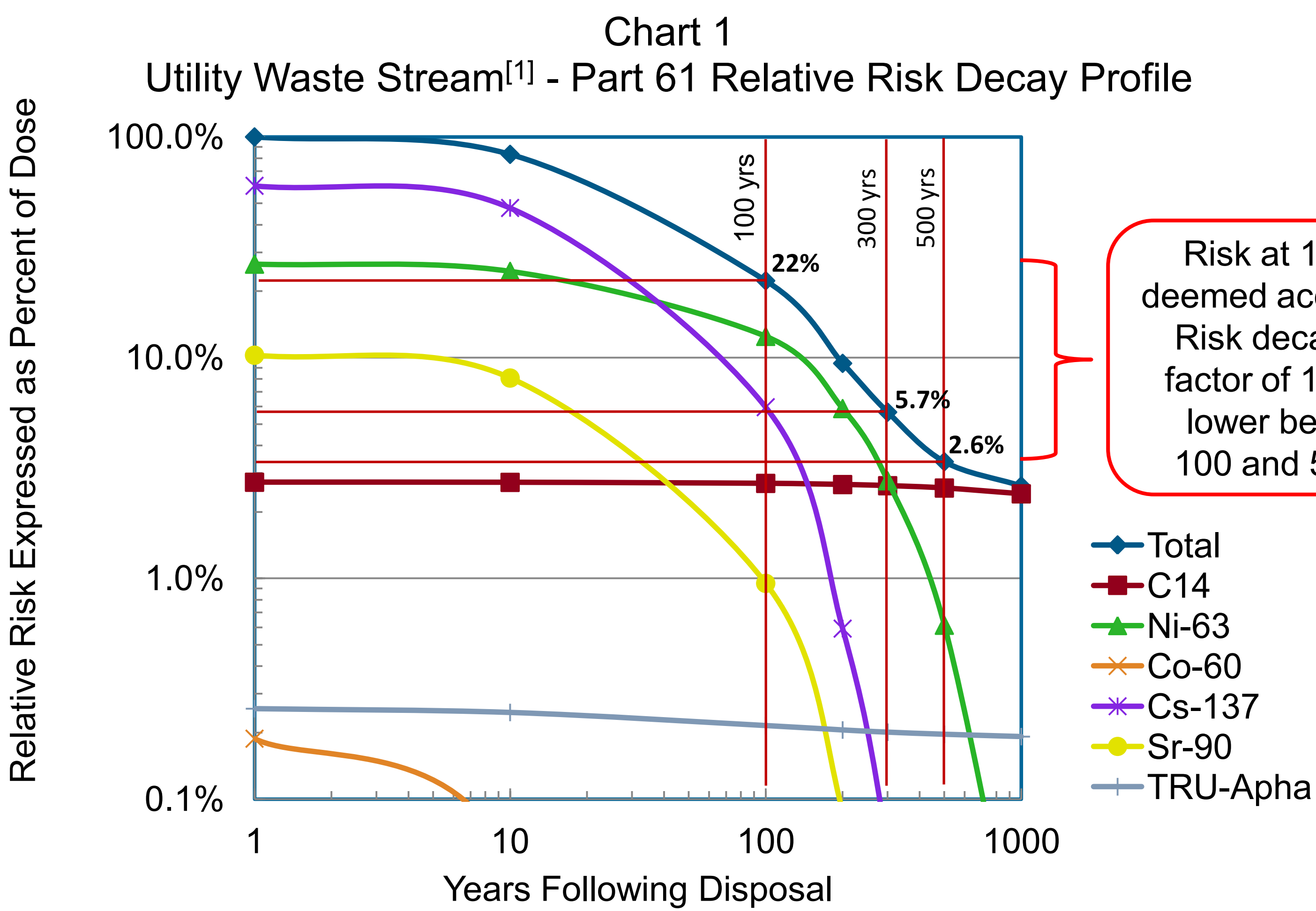
EPRI ELECTRIC POWER RESEARCH INSTITUTE

What is the Reasonably Foreseeable Future?
Varying Concepts and Guidance

- ICRP 81, Several hundred years with any level of certainty[4]
- IAEA SSG-23:
  - Surface disposal (mining wastes), several hundred years with any certainty
  - Engineered near surface disposal, a few thousand years may still be reasonable
  - Deeper geologic disposal facilities for HLW, tens of thousands of years and beyond may still result in meaningful estimates[5]
- NAPA 500-1,000
- RCRA: Hazardous waste disposal sites, 30 years
- Council on Environmental Quality: When considering cumulative effects of large field oil and gas development 35 – 55++ years[10]
- NRC High Level Waste 10,000 or 1,000,000 years quantitative time of compliance

Risk Vs. Decay - Actual LLRW Radionuclide Mix

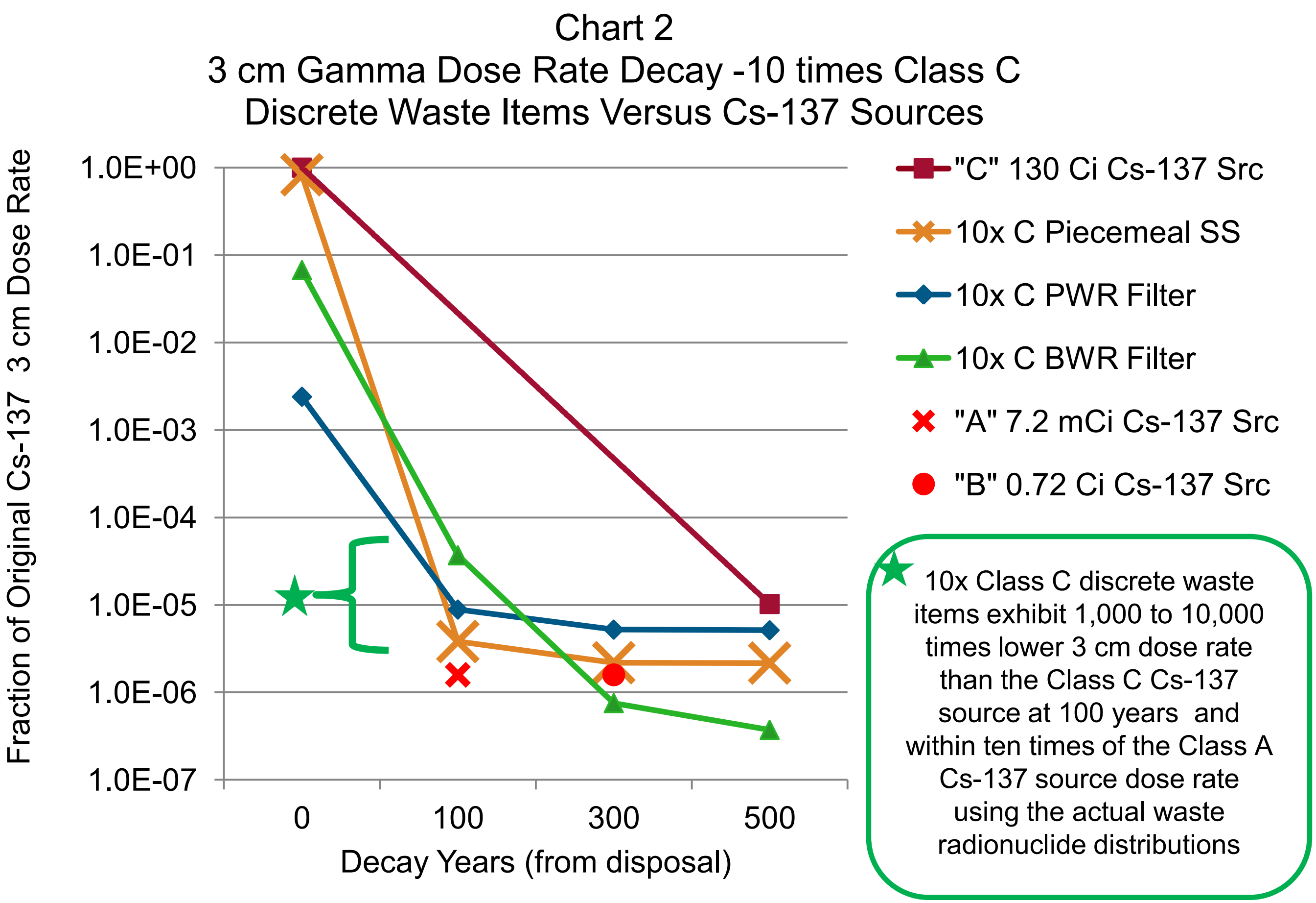
Using Current Part 61 Class A Concentration Limits



ELECTRIC POWER RESEARCH INSTITUTE

Risk Vs. Decay - Actual LLRW Radionuclide Mix

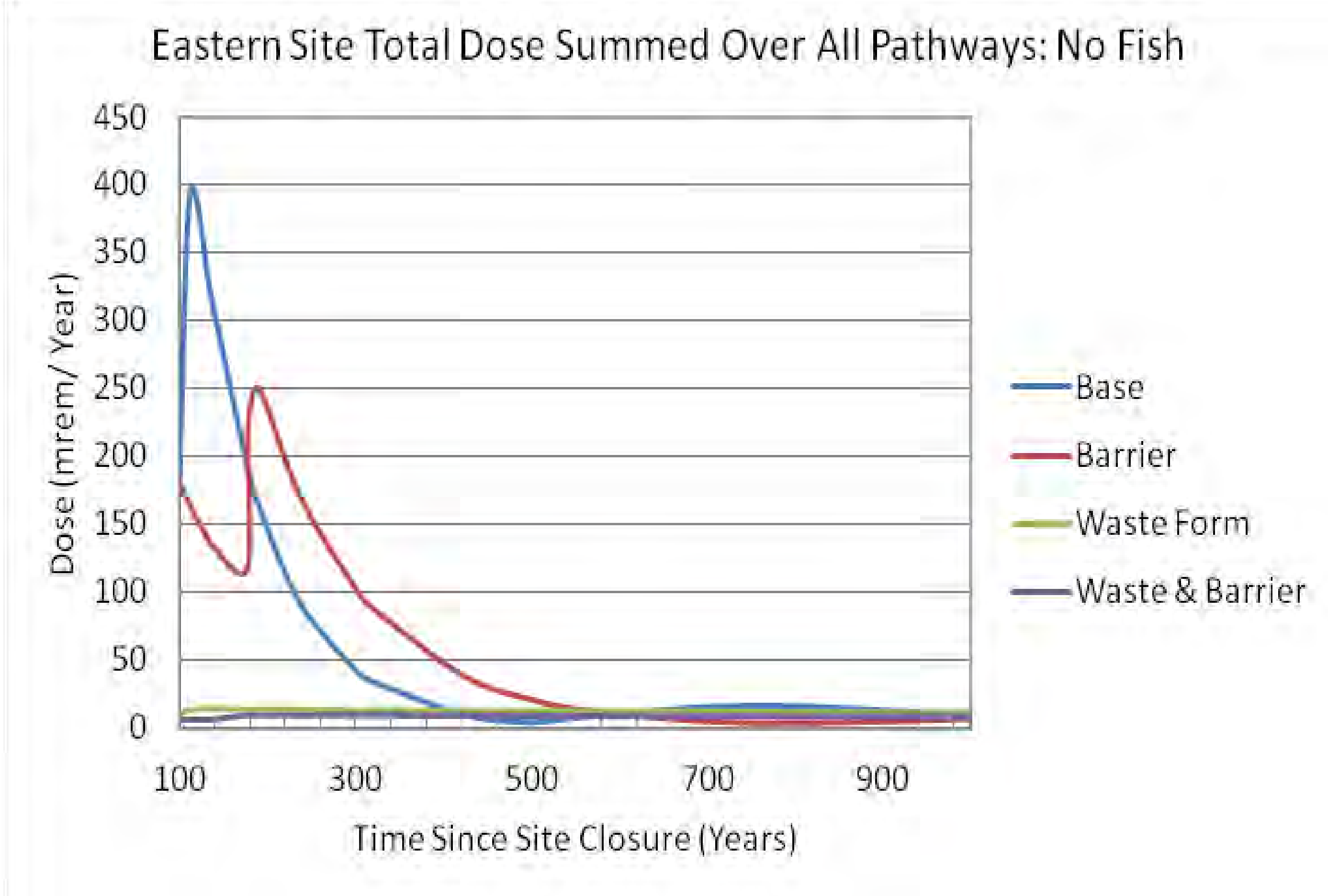
Intruder Acute Direct Dose Hazards[11, 12]



Actual LLRW Radionuclide Mix in One Site[3]

Utility and Non-Utility Waste 2009-2057 (9 mil m^3)

Chart 3



Shallow Land Disposal of LLRW
Acknowledging Uncertainties in PA

- NEA-OECD 4435 (2004): *"In order to maintain credibility within the scientific community…[and]… other stakeholders, it is important to acknowledge the limits of predictability of the repository and its environment in both regulations and in safety cases. …At times when the stability…can no longer be assured, a more qualitative assessment of radiological consequences is likely to be adequate,.."*[5]
- IAEA SSG-23 (2012): "*…if misused, results from overly conservative…representations of the disposal system may lead to poor decision making that is based on…results that bear little resemblance to the actual performance of the facility. …the use of an overly conservative approach can raise concerns…about manipulation of results, if later assessments adopt a more realistic…approach to demonstrate compliance with regulatory requirements*."[7]

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Quantitative Time of Compliance for LLRW

Summary and Conclusions

- Surface disposal of LLRW is safe within the current Part 61 framework and a TOC of 500-1,000 years is adequate
- It is not reasonable to believe that a shallow land disposal site can be accurately modeled over geologic durations
- The unique hazard from land disposal of DU should not dictate a generic TOC for LLRW sites not accepting DU
- There are other areas where Part 61 could be improved such as international alignment with the:
  - Duration of institutional controls
  - Application of updated dosimetry to the tables
  - Acknowledging very low level waste

  but that is not a topic for this limited rulemaking.

ELECTRIC POWER RESEARCH INSTITUTE

Together…Shaping the Future of Electricity

Assumptions, Bases, and References

ELECTRIC POWER RESEARCH INSTITUTE

Risk Vs. Decay
Assumptions and methods in Chart 1

- The existing Part 61 concentration limits were based on the best waste stream information available at the time and an assumed volume (50,000 m^3/yr for 20 years into each of four regional disposal sites) thus representing a total disposal site activity[1, 2]. Today we know the representative waste stream and the combined utility and non-utility waste generation rates far better . The waste stream is comprised of different radionuclide fractions than those used to develop Part 61 and the generation rate is about 50% of what was used[1, 2, 3].
- The radionuclide inventory used in this assessment is derived from four years of utility waste manifests between 2003 and 2006 (~7,000 records) less activated hardware[1]. This entire inventory when averaged over its volume is class A waste[1].
- The Part 61 concentration limits are taken to represent a level of risk (or dose) relative to each other. In this example the Table 1 and Table 2 values are simplified and evaluated together when the hazard would really occur at different times but this doesn’t impact the overall conclusion.
- The total utility waste inventory expressed as concentrations for the dominant class driving radionuclides is divided by the existing class A concentration limit for each and the results are normalized with the total set to 100% of the risk (or dose). The individual radionuclides each depict their individual contribution to the risk with the time set to zero.
- The relative risk is decayed by individual radionuclides for multiple time increments between 0 and 1,000 years and plotted in Chart 1.
- Observation; Intrusion scenarios drive the concentration limits and at 100 years, the concentration limits in the Part 61 volume basis are taken to represent an acceptable risk. Then the delta of risk between 100 years and 500 years is 10 times lower and there is little change after that out to 1,000 years. If at 500 to 1,000 years the dose rate is 1/10th of what was deemed acceptable at 100 years, why look further?

Risk Vs. Decay

Assumptions and methods in Chart 2

- The radionuclide mix used to develop the three individual (or discrete) waste items depicted in Chart 2 are derived from the same database as Chart 1 except that the individual waste streams for BWR filters, PWR filters and activated hardware are used. The BWR and PWR filter geometries are based on a standard industry configuration (6” D x 30” H) and the piece of activated metal is a cube sized to the 0.01 ft^3 individual item criteria from the draft concentration averaging BTP[11]. The total activity in the three waste items are proportionally scaled up until they reached 10 times class C which is the bounding averaging criteria from the draft BTP[11].
- Models were developed using MicroShield™ for each discrete waste item to calculate the dose rate at 3 cm from each with the time set to zero The same models were used to calculate dose rates from the decayed items at 100, 300 and 500 years[12]. All dose rates were normalized to the highest dose rate at time equals zero, or that of the Cs-137 source.
- These fractions of initial dose rates are plotted against the decaying dose rate exhibited by a 130 Ci Cs-137 source, all calculated at 3 cm.
- Also depicted is the decayed Class A and Class B Cs-137 source[11] at their respective time frames of 100 and 300 years.
- Observation; Using very conservative 10 times Class C concentration from the actual radionuclide distributions in individual (or discrete) waste items, the gamma dose rates from waste items are far lower than a permissible decayed Class C Cs-137 source and actually approximate the dose rates that would be exhibited by a permissible decayed Class A Cs-137 source 100 years even though the individual waste items were 10 times Class C when disposed. This analysis shows that direct dose hazards from individual waste items using a more accurate depiction of the LLW stream than used to develop Part 61 can be significantly lower than those of mono-isotopic sources used in more recent well drilling scenarios[11].

ELECTRIC POWER RESEARCH INSTITUTE

Actual LLRW Radionuclide Mix In One Site[3]
Assumptions and methods in Chart 3

- The radionuclide inventory used in this assessment is derived from our modern and accurate understanding of radionuclide mix from operational and decommissioning nuclear power plants and the non-power plant waste inventory from MIMS (2002-2006) [3].
- The entire volume from the remaining operating life and decommissioning of the current fleet of reactors including all eligible wastes (i.e., eligible activated metal) and non-utility waste is projected over 48 years (2009-2057)[3].
- This results in an aggregated volume of 9 million m^3 which is modeled in one disposal site using RESRAD. ICRP 72 dose factors were used and the fish pathway was turned off because it was assumed that one would not place a disposal site adjacent to a fresh water body, four models were run:
  - The base scenario uses just the minimum required 2 m cover and no barriers to prevent water infiltration.
  - The barrier case adds an impermeable layer over the disposal site to minimize water infiltration. We can see that even with this unrealistically large inventory placed in one site and in the absence of normal waste form practices that would reduce the rate at which water penetrates the waste the intruder dose rate is <500 mrem/year.
  - In the waste form case, we reduce the permeability of the waste by altering the kd in only the waste zone which is considered the most representative of current disposal practices (e.g.; HICs, concrete over packs, etc)..
  - Combining the barrier, to minimize water infiltration into the site, and waste form results in little change from the waste form case alone.
- The dry site dose model, not depicted here, begins to increase in the waste form model at 700 years up to 1,000 years because of the breakdown of the waste form and water infiltration from no cap but even at 1,000 years the dose rate is <1 mrem/year.
- Observation; Using a far larger volume than was used to develop Part 61, a more accurate depiction of the radionuclide mix and modern dosimetry, even in the absence of modern disposal practices and a cap (barrier), the resident farmer (intruder agriculture) dose would be less than 500 mrem/yr. Using modern disposal practices we end up with intruder agriculture dose rates of <25 mrem/year out to 1,000 years[3].

References

1. *An Evaluation of Alternative Classification Methods for Routine Low Level Waste From the Nuclear Power Industry*. EPRI, Palo Alto, CA: 2007. 1016120

2. *Investigation of Low Level Radioactive Waste Disposal Regulations and Practice: Recent Experience and Current Practices*. EPRI, Palo Alto, CA: 2009. 1019222

3. *Options for Improved Low Level Waste Disposal Using 10 CFR 61.58*. EPRI, Palo Alto, CA: 2010. 1021098

4. *Radiation Protection Recommendations as Applied to the Disposal of Long-Lived Solid Radioactive Waste.* ICRP Publication 81. Annals of the ICRP 28:13-22,1998

5. *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste : Specific Safety Guide 23*. — IAEA, 2012

6. *Deciding for the Future: Balancing Risks, Costs, and Benefits Fairly Across Generations.* National Academy of Public Administration, 1997

7. *The Handling of Timescales in Assessing Post-closure Safety Lessons Learnt from the April 2002 Workshop in Paris, France.* NEA No. 4435, OECD 2004

8. *Considering Cumulative Effects Under the National Environmental Quality Act*, The Council on Environmental Quality Handbook, 1997

9. Eccleston, C., *Environmental Impact Assessment : A Guide to Best Professional Practices*, CRC Press, Boca Raton FL, 2011

10. *Interagency Reference Guide, Reasonably Foreseeable Development Scenarios and Cumulative Effects Analysis , For Oil and Gas Activities on Federal Lands in the Greater Rocky Mountain Region*, USDI Bureau of Land Management, USEPA, USDI Fish & Wildlife Service, USDI National Park Service, USDA Forest Service, 2003

11. *Draft Branch Technical Position on Concentration Averaging and Encapsulation, Revision 1*, ML121170418, May 2012

12. Letter, EPRI to NRC, RE: *Docket ID NRC 2011-0022 Revised Branch Technical Position on Concentration Averaging and Encapsulation of Low-Level Radioactive Waste*, ML12284A264, October 2012

ELECTRIC POWER RESEARCH INSTITUTE

U.S. DEPARTMENT OF ENERGY | OFFICE OF ENVIRONMENTAL MANAGEMENT

DOE Activities for Management of Depleted Uranium

ACRS Part 61 Stakeholder Meeting

Christine Gelles, Office of Environmental Management
Roger Seitz, Savannah River National Laboratory

December 3, 2013

Savannah River National Laboratory™
OPERATED BY SAVANNAH RIVER NUCLEAR SOLUTIONS

Discussion Topics

- Overview of DOE's DUF6 Inventory and Conversion Facilities
- History of DOE Studies and NEPA analyses
- Basis for Selection of Conversion Product Form (DU3O8)
- Future Disposal Considerations


CC2 Row

DUF6 Conversion Project History

- DOE's inventory of DUF6 is legacy of DOE (and USEC) enrichment activities.
- DOE looked exhaustively at options for disposition of its DUF6 inventory.
- In 1999, DOE issued its *Final Programmatic Environmental Impact Statement [PEIS] for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride, DOE-EIS-0269.*
- In its August 10, 1999, programmatic Record of Decision (ROD) (64 FR 43358), DOE decided to convert the DUF6 inventory to depleted uranium oxide, depleted uranium metal, or a combination of both.
- Following the ROD, DOE initiated a competitive acquisition for construction of conversion facilities at the Portsmouth (OH) and Paducah (KY) gaseous diffusion plant sites.
- On August 29, 2002, DOE awarded a contract to Uranium Disposition Services, LLC (UDS) for such services and facility development began.
- Between 2002 and 2004, DOE reviewed the environmental consequences of building and operating the conversion facilities.

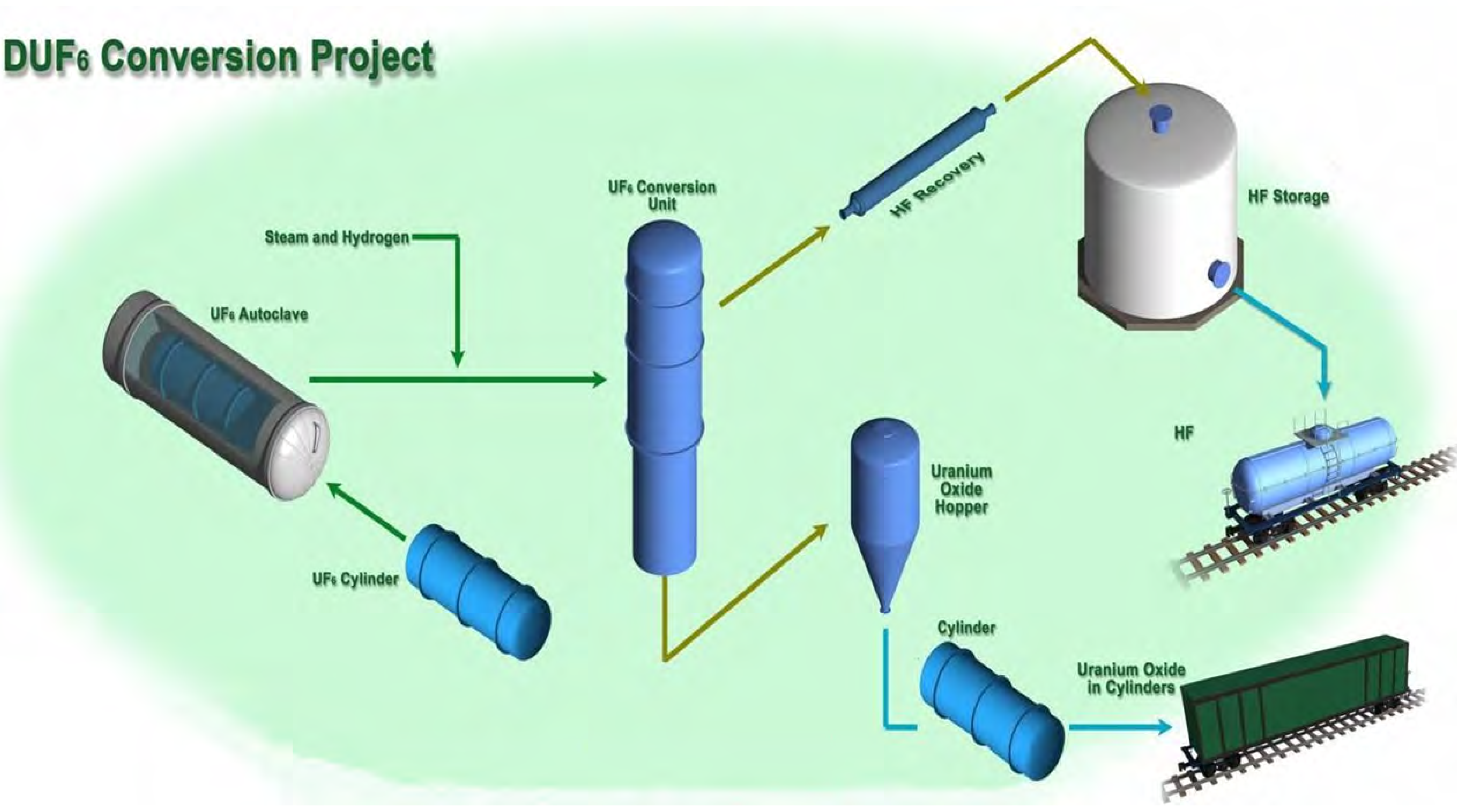
DUF6 Conversion Project History (continued)

- On June 18, 2004, DOE issued two site-specific EISs for the construction and operation of the Portsmouth and Paducah DUF6 conversion facilities (DOE 004a, b).
- In the RODs for these facilities, DOE decided that it would convert DOE's inventory of DUF6 to depleted uranium oxide (primarily depleted U3O8) and aqueous hydrogen fluoride (HF).
  - The aqueous HF produced during conversion is projected to be sold for use in commercial applications in accordance with approved authorized release limits.
  - The depleted uranium oxide conversion product will be reused to the extent possible or be disposed of as low-level waste (LLW) concurrently with emptied cylinders and the small amount of CaF2 produced during normal conversion operations.
- Although the site-specific EISs considered the NTS (NNSS) and Envirocare (Energy*Solutions*) as destinations for transportation and disposal of the these materials, DOE did not decide specific disposal location(s) in the 2004 RODs.

Piketon/Portsmouth OH
Three lines
Construction 2002 – 2008
HFT June 2010
240,000 MT DUF6
18 years operations projected

Paducah KY
Four lines
Construction 2002 – 2008
HFT Oct. 2010
550,000 MT DUF6
30 years operations projected

DOE's DUF6 Conversion Process



Status of DUF6 Project Operations

- Following construction of the facilities, DOE conducted competitive acquisition for the commissioning and operations of both facilities.
- In 2010, operations contract awarded to Babcock & Willcox Conversion Services, LLC.
- Hot functional testing began in 2010, and operations in 2011.
- Due to the first-of-kind nature of these facilities, a major focus on the path to stable, sustainable conversion operations has been determining the maximum possible throughput, based on actual experience and empirical data.
- DOE has focused on ramping up to full conversion operations, including continue to upgrade systems to achieve higher throughput in stages.
- Through FY 2013, 1600 cylinders have been processed and the conversion product is stored in re-used cylinders in the yards adjacent to the facilities.

DOE's responsibilities for commercial DU

(a) Responsibility of DOE

(1) The Secretary, at the request of the generator, shall accept for disposal low-level radioactive waste, including depleted uranium if it were ultimately determined to be low-level radioactive waste, generated by—

(A) the Corporation as a result of the operations of the gaseous diffusion plants or as a result of the treatment of such wastes at a location other than the gaseous diffusion plants, or

(B) any person licensed by the Nuclear Regulatory Commission to operate a uranium enrichment facility under sections 2073, 2093, and 2243 of this title.

(b) Agreements with other persons

The generator may also enter into agreements for the disposal of low-level radioactive waste subject to subsection (a) of this section with any person other than the Secretary that is authorized by applicable laws and regulations to dispose of such wastes.

(c) State or interstate compacts

Notwithstanding any other provision of law, no State or interstate compact shall be liable for the treatment, storage, or disposal of any low-level radioactive waste (including mixed waste) attributable to the operation, decontamination, and decommissioning of any uranium enrichment facility.

Excerpts from USEC Privatization Act (P.L. 104-134 §3113)

Assessment of Preferred Depleted Uranium Disposal Forms

- ORNL/TM-2000/161, June 2000
- Each DU form has a degree of uncertainty regarding acceptability, with the uncertainty decreasing in the following order: DU metal, DUF4, DUO2, and DU3O8.

Assessment of Preferred Depleted Uranium Disposal Forms (cont'd)

Chemical Properties of Uranium and its compounds under ambient conditions

DU product form	Solubility in water	
DU Metal	Insoluble	Reacts slowly with moisture to form oxides in the presence of oxygen; condensed moisture promotes generation of H2 Reactions may form pyrophoric surface in absence of O2

Assessment of Preferred Depleted Uranium Disposal Forms (cont'd)

DU product form	Solubility in water	
DUF_4	Very Slightly soluble	Reacts slowly with moisture to form DUO_2 and hydrogen fluoride (HF) and eventually other oxides and minerals
DUO_2	Insoluble	Powder only can be pyrophoric in air Reacts very slowly with oxygenated groundwater to yield more stable oxides and minerals

Assessment of Preferred Depleted Uranium Disposal Forms (cont'd)

DU product form	Solubility in water	
DU3O8	Insoluble	Reacts very slowly with oxygenated water to yield more stable uranium minerals Product tends to be a fine particulate or powder

NRC Comments on DU Waste Form

NRC Comment September 22, 1992

Letter from NRC (J. W. N. Hickey) to LES (W. H. Arnold)

- NRC staff expressed a preference for U3O8 as the chemical form for final disposition. Conversion of the DUF6 to DUF4, for final disposition is not acceptable because its physiochemical, long-term stability is incompatible with final disposal under 10 CFR Part 61.

NRC Comment January 3, 1995

Letter from NRC (R. Bernero) to DOE (C. Bradley)

- Disposal of the DUF6 will likely require conversion of the material to a more stable physiochemical form, such as U3O8. NRC staff has recommended in the past that U3O8, which is thermodynamically stable and relatively insoluble, is a likely form for disposal.

NRC Comment May 1, 1998

Letter from NRC (C. Paperiello) to DOE (C. Borgstrom)

- In 1998 regarding disposal of DU, NRC expressed preference for uranium oxides over metal in comments on DOE PEIS.

Future Considerations Related to Potential Disposal

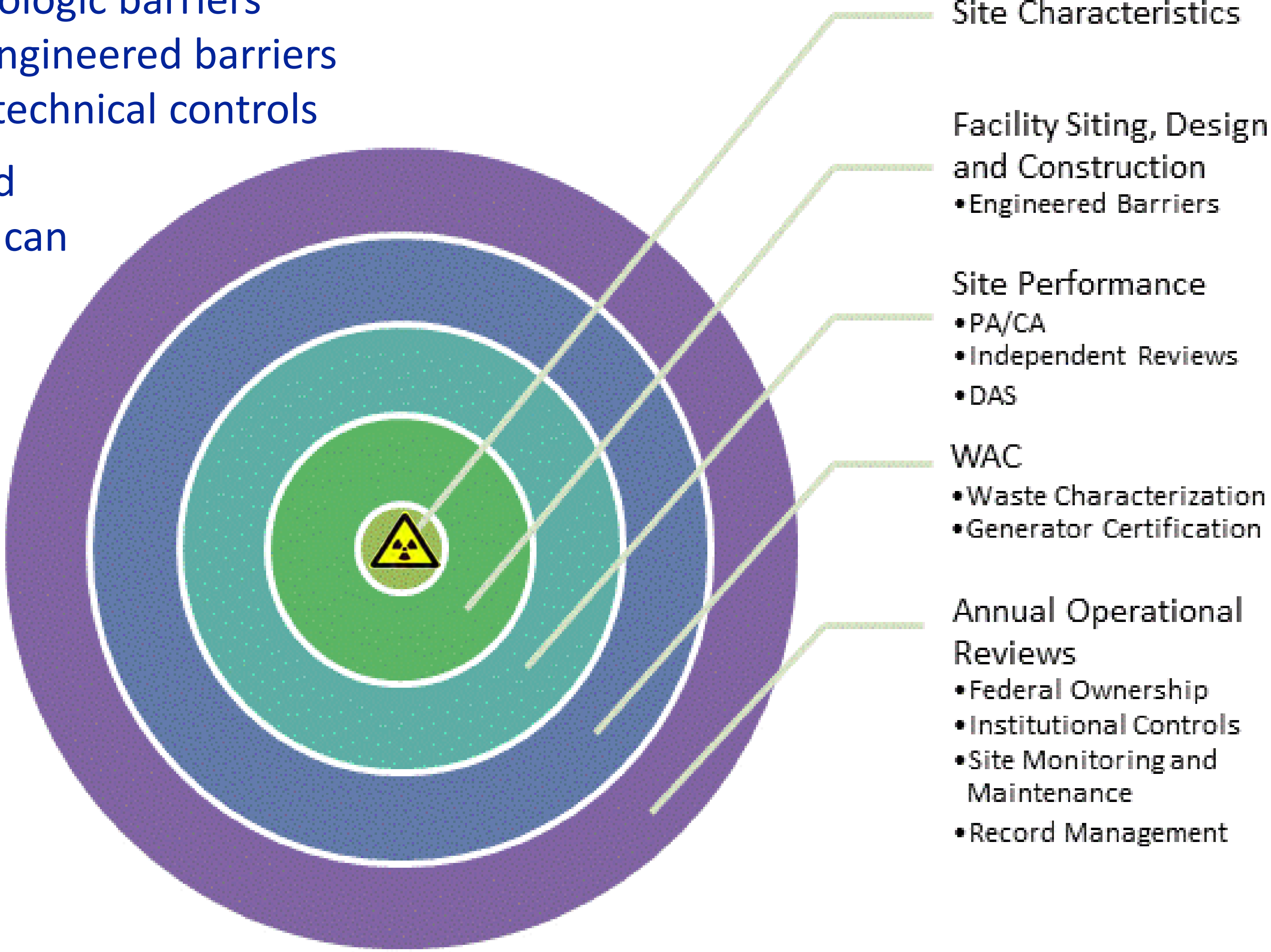
- DOE has committed to conduct additional NEPA analyses on the transportation and disposal of the conversion product.
- In March 2007, DOE published *Draft Supplement Analysis for Location(s) to Dispose of Depleted Uranium Oxide Conversion Product Generated from DOE's Inventory of Depleted Uranium Hexafluoride (EIS-0359-SA-01 _EIS-0360-SA-01-2007).*
- DOE has opted to <u>defer</u> finalization of this analyses or select disposal location(s), in light of the pending regulatory changes.
- DOE has closely monitored and participated in (i.e., provided comments) the NRC rulemaking efforts related to Part 61.
- DOE's schedule to complete the additional NEPA analysis and issue a Record of Decision remains uncertain.
- DOE is also pursuing potential sale of a portion of the DUF6 inventory for reuse.

Future Disposal Considerations

- Although near-surface disposal of DU poses challenges, it is considered to be a potentially viable option at a few sites with favorable conditions.
- Performance assessment and NEPA analyses to date support near surface disposal in favorable locations that provide for long-term protectiveness.
- Three locations currently considered as potential options
  - Nevada National Security Site, Energy*Solutions* (UT), and Waste Control Specialists (TX)
  - DOE oversees disposal at Nevada National Security Site (NNSS). DOE has safely disposed of DU waste forms in past, and the NNSS site specific performance assessment demonstrates that the uranium oxide waste form can safely be disposed at NNSS.
  - Energy*Solutions* and Waste Control Specialists are pursuing needed regulatory approvals from their regulators.

Basis for Near Surface Disposal - *Defense in Depth*

- Integrated, total systems approach to safety
  - Site characteristics which provide geologic and hydrologic barriers
  - Facility design – Engineered barriers
  - Administrative & technical controls
- Federal ownership and buffer zones until site can be released
- Site-specific approach
- Conservative bias
- Commitment to maintenance and monitoring



Questions?

Updating 10 CFR Part 61

John T. Greeves

Talisman International, LLC
1000 Potomac Street, NW
Suite 300
Washington, DC 20007
202/471-4244
www.talisman-intl.com

TALISMAN
INTERNATIONAL, LLC.

Regulatory Standards

- Adequate protection
- Simple
- Clear
- Implementable

Background

- Commercial LLW disposal was stabilized under 10 CFR Part 61 (1982)
  - Performance Objectives were <u>primary</u> (Site Releases, Intrusion, Operations, Stability)
  - Technical Requirements were very prescriptive
  - NRC Agreement States have successfully implemented these requirements
  - Technical Analysis advancements and emerging Unique Waste Steams require updated standards

Background

- Part 61 is a combination of deterministic and Performance Based approaches
  - Deterministic aspects are waste classifications (A,B, C, and greater than Class C)
  - Performance Objectives can be risk informed
- There are gaps in Part 61 that have been brought to forefront by current DU and blending issues

Preliminary Thoughts

- **Updated Part 61 Should**
  - **Clearly Require SS-PA for all waste streams**
  - **Provide an intruder dose standard (500 mr/y)**
  - **Use modern ICRP methods**
  - **Set two tier standard**
    - **Address short lived waste for 1,000 years**
    - **Evaluate long lived waste out to peak dose or impact**

Preliminary Thoughts

- Performance Objectives should continue to be <u>primary</u> standard
  - Proposed reference to 61.13 should be reconsidered
- Need quantitative metric for second tier performance period analysis
  - Minimize releases to the public would be difficult to implement
  - 1 R should be considered
- Long-Term analysis proposed under 61.7 and 61.13 is too complicated
  - Site specific waste acceptance criteria (WAC) is sufficient

Preliminary Thoughts

- Performance Objectives should have highest level Agreement State compatibility requirement
- Existing sites should be grandfathered for any new provisions
- Point of Compliance (beyond buffer zone) is a key concept
- Site specific performance assessment WAC should resolve outdated classification tables gaps

Comments on the Proposed Revisions to 10 CFR 61

Presented to the Advisory Committee on Reactor Safeguards

Radiation Protection and Nuclear Materials Subcommittee

John Tauxe, PhD, PE

Paul Black, PhD

NEPTUNE AND COMPANY

Neptune and Company, Inc.

Presentation Outline

- Site-Specific Performance Assessment
- Intruder Assessment
- Federal *vs.* Commercial Facilities
- Other Issues

Site-Specific PA

There is recognition (e.g. in the NRC revisions to 10 CFR 61) that site-specific PA is important in characterizing site performance.

NNSS Area 5 RWMS in Frenchman Flat

≠

ORNL SWSA 6 at White Oak Creek

Start by examining Features, Events, and Processes (FEPs).

Site-Specific FEPs

The foundation for defensible PAs

transpiration

wind

adsorption

weathering

groundwater

radioactivity

corrosion

earthquake

bioturbation

tsunami

erosion

inundation

diffusion

cliff retreat

Only some of these apply to a given site.

Site-Specific FEPSs

Exposure Scenarios should be included

farming

water well drilling

resident

basement construction

hunting

drainfield construction

mining

recreation

fishing

intrusion

oil/gas exploration

Again, only some of these apply to a given site.

Site-Specific Exposure Scenarios
help to discriminate site performance

site	on-site resident	well water supply and drilling	surface water supply	oil/gas well drilling	mining	farming	hunting	ranching	fishing	recreation
V	●	●	●			●	●		●	●
W		●					●			●
X							●	●		●
Y	●			●		●	●	●		●
Z	●	●				●	●	●		●

Presentation Outline

- Site-Specific Performance Assessment
- Intruder Assessment
- Federal *vs.* Commercial Facilities
- Other Issues

Intruder Assessment

We do not see the value in separating "inadvertent human intruders" (IHI) from other "members of the public" (MOPs) into a distinct Intruder Assessment.

The site-specific PA should evaluate all plausible receptors and exposure scenarios (and *not* implausible ones), whether they intrude into the waste or not.

Intruder scenarios must be site-specific, at any rate.

Intruder Issues

What makes an intruder?

This is not so clear.

Consider the situation where one person causes an event that later releases waste, but is not himself exposed.

A future person, while not occupying the site, is exposed to this waste.

Neither is the classic intruder.

This scenario falls through the cracks.

Presentation Outline

- Site-Specific Performance Assessment
- Intruder Assessment
- Federal *vs.* Commercial Facilities
- Other Issues

Federal *vs.* Commercial Facilities

There is no fundamental difference between radioactive waste facilities that are intended to be for commercial wastes from those for Federal wastes.

All such facilities should follow the same Performance Assessment methodology.

At Neptune, we have done our best to follow the same basic principles of PA for decision making at both DOE and commercial sites.

Presentation Outline

- Site-Specific Performance Assessment
- Intruder Assessment
- Federal *vs.* Commercial Facilities
- Other Issues

Other Issues in Proposed 10 CFR 61

- 10 CFR 61 suffers from vague and inconsistent language (e.g. protecting the “general population” and “any member of the public”).
- Inadequate definitions of “person”, “occupy”, “radiation from the waste”, “stability”, etc.
- It seems that an assessment must be done in order to determine if an assessment must be done.
- Much language belongs in guidance.
- According to § 61.7(e)(3), Depleted Uranium is now a Class C waste. (That must be pointed out.)
- Environmental impacts are mentioned but not an ecological risk assessment. Why not do eco risk?
- Dose is still used as a proxy for risk.

How Long is Dose Relevant?

The uncertainty in human behaviors becomes exceedingly large in just a few hundred years. This limits the utility of “dose” as a performance metric to relatively short time frames.

The same goes for risk to humans.

What About Longer Time?

There may still be utility in longer period assessments, even if dose (or risk) is too uncertain to be useful.

Site stability could be a useful discriminator.

- Some sites are inherently unstable.
- Others are inherently stable.

The Problem of Deep Time

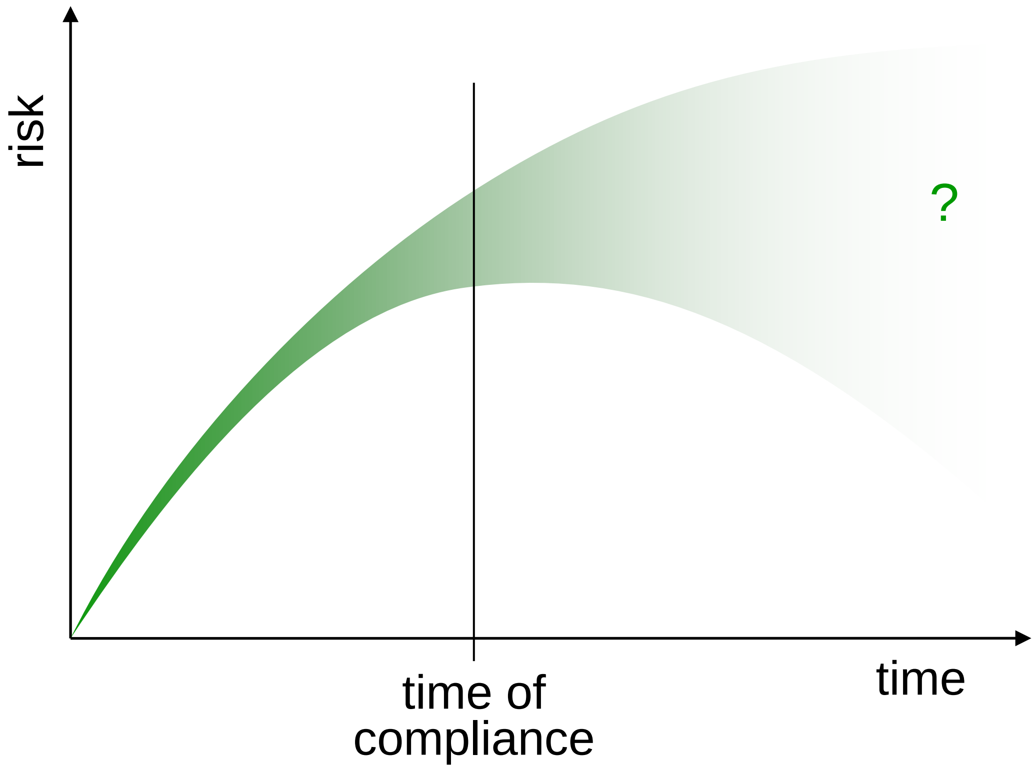
PAs are challenged to provide estimates of dose out into exceedingly long time frames.

(DU example: Secular equilibrium is not reached for over 2 million yr, and after that, the increased risk remains effectively forever.)

After 100,000 years...

- Los Alamos mesas will have collapsed
- Lake Bonneville will have returned to Utah
- West Valley will be under an ice sheet
- Oak Ridge valleys will have been further eroded
- Savannah River may have incised the SRS
- Hanford may have experienced another mega flood
- Southern Nevada may have seen volcanoes again

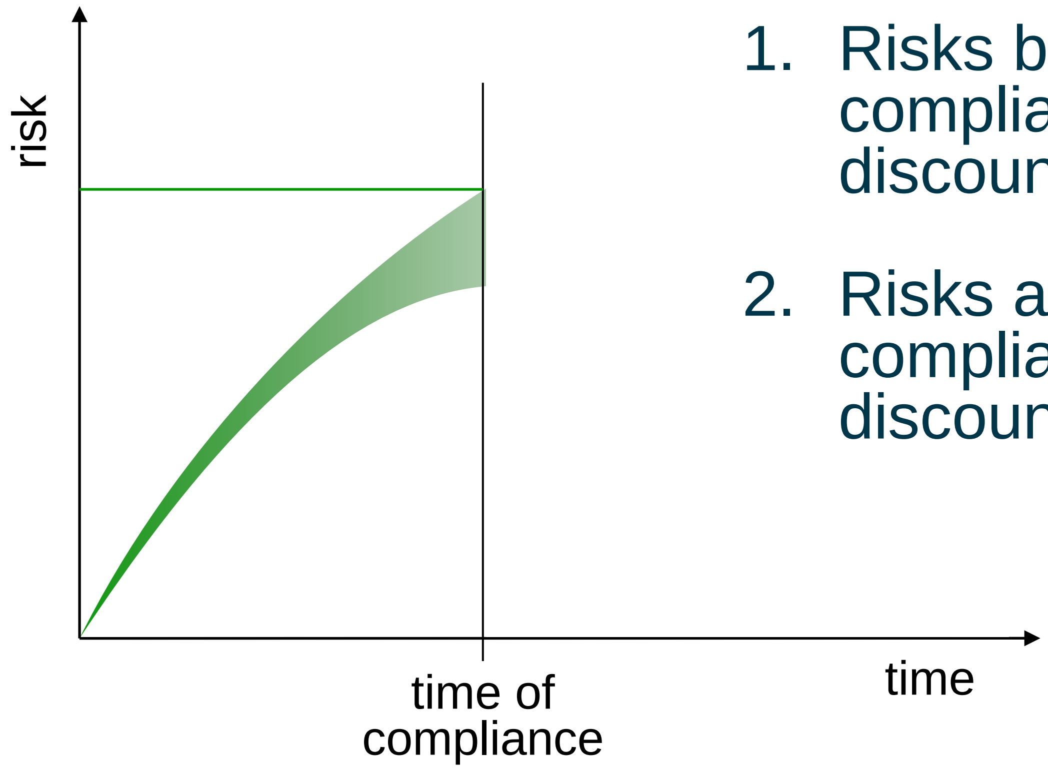
Consideration of Future Risk



uncertainties increase with time

How does a decision maker choose when higher risks in the future have high uncertainty?

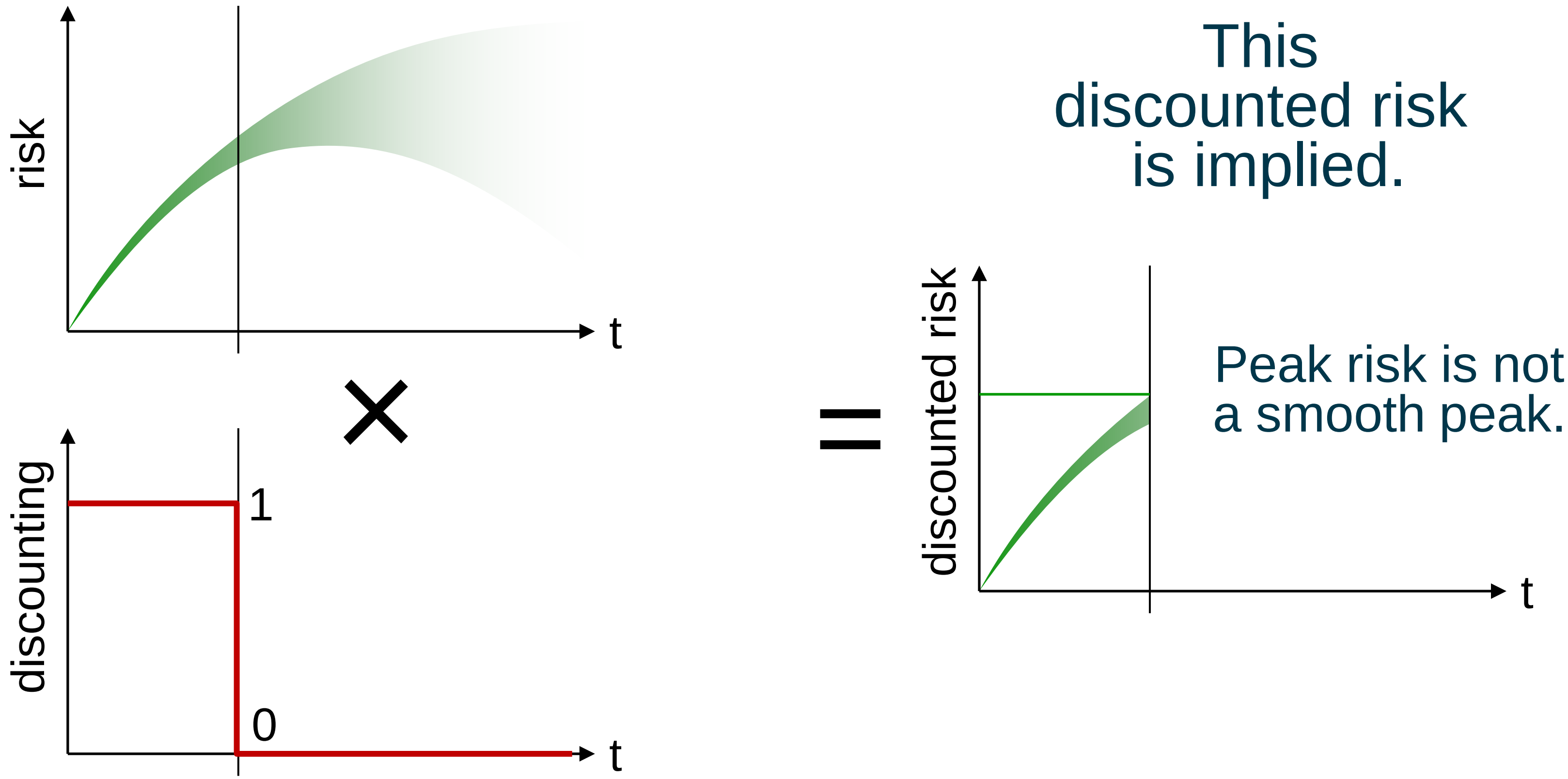
Imposing a Time of Compliance



1. Risks before the time of compliance are not discounted at all.
2. Risks after the time of compliance are completely discounted.

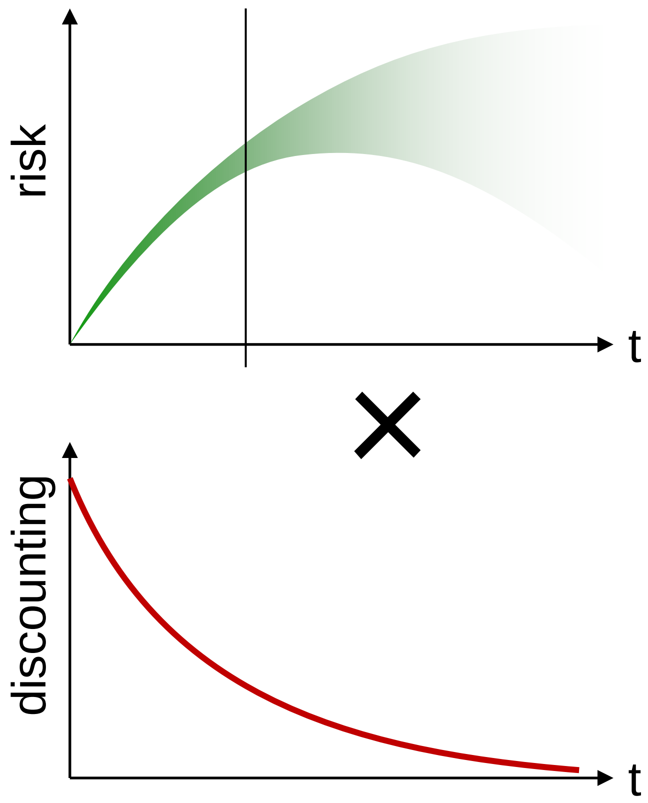
The full burden is on the current generation. This ignores uncertainty in future decision alternatives (e.g. technology).

Traditional Implied Discounting

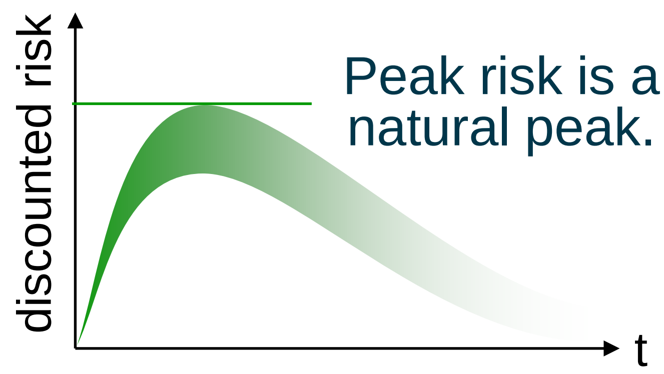


The traditional approach implies no discounting (0) up to $t_{compliance}$ and complete (1) thereafter.

A Proposal for Future Discounting



Discounted risk
is a function of
the discount function.



Another approach is to discount according to a site-specific, stakeholder-determined discount function.

More 10 CFR 61 Comments

For Neptune and Company's more thorough examination of issues in revisions to 10 CFR 61, please refer to our formal submittal of comments to the NRC, dated 7 January 2013.

Contact: Dr. John Tauxe
jtauxe@neptuneinc.org

Neptune and Company, Inc.
1505 15th St.
Suite B
Los Alamos, New Mexico 87544
866-245-5040
www.neptuneandco.com

7 January 2013

minor edits, 1 December 2013

Annette Vietti-Cook
Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
Rulemakings and Adjudications Staff

Subject: Comments on November 2012 Preliminary Rule Language for Proposed Revisions to Low-Level Waste Disposal Requirements (10 CFR Part 61)

Reference: Docket ID NRC–2011–0012

Dear Ms. Vietti-Cook:

Neptune and Company, Inc. (Neptune) is submitting the attached comments in response to the notice published in the 7 Dec 2012 Federal Register Vol. 77, No. 236, pp. 72997 *et seq*. We appreciate the opportunity to comment on the proposed language for 10 CFR 61.

We believe that the revision to 10 CFR 61 is a worthwhile endeavor that will lead to radioactive waste disposal decisions that are more beneficial for and protective of current and future generations.

Thank you again for this opportunity to comment. Questions regarding these comments may be directed to Dr. Paul Black at (866) 245-5040 ext 1 (pblack@neptuneinc.org), or Dr. John Tauxe at (505) 662-0707 ext 15 (jtauxe@neptuneinc.org).

Sincerely,

John Tauxe, P.E., Ph.D. and Paul Black, Ph.D.
Neptune and Company, Inc.

Comments on November 2012 Preliminary Rule Language for Proposed Revisions to Low-Level Waste Disposal Requirements (10 CFR Part 61)

Neptune and Company, Inc. (Neptune) appreciates the opportunity to provide comments on the U.S. Nuclear Regulatory Commission (NRC) proposed language for Code of Federal Regulations Title 10 Part 61. We believe the NRC efforts are timely, and that revisions to 10 CFR 61 are sorely needed.

The document entitled *November 2012 Preliminary Rule Language for Proposed Revisions to Low-Level Waste Disposal Requirements (10 CFR Part 61)* was provided for comment, and it contains sections of proposed revisions to the text of Part 61. Revisions are indicated in the document by the use of underlined text, and changed or omitted text is not identified. Also not identified are sections of the rule that are not proposed for revision, but are nevertheless proposed for the rule, by implication. The proposed revisions have implications for most of the rule, and so we consider the entire rule to be "proposed". Some of the following comments therefore are oriented toward parts of 10 CFR 61 that are not discussed in the document provided, but are nevertheless in need of revision.

The comments below are organized into a General Comments section, with application to the overall rule, and a Specific Comments section, with comments following the same order as they appear in the proposed revisions document.

General Comments

Much of the existing language in 10 CFR 61 suffers from being overly vague, and in many cases the proposed language does little to remedy this shortcoming.

Neptune had hoped for greater changes to the regulation. We were hoping that the revised regulation would open the door to performing a proper risk assessment, bringing in site-specific factors, and not tying the performance assessment to conservative unlikely MOP or IHI scenarios. Perhaps the proposed revisions accomplish part of this by providing options for site-specific analyses, but it is not clear that the concepts of MOP and IHI may be abandoned in favor of site-specific exposure scenarios.

The language of Part 61 could still use tightening up. A significant example of this is in the definition of the performance objectives, which apply in the title of § 61.41 to the "general population", but in the text of the same subsection refer to "any member of the public". These terms are quite different from each other, but are sprinkled throughout Part 61 as if they were equivalent. Protection of the "general population" implies that a population risk assessment should be developed, and protection of "any member of the public" implies protection of anyone, including the most vulnerable members of the public. This is different from protecting an "average" member of the public, such as the "reference man" that is commonly used. It is good that the regulation strives to protect both the general population and any member of the public,

and this can be done in a site-specific performance assessment, but the language needs to be cleaned up so that the two concepts are made to be clear and distinct. While the dose to any member of the public can be assessed against the performance objective of an annual maximum of 0.25 mSv, the population dose must be expressed differently. A new section is needed to do this, describing how a population dose is to be evaluated as a summed dose to a large number of individuals—all those receptors that will be exposed to radioactivity from the waste over the entire period of performance. The population dose thus calculated would be expressed in terms of total Sieverts (or rem), and this is to be kept as low as reasonably achievable (ALARA). There is no predetermined value that is acceptable for a total population dose—there is no equivalent to the 0.25 mSv maximum annual dose for individuals. Note also that the term “general population” needs to be better defined in terms of the potentially affected population. The “general population” is too vague. This is another place where changing focus to a risk assessment based on reasonable site-specific exposure/receptor scenarios would be beneficial.

The specific references to a scoping analysis (such as a features, events, and processes, or FEPs analysis) is encouraging. This should be a starting point for a site-specific performance assessment, and mentioning this in the regulation is appropriate. It could benefit from a scoping of human exposure scenarios as well, however, since these are also potentially significant in evaluating compliance with performance objectives. The regulation should not get into specifics, however, as these will vary so much from site to site. Examples of specific features, events, processes, and exposure scenarios (FEPSs) to include should be left to guidance.

If regulations are sufficiently vague or obfuscating, then they can open the door to wider interpretation, so compliance (and optimization) can be demonstrated as long as the performance assessment can be shown to fit the regulation in some reasonable form, and so long as it is demonstrated to be defensible. However, this could be achieved with a simpler regulation that requires a proper risk assessment and provides performance objectives for evaluation of compliance.

As is stands, the current regulation is very difficult to communicate, and consequently, current performance assessments are very difficult to communicate. They have very little basis in perceived reality. What is needed is to replace the concepts of a “member of the public” (MOP) and “inadvertent human intruder” (IHI) with site-specific receptor exposure scenarios and risk assessment. The proposed changes in language still include inconsistencies in the promotion of site-specific analyses.

The current form of CFR 61 was developed over 40 years ago, before the advent of modern computer technology. Because of the rapid change in technology and consequent modeling capabilities, there is a need to move beyond the methods and approaches that underlie the current regulation. The proposed revisions do not accomplish this. They are a small step that, in some ways, seems to allow site-specific analyses to be performed, but is otherwise still tied to and adversely affected by methods and approaches that are out of date. The opportunity to revise regulations does not come along very often. It is important, therefore, not to miss this opportunity, but the current revision does largely miss this opportunity.

Other items relevant to radioactive waste disposal under the purview of the NRC include the effects of the disposals on the environment. Since NRC is tasked with “protecting people and the environment”, one might expect that the analyses required in 10 CFR 61 would include ecological risk assessment as well as for human health. Also, in the analyses of long term effects, after the period of performance (currently suggested to be 10,000 years) there loom the inescapable effects of climate change. While prescribing methodologies for taking climate change into account is beyond the scope of regulation (more appropriately falling into the realm of guidance), the fact that climate change must be accounted for in these “deep time” assessments should be touched on somewhere in Part 61.

The proposed changes to Part 61 are marginal, with the primary issues being to accommodate disposal of depleted uranium (DU), to allow site-specific analyses to be performed, and to update the dose conversion factors (DCFs) to current methodology. The door is opened, but there could have been much more done to advance protection of people and the environment.

Specific Comments

§ 61.2 Definitions.

Several terms are used in the existing and the proposed rule language that require definition in this section. These are

- member of the public
- general population
- reasonable assurance
- unacceptable risk
- disposal facility
- disposal site
- disposal unit
- low-activity waste
- high-activity waste
- radiation from the waste

The following existing definitions are proposed for revision, with specific comments following each. We note, again, that if a proper risk assessment is applied, then some of these terms are unnecessary, and the regulation could be simplified and brought in line with modern risk assessment practices. We regard this as a serious flaw in the proposed revision.

Proposed definition:

Inadvertent Intruder means a person who might occupy the disposal site after closure and engage in normal activities, such as agriculture, dwelling construction, resource exploration or exploitation (e.g., well drilling) or other reasonably foreseeable pursuits that might unknowingly expose the person to radiation from the waste.

Comments:

We think the distinction between an inadvertent intruder and any other member of the public should be dissolved. It is a completely unhelpful distinction that obfuscates a proper risk assessment. It is difficult to understand how, on the one hand, the revised regulation is meant to convey the need for a "risk informed" analysis, and at the same time require an evaluation of a default or stylized inadvertent human intruder. We think the concept of an inadvertent human intruder should be removed from the regulation, and the risk informed process should, instead, be supported by proper risk assessment to the general population on the basis of the development of reasonable site-specific exposure scenarios. We presume that such a change has not been made because of the tables that exist for intruder analysis. It is unfortunate that this was considered a constraint too powerful to overcome.

Further, use of the word "person" (twice) becomes immediately problematic when the definition of "person" is considered:

> *Person* means (1) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, government agency other than the Commission or the Department of Energy (except that the Department of Energy is considered a person within the meaning of the regulations in this part to the extent that its facilities and activities are subject to the licensing and related regulatory authority of the Commission pursuant to law), any State or any political subdivision of or any political entity within a State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent, or agency of the foregoing.

Given this definition of "person", it is hard to imagine that this is all to be considered in the definition of inadvertent intruder, or anyone receiving a dose. A clarification is in order, perhaps by substituting another word for "person".

What is the meaning of the word "occupy" in this context? Does it mean that someone must set up residence on the site, or is a temporary visitation of the site considered an occupation? If a recreational hunter, for example, crosses the site and is unknowingly exposed to waste, or radionuclides that migrated from the waste, is that considered an occupation? Is such a visitor considered an inadvertent intruder? The definition of "inadvertent intruder" remains vague. This also requires clarification. This confusion would disappear if a risk-based approach were to be taken.

Use of the terms "reasonably foreseeable" and "might" makes this definition quite vague in practice. Is it left up to the applicant to determine what constitutes "reasonable foreseeable pursuits", and what "might" means in this context? Is an inadvertent intruder one who "might occupy the disposal site", or one who actually "occupies the disposal site"? Our recommendation is that the "foreseeable future" should be defined site-specifically by the local (potentially affected) population and by considering economic arguments. This is how society operates in practice in our everyday lives.

Finally, the phrase "radiation from the waste" is problematic in the context of inadvertent intrusion. Does this mean radiation only from the waste that is still in place as it was disposed?

What if the waste has migrated, or what if the radionuclides that originated in the waste have migrated to a location where the intruder might come into contact with it, or at least be irradiated by it? Consider that radionuclides from the waste may have migrated to the ground surface, or to surface waters, and that such radionuclides would irradiate anyone who might traverse the area. Is such an individual to be considered an inadvertent intruder?

Ultimately, the distinction between an inadvertent intruder and other members of the public, or the general population, becomes blurred. We recommend that the concept of the inadvertent intruder be abandoned, replaced by a performance assessment that assesses risks to populations of individuals that are expected to occur at any given site. Such an approach would be far easier to communicate to the stakeholders, which is very important to gain approval and hence be able to open a disposal facility.

Proposed definition:

Intruder assessment is an analysis that (1) assumes an inadvertent intruder occupies the site or contacts the waste and engages in normal activities or other reasonably foreseeable pursuits that might unknowingly expose the person to radiation from the waste; (2) examines the capabilities of intruder barriers to inhibit an inadvertent intruder's contact with the waste or to limit the inadvertent intruder's exposure to radiation; and (3) estimates an inadvertent intruder's potential annual dose, considering associated uncertainties.

Comments:

Given our views on the concept of the inadvertent intruder (above) it will be no surprise that we feel that the definition of an "intruder assessment" as distinct from a "performance assessment" is not needed. If a performance assessment examines all site-specific exposure scenarios, then it will naturally account for all receptors as part of the general population, be they "intruders" or "members of the public". This is overcomplicating what should be a straightforward problem.

Proposed definition:

Long-lived waste means (1) waste where more than ten percent of the initial radioactivity remains after 10,000 years (e.g. long-lived parent), ...

Comments:

If applied to a single radionuclide with no progeny, this would correspond to a half-life of just over 3000 yr. That calculation is useful just to get an idea of what is considered long-lived by this definition. However, perhaps the intent is to account for a "waste" that may contain quite a lot of various radionuclides in various concentrations, in any combination. It is difficult to assess the reasonableness of this definition without examining sample recipes of waste. We trust that this has been done, and that NRC is comfortable with the implications of this definition.

Proposed definition:

Performance period is the time after the compliance period for disposal facilities during which the performance objectives specified in §§ 61.41(b) and 61.42(b) must be met.

Comments:

A performance period is not necessary if a proper risk analysis, including an economic analysis, is performed. However, if such a concept is to be included, then it needs greater definition. There is also an implication in this definition that dose will be tied to performance objectives even within this period. This is completely unnecessary. This begs the question of how “foreseeable future” is defined and for what purpose. It might be an interesting exercise to evaluate concentrations beyond the Compliance Period, but a dose comparison should not be performed. Given the rapid changes that are likely to continue in society and technology, the assumptions concerning characteristic of humans that far into the future cannot be defended.

Proposed definition:

Compliance period is the time during which compliance with the performance objectives specified in § 61.41, § 61.42 and § 61.44 must be demonstrated. This period ends 10,000 years after closure of the disposal facility

Note that the same is the case for the Compliance Period. A proper economic or decision analysis performed under ALARA would not require specification of a Compliance Period. However, if a Compliance Period is to be used as an anchor in this way, then a shorter time frame than 10000 yr, for example, 1000 yr, likely corresponds better to the idea of a “foreseeable future”.

Proposed definition:

Site closure and stabilization means those actions that are taken upon completion of operations that prepare the disposal site for custodial care and that assure that the disposal site will remain stable and will not need ongoing active maintenance.

Comments:

It is not clear how such assurance can be provided. The language should be softened to explain the true intent. It is not possible to guarantee (assure) that stability will be maintained and that ongoing active maintenance will not be needed. Inserting the word “reasonably” in front of “assure” would at least make this consistent with other language in the rule.

Proposed definition:

Stability means structural stability.

Comments:

This definition is self-referential, and not particularly useful, even though we realize that the proposed revision is simply to correct a spelling error. The definition begs for discussion. What is the issue, actually? Is it exposure of the waste that is of concern? What about structural changes that do not release waste? What if waste is exposed to the environment through a structural failure but no one is exposed, and there is no dose or risk? Is the concern about stability simply for stability’s sake?

This issue is raised again in 61.7(e) below, which further defines stability as minimizing contact with water (not really a structural stability issue), and also states that stability "isn't necessary from a health and safety standpoint for most waste..." Well, if it is not necessary, what is the need for stability?

Since the regulation is supposed to support risk-informed decision making, it seems that the subject of site stability should also be framed in terms of risk. The basic definition in §§ 61.44 indicates that the intent is to "eliminate to the extent practicable the need for ongoing maintenance of the disposal site following closure, so that only surveillance, monitoring, or minor custodial care are needed". This, by itself, is a far better definition of site stability. Although it would be better again to regulate such that measures of site stability correspond to risk (dose).

§ 61.7 Concepts.

Proposed language:

§ 61.7(a) The disposal facility. [The contents of (1) and (2) are not reproduced here.]

Comments:

Sections 61.7(a)(1) and (2) clearly define the terms "disposal facility", "disposal site", and "disposal unit", but the use of these terms in the entire Part 61 seems to be inconsistent at times. Inconsistencies are identified in the comments below as they are identified. The entire text should be carefully reviewed to assure consistency in the use of these terms.

Proposed text:

§ 61.7(a)(2) ... In choosing a disposal site, site characteristics should be considered in terms of the indefinite future, take into account the radiological characteristics of the waste, and be evaluated for at least a 500-year timeframe.

Comments:

It is not clear what this means. How does this relate to the concept of a Compliance Period or a Performance Period? If a performance assessment is to estimate doses or risks for 10,000 years into the future, why would site characteristics be evaluated for only a 500-yr time frame?

§ 61.7(b) Performance objectives. Disposal of radioactive waste in land disposal facilities has the following safety objectives: protection of the general population from releases of radioactivity, protection of inadvertent intruders, protection of individuals during operations, and ensuring stability of the site after closure. Achieving these objectives depends upon many factors including the design of the land disposal facility, operational procedures, characteristics of the environment surrounding the land disposal facility, and the radioactive waste acceptable for disposal.

Comments:

We think that the concept of an inadvertent intruder should be removed, and the performance assessments should be aimed at doing a reasonable risk assessment. Protection of individuals during operations is handled through worker safety, and site stability can be folded into the risk assessment. Presumably a site is would be judged sufficiently stable if the risks are low enough, or is there another reasonable approach to evaluating site stability?

Protection of the "general population" is called for, but, as pointed out above, this is different from protection of "any member of the public", which is required in § 61.41. Again, a clarification of terms is needed. This seems to imply that the performance assessment should perform a population risk assessment, as opposed to (or perhaps in addition to) an assessment of dose to an individual. This is in concordance with the title of § 61.41: Protection of the general population from releases of radioactivity. That title also seems to suggest that a population dose assessment is in order. As discussed in the comments below for that section, however, this is in conflict with the text within that section, which mentions dose to "any member of the public". The point of this comment is that the "general population" is in practice quite different from "any member of the public". Since § 61.7 discusses concepts, it would be good to clarify the intent of the rule here as well as in § 61.41.

Note that we support the need to perform a population risk (dose) assessment to support decision making, whether performed using the principles of ALARA or otherwise. Ultimately, siting of disposal sites was done by considering population risks.

The proposed text also neglects to identify the significance of human behavior and demographics in the assessment of risk to the general population and inadvertent intruders. These are among the "many factors" that should be mentioned specifically.

Proposed text:

§ 61.7(c)(1) Demonstrating compliance with the performance objectives requires assessments of the site-specific factors including engineering design, operational practices, site characteristics, and radioactive waste acceptable for disposal. ...

Comments:

Demonstrating compliance requires assessment of site-specific factors. How is that reconciled with the evaluation of an inadvertent intruder who represents an exposure scenario that is not reasonable at a particular site? This clause is a step in the right direction, but other parts of the regulation need to catch up. An alternative is to leave it sufficiently vague that the applicant will address sufficiency of the analysis, so long as the analysis can be shown to fit the regulation in some reasonable form (i.e., demonstrate that the analysis is defensible).

Proposed text:

§ 61.7(c)(2) A performance assessment is an analysis that is required to demonstrate protection of the general population from releases of radioactivity.

Comments:

In the following sentences of this section, the term “site” is used twice, as is the term “facility”. Now that these terms have been carefully defined, care should be taken that they are used intentionally in this section. All occurrences in this section should probably use “site”.

Again, the term “general population” is used when it may not be what is actually intended.

The phrase “...that is required to demonstrate...” could be shortened to simply “...that demonstrates...”

Proposed text:

§ 61.7(c)(3) It is possible, but unlikely, that persons might occupy the site and engage in normal pursuits without knowing that they were receiving radiation exposure.

Comments:

This sentence has several problems. First, why is this considered “unlikely”? The likelihood of someone occupying the site (again, “person” is probably misused here, and “occupying” still requires definition) is quite site-specific. The word “unlikely”, used here with no quantification, is rather meaningless. Some waste disposal sites are much more likely to be encountered by humans than others, and some less likely. What is “unlikely” is completely a relative term. The words “but unlikely” should simply be removed, since for all sites future visitation by humans is certainly possible. That said, the idea that receptors have a likelihood of visiting (or occupying) the site is important, and should in fact become part of the site-specific performance assessment. The fact that remote or harsh sites are less likely to be occupied is an important factor. The likelihood of occurrence of a visitation or occupation scenario is less than unity, and this should be taken into account. This occurs naturally if a performance assessment considers the comings and goings of various types of receptors with various attributes and behaviors (the “normal pursuits”. The risk to each individual can thereby be assessed, as can the risk to the entire population of individuals. Of course, these individuals are projected into the future based on current societal conditions, and it would be good to clarify that is how a PA must be conducted – that is, project current conditions/knowledge into the foreseeable future.

In this sentence, persons (labeled “inadvertent intruders”) would not know “that they were receiving radiation exposure”. But at the end of the paragraph for (3), mention is made of “some form of intruder barrier that is intended to prevent contact with the waste.” The problem here is that “receiving radiation exposure” is different from “contact with the waste”. A future human could be some distance from the waste, at least from where it was originally placed, and still be exposed to radiation, while being exposed to radionuclides that have migrated away from the waste, or the progeny of those radionuclides. This begs the question of what is meant by “waste”. Is it the waste form itself as disposed, or is it the radionuclides that were at one time part of the waste? This lack of firm definition plagues the bulk of Part 61. These details may seem trivial to the casual reader, but they are critical to the analyst who must develop assessments that address the performance objectives in detail.

And, we again suggest removing inadvertent intrusion as a concept, and replacing with the need for a site-specific risk assessment, which should include human intrusion into the waste if that is

part of reasonable site-specific exposure scenarios. This would simply mean removing §§ 61.42 and revising §§ 61.41 towards a risk assessment.

Proposed text:

§ 61.7(c)(4) Demonstrating protection of inadvertent intruders requires an assessment of potential radiological exposures should an inadvertent intruder occupy the disposal facility following a loss of institutional controls after closure.

Comments:

This sentence is essentially tautological, since an inadvertent intruder, by definition, occupies the disposal site (not "the disposal facility", mind you) after the loss of institutional control, which also by definition occurs after closure. Note that institutional control applies to the site, but not to the facility.

Proposed text:

§ 61.7(c)(4) [continued] An intruder assessment can employ a similar methodology to that used for a performance assessment, but the intruder assessment must assume that an inadvertent intruder occupies the disposal site following a loss of institutional controls after closure, and engages in activities that unknowingly expose the intruder to radiation from the waste.

Comments:

This introduces yet another spin on the concept of future humans encountering radiation. Here, the intruder might unknowingly be exposed to "radiation from the waste". This continues to beg the question of what the waste is, where the radiation might be. Do radionuclides that have migrated away from the waste into the environment constitute "radiation from the waste"?

This also suggests that an intruder assessment is a different analysis from a performance assessment. This is indeed a new concept, as intruder analysis has always been part of performance assessments in the past. Is the applicant expected to develop separate analyses, and even separate documents, for an intruder assessment and a performance assessment?

This language also appears to require that an intruder assessment be performed at a site as if the scenario will happen. That is, a probability of 1. Is this the intent? If so, how is this reconcilable with the requirement to evaluate site-specific factors in § 61.7(c)(1), and the implication that there is a likelihood to occupation hinted at in § 61.7(c)(3)?

We recommend that this proposed text be removed.

Proposed text:

§ 61.7(c)(5) Waste with significant concentrations and quantities of long-lived radionuclides may require special processing, design, or site conditions for disposal. Demonstrating protection of the general population from releases of radioactivity and inadvertent intruders for [?] the disposal of this waste requires an assessment of long-term impacts.

Comments:

This is an example of vague language that is not helpful in a regulation. What does “significant concentration and quantities” mean? How is the significance evaluated except by performing an assessment of long-term impacts? It seems that the assessment must be done in order to determine if the assessment must be done. “Concentration” could mean concentration in the waste form, or in environmental media such as water, air, soil, or rock. “Quantities” could refer to activities, masses, or volumes. Perhaps what is really meant is that for any disposed waste, an assessment should be done in order to determine the long-term (and indeed short-term) impacts, and special processing, design, or site conditions should be modified in order to mitigate unacceptable impacts. If the assessment is to be performed anyway, then just say that the assessment must be performed.

The rest of § 61.7(c)(5) continues in this vein, discussing “limited quantities of long-lived waste”. It says that “...conditions should be evaluated on a case-by-case basis to determine whether analyses beyond the compliance period would be required.” It seems to say than an evaluation should be done in order to determine if an analysis should be done. Again, just rely on the performance assessment for the analysis and be done with it, and require that the performance assessment actually conduct a risk assessment.

And, again we have yet another variation in wording regarding what we are protecting against. In this case, we are to protect the general population from “releases of radioactivity.” Is the general population to be protected only from radioactivity that is released from the waste? What happens in cases where the general population comes into direct contact with the waste (which can happen in certain scenarios)? And further, the distinction between the “general population” and an “inadvertent intruder” becomes blurred.

Proposed text:

§ 61.7(d) Waste acceptance. Demonstrating compliance with the performance objectives also requires a determination of criteria for the acceptance of waste. The criteria can be determined from the results of the site-specific analyses that demonstrate compliance with the performance objectives for any land disposal facility or, for a near-surface disposal facility, the waste classification requirements of Subpart D of this part.

Comments:

The need for a site-specific assessment is indicated for specification of waste acceptance criteria (WAC). This continues the confusion in the document that sometimes default (intruder) scenarios are required, and sometimes site-specific analyses are required. This can all be cleaned up by simply requiring that a risk assessment be performed with associated Performance Objectives. (We presume the difficulty with such an approach is the waste classification tables and associated derivation that exist in the current regulation, and that apparently need to be maintained at this time. If that is the case, then the clean up that is needed can refer to intruders, for example, for specific evaluation but on a site-specific basis.)

Proposed text:

§ 61.7(e)(1) A cornerstone of the waste classification system is stability—stability of the waste and the disposal site—which minimizes the access of water to waste that has been emplaced and covered. Limiting the access of water to the waste minimizes the migration of radionuclides, which may avoid the need for long-term active maintenance and reduces the potential for release of radioactivity into the environment. While stability is desirable, it isn't necessary from a health and safety standpoint for most waste because the waste doesn't contain sufficient radionuclides to be of concern.

Comments:

This seems contradictory, in saying that stability is both a cornerstone of the waste classification system and that stability is not necessary. It also extends the original definition of "stability" (in 61.2, which says that stability means "structural stability") to claim that stability minimizes the access of water to waste. This seems to be confusing different concepts. Structural stability means that the site will not collapse, as in subside or erode—that it will retain its shape and strength. That really has little to do with keeping water out. Further, this focus on water belies a humid site bias—that water is universally the most significant process for contaminant transport in radioactive waste disposal. There are sites where water has a minor or even insignificant role to play—where, for example, biotically-induced transport or gas phase diffusion is of far greater significance than waterborne transport.

Structural stability has another unspoken but much more significant role: It keeps the waste from being exposed to the environment and especially from being directly exposed to human receptors. That function of stability is not even mentioned in this section.

It is somewhat jarring to read that "most waste ... doesn't contain sufficient radionuclides to be of concern." If that is the case, when what is all the fuss about in creating regulations for it in the first place? Perhaps this is just a confusion generated by poor presentation of context, however, as this section eventually seems to identify the waste under discussion as Class A waste, in the next part.

Why is site stability an issue? If it's tied to potential risk (dose), then that could make sense. But requiring stability with no metrics does not make sense, and the metrics should be dose or perhaps long term costs. The language in §§ 61.44 already provides the necessary impetus for framing site stability in the context of risk (dose): "The disposal facility must be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required."

Proposed text:

§ 61.7(e)(1) [continued] This low-activity waste (e.g. ordinary trash-type waste) tends to be unstable, which can become a problem with high activity waste of long-lived low-activity waste. If lower activity waste is mixed with the higher activity waste, the deterioration of unstable waste could lead to the failure of the system. The failure of the system could permit water to penetrate the disposal unit, which may cause problems with higher activity waste..

Comments:

This further confuses concepts. The real concern seems to be stability, which again is couched in terms of water even though it should not be assumed that water is the principal mode of contaminant transport at any given site. But, water aside, stability of the system (meaning the site, one presumes) may be compromised by unstable waste. Fair enough—so the operator should not mix structurally unstable waste with structurally stable waste. Activity has nothing to do with it, except that apparently we are not to be overly concerned with unstable low-activity waste, since it is not “of concern”. If the classification of waste is driven by stability, which this section seems to imply, then let it be defined by stability, and not by concentration of specific radionuclides. Having classification tables based on radionuclide concentrations does not make sense if the real driving factor is structural stability of the wastes. Also, a properly formed risk assessment would take care of all of this, since it should factor in stability of waste.

Isn’t “ordinary trash-type waste” what goes in a municipal landfill? This term is undefined and potentially misleading.

The language in this section goes on to discuss unstable Class A waste as opposed to stable Class A waste, but makes no formal definitions of what “stability” means. § 61.2 defines stability only as “structural stability”, which is a pretty useless definition. Here, at least somewhat more of a definition is provided “”to maintain gross physical properties and identity [for] over 300 years.” And, is this “stability” meant to apply to the waste form itself, or to the disposal unit (or perhaps even disposal site) as a whole?

In general, waste classification is an anachronism that needs to be abandoned at some point. The classification scheme is no longer necessary, now that site-specific risk assessments can be performed fairly routinely.

Proposed text:

§ 61.7(e)(1) [continued] The stability of long-lived waste may be more uncertain and require more robust technical evaluation of the processes that are unlikely to affect the ability of the disposal system to isolate short-lived waste.

Comments:

Again, are we concerned with the stability of the waste itself, or that of the disposal system (disposal unit or site)? What does stability of the waste imply here? Is this relative to migration potential? Again, lots of concepts not clearly separated in here.

Proposed text:

§ 61.7(e)(1) [continued] For long-lived waste and certain radionuclides prone to migration, a maximum disposal site inventory based on the characteristics of the disposal site may be established to limit potential exposure.

Comments:

This seems to imply the need for site-specific assessment again, but that is not made clear. It also ties site stability with risk for the first time (limit potential exposure). This idea should be expanded upon, and site stability as a concept should be tied to risk (dose).

Proposed text:

§ 61.7(e)(2) Institutional control of access to the site is required for up to 100 years. This permits the disposal of Class A and Class B waste without special provisions for intrusion protection, since these classes of waste contain types and quantities of radioisotopes that will decay during the 100-year period and will present an acceptable hazard to an intruder.

Comments:

If Class A and Class B wastes are so benign, one might ask rhetorically, then why is a performance assessment needed? It seems that this clause needs to be revised, especially since depleted uranium (DU) is currently (and apparently will continue to be, following these proposed revisions) considered a Class A waste. If Class A waste disposal is basically no more than a landfill, then why are all of these protections implied in this regulation being taken at great cost to the taxpayer? The regulation should be grossly simplified if this is the case.

Since DU is still defined as a Class A waste after all these revisions, it is not accurate to state that "these classes of waste contain types and quantities of radioisotopes [*sic*] that will decay during the 100-year period and will present an acceptable hazard to an intruder".

On an editorial note, the word "radioisotopes" should be replaced with "radionuclides" to maintain consistency with the rest of the rule and to be correct. Usage of "radioisotopes" should be restricted to discussions of actual isotopes (which by definition are all the same chemical element).

Proposed text:

§ 61.7(e)(3) Waste that will not decay to levels that present an acceptable hazard to an intruder within 100 years is designated as Class C waste. Class C waste must be stable and be disposed of at a greater depth than the other classes of waste so that subsequent surface activities by an intruder will not disturb the waste. Where site conditions prevent deeper disposal, intruder barriers such as concrete covers may be used. The effective life of these intruder barriers should be 500 years.

Comments:

The choice of 500 years for the effective life of a concrete barrier seems arbitrary. Concrete materials will often last much longer than this, but at any rate will last longer in some environments than others. As part of a site-specific performance assessment, it seems that a given site should take into consideration whatever local conditions dictate the effective life would be. In general, arid sites will enjoy longer effective life for cementitious materials than will humid sites, and this difference, like so many other site-specific differences, should be take into account in the performance assessment. Specifying that they should be effective for 500 years is just another example of subverting the goal of using site-specific information to support

a performance assessment. Perhaps this could be rephrased to “at least 500 years”.

If it is true that “waste that will not decay to levels that present an acceptable hazard to an intruder within 100 years is designated as Class C waste”, how is DU not a Class C waste? It decays to levels that are increasingly hazardous for over 2 million years. “Decay” does not imply a reduction in hazard.

It is also not clear why Class C waste must be disposed at greater depth. This statement is too general. A performance assessment should be performed, no matter the waste stream, to determine if a waste stream can be disposed in a given disposal configuration or engineered system. This also seems to presume that the pathway of interest is unvaryingly upwards. This might not be the case—for example, it is not clear that disposing deeper in a system that has potable groundwater at, say 5 meters below ground surface, would make sense.

Proposed text:

§ 61.7(e)(3) [continued]... Disposal of this waste will be evaluated on a case-by-case basis with the long-term analyses required in § 61.13(e).

Comments:

The language in this clause also implies that a performance assessment with a Compliance Period of 10,000 years is totally unnecessary for anything other than waste that is greater than Class C. How does this address the issue of DU, or large quantities of Tc-99 or I-129 for example (which are classified only by concentration, not quantity)? Why are the many details of this regulation necessary for anything other than greater than Class C waste given this clause? Again, all of this would be simplified if the regulation simply required a site-specific risk assessment. And, that would be easier to communicate.

Proposed text:

§ 61.7(e)(4) Regardless of the classification, some waste may require enhanced controls or limitations at a particular land disposal facility to provide reasonable assurance that the waste will not present an unacceptable risk over the compliance period. A performance assessment and an intruder assessment are used to identify these enhanced controls and limitations, which are site-and waste-specific. Enhanced controls or limitations could include additional limits on waste concentration or total activity, more robust intruder barriers (such as burial below 30 meters), and waste-specific stability requirements. These enhanced controls or limitations could mitigate the uncertainty associated with the evolutionary effects of the natural environment and the disposal facility performance over the compliance period.

Comments:

This newly introduced clause appears to have been written to accommodate DU. The same general concepts should be applied to all waste, however, since this clause is essentially requiring that a site-specific performance assessment be performed. The intruder assessment is also site-specific according to this language. Again, simplification of the regulation to require a properly formed probabilistic risk assessment would avoid the need for so many clauses, and

would facilitate better communication.

Proposed text:

§ 61.7(f)(3) During the period when the final site closure and stabilization activities are being carried out, the licensee is in a disposal site closure phase. Following that, for a period of five years, the licensee must remain at the disposal site for a period of post-closure observation and maintenance to assure that the disposal site is stable and ready for institutional control. The Commission may approve shorter or require longer periods if conditions warrant. At the end of this period, the licensee applies for a license transfer to the disposal site owner.

Comments:

In the context of a 10,000-year Compliance Period, it is not clear how it is helpful to have a five-year post-closure period. In general, the language in § 61.7(f) is very vague. Time frame is not well defined, and the nature and intent of the monitoring program is not well defined. It might be better to use some of the concepts from the DOE and from NUREG/CR-6948 on long-term PA maintenance, reduction in uncertainty, etc. to provide a technical framework and basis for long term monitoring and maintenance.

Proposed text:

§ 61.7(f)(4) After a finding of satisfactory disposal site closure, the Commission will transfer the license to the State or Federal government that owns the disposal site. If the Department of Energy is the Federal agency administering the land on behalf of the Federal government the license will be terminated because the Commission lacks regulatory authority over the Department for this activity. Under the conditions of the transferred license, the owner will carry out a program of monitoring to assure continued satisfactory disposal site performance, physical surveillance to restrict access to the site, and carry out minor custodial activities. During this period, productive uses of the land might be permitted if those uses do not affect the stability of the site and its ability to meet the performance objectives. At the end of the prescribed period of institutional control, the license will be terminated by the Commission.

Comments:

In this section, a "program of monitoring to assure continued satisfactory disposal site performance" is specifically mentioned. NRC would do well to broaden the concept of monitoring to encompass more than simply sampling for radionuclides that are headed for the fence line. As pointed out in NUREG/CR-6948, monitoring can and should include key elements of those processes that are known to be sensitive in the performance assessment in contributing to migration of radionuclides, and ultimately to receptor exposures. This could include, for example, monitoring for excessive water content in unsaturated materials, or a particularly dense population of deeply-rooted plants, if these are known to contribute to human exposures. This is addressed further in § 61.12(l).

If a decision analysis structure based on a properly formed risk assessment were required, then all decisions concerning disposal of radioactive waste could be optimized (disposal, closure) and long term monitoring programs could be designed with stopping rules. Otherwise, long-term

monitoring could continue indefinitely. As such, the performance assessment would become the decision document that it should be.

What happens to the site after the license has been "terminated by the Commission"? Is it assumed that the site poses no further risk to the public? How can the license ever be terminated in a case where risks continually grow in time, such as for the disposal of DU?

Proposed text:

§ 61.7(g) Implementation of dose methodology. The dose methodology used to demonstrate compliance with the performance objectives of this part shall be consistent with the dose methodology specified in the standards for radiation protection set forth in Part 20 of this chapter. After the effective date of these regulations, applicants and licenses may use updated factors, which have been issued by consensus scientific organizations and incorporated by the U.S. Environmental Protection Agency into Federal radiation guidance. Additionally, applicants and licensees may use the most current scientific models and methodologies (e.g., those accepted by the International Commission on Radiological Protection) appropriate for site-specific circumstances to calculate the dose. The weighting factors used in the calculation of the dose must be consistent with the methodology used to perform the calculation.

Comments:

Exactly how does the dose methodology relate to "reasonable assurance that the waste will not present an unacceptable risk"? Again, the terms "dose" and "risk" are assumed to be equivalent, and yet they are not. Risk, which we agree should be the proper metric for assessment and compliance, includes more than just dose. For example, many radioactive wastes contain uranium, or decay to lead, both of which present toxicity risks to exposed humans. Since they are part of the waste, either as disposed or through decay, the risk presented by the waste should include this toxicity. If NRC wishes to ignore toxicity risks presented by substances that are integral to the waste (e.g. uranium and lead) then it should restrict its language in Part 61 (and perhaps indeed in Title 10) to the language of dose, not risk. These are conceptually different.

This section also seems out of place here after the discussion on closure and monitoring under institutional control. It should be moved up, and everything else moved down.

§ 61.12 Specific Technical Information

Proposed text:

§ 61.12(a) A description of the natural and demographic disposal site characteristics as determined by disposal site selection and characterization activities. The description must include geologic, geotechnical, geochemical, geomorphological, hydrologic, meteorologic, climatologic, and biotic features of the disposal site and vicinity.

Comments:

The second sentence should also include the word "demographic". We also suggest adding this sentence: "These features, events, processes, and exposure scenarios must be related to their

respective roles in both migration of and human exposure to radionuclides originating in the disposed waste."

Proposed (existing) text:

§ 61.12(b) ... For near-surface disposal, the description must include those design features related to infiltration of water; integrity of covers for disposal units; structural stability of backfill, wastes, and covers; contact of wastes with standing water; disposal site drainage; ...

Comments:

Somewhere in there should also be added "occurrence and activity of biota;".

Proposed (existing) text:

§ 61.12(e) A description of codes and standards which the applicant has applied to the design and which will apply to construction of the land disposal facilities..

Comments:

Change first occurrence of "which" to "that". This particular grammatical error seems to have been proposed for revision on other parts of Part 61. This one should be changed, too.

Proposed (existing) text:

§ 61.12(g) A description of the disposal site closure plan, including those design features which are intended to facilitate disposal site closure and to eliminate the need for ongoing active maintenance.

Comments:

Is should be acknowledged that in some cases it is not possible to "eliminate the need for ongoing active maintenance" (e.g. for wastes that pose ever-increasing risks). NRC should acknowledge that there will be cases when sites require perpetual maintenance.

Also, change "which" to "that".

Proposed (existing) text:

§ 61.12(j) A description of the quality assurance program, tailored to LLW disposal, developed and applied by the applicant for the determination of natural disposal site characteristics and for quality assurance during the design, construction, operation, and closure of the land disposal facility and the receipt, handling, and emplacement of waste.

Comments:

Of equal importance is the quality assurance applied to the performance assessment (and intruder assessment, if this is to exist). Language should be added to this effect.

Proposed (existing) text:

§ 61.12(l) A description of the environmental monitoring program to provide data to evaluate potential health and environmental impacts and the plan for taking corrective measures if migration of radionuclides is indicated.

Comments:

As mentioned above in the discussion of § 61.7(f)(4), NUREG/CR-6948 demonstrates that monitoring can and should include key elements of those processes that are known to be sensitive in the performance assessment in contributing to migration of radionuclides, or more to the point, risks to future humans.

The change to § 61.12(l) that we would recommend, then, is to include more than simply monitoring for the migration of radionuclides. Once a sensitivity analysis of a probabilistic performance assessment is completed, the most significant features, events, processes, (FEPs) and exposure scenarios (FEPSs) in contaminant transport and human exposure can be identified, and it is these FEPSs that can be monitored (perhaps indirectly) to flag conditions that would lead to migration of radionuclides. It is best to mitigate migration pathways before migration has occurred. Language to this effect could be added to this section.

§ 61.13 Technical Analyses

Proposed text:

§ 61.13(a)(1) Consider only features, events, and processes that might affect demonstrating compliance with § 61.41(a).

Comments:

This language implies a scoping analysis, commonly known as a FEPs analysis. We would modify the language to include phenomena related to human exposures, as in “features, events, processes, and exposure scenarios”.

Proposed text:

§ 61.13(a)(2) Consider the likelihood of disruptive or other unlikely features, events, or processes for comparison with the limits set forth in § 61.41(a).

Comments:

We agree that consideration of likelihood of specific FEPS in scoping, as well as in site-specific performance assessment, is critical. The question is, how to evaluate the likelihood, and how to use it to screen out FEPs. For Yucca Mountain, for example, the likelihood was quantified to justify omission of some FEPs. The question remains here of what exactly is being required.

Again, we would suggest modifying the language to include “features, events, processes, and exposure scenarios”.

Consequence should also be considered. If the consequence is very small, then a high likelihood

(probability) will not matter to the overall performance. However, it also raises the issue of how to measure and evaluate consequence. This can only be done formally in the context of using performance assessment as a decision analysis.

Proposed text:

§ 61.13(a)(3) Provide a technical basis for either inclusion or exclusion of degradation, deterioration, or alteration processes (e.g., of the engineered barriers, waste form, site characteristics) and interactions between the disposal facility and site characteristics that might affect the facility's ability to meet the performance objective in § 61.41(a).

Comments:

It's not clear why this is being separated out, as this is a natural part of the FEPs scoping process. It could be eliminated because it is already covered by the FEPs process additions, and because Part 61 is meant to be regulation, not guidance. This entire section has become guidance it seems. The regulation would be better served by requiring a reasonable risk assessment (which should naturally include a scoping analysis) and providing performance objectives for comparison. This type of technical guidance should be removed.

If it is to remain, the word "naturalization" should be added after "degradation", since it does not have a negative connotation. As discussed extensively during the NRC Workshop on Engineered Barriers in August 2010, the change of engineered barriers (and other parts of the system) to move toward natural conditions is not always detrimental to performance, and in any case must be recognized.

Proposed text:

§ 61.13(a)(4) Provide a technical basis for models used in the performance assessment such as comparisons made with outputs of detailed process-level models or empirical observations (e.g., laboratory testing, field investigations, and natural analogs).

Comments:

This is a surprise as well. Why is this in the regulation? It is worthwhile, but not as part of the regulation. This is technical guidance.

It also would be good to specify what sorts of models are meant, here. It seems that it would mean computational models, but it could apply to conceptual models or mathematical models as well. Perhaps it should.

Proposed text:

§ 61.13(a)(5) Evaluate pathways including air, soil, groundwater, surface water, plant uptake, and exhumation by burrowing animals.

Comments:

There is a mix of categories, here. Some of these are contaminant transport processes (plant

uptake and exhumation by burrowing animals) but the others (air, soil, ground water, and surface water) are environmental media, rather than pathways or processes. Contaminant transport processes within these media might be diffusion, advection, chemical partitioning, etc. This distinction could be made. One drawback to include these, and only these, is that the list may become dated. As we learn more about the world of radionuclide contaminant transport, we find previously unknown or at least underappreciated mechanisms. For example, the only biotic pathways mentioned here are for plants and animals, but the potentially significant roles of mycological and microbiological entities are only now beginning to be appreciated.

Again, this is technical guidance and not regulation (it opens the door to dealing with biota, which is a good thing, but should be in guidance rather than regulation). As such, its presence in the regulation may not be appropriate. If it is retained, it should use more general language, rather than calling out specific mechanisms or materials.

Change “groundwater” to “ground water” in keeping with established NRC style.

Proposed text:

§ 61.13(a)(6) Account for uncertainties and variabilities in the projected behavior of the disposal system (e.g., disposal facility, natural system, and environment).

Comments:

This appears to be requiring a probabilistic performance assessment. However, nothing else in the regulation explicitly requires this. Obviously, we think this is needed, but some other adjustments to the regulation are really needed to go along with this.

As a companion section, we would also propose the following (to follow § 61.13(a)(6):

§ 61.13(a)(6½) Account for uncertainties and variabilities in the projected demographics and behavior of human receptors.

Since the principal performance objectives for future humans is one of dose (or risk) to any member of the public (and/or to the general population), uncertainties and variabilities in the human element must be considered. These have the potential to be of greater significance than disposal system behavior in determining the risk and its uncertainty.

Proposed text:

§ 61.13(a)(7) Consider alternative conceptual models of features and processes that are consistent with available data and current scientific understanding, and evaluate the effects that alternative conceptual models have on the understanding of the performance of the disposal facility.)

Comments:

In addition to alternative conceptual models, alternative implementations as mathematical models could be considered (e.g. various representations of porous medium tortuosity). This

could further be extended to alternative computational modeling implementations. The same system could be modeled as a system model, or as a process model using finite-difference, finite-element, or some other discretization paradigm. Solutions could be implicit, explicit, or hybrid. All of these variations could produce somewhat different results, and all will no doubt evolve as better technologies are developed. The question is how far do we want to take this evaluation of alternative approaches? Perhaps the proposed language is sufficient.

At any rate, this is guidance, not regulation. It is not useful for the regulation to instruct analysts to merely “consider” an approach, but it would also be inappropriate to here require that specific approaches be tried.

If this section is to remain, then we would further suggest that “features and processes” be expanded to “features, processes, and exposure scenarios” so that alternative conceptualizations of the human element would be considered.

Proposed text:

§ 61.13(a)(8) Identify and differentiate between the roles performed by the natural disposal site characteristics and design features of the disposal facility in limiting releases of radioactivity to the general population.

Comments:

While this is an important activity to be performed as part of performance assessment, this is again guidance, not regulation.

Proposed text:

§ 61.13(b) Analyses of the protection of inadvertent intruders that demonstrate there is reasonable assurance the waste acceptance criteria developed in accordance with § 61.58 will be met, adequate barriers to inadvertent intrusion will be provided, and any inadvertent intruder will not be exposed to doses that exceed the limits set forth in § 61.42(a) as demonstrated in an intruder assessment. An intruder assessment shall:

(1) Assume that an inadvertent intruder occupies the disposal site at any time during the compliance period after the period of institutional controls ends, and engages in normal activities including agriculture, dwelling construction, resource exploration or exploitation (e.g., well drilling), or other reasonably foreseeable pursuits that unknowingly expose the intruder to radiation from the waste.

(2) Identify adequate barriers to inadvertent intrusion that inhibit contact with the waste or limit exposure to radiation from the waste, and provide a basis for the time period over which barriers are effective.

(3) Account for uncertainties and variabilities.

Comments:

NRC is moving in the wrong direction with respect to assessing inadvertent intrusion. It’s not

that inadvertent intrusion should not be evaluated—it must be—but rather that it be considered fundamentally different from other types of site occupation. Rather than develop or suggest particular scenarios as done in (1) above, and rather than develop a separate "intruder assessment," a site-specific performance assessment can cover all of this by evaluating likely future scenarios of who might occupy the site and what they might be doing. It must be recognized that agriculture, dwelling construction, and resource development are not universally normal activities. There could be disposal sites where none of these would be considered likely enough to survive a scoping analysis, let alone become part of a model. On the other hand, there are sites where all of these could happen, although with some likelihood that is probably less than 1 every year for in 10,000 years. There are still other activities that could lead to future waste releases or exposures, but would not of themselves be considered intrusive. The variation in likely activities between sites is part of what makes them different, and is important information for a site-specific performance assessment to incorporate.

Future humans who would intrude inadvertently into the waste should be considered just as any future member of the public would be considered, and with the same dose or risk metrics. However, the likelihood of any activity should also be considered, as the risk to future individuals is consolidated into a composite risk for the general population. There will be some individuals who experience greater exposures through their behavior or the activities of others, and there will be differences in how each individual responds to a given exposure. The language of risk to the general population and to any member of the public has been in Part 61 all along, but it has never been adequately spelled out. More of this discussion follows in comments to § 61.41 below.

Under our recommendation it would still be possible to distinguish between receptors that are deemed MOP or IHI, but only for the purpose of comparison to the appropriate performance objective. This would, however, assume that an inadvertent intruder should not be as protected as a MOP, which might not make sense when performing a proper risk (dose) assessment.

Proposed text:

§ 61.13(e) Analyses that assess how the disposal facility and site characteristics limit the potential long-term radiological impacts, consistent with available data and current scientific understanding. The analyses shall only be required for land disposal facilities with long-lived waste that contains alpha-emitting radionuclides with average concentrations exceeding 10 nCi/g or radionuclides with average concentrations exceeding one tenth of the values listed in Table 1 of § 61.55, or if necessitated by site-specific factors including engineering design, operational practices, and site characteristics. The analyses must identify and describe the features of the design and site characteristics that will demonstrate that the performance objectives set forth in §§ 61.41(b) and 61.42(b) will be met.

Comments:

This appears to be asking for a "deep-time" analysis, meaning one that evaluates the fate of long-lived radionuclides and their progeny long after the compliance and performance periods have passed. That can be done, though as time progresses the uncertainties in performance-related processes should overwhelm the analysis (the only reason they do not is that all models project

out current societal conditions/knowledge into the indefinite future—it is not clear that this should be required beyond what might be termed the “foreseeable future”). But the fate of radionuclides and their progeny is not a “performance objective”, which would imply a peak risk or dose to humans. If uncertainty in the future of physical processes is uncertain, uncertainties in demographics, behaviors, and even physiology of humans in the distant future are even greater. Long-term radiological impacts of the sort implied by the performance objectives presented in this part are difficult to estimate with any certainty, and are more difficult to defend.

§ 61.41 Protection of the general population from releases of radioactivity

Proposed text:

§ 61.41(a) Concentrations of radioactive material that may be released to the general environment in ground water, surface water, air, soil, plants, or animals must not result in an annual dose exceeding an equivalent of 0.25 milliSievert (25 millirems) to any member of the public within the compliance period. Reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable during the compliance period. Compliance with this paragraph must be demonstrated through analyses that meet the requirements specified in § 61.13(a).

(b) Reasonable effort should be made to maintain releases of radioactivity from a disposal facility to the general environment as low as reasonably achievable at any time during the performance period. Compliance with this paragraph must be demonstrated through analyses that meet the requirements specified in § 61.13(e).

Comments:

This is a welcome direct invocation of ALARA, which is appropriately applied to assessments of dose (or risk) to the general population. But while the term “general population” is used in the title, the text of this section uses the phrase “any member of the public”. These are conceptually different. If we are to accept the phrase “any member of the public” at face value, then this implicitly means that the most vulnerable members of the public should be protected. This would include children, for example, who generally incur higher risks from exposure to radionuclides in the environment than do adults, due to both behavioral and physiological differences.

In performing a risk assessment of the general population, such members of the public should be considered, as should anyone else deemed to be exposed to radionuclides disposed at the site. This is where the so-called “inadvertent intruder” can be included as well, as a member of the public (i.e., as a potential receptor), rather than couched in some distinct assessment. The proper way to go about doing a population risk assessment is to consider who the receptors would be, what activities they would be pursuing, and what exposures they would encounter. Each receptor has its own likelihood of encountering radioactivity, for different amounts of time, in different exposure media, and with different physiological responses based on age, for example, as outlined in ICRP documents. This approach evaluates risks to each individual member of the public as well as the general population, and is required to satisfy the language of the title and text of this section.

Note this section also acknowledges a role for the compliance period. This means that zero discounting of risk or dose is allowed up to the compliance period, followed by complete discounting thereafter. We might suggest a smoother discounting function than this 0/1 step function. In general, a discounting function should be developed site-specifically to take into account the desires of the local potentially affected population. Discounting should not be construed negatively—it is simply a mechanism for deciding when to use available resources for further evaluation.

The same comments (see response to § 61.13(a)(5)) about using language that considers only part of the biotic spectrum applies here as well.

An additional problem is presented with the use of the term "effluents" in § 61.41(a). It seems to be assumed that the only mechanisms for the migration of radionuclides from the waste into the larger environment involves effluents, but this is not the case. Plants translocate chemicals (including radionuclides) within their tissues, though the fluids in plant tissues might be considered effluents. Burrowing animals move bulk soils, which are not effluents. Erosion can cause bulk movement of solid materials as well—again, not effluents. Atmospheric dispersion transports radionuclides from the ground surface that are not "effluents". Perhaps this language can be remedied by substituting something like "...effluents and other mechanisms of contaminant transport...". Alternatively, a sentence structure could be used that does not use the word "effluents" at all, as in § 61.41(b).

§ 61.42 Protection of inadvertent intruders

Proposed text:

§ 61.41(a) Design, operation, and closure of the land disposal facility must ensure protection of any inadvertent intruder into the disposal site who occupies the site or contacts the waste at any time after active institutional controls over the disposal site are removed. The annual dose must not exceed 5 milliSieverts (500 millirems) to any inadvertent intruder within the compliance period. Compliance with this paragraph must be demonstrated through analyses that meet the requirements specified in § 61.13(b).

(b) Reasonable effort should be made to maintain exposures to any inadvertent intruder as low as reasonably achievable at any time during the performance period. Compliance with this paragraph must be demonstrated through analyses that meet the requirements specified in § 61.13(e).

Comments:

This language clarifies the allowable dose to an inadvertent intruder, but still we have members of the public who might be considered intruders who "fall through the cracks". Consider the case where an initial visitor to the site causes a disturbance to the engineered or natural barriers, and a later visitor is exposed to radioactivity. The initial visitor is not considered an intruder by the definition in this part, since s/he does not actually come into contact with the waste. Assume that this initial disturbance, however, compromises the integrity of the site in such a way that it causes radioactivity to be released after some time. A later visitor to the site, who would be a

member of the public because s/he would cause no disturbance of the site, could be exposed to that released radioactivity, or conceivably to the waste itself. How is this case to be considered given the definitions of “inadvertent intruder” and “member of the public” in this part? Here we have what seems to be an inadvertent intruder who is not exposed and a member of the public who could come into direct contact with the waste.

It would be far more straightforward to dispense with these definitions, and consider this receptor as someone who should be protected to the standard presented in § 61.41: with an annual dose not to exceed 0.25 mSv.

§ 61.58 Waste Acceptance

Proposed text:

§ 61.58(a)(1) Allowable activities and concentrations of specific radionuclides. Allowable activities and concentrations shall be developed from the technical analyses required by either § 61.13 for any land disposal facility or the waste classification requirements set forth in § 61.55 for a near-surface disposal facility.

Comments:

The only way to determine “allowable activities and concentrations of specific radionuclides” is to develop a site-specific performance assessment. Even with that support, a classic problem in developing waste acceptance criteria (WAC) is the non-unique solution of the sum-of-fractions. Further, with the incremental disposal of wastes, the remaining capacity for future wastes changes, thence changing the universe of wastes that can be accepted. Ideally, the criteria for the acceptance of waste would change with each disposal, reflecting the amount of remaining radiological capacity. This is not practical, however, as it is problematic for generators and operators both to have to contend with a “moving target” of WAC.

A more practical approach, then, is to have a sub-optimal working WAC that serves to ensure that the site does not accept more waste than its performance assessment would allow. In addition to meeting a standard WAC, candidate wastes that might not meet the WAC could also be considered on a case-by-case basis. Further, allowance should be made that a WAC be updated periodically, so that a site may be fully utilized. It would be better, then, to have as part of a license application, a defined methodology for developing a WAC, rather than the specific allowable activities and concentrations of radionuclides. The method may not change, but the allowable amounts will, and it would be beneficial to be able to make those changes without requiring license amendments. As long as the performance objectives for dose or risk are met, that should be sufficient.

Proposed text:

§ 61.58(b) Waste characterization. Each applicant shall provide, for Commission approval, acceptable methods for characterizing the waste for acceptance. The methods shall identify the characterization parameters and acceptable uncertainty in the characterization data. The following information, at a minimum, shall be required to characterize waste:

(1) Physical and chemical characteristics;
(2) Volume, including the waste and any stabilization or absorbent media;
(3) Weight of the container and contents;
(4) Identities, activities, and concentrations;
(5) Characterization date;
(6) Generating source; and
(7) Any other information needed to support the technical analyses set forth in § 61.13.

Comments:

This gets to the practical approach of defining a methodology. It is good to require “acceptable methods for characterizing waste for acceptance”, and the data required are reasonable for supporting development of a WAC, in addition to a site-specific performance assessment. Since these data will change as disposal operations proceed, however, it is not sensible to require the data itself as part of a license application. It is reasonable to indicate that these data could be made available, and it is reasonable to indicate how the data would be used in developing a WAC.

Section 61.58 (b)(7) asks for “any other information”, leading to two issues that we think need to be addressed in waste manifesting. Those are lower limits of detection (LLDs) and general reporting of concentrations that are greater than necessary, because they are often reported at a disposal site’s waste concentration limit (part of a site’s WAC). This over-estimation of inventory limits disposal capability. Perhaps some clarification is needed of the intent of (7).

Proposed text:

§ 61.58(c)(1-4) Waste certification. Each applicant shall provide, for Commission approval, a program to certify that waste meets the acceptance criteria prior to receipt at the disposal facility. [...]

Comments:

We interpret this as asking for a program that will need to be statistically based in order to justify that the waste that is accepted is properly characterized for disposal. We are pleased that NRC encourages better characterization and specification of waste concentrations so that disposal can be more effectively managed. With improved characterization and manifesting, including appropriate reporting of LLDs, radioactive waste disposal resources can be better utilized.

This concludes comments from Neptune and Company, Inc. on the proposed revisions to 10 CFR 61.