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(202) 234-4433

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UNITED STATES NUCLEAR REGULATORY COMMISSION'S
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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712TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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OPEN SESSION

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WEDNESDAY

FEBRUARY 7, 2024

The Advisory Committee met via hybrid In-Person and Video-Teleconference, at 1:00 p.m. EST, Walter L. Kirchner, Chairman, presiding.

COMMITTEE MEMBERS:

WALTER L. KIRCHNER, Chairman

GREGORY H. HALNON, Vice Chairman

DAVID A. PETTI, Member-at-Large

RONALD G. BALLINGER, Member

CHARLES H. BROWN, JR., Member

VICKI M. BIER, Member

VESNA B. DIMITRIJEVIC, Member*

JOSE MARCH-LEUBA, Member

ROBERT P. MARTIN, Member

THOMAS E. ROBERTS, Member

DESIGNATED FEDERAL OFFICIAL:

DEREK WIDMAYER

ALSO PRESENT:

DAVID ESH, NMSS

TIM McCARTIN, NMSS

CHRIS McKENNEY, NMSS

SCOTT MOORE, ACRS

GEORGE TARTAL, NMSS

PRIYA YADAV, NMSS*

* present via video-teleconference

A-G-E-N-D-A

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

1:02 p.m.

CHAIR KIRCHNER: Okay, this meeting will now come to order. This is the first day of the 712th Meeting of the Advisory Committee on Reactor Safeguards.

I am Walt Kirchner, Chairman of the ACRS. Other members in attendance are Ron Ballinger, Vicki Bier, Charles Brown who just stepped out, he'll be back, Vesna Dimitrijevic is attending virtually, Greg Halnon, Jose March-Leuba, Robert Martin, David Petti, and Thomas Roberts. Matt Sunseri will be joining us virtually tomorrow afternoon. I want to note we have a quorum. Today the committee is meeting in person and virtually.

The ACRS was established by the Atomic Energy Act and is governed by the Federal Advisory Committee Act, FACA. The ACRS section of the U.S. NRC public website provides information about the history of this committee and documents such as a our charter, by-laws, federal register notices for meetings, letter reports, and transcripts of full and subcommittee meetings, including all slides presented at those meetings.

The committee provides its advice on

safety matters to the Commission through its publicly available letter reports. The Federal Register notice announcing this meeting was published on January 10th, 2024. This announcement provided a meeting agenda as well as instructions for interested parties to submit written documents for a request for opportunities to address the committee.

Today's designated federal officer for today's meeting is Mr. Derek Widmayer. The communications channel has been opened to allow members of the public to monitor the open portions of the meeting. The ACRS is inviting members of the public to use the MS Teams link to view slides and other discussion materials during these open sessions.

The MS Teams link information was placed in the agenda on the ACRS public website. Periodically, the meeting will be open to accept comments from members of the public listening to our meetings. Written comments may be forwarded Mr. Derek Widmayer, today's designated federal officer.

A transcript of the open portions of the meeting is being kept, and it is requested that speakers identify themselves and speak with sufficient clarity and volume so that they may be readily heard. Additionally, participants and members of the public should mute themselves when not speaking. And that also pertains to cell phones.

During today's meeting, the committee will consider the following topics, Integrated Low-Level Radioactive Waste Disposal Proposed Rule, and NuScale Subchannel Analysis and Rod Ejection Accident Methodology Topical Reports.

And before proceeding, I'd just like to note, on behalf of the committee, the passing of several former ACRS meeting members, Joe Henry, who was an ACRS member and chair of the committee, back in the 1970s timeframe, and also went on to be a commissioner and chairman of the Commission. Forrest Remick, also an ACRS member who was also chair, that was in late 1980s timeframe, and also become a commissioner. And finally, Mario Fontana, who also was an ACRS member. So we acknowledge their dedicated service and extend our condolences to their families.

And now at this time I'd like to ask other members if they have any opening remarks.

Okay. Hearing None, I also note because of potential COI considerations, Member Halnon is recused from deliberations on the next topic, LLW rule topic. And with that, I am going to turn to Member Ron Ballinger to lead is on our first topic for today's meeting. Ron?

MEMBER BALLINGER: Thank you, Mr. Chairman. Today we're going to hear what we believe will be the closing, ultimate presentation on this proposed rule which has been under some form of deliberation for about 15 years, near as I can tell.

We had a subcommittee meeting on December the 5th where we had a pretty extensive presentation. And the presentation today will be a bit of a condensed version of that. And we expect that we will write a letter after this presentation. And I don't know who would like -- would somebody in the staff like to make a comment?

Okay, you have the floor.

MR. TARTAL: Thank you, good afternoon, everyone, I'm George Tartal. I'm a senior project manager in the Office of Nuclear Materials Safety and Safeguards. And I'm the project manager for the Integrated Low-Level Radioactive Waste Disposal rulemaking.

My co-presenters with me today are Dave Esh, Tim McCartin, and Priya Yadav, all from NMSS, and I'll note that Priya is going to be presenting remotely. So when we get to her slides, I'll ask that she be allowed to speak.

We presented on this rulemaking to the ACRS Subcommittee on December 5th, 2023, and we're happy to return today to present to the full committee.

For our presentation today, I'll start with a quick overview of the scope of the rulemaking. Then Dave will discuss the safety case and technical assessments and the time frames for the technical analyses. Then we'll move on to Tim, who will talk about GTCC waste considerations and waste acceptance. Then Priya will talk about exception criteria, significant quantities, and implementation guidance. Then we'll come back to me at the end with a brief update on next steps for the rulemaking.

On this slide, this is a high level summary of the scope of this rulemaking. And the following slides will describe these changes in a lot more detail.

The scope of this rulemaking is based on the staff's recommendation to the Commission in SECY Paper 20-0098 which was to integrate what were at the time two ongoing rulemakings, one for addressing waste that hadn't been previously considered in the development of Part 61, such depleted uranium, and one for addressing disposal requirements for greater than

Class C or GTCC waste.

The Commission approved the staff's recommendation and the SRM to that paper. Over the past year or so, we've been developing this new integrated proposed rule.

The proposed rule will consolidate and integrate the criteria for licensing the disposal of GTCC waste into Part 61 with other low level waste, require conducting site-specific analyses for all waste streams, including depleted uranium, and GTCC, include a graded approach to the compliance period, revise the definition of low level waste to include trans-uranic waste, address physical protection and criticality concerns in GTCC waste streams, and provide for agreement to state licensing of those GTCC waste streams that meet regulatory requirements for near-surface disposal and do not present a hazard such that the NRC should retain disposal authority.

So that's a very quick overview of the scope of the rulemaking. And at this time, I'll turn the presentation over to Dave Esh, and then Tim and Priya will follow. And they're going to provide you a more detailed presentation on the proposed changes. Dave?

MR. ESH: Thank you, George. And good

afternoon to the committee. Member Ballinger, I share your optimism of hopefully this being the last time we see you. But I wouldn't be expected by any outcome in this process.

So there are some key messages I wanted to relay about what we're doing and why we're doing it. The first one here, the proposed changes will remove limitations that we have right now in the requirements that were developed.

So the way the Part 61 current regulations work is they were derived considering what waste was expected to be low level waste in the early 1980s. And so that means both its characteristics, its radiological characteristics, what radionuclides are present, and their concentration.

So when you do that, and then you fast forward to today, 40 years later, in some cases the wastes are different. And so how do you make a regulation that was derived for certain waste and certain conditions work more generally?

And that's what we're attempting to do in this rulemaking. We believe the most effective way to do that is through the site-specific technical analyses. I think that is the closest we can get to being risk informed in this process in low level waste disposal. And I'll step through the pieces of the technical analysis and other relevant components to describe to you why we think this is the best approach for the problem.

These proposed changes we believe are consistent with domestic and international practice. Now, there is quite a bit of variability in domestic and international practice, so you could pick an individual data point and say oh, well, that's inconsistent. But if you look at the global picture of all the data points, we think we're as consistent as we practically can be.

Now we would assert that the waste that has significant quantities of long-lived radionuclides is more challenging to dispose in the near surface than, quote, unquote, traditional low level waste. And you'll see that across the international spectrum.

So some programs, and I'll go into this in some more detail, they'll address this issue with policy. Others will address it with design, and some will address it with technical analyses, and others will address it with a combination of all of those components.

We do believe that the technical requirements must align with the characteristics of the waste, so if we have new wastes that have different characteristics than the traditional waste, then our regulatory structure and scheme needs to be able to acknowledge those characteristics and provide proper technical requirements for them.

Next slide, please. So there's different ways to achieve safety and compliance. So safety can be achieved through the disposal concept. This is done in some programs, such as Germany where they basically state that all radioactive waste must go in deep geologic disposal. So by policy, they avoid near surface disposal.

Another method is through prescriptive design. And a good analogy there, I think, would be RCRA disposal, disposal of hazardous waste in the U.S. under EPA. So that's a prescriptive design approach where you have the standard design for the materials and all the materials go in the same design.

And then the third item here is through technical analyses. And that's more of a -- you analyze your problem, so what's your site, what's your design, what's your waste, and come up with the optimum approach for that solution and show that, through your technical analyses, that you can meet your performance criteria.

Our approach, the proposed approach leans more heavily on the technical analyses, because this affords the most flexibility. And the U.S. situation is a bit different than some of the international ones, so in the U.S. we have a big country with a lot different potential disposal site environments. And that can be important in the technical analyses, so the risks that are derived when you put waste in those locations.

In many of the international programs, they might have one disposal facility in one location. So you can, in that case, as a regulator, derive a prescriptive design to solve that problem. But when you're dealing with a wide range of different wastes, different disposal sites, and you want to let engineers be engineers, then the technical analysis approach to solving the problem becomes more favorable.

Next slide, please. So the components I'm going to talk to you about are safety case and these technical assessments. And I'll give more detail on each of these slides going forward.

The safety case, it's widely recognized internationally. We believe that this original Part 61 developed in the 1980s has many of the elements of a safety case. And so therefore it doesn't require significant change to present the -- to achieve the principles of what a safety case is trying to do. And we believe that the safety case is useful to stakeholders in order to better understand the basis for decisions.

So in one sense you want the safety to be achieved in the most efficient way possible. But then you also have to balance that with ensuring that your stakeholders understand the basis for your decisions, why you're making them, and why both the licensee and the regulator believes the facility can be safely operated.

So the technical analyses right now are found in Section 61.13 of 10 CFR, Part 61. There are different components there. And in this rulemaking, some of these elements are new. But most of them are not. So the first one, performance assessment, in the existing regulation that's typically referred to as pathway analysis. That's to demonstrate 61.41, that's protection of a member of the public who is located off the disposal facility.

So the disposal facilities, you know, they might be many hundreds of meters in each dimension.

And then there's a buffer zone around them. They tend to be located in areas that are pretty isolated with not many people. They currently have four operating in the U.S. in the states of South Carolina, Texas, Washington, and Utah. They're all near surface trench type disposal facilities of different depths. And then there's some additional engineering that goes into each one.

So the performance assessment is to look at after you're done operating, you close the facility, generally you'll put some sort of engineered cover over the top of it to serve a variety of purposes. You'll limit water getting into the waste, to prevent biota to get into the waste, to keep the waste there, so to limit erosion, and to inhibit future use of the site by humans.

All of those -- then technical aspects are evaluated in a performance assessment. And that looks at, over the long-term, different time frames, how that radioactivity may be released from the facility and what sort of impacts it may cause to a person located off the disposal site. So that part is not new, it's just renamed. All the existing facilities have already done that type of analysis.

The second one there, intruder assessment, that's 61.42 in our regulations, that part will be new. And I'm going to talk about, you know, why that is and why it's new. I should say it's not new for all. Some of the existing licensees and their regulators have completed intruder assessments and some have not. So it's not completely new.

The third one down, the site stability assessment, that is also not new, that aligns with 61.44 in our regulation. But it would be some aspects of --

(Audio interference.)

MR. ESH: -- should implement it, would be new for significant quantities of long-lived waste. So you're going to hear, when I talk today, we're making a distinction between the, quote, un-quote, "traditional low level waste," and then some of this new low level waste that might have different aspects and different considerations.

The fourth one, operational safety assessment, is going to be possibly necessary for certain types of GTCC waste. And I will explain that in more detail, but otherwise, it is also not new.

And then the final part would be new, but it would only apply for significant quantities of long-lived waste. This is to look at the very long-term component of some of the waste that might be disposed.

So now I'll go through each of these in a bit more detail. Okay, so the safety case is a high level summary of the information. We think this is a valuable addition. It was given to us in one of the numerous Commission directions to us. And this is, I would like to have you think about executive summary.

So in a condensed form, if you, as a committee member, wanted to look at the basis for one of these facilities, and how it was licensed, and why they believe it's safely operating, you should be able to go to Google and type in safety case, you know, site name, or site location, and pull up what this document would be and be able to see what's the basis for this facility, and why it was licensed, and why it's operating.

They don't need 1,000 pages to do that, you know, tens of pages is probably going to be appropriate to get the message across and clearly describe it. In the licensing of these facilities, there may be hundreds or thousands of pages that are generated to demonstrate that all the regulatory requirements are met.

But the safety case itself, we think, is an important addition to what's done now. We do believe that it is important for the public to have transparency of these decisions and understand what the basis for the decisions are.

(Simultaneous speaking.)

MR. BLEY: I think I asked you this before. But after you just described that process of Googling for the safety case, safety case hasn't been typically an NRC used term. It's used in Europe a lot. Is it now a part of NRC's lexicon, and should people be noting this more broadly.

MR. ESH: Yes. Thanks, Dennis. And right now it is not part of our regulatory language and documentation. So if you pull up the existing regulation, it's not there. In this proposed regulation, it will be there, albeit very lightly. But in the guidance document, NUREG 2175, we step through what we think the information that somebody should supply for a safety case or to describe the safety case.

And the reason for this is, like I said, we wanted to take a light-handed approach to this, because we believe it's all there. All the information is there in the existing process and licensing decisions. There just needs to be some distillation and repackaging of that information to make if useful, more useful to the stakeholders.

MR. BLEY: I hate to nag on this one thing, but is it being considered any more broadly at the agency or is it just applicable to this rule?

MR. ESH: Yes, I can't answer that specifically. I mean, in my opinion it is a strongly adopted international practice. But NRC tends to be at the forefront of a lot of these safety evaluations, analyses, et cetera. And the components of the safety case, I think, are present in so many of our regulatory programs.

So experts in safety case in some of these international programs, I'm sure they would quibble with that, and they would say no, you don't have this, you don't have that. They do things differently. For instance, in the area of waste disposal they might do what they consider to be a safety case for the site selection process. And then they do a safety case for operations. Then they do a safety case for closure, and they do a safety case for post-closures. They do these different safety cases for different steps in the process.

Our licensing process isn't like that. So we do -- all the licensing basis for each of those steps in the process has to be provided up front in your initial application. And so they'd have differences like that. You know, you could have an interesting discussion about the safety case and how it's implemented.

But I think the principles of the safety case are present in much of what NRC does. Yes, we could improve the language in some cases and bring it forward, but I don't know if that would materially change the decisions that are made and how they're made.

MR. BLEY: Yes, I don't think so. I appreciate your discussion. And I guess we'll be using it here in kind of its obvious informal meaning. And that's fine.

MR. ESH: Yes, okay. Thanks, Dennis.

MEMBER MARTIN: Member Martin, simple question, when you make a point about an expectation for this high level summary, do you plan on having kind of a NUREG-0800-like standard content format to ensure the quality of the product that you expect?

MR. ESH: Yes, so in our existing regulatory process, we have NUREGs that outline the format content of the applications and then how the standard review plan basically, how that information is reviewed.

As you'll see, if you if you take a look at the guidance document that we've made to go along with this, it is, I would say, a more performance-based approach to the content that somebody would generate. So we don't provide a checklist of, you know, A through B with Steps 1 through 17 --

(Simultaneous speaking.)

MR. ESH: Yes. We don't do it that way. Because if we were licensing, say, for the agreement states, all these facilities are in the agreement states when they do the licensing, if we were licensing 100 or 1,000 facilities, then yes, that would be warranted. When you're licensing four, or maybe one, in the next decade --

MEMBER MARTIN: One off --

MR. ESH: Yes, right.

MEMBER MARTIN: Or four off.

MR. ESH: -- that it might have a unique design and it might be designed to take a unique type of waste, I don't know how amenable that is to --

(Simultaneous speaking.)

MR. ESH: -- to that regulatory process right now.

MEMBER MARCH-LEUBA: That's why --

MR. ESH: Yes, it might require a bit more iteration with the regulator and the licensee, and/or agreement state regulators and the NRC, you know, to make sure we're all get on the same page. But those things are easily done with, you know, modern technology and everything.

The other two, last two points here on the safety case, we think it will provide and describe the strength and reliability of the technical analyses. If you're relying on it, you have to demonstrate that the technical analysis is doing what it's supposed to do. And it includes consideration of defense-in-depth as well as the safety relevant aspects of the site, facility design, the managerial, engineering, regulatory and institutional controls.

So there's lots of pieces that go into the safety decision. It is not just the technical analyses. But technical analyses do play an important role in the safety decision.

I will highlight here that defense-in-depth is going to be present in the low-level waste regulations, at least I'll explicitly mention by terminology. That was at the direction of the Commission also, as was safety case in one of our previous iterations.

We have taken a light-handed approach with that now too, because we pointed out to the Commission when that first came in, they were thinking of it, I think, primarily in the view of reactor design. And a passive disposal system is quite a bit different than an active reactor system.

So the way that you demonstrate, and evaluate, or consider that you have defense in depth might be different or is different for a waste disposal system and some of those other types of systems. We talk about this in the guidance. We provide ways that somebody could demonstrate that they have defense in depth.

The way that these facilities are designed, they inherently have a lot of defense in depth. So the selection -- the remoteness of the site, and selection of the site, the geology of the site, and then there's engineering that goes into the barriers, containers, waste forms, buffer materials, cover system. And then finally all the managerial, operational, and institutional controls provide another layer of depth of protection. All those things work together to achieve the performance criteria.

Next slide, please. So each of the

technical analyses I'll step through in a little bit more detail here. The performance assessment is basically the technical analyses completed for the existing sites for the potential impacts of off-site members of the public.

These are synonymous with what we call performance assessment. Performance assessment is not necessarily terminology that's used internationally. Some international programs do. They usually more commonly refer to it as post-closure safety assessment. So post-closure safety assessment will include what I'm going to talk about here with performance assessment.

It usually includes intruder assessment, and then we specifically break out this piece on stability, because many of the early facilities in the U.S. had a lot of challenges associated with sufficient stability.

So just to understand the context internationally, they use somewhat different terminology. Performance assessment is commonly used in the U.S. in this field and in this industry. The understanding tools and capabilities have improved significantly, and we think people should be able to take advantage of those tools in this process. By using the technical analyses you can take advantage of these improvements and understand tools and capabilities.

We have developed a pretty significant guidance document to support the proposed requirements. It's NUREG-2175. It goes through all of this in a lot more detail than you'd probably ever care to read. It covers things like FEPs here, Features, Events, and Processes.

So that's how you get the scope of the assessment correct, what you can omit and what you need to put into the assessment, uncertainty, you know, about different types of uncertainty, aleatory and epistemic, how you might evaluate them, different sensitivity and uncertainty methods.

And then the area that I think is probably the most important for this process, model support, so this isn't just about doing calculations, usually these are models. And so you have to support them. Performance assessments and these other calculations extending out into time, you can't validate them in the same way you would a normal model, you know, if you're building a bridge or something like that.

Because of the time frame, because it's a human health impact that you're trying to evaluate, so you have to get creative with the model support. And we have a pretty good section on that of how somebody might go about that. It includes things like, you know, comparing to other models, and looking at subsystem results, consideration of analogs. There's a whole bunch of things you can do to support these models.

MEMBER BALLINGER: This is Ron Ballinger. I'll grant that sophistication of modeling tools and the computing power have gone up by orders of magnitude. But I guess my question is has the uncertainty and the result changed, especially the long-term? Yes.

MR. ESH: It's a good question. So I think the uncertainty and the long-term result, the understanding or confidence in it, has improved. The calculated uncertainty might not show that, right. So if you have the ability to generate more probability distributions that go into these models, and there usually are a lot of them if you're doing a probabilistic analysis, and you propagate that all forward, you can get a broader variance in the results, calculated variance in the results.

But if you do your model support, you can develop a good understanding about what's driving that variance, how you might be able to mitigate it, changes to your design that can mitigate the uncertainties. So all those things go into this process. The performance assessment process is usually iterative at a given site. And it might start out more uncertain and less confident. And as they go through their iterations, they develop more confidence.

Next slide, please. I'll show you an example here, this is from the guidance. This is what it looks like in the upper left there, the picture of a real facility, it no longer accepts waste, but it isn't officially closed. It's a near surface trench facility covered by a geomembrane. There are some pictures of barrels and trenches there. So that's your starting point as real system.

It's characterized by data and other information like, you know, the example in the chart there with all the noise. That feeds into development of a conceptual model. The conceptual model is shown in the middle of the left hand side. There are some little barrels there under the ground, so that's your unsaturated zone. That would represent the waste.

And then how waste gets out or how radioactivity can get out of these systems, usually you can have some transport in the unsaturated zone, possibly through a surface water body or through and aquifer, so leaching of the waste down to an aquifer, transfer through an aquifer, extraction through a well, or discharged to a surface water body.

You can also have release, gaseous releases that end up in the air and then get in the atmosphere. Basically any of those releases then end up in the potential food chain or human environment. It's the same as like a severe reactor consequence analysis. You have a pathway analysis and all the exposure pathways that you evaluate on the back end then.

But what might be similar and/or different from some of the systems you might be familiar with is that these are truly system models for each one of these components. Like, the aquifer might be a model unto itself. And that's shown on the right hand side here. So the dash on the left expands to the figure on the right hand side.

There's a conceptual model for the hydrology, the hydrologic conceptual model shown at the top. And then that gets represented as a numerical model or a computational model which is shown in the center there with a bunch of cells, and how the different components are oriented, and ultimately described by equation.

So you see at the bottom there's a transfer function, you have a little graph of a pulse that's a release, and that's out of the way, so out of the system. It gets into the aquifer which is shown by the cylinder in the center. And then you see the pulse, X, on the other side. So that's your numerical, mathematical model and your transfer function for how that release ends up at, say, the well location or the receptor location.

So that little piece then might be represented in detail, or it might be what's shown on the bottom left there, an abstracted model or some modification. So we allow the use of and encourage the use of abstractions if they represent the essential features of the more detailed modeling.

But these performance assessments might have many, many different conceptual models or numerical models that all fit together in this model. And we use that to estimate the system performance which in this case is the radiological dose to a person living offsite from this facility.

Next slide, please.

MEMBER MARTIN: Just real quick?

MR. ESH: Yes.

MEMBER MARTIN: You have this guidance in the NUREG. Do you envision any new regulatory guides at that level that will eventually come from these efforts?

MR. ESH: Yes. I don't think we envision any regulatory guides, but we have started very recently on a task to develop training, develop training materials and a training class that we could use with, especially, our agreement state regulators to make sure that we effectively communicate with them these products and how they may implement them.

Regulatory guides aren't too common in the low level waste area. We do have some branch technical positions, but they're few and far between and not used as commonly as they are in, I think, like the reactor space.

MEMBER MARTIN: I was hoping we'd see you more often.

(Laughter.)

MEMBER MARTIN: Despite what Ron --

MR. ESH: Member Ballinger promised this the last time, I think. So --

MEMBER BALLINGER: Just get into 2175 and about six months from now, when you get through reading it, ha, ha, ha.

MR. ESH: Yes. We have a good team. I drew the short straw and got the speaker role here, but we have a good team that developed all those materials. So I don't have time to go over everybody and their contributions, but there's a lot of people that have worked on this project.

The next technical analysis assessment that I'd like to go over is the intruder assessment. This is the one that if you're going to change it, if you're going to get rid of everything else, you need to keep this one, okay. The way Part 61 is structured right now is the intruder protection, 61.42, is provided by the waste classification system and the waste classification tables, Table 1 and Table 2, and the regulation.

Those were derived by the NRC using generic calculations considering what waste they thought would be disposed of as low level waste in the early 1980s, and how it would be disposed. So those tables are based on a human site and shallow disposal. So many of the modern sites don't meet either of those criteria.

So they tend to be more arid and they tend to be deeper. So you're applying restrictions for a human shallow site on offsites, regardless of the technical features of those sites, and possibly maybe additional engineering or other things that might go into them. It works, it's protective, but is it efficient and effective? It definitely not is efficient and effective as it could be.

So the other thing is the assumption was made essentially that no low level waste would differ substantially from what was considered in that initial analyses. So the list of radionuclides that are found in the tables, Table 1 and Table 2, represent any type of low level waste that's generated. If it's not in Table 1 and Table 2, then it's default Class A, under 61.55(a)(6), okay.

So something like large quantities of depleted uranium, uranium isn't on the tables, so it's automatically Class A and would only be limited to the Class A requirements. It's definitely a bigger challenge than normal Class A waste. So this logic or what I've described to you would apply to new waste.

So if you have new reactor systems or cycles that generate different waste, and isotopes and radionuclides that aren't listed in the tables, they would also be Class A by default, may or may not be appropriate, depending on the isotopes, and radionuclides, and their concentration.

So what we're changing here is we're requiring that everybody do a site-specific intruder assessment. And that will ensure that whatever waste you're putting in that site is going to be analyzed to ensure the intruder protection under 61.42.

This is a flexible and risk informed approach. We think it's the best way to solve this problem. There's a lot of criticism of this intruder component to NRC's regulations. I think it serves a lot of great roles, so it does provide a limitation on some of the uncertainties that you might consider in other parts of the problem.

Because if you have to evaluate the intruder, that's going to generate some restrictions on the type of waste that you take. You'll identify your boundaries. That will help alleviate some of the concerns associated with the long-term uncertainties for certain radionuclides or isotopes. And it provides a framework that you can evaluate not just the potential for offsite impacts but the potential for onsite impacts.

We rely on or provide for that somebody can rely on up to 100 years of institutional controls. That's active institutional controls. So that involves a fence, security, monitoring, you're going to prevent anybody from being on that site for 100 years.

But it would be expensive, or it could be expensive to provide that sort of active controls for much longer periods or indefinitely. And therefore, at some point, you move from active controls to passive controls. And it's when you move to that passive control range where this evaluation of the intruder comes in. And we don't expect that to happen.

MEMBER MARCH-LEUBA: So for curiosity, when you say intruder, are you talking about sabotage, a terrorist?

MR. ESH: No, it's not advertent, it's inadvertent, yes.

MEMBER MARCH-LEUBA: So anybody that walks into the (audio interference).

MR. ESH: Yes. So it's shown there on lower right, the types of things that were considered when the original regulation was developed. So if somebody might come in and build a house, they might excavate for some reason, they might put in a well for getting water for domestic or agricultural purposes.

MEMBER MARCH-LEUBA: The intruder is

(audio interference).

MR. ESH: Yes, inadvertent intruder. We usually use inadvertent. I probably -- yes, we should probably always include that on it, yes. It's not sabotage or advertent processes. We don't -- it's not designed to protect them.

MEMBER MARCH-LEUBA: Yes, I know, for example, 100 kilos of TNT can do a lot of damage.

MR. ESH: Right, yes. Now the challenge is here that there's lots of difference in opinion about what are the scenarios, so what are people going to do and why?

We believe this is a regulatory construct to deal with this long-term containment or isolation issue in a practical way. It's a regulatory construct. It's not a risk calculation per se. And we are not applying the same dose standard to the inadvertent intruder which is applied to the offsite member of the public. That reflects the likelihood of the scenario.

We don't expect this, this is not an expected scenario. It's a less than expected scenario. If it was an inspected scenario there'd be no health and safety basis for using different dose limits for the person on one side of an imaginary line compared to the other side of the imaginary line. So that's the part that definitely, if you jettison everything else, you need to retain this.

Next slide, please. So one thing we did to try to look at, well, why is it there are these differences of opinions about this whole construct and how it's used, is I took the information I had on any disposable facility I could find. And I gave it to a GIS expert. And I said find me the nearest resident to the facilities. And that's what's reflected in this chart here.

And what you'll notice is a couple of things. One, the minimum distance is greater than 100 meters, so you have at least 100 meters from any facility in the world, that I could find, and the nearest resident. I believe that's a facility in Germany, Morsleben, which I actually toured a couple of years ago.

There's crops grown right up to the fence of the facility. So, you know, people are right near where that -- now, that's a deep mine facility. It's an old salt mine, I believe, so it's not a surface facility like the ones in the U.S.

At the other extreme, you see the far right point, that's a facility in Australia by Tellus

Holdings. They have 100 kilometer access road to get to the facility. And my GIS expert did find some people that were closer than 100 kilometers, but that looked like it was a little mining site of some sort. It wasn't a true resident. That's a fly in, fly out facility for the workers. They have trouble getting people there because of how remote it is.

But what you see is that these facilities are pretty remote in the present day, most of them. The question becomes where do these dots end up as you go forward 100 years, 500 years, 1,000 years, right? Are the people going to stay far away from the facilities as everything goes on socioeconomically in the world, or are you going to get migration closer to the facilities? Who knows.

But we have some confidence that right now the siting is effective, and they are pretty remotely located. And if you choose a good site, especially that there's really no resources there, there's no mineral resources, it might be hard to live there, it's hard to envision why you would get people encroaching on those types of facilities.

Now the one in Germany, for instance, it looks like they're doing growing great crops right next to it. So, you know, there's no reason why people wouldn't want to live there. But some of these are fairly and pretty inhospitable places. So this construct and this information, I think, was important to consider when we looked at our intruder assessment.

MEMBER BROWN: Can I --

(Simultaneous speaking.)

MEMBER BROWN: I didn't mean to interrupt you --

(Simultaneous speaking.)

MEMBER BROWN: How much acreage is devoted to these throughout the U.S. right now, generally?

MR. ESH: For the disposal facilities themselves?

MEMBER BROWN: Yes.

MR. ESH: It's relatively small, you know, so they might be a few hundreds of meters by a few hundreds of meters, like active disposal area --

(Simultaneous speaking.)

MR. ESH: For one of them, yes. And then they have supporting land around the facilities.

MEMBER BROWN: So we have four of them right now?

MR. ESH: Yes. They have supporting land around them, and a fence, and a buffer zone around the facility. So I'll have to think about, like, how many acres or square meters that might be.

Chris, do you have a --

MEMBER BROWN: Forty-five thousand square feet.

MR. ESH: Yes.

MR. MCKENNEY: It's Chris McKenney, Risk and Technical Analysis Branch. It's approximately 100 acres or less per one. Some of them --

MR. ESH: For each one of them?

MR. MCKENNEY: For each one of them. Some of them, a lot of land, like WCS is, I think, on a 15,000 acre farm is what it used to be before it became a WCS. But the active area is way reduced. You know --

MEMBER BROWN: I always think about the active area for the -- not the surrounding --

MR. MCKENNEY: Yes. It's pretty small below that. But that would be for, like, all the above ground structure and everything else that they have. They might have it -- they have a licensed area of 100 acres or less to have a facility. And then they'd be on only a few acres.

(Simultaneous speaking.)

MR. MCKENNEY: Yes.

MEMBER BROWN: You wouldn't be using the

full 100 acres.

MR. MCKENNEY: No, you would not separate these disposal sites too. They keep them, like, we made a trench here, we're making a trench as close as we can to it. We're making another trench. We're making a new disposal facility, face on, exactly against each other.

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: How big of a problem is the generation rate? I mean, every time you walk into a place and you take off your gloves, you have to bury them, or you consider an incident?

MR. MCKENNEY: We have -- 2012 the NRC issued an update on the volume reduction strategy for the reactor, well, all reactor material. And there has been a great reduction since 1980 when we started here, down to, like, less than 30 percent of waste because of --

MEMBER MARCH-LEUBA: By generation or by pressing it together?

MR. MCKENNEY: Generation because of the fact that people were reusing things as much as possible. We redesigned all types of activities to not generate waste in the first place. And treatment methods and going to, like, other reductions, like going to dissolvable MPP clothes so you don't have to dispose of those now into a low-level waste site.

All sort of practices continued from 1980, and continue to, to avoid the generation, and the ability to reuse, and other methods to avoid things becoming -- taking longer to become that final waste point, reducing that.

(Simultaneous speaking.)

VICE CHAIR HALNON: This is Greg. Just the cost alone kind of forces that reduction process. And utilities have been doing that for years, compacting, and reducing, and reusing.

MR. MCKENNEY: Yes, that's what --

MEMBER MARCH-LEUBA: There's a theory on that, you can put a tax on tobacco people smoke less for about three months, and then they start the smoking again.

(Laughter.)

MEMBER MARCH-LEUBA: It's a balancing act.

MR. ESH: Yes. I was going to add exactly what you added, that the market forces drive, part of it too. If you have to spend a lot of money getting rid of waste, then you might say, well, how can I spend less money and dispose of less waste?

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: -- over in that area.

MR. ESH: Yes.

MEMBER MARCH-LEUBA: I mean, in Florida you run out, where I now go, disposal places for regular trash. I mean, mountains --

MR. ESH: Yes, I don't

MEMBER MARCH-LEUBA: They want it close to the house.

MR. ESH: I don't think we have a disposal capacity issue in the U.S. right now. Even though we only have four facilities, they have plenty of capacity for the waste that's being generated for the foreseeable future.

And if you got to the point where you do start needing capacity, many times the operating ones will seek expansions if they're able to. Because they're established in the community, they've provided the regulatory basis already, and if they have the land and the capability to expand, then usually that's what happens.

MEMBER BROWN: Is there a projection of the usage rate, the disposal rate now in terms of the available capacity? Is it 100 years before they're full, or is it ten years? I mean --

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

(Simultaneous speaking.)

MR. ESH: Does somebody else, one of the other staff members, Chris, do you know the answer to that?

MR. MCKENNEY: Honestly, NRC doesn't track that. That is outside the Atomic Energy Act procedures. We are to establish what capacity generated is safe. The federal government established legislation, a compact system among the states. The states can join into compacts to -- and it is the state's responsibility to develop disposal capacity. And they have a tracking system through DOE to track out waste generation rates.

And then the compacts track that to say will they need expansions. And they work to say whether they need a site or whether they can continue, as most compacts do right now. They all use the Texas-Vermont Compact as their disposal source along with the second site and the Pacific Northwest Compact because energy solutions.

MEMBER BROWN: So the safety aspect, not necessarily --

MR. ESH: Right.

MEMBER BROWN: -- can you accept more?

MR. MCKENNEY: We do have a regulation in

Part 62 which is about emergency access. If there were to be a situation develop, that a waste type needed access to a disposal facility and, for example, the compact said don't, we have a method that we can open the door. But we have never had to use that. It's just on the books.

MR. ESH: So next slide, please.

MEMBER ROBERTS: On this slide, is there a curie aspect to this risk part? It seems like maybe you're using the disposal deficit as a surrogate for curie inventory. Or is there -- it seems like the risk really relates more to the, you know, about curies in the disposal site more-so than the proximity to population.

MR. ESH: Yes, possibly. There's not really a radiological component to this particular figure. There will be to a couple that I'll show you coming up. But you will notice that probably there's a higher percentage of symbols that are more than a shallow depth than there are for the U.S. and for the Department of Energy.

And I think that's because those points have shifted more to the left of the figure, closer to people. So they tend to put them deeper if they're closer to people.

Next slide, please. So site stability assessment, I'll go through this pretty quick. This is an important part of the regulation because many of the problems with the early disposal sites arose from the short term stability issues, primarily with surface water management.

So they found, they conceptually thought, well, we can choose an impermeable geology. We'll dig it up, we'll put waste in it, and we'll close it. It turned out it's not that easy. Water gets where you don't intend it to, and volumes you don't intend it to.

And then the waste itself can have a high porosity, so you can have subsidence, and settlement for the waste as the containers degrade or the materials used to backfill, if they aren't compacted properly, for instance. Those problems were addressed through design and safe characteristic requirements that are in the existing regulation, and we're primarily not changing those at all.

The site stability part that would be changed in this proposed rule is that, when you move into the disposal of significant quantities of long-lived radionuclides, then that could require a long term stability assessment that's a little bit different than what you would do for typical waste.

And that's because when you move into the long term, and the hazard is present in the near surface, then you have to start worrying about more than what's going on with the waste. In the engineering itself, you have to start worrying about the stability of the site overall.

Now, we recommend in our guidance that when you're in that -- if you are in that scenario, which should be rare for most facilities, because not a lot will probably desire to take these significant quantities of long-lived radionuclides, then you can evaluate that in the context of 61.41 and 42.

So we think this is a risk informed approach, because for those you're calculating, you know, estimates of human health impacts for 61.41 for an offsite member of the public and 61.42 for an onsite member of the public, rather than the abstract, or the indirect measures of health that might be like, well, how much settlement is allowable?

Well, who's to say? Like, six inches might be -- maybe you have a requirement for six inches or 15 centimeters of total consolidation. And that doesn't matter for a hill of beans when it comes to human health impacts. So we think that's the right way to solve that problem.

There's a couple of ways that that's done now, this long term stability. It's done in the context of engineered design, so that's like NUREG 16.23 which is shown at the top there. That's erosion protection control that's developed with consideration of the EMP, the probable maximum precipitation and the probable maximum flood.

And then you size your rock for the cover, you go through a scoring procedure to ensure that the rocks are going to be durable for the environment that you intend to place them. But you're basically protecting against surficial erosion in that manner through an engineered design approach. I worked with the individual who made that guidance, and is now retired, to extend it to our problem that could have some longer time frames.

The other way that it's done is through geomorphological modeling such as in computer tools such as Siberia or CHILD. That's being done at the West Valley site by the Department of Energy to evaluate the decommissioning of that site, because it's a site that is likely to experience high rates of erosion.

Next slide. You have a question?

CHAIR KIRCHNER: Yes. Could you just give a shorthand for what significant quantities is defined as?

MR. ESH: Yes. So it's not a short answer. I'll give you a short answer now. We have some slides on it.

CHAIR KIRCHNER: Okay --

(Simultaneous speaking.)

MR. ESH: So basically the concept is -- the answer to that question is a contextural, or contextual and relative answer based on your site, the engineered design of that site.

And so we, as a regulator, can't just specify, you know, X curies of plutonium-239 is considered a significant quantity. Because it might differ somewhat substantially based on the considerations I just stated.

Instead, we have a guidance -- we have an appendix in our guidance document that steps through how one might answer that question of do I have a significant quantity. And it starts simple with screening and then progresses to more complicated using more inputs and variables.

But it still should be a relatively -- if you're doing very complex modeling to answer the question of do I have significant quantities, then you should probably already be doing the long-term assessment which is where this comes in. So the significant quantities comes in, as I'll talk about in a few slides here, in the context of the compliance period essentially, or how long you're going to analyze your problem.

Okay. Next slide, please. So the next part is the operational safety assessment. This is typically achieved through a combination of system procedures, controls, and training for the operating facility. They've been operating for many, many decades and have done so very safely. So that's a testament to both their licensees and the regulators, that they've done this very effectively.

NRC did evaluate accident scenarios when Part 61 was developed, different types of fires, such as a trench fire. But those analyses did not result in changes to Table 1 or Table 2, so in the waste classification system. Because NRC thought at that time that the items listed in the first bullet were going to work effectively. And that's proven to be true, those things have worked effectively, no change needed there whatsoever.

The only place where you could possibly

need some change, and that's where we discussed this in our rule and guidance package, is that when you move to GTCC waste, some of that may have very high levels of certain radionuclides, plutonium, for instance.

It doesn't take a lot of plutonium in a fire to cause a big impact, okay. So when you're in that scenario, then you should be doing your site-specific operational safety assessment to determine if you need anything more than your typical controls, procedures, et cetera, that you're applying for your traditional waste.

And it's not overly cumbersome, those types of calculations. If you start relatively simple, you could do them in a spreadsheet, for instance. You don't need a computational model to do that sort of calculation. You do your leak pathway factor, your respirable fractions, you know, how much ends up in the air, how long the fire duration is, if you're looking at a fire, for instance, and then do your atmospheric dispersion calculations with Chi-over-Q or a numerical model, or whatever you want to do.

So this isn't burdensome. We do believe it could apply to certain types of waste when you move up in the risk factor. That would be very consistent with what's done with other nuclear facilities, whether it's a fuel cycle facility or something else.

Next slide, please. So I'll go over time frames here relatively quickly and hopefully allow you enough time to ask as many questions as you want on this topic. We looked at this and had a long debate over it internally and externally.

The Commission gave us direction. We looked at it and said it pretty much has two options, a peak dose approach, and that's used in a number of programs, especially internationally, or use a different compliance period depending on the long-lived component if the waste.

We liked the second option better for a variety of reasons. We think it's more flexible and site-specific. And so what that ends up in as the bottom bullet there, this compliance period would be 1,000 years, so that's how long you're going to do the technical analyses if you do not have significant quantities of long-lived radionuclides.

Otherwise, we would analyze 10,000 years plus a performance period, so the performance is post 10,000 years out into long time eventually. And I'm going to talk about this in detail in a few slides.

We carefully examined comments on this issue. We got a lot of comments. One of our primary considerations is what are the practices in the agreement states. Because they're the ones that host, that regulate the facilities, it's their citizens that would be impacted by the facilities.

We have this whole process where NRC makes regulations. And then our agreement states make compatible regulations that they implement. And we go through an evaluation to ensure that they're compatible.

There's these things called compatibility classes which you probably don't want to learn about, but the bottom line is here that the compatibility class for this would likely allow the agreement states to be more restrictive. So if they wanted to use longer time frames they could, but our requirement would essentially set the minimum standards that each one should use.

We did consider in great detail what has been done in the U.S. and internationally. That doesn't mean that what we're proposing here is identical to everyone of those data points, because there is a lot of variability in the data. But we think we are consistent with what's done from a principle standpoint.

Next slide, please. We will acknowledge that the uncertainties in society, and especially environmental conditions, will increase over time. But we also believe that that doesn't mean that that's a reason to stop your analyses or not do analyses.

We have to provide requirements that are going to allow for the safety of disposal, not just the disposal. So whatever way you choose to get to safety, that's fine. If you don't like the analyses, there's different ways to get there, such as what's listed in the bottom here. In Germany they say, well, we don't, for whatever reasons, policy, or because of the uncertainties, we're going to require that all radioactive waste be placed in a deep geologic repository. That would be one way to solve the problem, wouldn't it?

I don't think it's necessary or effective for certain types of waste. For other types of waste, it is. Mr. McCartin here worked on a high-level waste project for most of his career, will probably tell you that geologic disposal is the right way to go for high-level waste and spent nuclear fuel.

Some of these low-level wastes can get

pretty risky, right. So those low-level wastes are not all created equally. Some of them are not very risky at all and some of them are pretty risky So you need a regulatory program that's going to allow you to evaluate or accommodate each.

In most international programs, there are restrictions placed on the long-lived radionuclides that are appropriate for near surface disposal. The most common level that that's set at is around our Class A limits in the U.S. So they say if you're at Class A, sure, go ahead and do near surface disposal. If you're greater than Class A, then you're at intermediate depth or deep geologic disposal.

You can also use design requirements for special waste or special scenarios, such as one way to mitigate radon from depleted uranium is to put it deeper. And it's very effective. It's not expensive maybe, compared to some of your other options. It's used in our uranium mill tailings management if we need to mitigate radon fluxes.

The primary way you do that is to put cover materials that hold moisture through a greater thickness. A very simple approach, keep in place then, but it's a simple approach to solving the problem. Next slide, please.

So here's this, what I'll spend a little bit of time on. This was generated to try to answer this question of, well what do people do? Because we got comments that, in the previous iterations of this, that basically whatever NRC was proposing was not consistent with what people were doing.

I didn't think that was the case. So, we went through, I don't know, 30,000 pages of documents, lots of very big reports to extract this information out of it. And there's a lot reflected on here.

So, the dots themselves, you see there's green ones for Department of Energy, red for the commercial facilities in the U.S., and the blue are international. So there's, each component is represented there.

First message is, you see the dots, and this is a long, long plot, and for timeframes. And what's on the Y axis is the fraction of the Class A limits for long lived alpha emitters. So, those are your plutonium, americium, you know, the things that drive long term risk that aren't very mobile.

You see that the values generally increase from lower left to upper right. So, as you get to more concentrated long lived alpha emitting waste generally the analysis timeframes are longer, okay.

So that's message Number 1. And that's exactly what we're proposing in this regulation.

So, the green area is kind of how our requirements would lay over the state Act. That's what that green area is showing.

Message Number 2, you'll notice that the blue symbols for international tend to be more to the left than the domestic and the DOE ones. There's a variety of reasons for that.

But I think part of it is in that previous dot plot that I showed you the people are closer to the facilities. So they analyze them longer. They want to have more confidence due to the actual physics and chemistry of the problem that people are going to be protected, rather than relying on isolation and other forms of control to protect people. Okay.

For each of the different colored sets of dots they all tend to trend kind of lower left to upper right. International do that. The domestic commercial facilities, the red ones, and the green ones, DOE. So they're all kind of doing what we're proposing in this regulation.

Now I will say, we had a meeting recently. And one commenter looked at this figure and said, well I think this demonstrates that most facilities if, you know, use 1,000 years in their evaluation. I looked at that and I was like, what? I don't see that. But maybe I'm looking at it differently than you are.

It looks like the predominant approach is that they use longer analyses. All of these facilities have been licensed and are operating. So the closed symbols are operating. The open symbols are closed. So, they all were licensed using various forms, different types of analyses here.

Another criticism we got about this is the fact that the X axis says compliance period or time evaluated in the assessment. Well the reason for that is, everybody uses different language to describe these things. They don't all use compliance period.

But when you talk to them, you talk to the regulator, you talk to the operator, you look at their reports, they're using the long term technical analyses in their licensing decisions in some form or another.

I don't care what you call it. Call it a compliance period. Call it a performance period, whatever. They're using the information on the long term characteristics of the problem to make their safety decisions or to factor into their safety decisions, not make their safety decisions.

Now the black line there, Class C, and then the arrow for GTCC, that is to show that if we implement this proposed regulation some types of GTCC are falling at the upper range of what people have done, okay.

So in the U.S. we believe we can specify requirements that will provide protection of public health and safety. But it should be acknowledged that this is not, you're at the hard end of the problem. You're not at the easy end of the problem, okay. That's a important message for you to take away today.

Now, if there's questions on this one, I have another one similar to it. Let's go to Slide 18. So this is similar to the previous one. But it's only long lived mobile. So that's technetium-99, iodine-129, carbon-14.

The couple of things from this. It still pretty much trends from lower left to upper right. But maybe not quite as strongly. And one thing you'll notice is that there's not a lot of these radionuclides present. They all are generally below 1/10th of the Class A limits in the U.S.

Even with that being the case though many of these radionuclides are the risk drivers in the assessment. So it's the mobile long lived ones that you usually see coming out of these assessments.

The system can result in a delay of when those come out. But a delay is not a mitigation of risk. What we really look to see in these systems is reductions in risk, rather than delay in risk.

Delay is good. But reduction is preferred. Because reductions, regardless of how correct or incorrect you may be about the timing, is going to ensure that somebody is protected once that radioactivity eventually gets there.

If you're curious, the point way up at the top, on the upper right, is a facility in South Korea. Next slide, please.

So the last piece I'll talk about is this performance period analyses. This is for those facilities that will accept waste with significant quantities of long lived radionuclides, what do they do after the compliance period? That's called the performance period.

It's going to be similar but different in that the standard is going to be to reduce exposures to the extent reasonable achievable. But it's not going to have a dose limit for that period, per se.

The reason why we structured it that way is it is a very long time assessment. And we probably need to face the reality of what people do with radiation in their own lives, and how restrictive you should be with that long term information.

Because there is considerable uncertainty associated with it we do want to ensure that we achieve transparency with the stakeholders on what's expected for the long term performance of these systems. But these outputs are, should not be constituted as a measure of projected human health impact.

So what we describe in our guidance associated with this is there's a variety of ways you could do it. If I was doing it I would probably start off with running my assessment out for the long time, and see what it tells me.

Then I would also consider comparing to other metrics. So if there's heartburn and apprehension about using long term calculated doses, you could use fluxes, compare it to natural fluxes, like it's done in one of the Scandinavian programs, I think Norway perhaps.

You could look at subsystem performance, or how the individual components might be releasing material, and what you might be able to do to reduce that. So, can I change a material and make a measurable impact at minimal cost?

It's those sorts of decisions that you would do in this analysis, similar to ALARA, but not identical to ALARA.

MEMBER MARCH-LEUBA: Yes. So we don't forget. Is this conclusion very expensive? Because it feels to me that once you set up your model for 1,000 years you can run it to 10,000 years. I mean --

MR. ESH: Yes.

MEMBER MARCH-LEUBA: --it cost you much money though.

MR. ESH: Yes. So the cost is a consideration. And I would assert this. If you have a good site and a good design, then the costs associated with changing that analysis timeframe is minimal, okay.

If you have a site and design where you're pushing the limits of what that site can accept, then it's going to get, it could get more expensive for your calculations.

MEMBER MARCH-LEUBA: Is it, is the cost, I don't see it with a part that you are going to encounter a problem that you would have to fix. Or is it the cost of CPU cycles?

MR. ESH: Oh, so yes. Not CPU cycles.

Because generally now CPU cycles are cheap, right. But in PHD hours, yes. In PHD hours is where your costs would come in.

MEMBER MARCH-LEUBA: Yes. But my question --

MR. ESH: They hire you as a consultant and they say, we need 1,000 hours for you for this problem now instead of 100, then it gets more expensive. So --

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: -- table.

MR. ESH: It's --

MEMBER MARCH-LEUBA: It's never --

MR. ESH: -- intellectual labor, yes.

MEMBER MARCH-LEUBA: Rather than hiding the head under the sand, say I don't want to know what happened after 1,000 years.

MR. ESH: Yes.

MEMBER MARCH-LEUBA: Because if I know I have to fix it.

MR. ESH: Yes, right. And I don't think it's as much as I think it is. Intellectual labor and say you have a new process that kicks in at that longer timeframe, and you need information to put in to model it, right.

So you might either need to do a literature search to get the information, do some field measurements, you know. There might be information needs associated with a process that would apply for the longer term that doesn't apply for the shorter term. So there's that part of it too.

But I definitely, if I was in their shoes and faced with the long term analyses I would start simple and progress to, you know, the more complicated and expensive.

In many cases if you talk to the practitioners, like there's one that retired, and he worked in this field for, I don't know, 35 or 40 years. He said, yes, like, you know, once you've set up the 1,000 year calculation and provided all the inputs for it, it's not a multiple more expensive to do the longer term analyses, it's percentages, you know, ten percent, 20 percent or something, you know. It's not --

MEMBER MARCH-LEUBA: One you have you --

MR. ESH: -- a factor of ten more expensive to do ten times longer, right.

MEMBER MARCH-LEUBA: And finally, if there is some uncertainty on your model of 10,000 years versus 1,000 you should listen.

MR. ESH: Yes. I mean, so I really, one of the things I heard which I liked least out of all of this 15 years of process is this argument that large uncertainties mean you should do less.

I don't know. That doesn't, no. I'm saying, I'm not attributing that to Member Ballinger. I'm saying that we heard that line of thinking, and it doesn't make sense to me at all, right.

We, you don't apply that in any nuclear regulatory system and say, well I really don't know what's going to happen. So here, I'll give you a lesser requirement. I mean, you have to make a safety decision. So what are you going to do to make that safety decision?

MEMBER MARCH-LEUBA: What if you do bounding operations?

MR. ESH: Yes. Start with a bounding. And then sharpen your pencil and get more detailed and sophisticated if you need to, right. So --

MEMBER PETTI: I have a question on the previous slide.

MR. ESH: Yes.

MEMBER PETTI: Carbon-14, I know that this is very sensitive in your -- I'm talking about the disposal of irradiated graphite, which is an advanced reactor material. And they're very super sensitive, because it gets biosphere, yes.

But I had never heard it really talked about in the U.S. waste lexicon. I mean, iodine-29 for sure, tech-99 for sure. But not carbon-14. And I was always trying to figure out what the difference was.

I mean, is there a difference in terms of the, you know, their specific rules versus what we do? The graphite manufacturers have asked me about this. Because it has, it's fascinating.

It's oxygen, okay, that's trapped at crystallite edges when they fabricate it that gets on the neutron radiation, or nitrogen.

Nitrogen, sorry, nitrogen. You're right.

MEMBER MARCH-LEUBA: I'm on the Wikipedia page for carbon-14.

MEMBER PETTI: Okay.

MR. ESH: So, I just worked on this project with the IAEA on irradiated graphite, okay. So, and one of the messages I had to them was, are the disposal facilities in the U.S. contain carbon-14, okay.

It's not irradiated graphite carbon-14. But from a performance assessment or interior assessment calculation it doesn't matter. It matters in one aspect. And I'll talk to that.

But it doesn't matter whether it's carbon-14 in some other source or generation, or whether it's an irradiated graphite. It still will translate eventually into some sort of dose impact once it gets in water, okay.

Thought the point where it will differ is in the, in some cases there can be stored energy for the low temperature graphite. So if you apply heat to it or some energy source, then it basically self heats. And it can get very hot, you know, like 800 degrees C or something like that. Yes. Windscale yes.

Yes, yes. Windscale set a primary example. So the irradiated graphite is a concern for some of these countries. But I think the IEA is working on providing case studies of what is being done with irradiated graphite in different countries. There is a little bit in the U.S., but not much. And that's why you hear more about it for the international programs and --

MEMBER PETTI: They're disposing, they've DND's a gas reactor there. And so it's a big issue.

MR. ESH: Yes.

MEMBER PETTI: It talks about treating it. You can lightly oxidize it because it's all on the crystallite edges --

MR. ESH: Yes.

MEMBER PETTI: -- and do it in a hot cell or something. But that's still a lot of processing.

MR. ESH: So the main, so Russia has some irradiated graphite that is pretty hot in terms of the amount of carbon-14, probably more so than most other places.

But that is being evaluated in many programs, what the solution to it may be. The default seems to be that they're all looking at intermediate level depth disposal or geologic disposal for that material.

MEMBER MARCH-LEUBA: Excuse me. I think the problem is a little similar to tritium, in the sense that if any volatile hydrocarbon, the Carbon-14 might attach to it, then you can, same way that CO2 becomes water. Carbon-14 can migrate to volatile hydrocarbons and move.

MR. ESH: Yes.

MEMBER MARCH-LEUBA: Whether it's technetium, or something else --

(Simultaneous speaking.)

MEMBER PETTI: Well thanks. That helps. I hadn't heard the most recent stuff.

MR. ESH: There have been treatability studies on it too. And those are interesting from the standpoint of, in the assessments they'll mainly assume like they did for other long lived mobile isotopes, they generally don't partition very strongly to the waste. And therefore, when water contacts it they're released pretty readily.

But when you look at the graphite waste, when they try to treat it, it can be pretty hard to get the carbon-14 out of it, right. So, if it's hard to get it out in a treatment process, it should be hard to get it out in a disposal facility too, right.

So I think that's factoring in to the solutions to it right now. And that as they get more information they may find that the less aggressive solutions may be appropriate for that material. I think the, yes, Tim.

MR. MCCARTIN: Okay. As you've heard, the graders in Class C waste has higher concentrations by its definition than Class C. And so we looked at, are there certain requirements that would need to be changed in Part 61 to accommodate these higher concentrations?

And there's a couple of things. Currently for Class C waste the requirement is that it's buried at a depth of at least five meters, or an intruder barrier.

For greater than Class C we're proposing that it requires a depth of at least five meters and an intruder barrier because of the greater concentrations of radionuclides. That does present a higher hazard to the intruder, inadvertent intruder.

Also along those lines, when we look at it there were a few waste streams that had the potential to have very large concentrations of long lived transuranic radionuclides.

Currently the Class C limit is 100 nano curies. We're proposing a threshold for the Class, the greater than Class C waste that you could have no higher than 10,000 nano curies per gram.

But recognizing there could be particular designs, site characteristics. Importantly, the quantity of the waste that it could be looked on, on a case by case basis for approval.

But generally, as you get to that 10,000 nano curies per gram it's becoming more and more challenging to demonstrate safety through the types of analyses that Dave was talking about.

And then there's also additional waste characteristic requirements that we've provided. There's a possibility for the waste stream in terms heat generation, radiolysis, criticality.

And we'd like to see non dispensability for things like, if you have enough plutonium you really want to make sure there's a limit for what could get out in dispersable from an operational standpoint.

And all these kinds of things, as Dave said, there's a lot of different waste streams out there even for greater than Class C waste. We don't know how much a particular facility would take.

And so that's the beauty of this performance based approach where you do the technical analysis. Because it will depend in part, well are you taking say 1,000 cubic meters of this waste? Or are you taking 100 cubic meters?

There is a difference in the hazard level. And that's what these analyses allow you to do, is look at how much. And so we've put these particular requirements.

I want to talk, next slide, to two particular aspects. And first is criticality. And currently Part 61 points to Part 70 in terms of the thresholds for looking at criticality requirements for prevention of criticality.

It's based on a quantity of fissile material that's present there, without consideration of the concentration of that fissile material. And that's where, or the operational part.

We looked at what was done in Part 71 for transportation, where they have an exemption for fissile material that, solid fissile material of very low concentration does not have to be treated as fissile material.

They did extensive analyses to show that there is really no way you could make it to go critical. And so we are proposing to provide that same exemption in Part 61, that if you're less than that concentration you aren't subject to the criticality requirements.

Now that's the operational part of. From a post closure standpoint there is a recognition that if indeed all the GTCC waste currently estimated by the Department of Energy went to a particular site, that could have a lot of fissile material, tens to hundreds of kilograms of fissile material. Even at potentially a low concentration.

And so what does that mean for the long

term? And so we've put in a requirement, while we've provided additional flexibility with that exemption for the concentration from an operational perspective.

From the long term perspective, once again, if you have enough fissile material in a single disposal unit the applicant would have to identify what measures are you taking, such that this material would not have an easy pathway for re-concentration?

Let's say everything funneled to one drain would not necessarily be the best design for something that had say 500 kilograms of plutonium in it.

MEMBER MARCH-LEUBA: Do you see the, not chemical but -- I will rather have 500 kilos of natural uranium than one kilo of 99 percent enriched uranium.

MR. MCCARTIN: Well, and that could be part of their analysis, looking at what is the chemical form of the material? Yes. Yes.

MEMBER MARCH-LEUBA: There is no way you can mix natural uranium and make it all --

MR. MCCARTIN: Yes, right.

MEMBER MARCH-LEUBA: If you have highly enriched uranium, which you and I wanted to throw away, but --

MR. MCCARTIN: Right.

MEMBER MARCH-LEUBA: -- as an example.

MR. MCCARTIN: Yes.

MEMBER MARCH-LEUBA: You can conceive of ways of concentrating it.

MR. MCCARTIN: Yes. They'll have to look at what they have and what they take. And I think plutonium is probably, it's, plutonium is the biggest concern that might --

MEMBER MARCH-LEUBA: How does the plutonium make it there? Is contamination involves the general and to be disposing of this of -- And, you know, the (audio interference).

MR. MCCARTIN: Right. Well some of it is material from West Valley that is potential for disposal. The exact waste stream that has the plutonium, I'd have to get back to you on that. It could be some of the sealed sources. But I don't want to, I'm not --

MR. TARTAL: TMI-2.

MR. MCCARTIN: I can get back to you with exactly -- What?

MR. TARTAL: TMI-2.

MR. MCCARTIN: Okay.

MR. TARTAL: When they get that decommissioned out there.

MR. MCCARTIN: Okay.

MR. MOORE: This is Scott Moore. As you mentioned, there are some sealed sources with, for instance, could be neutron generated.

MR. MCCARTIN: Oh, okay. Yes, yes. Yes. And, but the goal is I think, if you got anything out of Dave's early part of his presentation, it was Part 61 was initially developed with a fixed mindset on very particular waste.

And as time went on things changed. We're hoping that some of these requirements are broad enough that -- We don't know ten years, 20 years from now what waste streams might be considered GTCC. And this will capture that.

And that's the goal, to make sure the requirements are appropriate and commensurate with the risk. And so, that's for criticality. Then the next slide is for, it's really the same issue with physical protection.

The thresholds, and I will say the second line of the first bullet exceed the thresholds in 10 CFR 150.14 is missing. But it's a quantity based threshold. It has, it isn't based on a concentration.

And so, in addition, the physical security requirements in Part 73 is a common defense security requirement. NRC is the, is responsible for that. That is not delegated to an agreement state.

And so, in looking at that, to give additional flexibility where Part 73.67 does have exemptions for special types of materials, and there's certain material if the concentration is low enough, it really does not present a threat. And it's limited attractiveness for theft.

And so we're putting in proposing an exemption there so that the physical protection requirements are commensurate with that threat. And that would allow, that exemption would allow additional waste streams of sufficiently low concentration to be regulated by the agreement state.

And they still would have physical protection requirements under Parts 20 and 37, just not 73. And so that was another consideration we had.

Because we are going to see the waste streams that DOE provided in their environmental impact statement does have concentrations that would result in quantities that exceed the threshold.

But the concentrations are so low you would need to divert massive amounts of waste, then be able to reprocess that waste in a way to extract the material.

And we're, our recommendation is that this waste does not meet the physical protection requirements of Part 73. But as I said, 20 and 37 would still be enforced for physical protection.

And that's it for my portion. Priya's next. I don't know if there are any questions on that particular aspect.

MR. TARTAL: Okay. If we can open up Priya's mic, please.

MS. YADAV: Okay. Can everybody hear me?

CHAIR KIRCHNER: Yes.

MS. YADAV: Okay, great. My name is Priya Yadav. And I am the Part 61 project manager on the rulemaking working group. I've been working on this effort also with Dave since 2008. So, we've been living through the many SRMs and the many changes on the rulemaking.

And thank you for inviting us again to brief you at the ACRS. And we look forward to hearing your advice and guidance.

So I have a few slides that we will wrap up with. And then we will go back to George for a schedule update.

So I'll talk about waste acceptance. We are envisioning this rulemaking to allow licensees the flexibility to develop site-specific waste acceptance criteria. And so this is also a topic that was given to us in one of the SRMs along the way.

The waste acceptance program would have three components. So, the licensee would develop the specific criteria, which is the allowable activities and concentrations for each radionuclide for disposal.

The licensee would develop the waste characterization methods. And they would also have a waste certification program to ensure the waste that arrives at the facility meets the waste acceptance criteria prior to arrival.

Licensees could choose to use generic limits for their waste acceptance criteria. So they limits in 61.55 and the waste characteristic requirements in 61.56.

Or they could develop site-specific waste acceptance criteria based on the results of their 61.13 technical analyses, which are the analyses that Dave just ran through.

Licensees would review their waste acceptance program annually, and present their proposed criteria to the regulator. And if they're approved they would be incorporated into their license.

Generator shipping waste would still be using the 61.55 waste classification scheme. So the ABC greater than Class C would still be used to ship the waste. And we will not be changing those tables and those limits in this rulemaking. Next slide, please.

So, a new area, a new topic in this rulemaking is the concept of grandfathering. And so this is an area that ACRS did provide a recommendation on in 2016 in their letter to the Commission.

So, in the SRM on SECY-16-0106 staff was directed by the Commission to allow for grandfathering of existing licensees who indicated they did not choose to dispose of large quantities of depleted uranium.

So we have learned that there's some sensitivity to the term grandfathering. So we are considering using a different term, considering using the term exception criteria, and including some criteria in the 61.1(b) purpose and scope section of the proposed rule.

And so these criteria would indicate four land disposal facilities with licenses already issued before this rulemaking goes into effect for these licensees who also do not accept greater than Class C, or significant quantities of long lived radionuclides.

After this rulemaking goes into effect these licensees would not need to comply with select parts of our proposed regulation. So the revised technical analyses. So, all of the analyses that Dave went through, which would be located in 61.13.

The revised performance objectives located in 61.41 and 61.42. And 61.42 is the key intruder assessment that would have the 500 milligram dose limit. And then also the waste acceptance criteria regulations, which I just detailed in, we would plan to put those in 61.58.

So, licensees who meet these criteria would not be required to meet the revised regulations, but would be required to comply with the original Part 61 regulations for these sections. Next slide, please.

We are planning to include, as Dave alluded to earlier, a definition for significant quantities in the rule. And so the definition would say something like, significant quantities means an amount and concentration accepted for disposal that if released could result in the performance objectives not being met.

So this would be the criteria for

selection of the compliance period, either 1,000 years if you don't have the, if the licensee does not have significant quantities, or 10,000 years if they do. And it would also be the amount for demonstrating meeting the criteria in 61.1(b).

So the calculation of significant quantities, as Dave alluded to, it's detailed. Examples are provided in our guidance document. But it would be different, depending on the, you know, specific disposal characteristics at the specific site.

Based on staff's work in SECY-08-0147, where we concluded that for depleted uranium ten metric tons was okay for near surface disposal, was acceptable for near surface disposal.

We are considering including in the regulation that less than ten metric tons of depleted uranium is not considered a significant quantity of long lived radionuclides.

CHAIR KIRCHNER: And that would be applied at one site? Or how would you apply that?

MS. YADAV: Yes. That would be applied per licensee.

CHAIR KIRCHNER: And what is the total amount that is in the DOE's inventory?

MEMBER MARCH-LEUBA: But one 48 wide container has five tons. And you would go to the (audio interference) and you got to see the end of them.

MR. ESH: Yes. It's over a million metric tons.

CHAIR KIRCHNER: So the bottom line would be that these at least existing sites under this new rule would not be taking a significant, different use of the word significant, a large, as measured in many tons of depleted uranium on their sites for disposal.

MR. ESH: Correct. If somebody wished to take a large quantity of depleted uranium they would be using the new criteria rather than the old criteria.

CHAIR KIRCHNER: Thank you.

MS. YADAV: Sure. Next slide, please. So licensees, like we said, so if they choose to use, if they are seeking to use only 1,000 years as their compliance period, or they're seeking to meet the criteria in 61.1(b), the exception criteria, they would need to do calculations for the specific waste they are disposing of at their site.

And so, they would do these calculations and then present them to their regulators. And then determine, you know, if they are in fact not accepting significant quantities.

And so that's why we have example approaches in the new reg. And we've also included a table of concentrations of long lived radionuclides that could be used as screening values. Next slide, please.

One new area that we're considering including in this, in the proposed rule is to have a minimum depth of disposal for significant quantities of uranium.

So because the decay of uranium can produce radon that diffuses to the land surface we're considering have a requirement, you know, that would say significant quantities of uranium must be disposed so the top of the waste is a minimum of five meters below the surface cover, the top of the surface cover. Next slide, please.

CHAIR KIRCHNER: Now, the surface cover there would be specified, or is, I mean, obviously you're probably not thinking of just loose soil.

MS. YADAV: Right.

CHAIR KIRCHNER: Or maybe you are.

MS. YADAV: I think -- We haven't, we're thinking it would be specified as like, this is the actual surface cover, the designed surface cover.

MR. ESH: To achieve the stability criteria they, they surface covers are usually one of two types. So they're usually, they're a resistant design where you're using, you know, clay layers as a radon barrier, and as geomembranes perhaps as an infiltration barrier, you know, multi layered engineered cover.

Newer thinking, or at least more recent thinking has started migrating to look at evapotranspiration covers that are simpler designs with less layers, where you'd use evaporation plus plants to achieve the moisture removal.

And they tend to be maybe a little bit thicker so they have a water storage component to them, which helps also mitigate something with radon. Because radon diffusion goes way down with higher moisture, with higher moisture content.

MS. YADAV: Thank you. Okay. So now addressing the comment about taking six months to review our implementation guidance. Yes. I have been working on the implementation guidance for many, many a year now. It has been published in, with Dave and with Tom, and several other, you know, members of our team. It does keep getting bigger and bigger.

But our hope is that we've designed it such that each chapter addresses one of the technical analyses that, you know, Dave alluded to earlier. So Chapter 3 talks about the performance assessment. Chapter 4 talks about the inadvertent intruder assessment. Chapter 5 talks about site stability.

So we hope that it could be used as a reference guide. And we don't intend for anybody to kind of start at Page 1 and end at Page 600.

So hopefully you guys have received kind of a pre-decisional version of that, you know. Hopefully that, you know, kind of gives you kind of glimpse into what, you know, the changes that we've made with this rulemaking.

So there are currently two public versions available. In 2015 we issued for public comment a draft Nu Reg 2175. And then we briefed your committee in 2016 and we made a draft final version available. Those are both available on the public website.

But for this rulemaking we're updating and calling it Revision 1. And we added an appendix for GTCC disposal. So if you just want to refer to Appendix G that talks all about GTCC.

Appendix H addresses this whole concept of how to figure out what significant quantities are for what waste streams. And then, and overall we've updated the guidance to be, you know, conform with the proposed ruling, which --

And that is my last slide. So with that I can go back to George.

MR. TARTAL: Okay. I get to wrap us up here. So this slide talks about next steps for the rulemaking. It's a pictorial view of the rulemaking process, and shows you where we're at now.

As I mentioned earlier we've been working on this proposed rule for well over a year now. We've held two public meetings now on this rulemaking. We had the first on in May of last year. And then we just held the second public meeting last month in January 2024.

We've been presenting on this topic for quite awhile now to various audiences, such as agreement state regulator workshops. We've been getting the word out on this project. And we plan to submit the proposed rule to the Commission in May of this year.

And then if the Commission approves we'll publish the proposed rule in the Federal Register and request public comments, and then work on developing the final rule, that at this point we're preliminarily targeting to deliver it to the Commission in November of 2025. And of course that depends on how quickly the Commission votes on it, and how many public comments we get. So that's the end our slides. Are there any final questions for us?

CHAIR KIRCHNER: Yes. I have a couple if I may start. One, could you just give us a summary and highlight what you received in the most recent set of public meetings and comments that might be actionable or influence your, this process?

MR. TARTAL: Well, that's a tough question to take on. We, I think we heard from a really wide range of stakeholders. Anywhere from industry representatives who were concerned about the regulatory analysis, and concerned about costs for their facilities. Would we be increasing costs for their facilities?

We heard from non Government organizations who were concerned about any kind of waste disposal, and things of that nature.

I don't think we heard anything though in either of the public meetings that we've held that would give us pause as to the content of our rulemaking. I think we're still very confident in our approach.

CHAIR KIRCHNER: Okay. I should have narrowed my question down to the content. Then secondly, what about comments from the agreement states that currently have sites?

MR. TARTAL: Okay. We're a little bit too early for that unfortunately. We're right in the process of requesting the agreement state comments at this point.

CHAIR KIRCHNER: Okay.

MR. TARTAL: So --

CHAIR KIRCHNER: So that was not part --

(Simultaneous speaking.)

MR. TARTAL: Right.

CHAIR KIRCHNER: -- comment period.

MR. TARTAL: Yes.

MR. ESH: We did have a member, agreement state member on the working group from the state of Texas, who took part in all of our meetings, and has been helpful to have participate with us.

CHAIR KIRCHNER: Okay. Thank you. I thought I heard Dennis. Dennis, did I hear you trying to ask a question?

MR. BLEY: You did. And you already asked the one I was going to ask, to the more general form would be, how much confidence do you folks have we're going to get through this?

CHAIR KIRCHNER: That's a less fair question than my question, Dennis.

MR. BLEY: It is. It feels no matter how they would have gone, there's going to be a lot of opposition. But I think you've done quite a job to get to this point.

MR. TARTAL: I guess I'll start and just say that the staff is confident with the proposal that you have gotten to look at. I think we have a sound and reasonable basis for the rulemaking.

And again, as I mentioned a few minutes ago, we haven't heard anything from our stakeholders that seems to imply that we're doing the wrong thing. So I'm pretty confident, at least from my staff point of view.

MR. ESH: Yes. My joking answer is 0.00 percent. But my real answer is, I agree with George. I think we put a lot of work in to try to make a smart and balanced regulation addressing the realities of what we're facing with these proposals for some different wastes, and everything that's going on in the nuclear fuel cycle, and the reactors, fusion, et cetera.

And as Tim alluded to, these changes if

implemented should be flexible enough to deal with those challenges as they come forward. And we won't, where my kids or grandkids won't be here briefing your kids or grandkids about the need for new changes to the regulation.

So we do have a task that was given to us by the Commission, to consider revising the waste classification system after we got through this process.

That would be a much more difficult task and a bigger challenge because of how the waste classification system has many tendrils that extend all throughout different laws, programs, et cetera.

So, but that is out there if we do get through this process, to consider if we need to change the waste classification system, and how we might do that.

I have lots of ideas about what we could do, and do smartly with that. But, you know, I've been conditioned to know that it's never going to be as easy as I think it would be.

MR. BLEY: Well, thanks for taking that --

MR. MCCARTIN: I just, I guess I would add that as has been said, we believe we have put together a solid proposed rule. But the emphasis is on proposed.

Now the benefit of the comment period is you get a lot of comments with, from a lot of different people, different groups with different perspectives.

And hopefully that makes for a better rule, final rule based on, I'm not sure what it will be. But I'm sure there's aspects that we will rethink because of the comments we received. And it sure would be nice to go out for public comment.

MEMBER BALLINGER: Any other questions from members?

MEMBER DIMITRIJEVIC: Hi.

MEMBER BALLINGER: Vesna.

MEMBER DIMITRIJEVIC: Yes, yes. That's me. I just couldn't resist actually just to come back to something which was brought in discussion there, when we were talking about large uncertainty. And then said that, the presenter said that obviously you don't do less when you have large uncertainty.

So then I was going to ask actually, so does that mean that, will that be part of a need to do more? And then more of what? I just would like to hear the presenter opinion. More of what we need to do when we face large uncertainty.

MR. ESH: Yes. That's a good -- That was me, Dave, that -- Yes. That was a good, that's a good question. And there's a variety of things you can do. So there is a iterate process to the technical analysis in the modeling, for instance.

So if you identify that you have large uncertainties, many times people will go back and they'll sharpen their pencils, or collect more information to try to reduce or mitigate those uncertainties.

Some are irreducible, you know. So sometimes you'll have something that it doesn't matter. You can't collect more information to better define the probability distribution for a parameter, for instance. So that has its limitations.

But in this process it's not just all about the technical analyses. So you can implement new engineered barriers. Or in particular, for low level waste disposal in the U.S. not a lot of waste conditioning occurs.

Internationally a lot of waste conditioning occurs. So there's an opportunity if we needed it, to apply material science and engineering to mitigate some of the uncertainties associated with say natural system performance. That's one way to mitigate an uncertainty.

So the other thing is like if you have uncertainty associated with near surface, the performance of a near surface disposal facility, you can always go deeper, which lessens many of those driving forces that cause that uncertainty, whether it's from climate, human interaction, plant and animal interaction, erosion. Depth is one mechanism that can mitigate those sources of uncertainty.

So for instance, the near surface disposal facility in Texas, it's a near surface disposal facility. But it goes down almost 40 meters. It's a very deep near surface disposal facility. Great facility to mitigate those types of uncertainties that I just talked about.

MEMBER DIMITRIJEVIC: Okay. Well, thanks. And I'm glad you presented to be what you had in mind. Because, you know, I always just personally don't believe the answer is to address the big uncertainties to do more quantification. Because then we lose more parameters, more assumptions, more uncertainties.

And in the general we have introduced calculation of uncertainties in this century to all these quantifications. But we didn't really have the clear approach what to do in the case when we have such large uncertainties like here, you know.

What is the implications? We don't really have a clear definition how do we use these uncertainties which we start as demanding, or prompted by.

And in my opinion, just this is totally personal. And this is very important subject for me in the general, is that the, one of the solutions of it should be to choose the different approach, or different method.

If we are facing large uncertainties then you go back to your Slide 16 and look in other approaches, you know. So the thing is, back to what I think should be really one of the considerations.

Not that I have a comment. You have done state of the art quantification or something. But way of addressing uncertainties could always be just to look in the, you know, different approach. So, okay. That's just my comment to those uncertainties which are here really large.

CHAIR KIRCHNER: Okay. I see that Steve Schultz has his hand up. Steve, go ahead.

MR. SCHULTZ: Yes. This is Steve Schultz. The comment I wanted to make, or a question I have is related again to public information, communication to the public.

You've mentioned the meetings that you have had and the upcoming ones associated with the rulemaking. Have you also considered, given the level of effort in terms of knowledge and development that has gone into this, more communications in venues such as the Regulatory Information Conference upcoming, or the American Nuclear Society meetings, to get more out about what you've done?

Because the accomplishments that are being shown in our public meeting today are quite substantial. This would be to George or to Dave.

MR. TARTAL: Yes. This is George. I'm going to start answering that question. Maybe others have some things to add.

As I mentioned, we've been trying to get the word out to a number of different stakeholder groups. And I think I mentioned agreement states is one of them.

We've been traveling to various places to present on this rulemaking. I think we did a poster at the RIC a little over a year ago. We've been doing other things like that ever since we've started working on this integrated proposed rule, the restart of this rulemaking.

So I think that's how I would answer, that we've been trying to get the word out as much as we can. But at the same time, you know, the more that we do those kinds of interactions the more it takes us away from writing the rule. So we've been trying to balance the outreach with making progress on writing the rule.

MEMBER BALLINGER: I just had a thought. Recently the ANS published a white paper, if you want to call it, related in high level ways to their proposal with how to deal with especially the long term issue.

Is there thought to enlisting the ANS on the low level waste side? I mean, I don't know if it's appropriate. But it, they did a pretty good job on the high level waste white paper, whatever.

MR. MCCARTIN: Well, they're certainly free to comment on the proposed rule when it comes out, you know. And I think they've commented before. I'm not, on the -- okay, draft regulatory basis they might have commented.

MEMBER BALLINGER: Okay.

MR. MCCARTIN: And, but --

MR. MCKENNEY: Well, I believe the Health Physics Society also has (audio interference) these ones too. This is Chris McKenney. The, but we have been talking about this rule. Again, it's been in development in various forms for 15 years.

And it's been, at its core a lot of it is very similar to the 2016, except for the GTCC, which of course was not addressed in the 2016 rule that went to the Commission.

And so we have been going to a lot of things. It happens to be that there is a regulatory information conference like event that is for waste management. The Waste Management Symposia in the United States, which is an international conference. And we have been talking about this for many, over a decade on this topic with them, and interacting with the international community also at international meetings on the topic too.

For those who are much more into the, again into waste management is a comment. They're sick of us talking about it so much.

MEMBER BALLINGER: This is the one in March?

MR. MCKENNEY: Yes. It happens, unfortunately this year the Waste Management Symposium is the exact same week as the Regulatory Information Conference. I believe next year they will be on separated times. But they have been together for the last couple of years.

And, or we haven't discussed like enough on the issues of like performance assessment and stuff, or timeframes in that way. But we have had staff who have worked on waste related issues where, you know, on the, for the generator side of waste forms, and other things like that, to make sure that the generators are able to produce a proper waste form in the past.

CHAIR KIRCHNER: Ron, before we go to committee deliberations, and then on to a proposed letter report, I think we should take comments from the public, and then take a break.

MEMBER BALLINGER: Okay.

CHAIR KIRCHNER: So with that --

MEMBER BALLINGER: I was kind of, okay.

CHAIR KIRCHNER: Let me go ahead and open it to any participants online. If you wish to make a comment please state your name, affiliation if appropriate, and please make your comment. You'll have to unmute yourself.

And I'll just pause here and wait for anyone to speak up. Hearing None, I think then at this point we'll take a 15 minute break that will allow us a chance to set up for the next deliberations and letter writing.

And with that we will just take a short recess here until, let me look at the clock, 3:15 p.m. Thank you.

(Whereupon, the above-entitled matter went off the record at 3:01 p.m. and resumed at 3:58 p.m.)

CHAIR KIRCHNER: So, on our agenda we have, yes, I think we're done with Sandra. Do you want, one last housekeeping thing, Ron. Do you want this evening to work on this, this afternoon, this evening? And then bring something back --

MEMBER BALLINGER: Well, if I get something from Dave and I get something from Vesna I'll go away and produce another revision.

CHAIR KIRCHNER: Yes. I'm asking a leading question. Do we return this afternoon, or do we wait until --

MEMBER BALLINGER: I think 1:00 p.m. tomorrow would be -- Yes.

(Simultaneous speaking.)

CHAIR KIRCHNER: Okay.

MEMBER BALLINGER: Because I'm going to stick around for the rest of the meeting.

CHAIR KIRCHNER: Okay. All right.

MEMBER BALLINGER: So I won't do anything until Dave --

CHAIR KIRCHNER: Okay. All right. So, we will come back to letter writing when we finish P&P tomorrow morning. Okay. With that, on our agenda we have a report out from the NuScale Subcommittee.

And since I am the lead for that I would like to report out on behalf of the subcommittee that we heard from NuScale and the staff on their subchannel analysis and rod ejection accident methodology topical reports, as revised and supplemented.

There were not, at least I think in the opinion of the subcommittee, major significant changes to either of the methodologies. We had previously written letters on the initial urgings of both topical reports as were referenced in the design certification application.

So the subcommittee recommends that the full committee not review these methodologies, and not write a letter report. Rather that we take this information under advisement.

And when we turn to the standard design application review, in particular Chapters 4 and 15, we will examine how the methodologies were applied in the areas of reactor design and accident analysis.

So that is the recommendation. And I need from the committee a decision whether you accept that recommendation or you would prefer to write a letter report on these topics?

MEMBER MARCH-LEUBA: On preliminary --

CHAIR KIRCHNER: Go ahead.

MEMBER MARCH-LEUBA: If the votes are only allowed on P&P? Or can we take a vote now, this being the full committee. And then --

CHAIR KIRCHNER: We often take votes on all kinds of matters, including wording and letters. So yes. Is there anyone that feels we need to write a letter report on these two methodologies?

MEMBER BIER: Can you repeat exactly what the letter would be addressing? Sorry.

CHAIR KIRCHNER: Well, if we were to write a letter report it would be, the first order, a reprise of the letters we wrote in 2018 on subchannel analysis, and 2020 on rod ejection accidents.

The significant revisions and/or supplements to the topical report methodologies were mainly in the subchannel analysis methodology to add a statistical treatment and approach for evaluating critical heat flux.

And in the case of the rod ejection accident analysis, at the time we reviewed the topical report the draft reg guide that covers rod ejection and rod drop accidents were BWRs and DWRs had not been issued.

So the standing guidance and criteria that was in the Reg Guide 1.77 and the standard review plan were in transition, I guess is the way to describe it. And subsequently we pointed this out in our letter on the rod ejection accident methodology.

And then NuScale came back and showed in some example problems application of their methodology against the criteria or figures of merit from the new, then newly issued Reg Guide on rod ejection accidents.

And that seemed to be a plausible and reasonable approach. And based on that it was the consensus of the subcommittee that this did not require writing a new letter report. Is there any discussion --

MEMBER MARCH-LEUBA: They weren't seeking exception to the new rule.

CHAIR KIRCHNER: Yes. There are no exceptions --

MEMBER MARCH-LEUBA: I know that.

CHAIR KIRCHNER: -- to the guidance that's in the Reg Guide --

MEMBER MARCH-LEUBA: Only there would be (audio interference) and publish the CR.

CHAIR KIRCHNER: Yes.

MEMBER MARCH-LEUBA: Not worth it.

CHAIR KIRCHNER: And as some of our subcommittee members pointed out, that the inclusion of the statistical treatment was just bringing up their methodology to what is current state of the art practice elsewhere. So, if there's no other comment --

MEMBER MARCH-LEUBA: Make a motion --

CHAIR KIRCHNER: Jose, why don't you make the motion?

MEMBER MARCH-LEUBA: I make a motion --

CHAIR KIRCHNER: Because you were our primary reviewer.

MEMBER MARCH-LEUBA: Yes. I make a motion that we take a vote to take on what, all you said, and not write a letter. Do we need a second?

MR. RODGERS: I think you first. I'll second.

CHAIR KIRCHNER: Okay. Any further discussion? All those in favor?

(Chorus of aye.)

CHAIR KIRCHNER: Okay. I think that's unanimous. So we will enter a short paragraph into the meeting summary that repeats, probably in better English, what I just shared with you.

And with that, and we're done with our NuScale topical reports. And I can release the court reporter. Do we need, Larry, the court reporter for any further parts of this meeting?

Okay. Then I thank you. And I think we're done with your transcriptions for this meeting. Yes, thank you very much.

(Whereupon, the above-entitled matter went off the record at 4:05 p.m.)

INTEGRATED LOW-LEVEL RADIOACTIVE WASTE DISPOSAL PROPOSED RULE

ACRS Full Committee Meeting

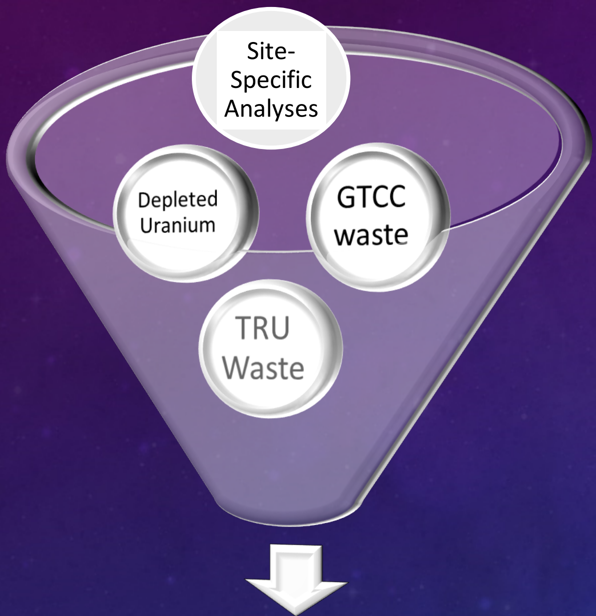
February 7, 2024

George Tartal
David Esh
Tim McCartin
Priya Yadav

Agenda

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

Rulemaking Scope



Integrated Low-Level Radioactive Waste Disposal Rulemaking

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

Key Messages

- Proposed changes will remove the limitation that the requirements were developed for particular waste types (concentrations)
- Site-specific technical analyses are risk-informed regulation
- Proposed changes are consistent with domestic and international practice
- Waste with significant quantities of long-lived radionuclides is more challenging to dispose in the near-surface than "traditional" low-level waste
- Technical requirements must align with the characteristics of the waste

Safety and Compliance

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

Safety Case and Technical Assessments

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

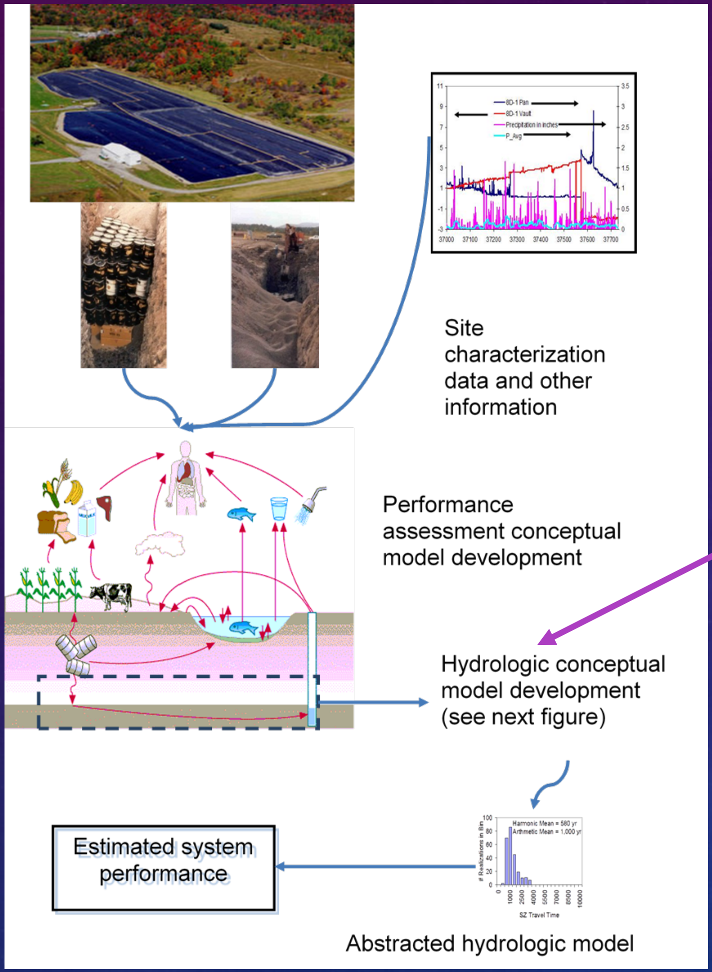
Safety Case

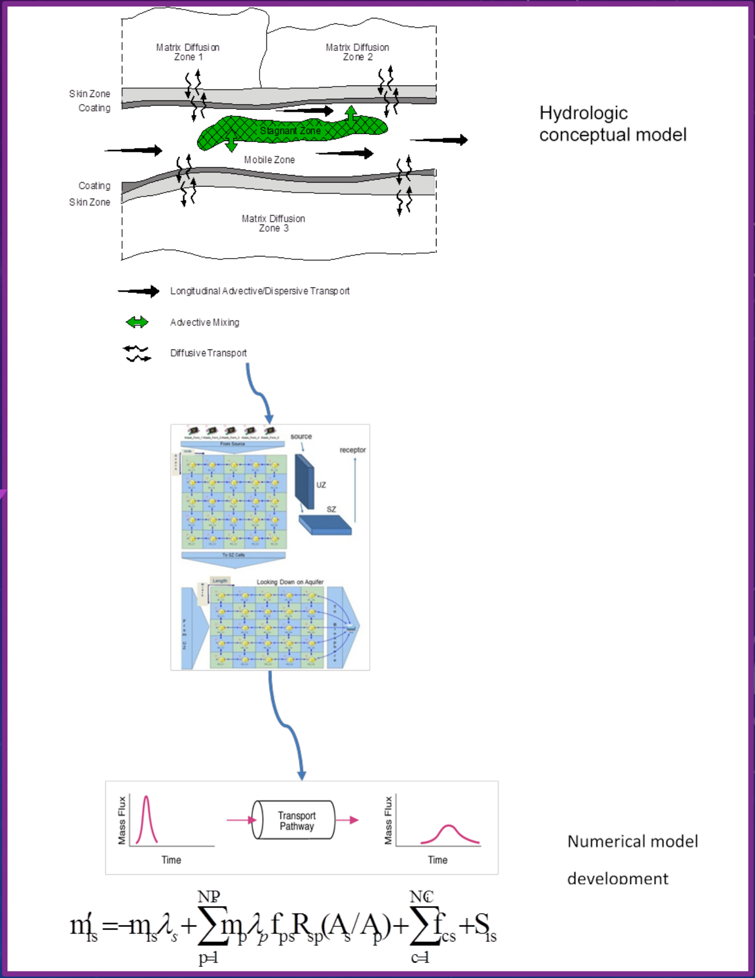
- A high-level summary of the information and analyses that support the demonstration that the land disposal facility will be constructed and operated safely – think executive summary.
- Provides reasonable assurance that the disposal site will be capable of isolating waste and limiting releases to the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

Performance Assessment

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

Performance Assessment – Guidance Example





Intruder Assessment

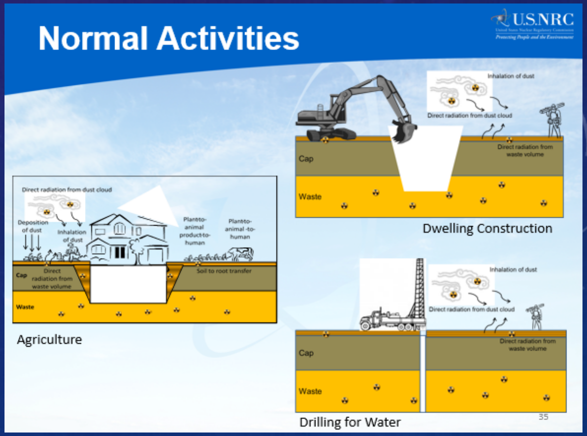
- The basis for § 61.55 in the current regulation is an NRC intruder assessment
- Revised requirements would allow for a site-specific intruder assessment

This is a flexible and risk-informed approach

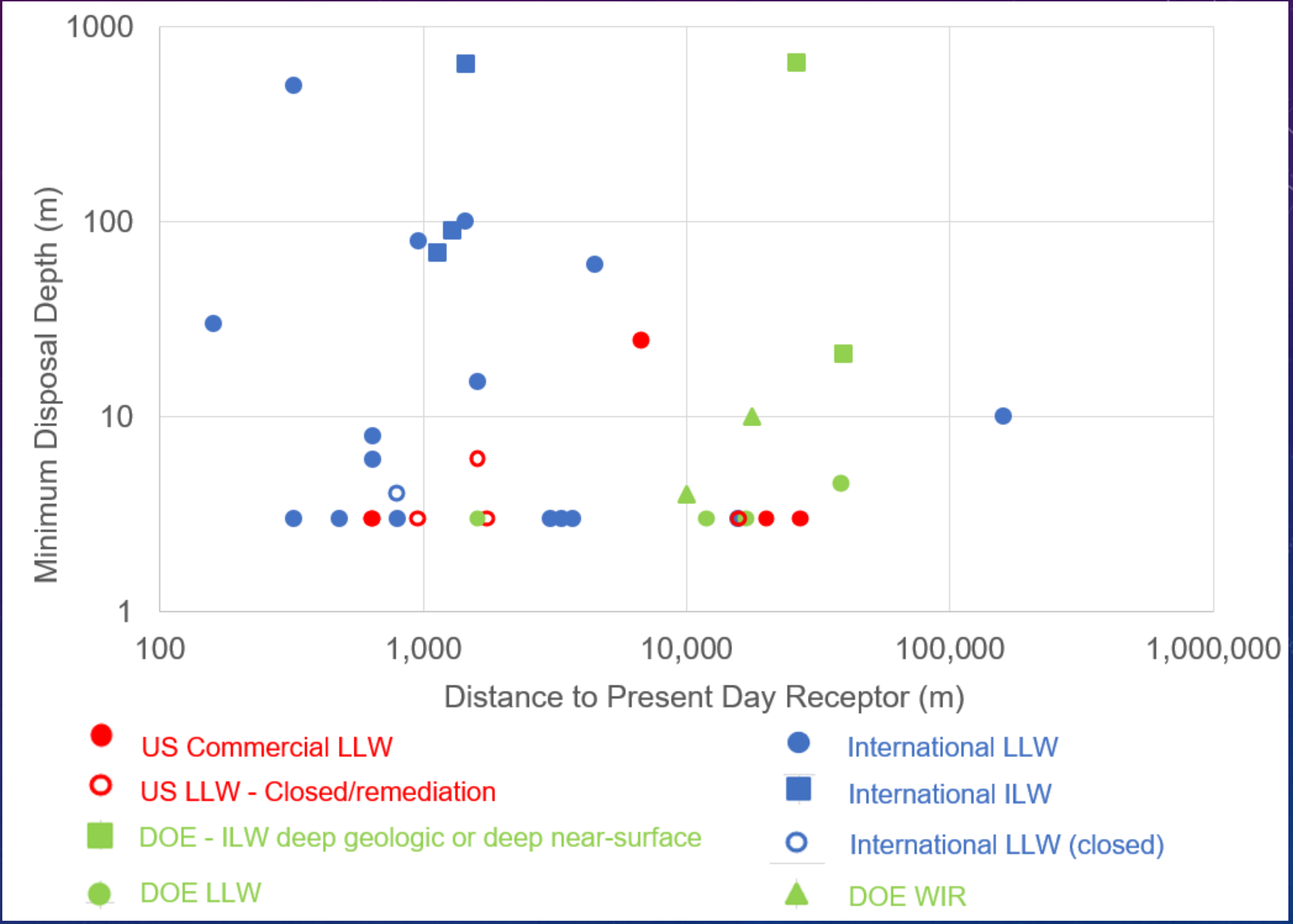
Table 1

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

[1] Units are nanocuries per gram.

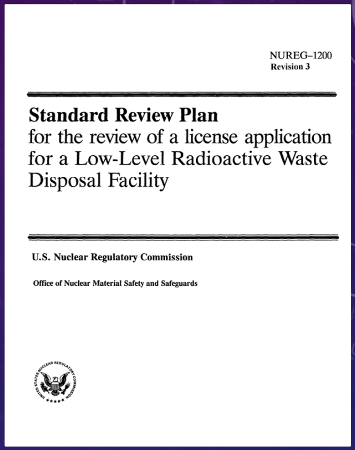


Intruder Assessment



Site Stability Assessment

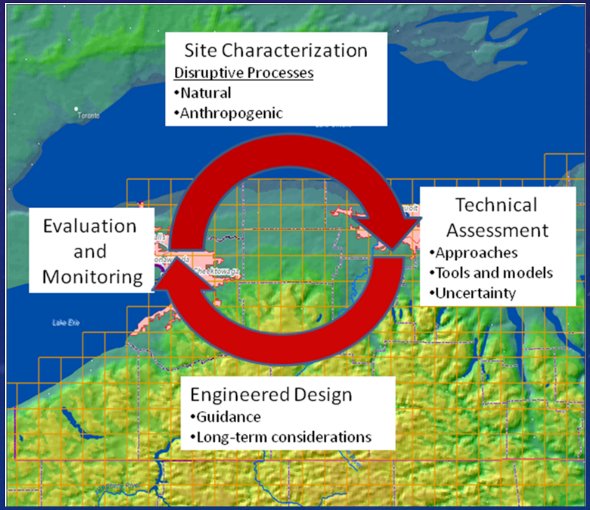
- Most problems with early disposal sites arose from short-term stability issues
- Those problems were addressed through design and site characteristic requirements
- Disposal of significant quantities of long-lived radionuclides may require long-term stability assessment
  - Addressed in the context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


NUREG–1200
Revision 3

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

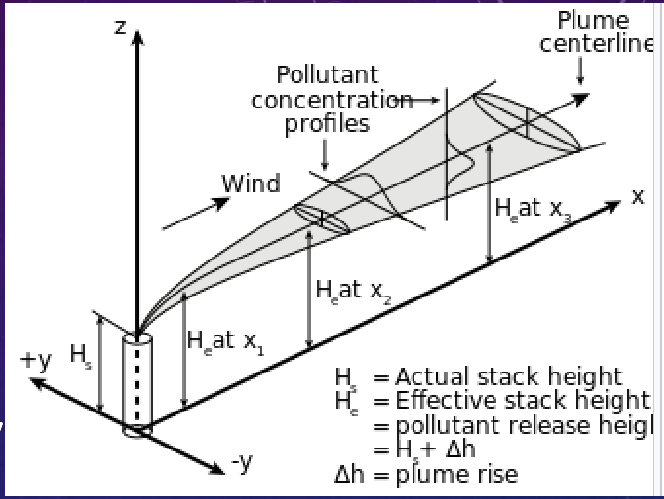
U.S. Nuclear Regulatory Commission

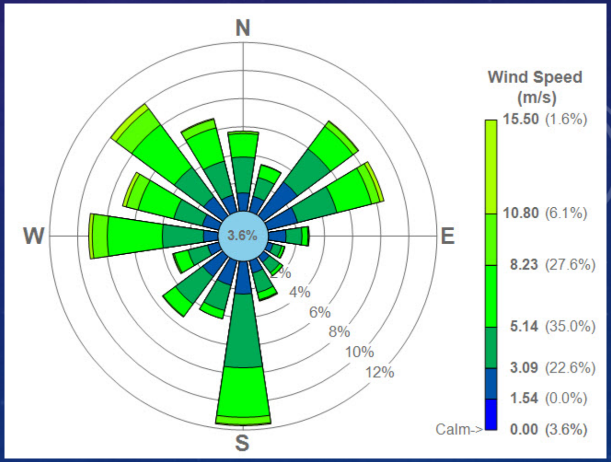
Office of Nuclear Material Safety and Safeguards



Operational Safety Assessment

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





Timeframes (Compliance Period)

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

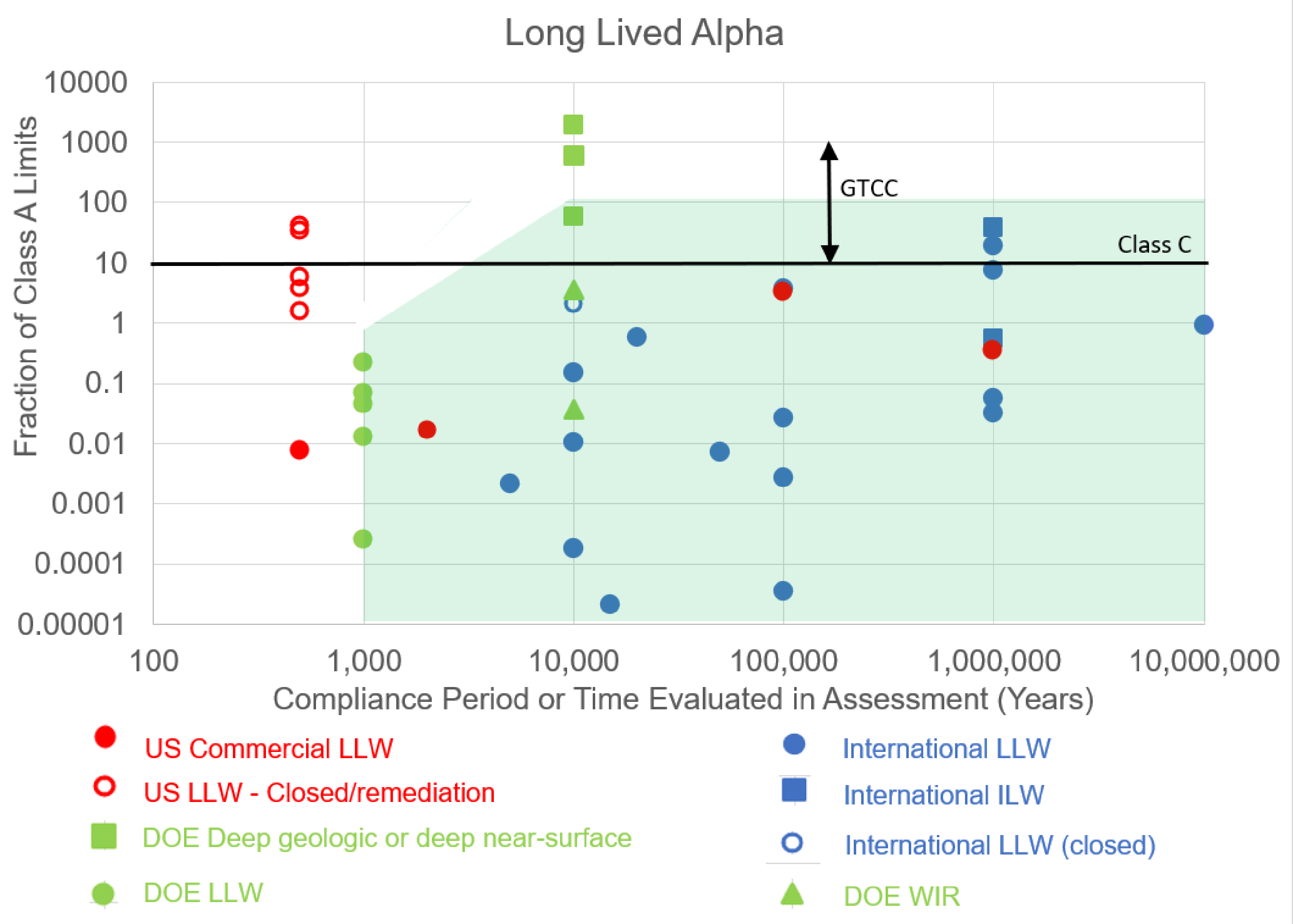
Timeframes (Compliance Period)

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

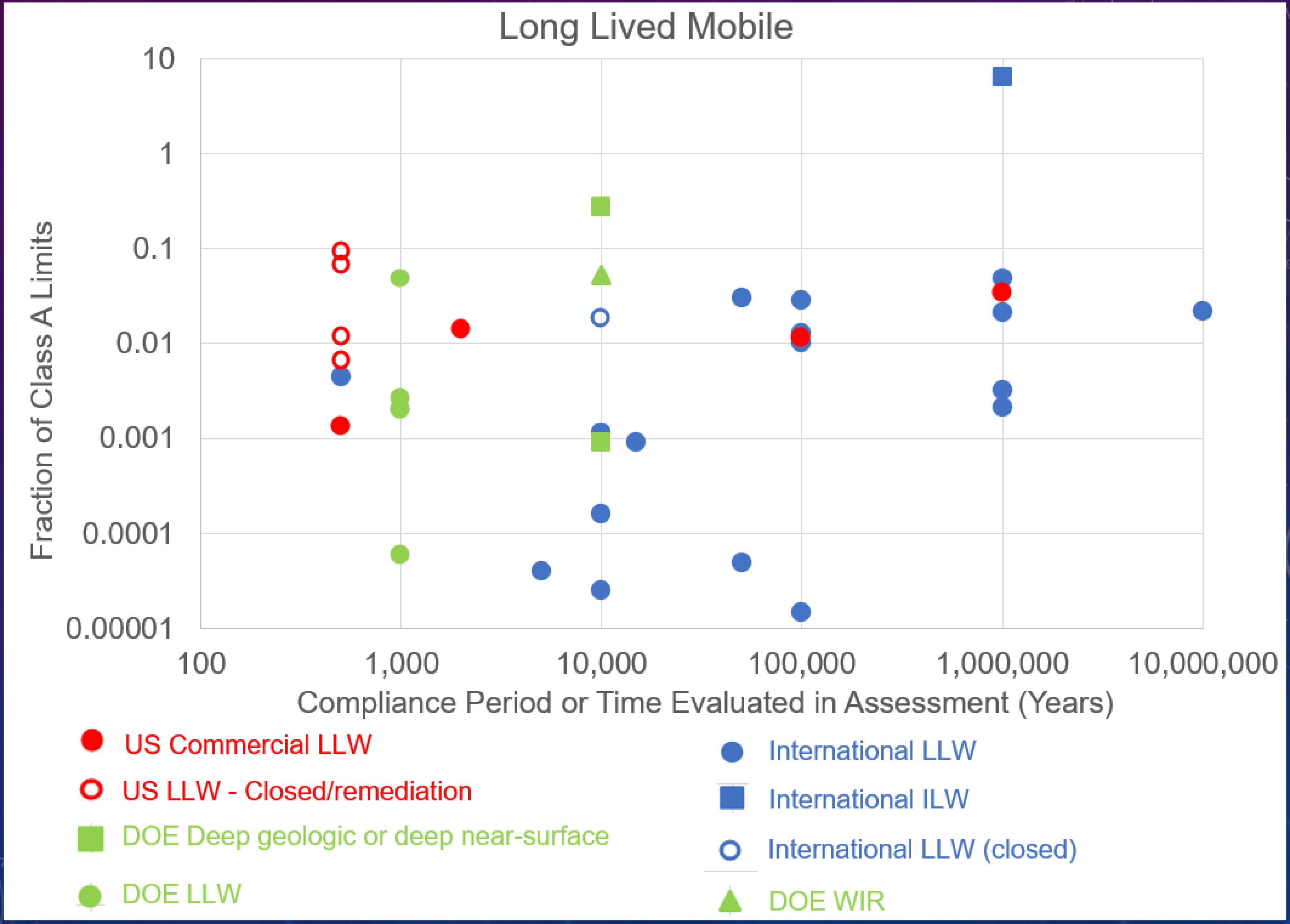
Timeframes (Compliance Period)

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

Timeframes (Compliance Period)



Timeframes (Compliance Period)



Performance Period Analyses

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

GTCC Waste Considerations - Disposal

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

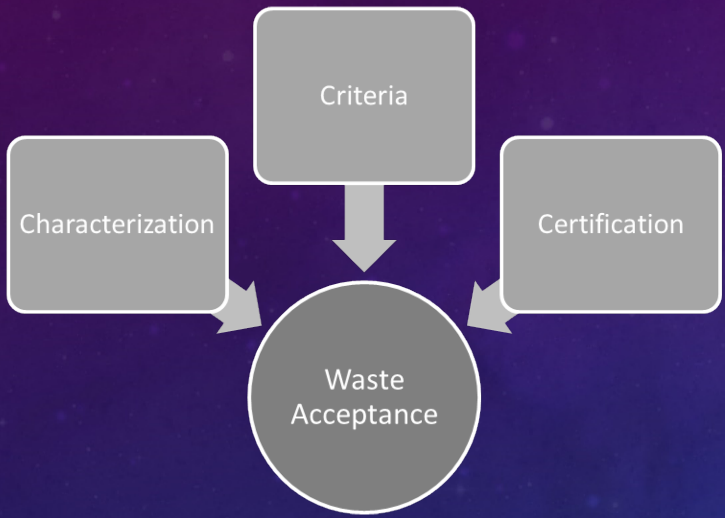
GTCC Waste Considerations - Criticality

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

GTCC Waste Considerations – Physical Protection

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

Waste Acceptance



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

Exception Criteria

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

What are Significant Quantities?

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

Significant Quantities

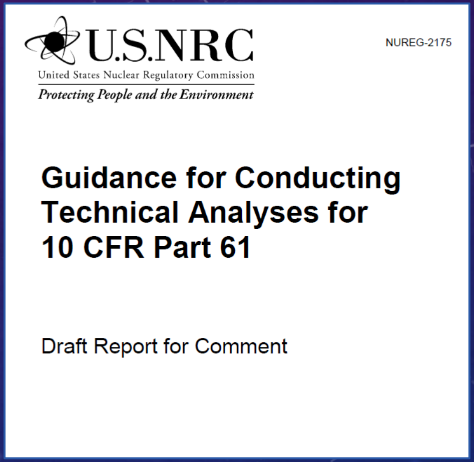
- Site-specific calculations to determine what amounts are significant
  - Though a simple approach is preferred, to properly account for the multiple key factors a more complex approach could be needed
  - Determined by licensee and approved by regulators
- Example approaches included in NUREG-2175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

Minimum Depth of Disposal for Significant Quantities of Uranium

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

Implementation Guidance

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


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

NUREG-2175

Guidance for Conducting Technical Analyses for 10 CFR Part 61

Draft Report for Comment

Next Steps

You are here

Rulemaking

1. Develop Proposed Rule that Integrates GTCC and 10 CFR Part 61 Rulemaking
2. Submit to Commission for Approval
3. Publish Proposed Rule
4. Hold Public Meetings and Comment Period
5. Develop Final Rule
6. Submit to Commission for Final Approval
7. Publish Final Rule

Public Meetings

May 2024

Onsite meetings at "sited" states and virtual meetings

November 2025

Guidance

1. Revise NUREG-2175 and Develop GTCC Guidance
2. Hold for Commission Approval of Proposed Rule
3. Publish Draft Guidance
4. Hold Public Meetings and Comment Period
5. Develop Final Guidance
6. Hold for Commission Approval of Final Rule
7. Issue Final Guidance