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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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SUBCOMMITTEE ON RADIATION PROTECTION

AND NUCLEAR MATERIALS

+ + + + +

TUESDAY,

MAY 18, 2010

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ROCKVILLE, MARYLAND

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

SUBCOMMITTEE MEMBERS PRESENT:

MICHAEL T. RYAN, Chairman

ACRS STAFF PRESENT:

DEREK WIDMAYER, Designated Federal Official

ALSO PRESENT:

ED ROACH, NRO

RICHARD RAIONE, NRO

JEAN-CLAUDE DEHMEL, NRO

HOSUNG AHN, NRO

JOE GIACINTO, NRO

STEVE SCHAFFER, NRO

SHERYL BURROWS, NRO

GOUTAM BAACHI, NRO

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

(1:00 p.m.)

CHAIRMAN RYAN: It is the appointed hour, so we will begin. ACRS members in attendance are me. The other members are not here today.

Derek Widmayer of the ACRS staff is the Designated Federal Official for this meeting. The purpose of the meeting is to review and discuss two guidance documents that address the ongoing issue of leaking underground pipes and groundwater contamination at nuclear powerplants.

The two documents are ISG-013, "Assessing the Consequences of an Accidental Release of Radioactive Material from Liquid Waste Tanks for Combined License Applications," and ISG-014, "Assessing Groundwater Flow and Transport of Accidental Radionuclide Releases."

The Subcommittee will hear presentations by, and hold discussions with, representatives of the NRC staff and other interested persons regarding this matter. The Subcommittee will gather information, analyze relevant issues and facts, and formulate positions and actions as appropriate, with deliberation by the full Committee at its June

meeting.

The rules of participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register. We have received no written comments or requests for time to make oral statements from members of the public regarding today's meeting.

A transcript of the meeting is being kept and will be made available, as stated in the Federal Register notice. Therefore, we request that participants in this meeting use the microphones located throughout the meeting room when addressing the Subcommittee. The participants should first identify themselves, and speak with sufficient clarity and volume, so they may be readily heard.

Copies of the meeting agenda and handouts are available at the back of the room.

We will now proceed with the meeting, and I call on Mr. Ed Roach and Mr. Rick Raione. Is that correct?

MR. RAIONE: Yes, sir.

CHAIRMAN RYAN: Okay. Thank you. Of NRO staff for some introductory remarks. Ed?

MR. ROACH: Thank you, Mike, and good afternoon to all of the attendees today. My name is

Ed Roach, and I'm the Branch Chief for New Reactors and Health Physics. And the topic we are discussing today is the Interim Staff Guidance 13 and 14, which were prepared by Health Physics Branch and the Hydrology Branch of NRO.

And as far as the Health Physics Branch, we originally placed this out for comment in May 2009. And this was brought out as we performed our ongoing COLA reviews, identifying several inconsistencies in the standard review plan NUREG-0800 guidance and the information the applicant submitted and we needed to make a reasonable determination.

As a result of that, a team of our staff put together the draft ISG-013 and worked with Hydrology to develop ISG-014, to make sure they made it up. What we found is that we -- when ISG-014 was ready to go for public comment, ISG-013 was laced out again on the Federal Register for comments.

And at this point, we have just received comments from NEI, and we are beginning to address those. Those comments will be discussed at our next NEI public meeting that our staff has, and that is May 26th. And so we will continue to resolve the issues and discrepancies and address the comments and any other public comments that were submitted on this.

So without --

CHAIRMAN RYAN: I think it's fair to say, just based on your comment about NEI, we are really in the information-gathering. We have not seen your comments or -- and we would like to, because I'm sure that's going to have an impact on the Committee's thinking. So I'm not sure where our schedule will be going forward in terms of hearing and, you know, gathering the rest of the information. It might have an impact on when the letter lands in the schedule.

MR. ROACH: Yes. They were submitted to the public document approximately, I believe, a week ago.

CHAIRMAN RYAN: Okay.

MR. ROACH: So we anticipate starting to work on them and open the discussions at the NRC/NEI Health Physics public meeting.

CHAIRMAN RYAN: Okay. Great.

MR. ROACH: So, and any other public comments that came in. We're not aware of any yet.

What I'd like to do is introduce a senior member of my staff after Richard Raione has discussed, and that is Jean-Claude Dehmel, who is the responsible individual for the development of the ISG, and the rest of the team that supported him is here also.

So I will now turn it over to Rich Raione for his introductory comments.

MR. RAIONE: Good afternoon. My name is Richard Raione. I'm the Chief of the Hydrologic Engineering Branch. ISG-014 is designed to provide improved guidance to our staff on how to deal with the radiological consequence of accidental liquid radioactive release scenarios dealing primarily with groundwater.

As a branch, we noticed a lot of RAIs being issued to address the regulatory requirement for this analysis. So this guidance is intended to clarify existing guidance provided in SRP 2.4.12 and 2.4.13, in addition to Reg Guide 1.206.

A risk-informed hierarchial process is proposed, where conservatively-bounding scenarios can be first applied to determine compliance with Part 20, Appendix B. An example of this approach could involve an applicant setting K_d values to zero. This would normally mean that the time of transport is minimized, and, therefore, resulting in a maximum concentration at the receptor point.

For this example, then, carried forward, the applicant would determine radioactive concentrations at a receptor point offsite, and then

comparing these concentrations with the ECLs, also known as effluent control limits, to determine the rad risk. This ISG allows for the flexibility, however, of ratcheting in more realism throughout the process, such as the collection and analyses of onsite measurements of K_d as appropriate.

I would like to thank Dr. Hosung Ahn, Joe Giacinto, and Mark McBride for their efforts in drafting this ISG at this point, and Dr. Hosung Ahn will be providing -- or presenting for the branch, for RHEB.

MR. DEHMEL: All right. This presentation consists of five major parts -- an introduction, addressing the need of ISG-013, given SRP Section 11.2 and BTP 11.6, and some of the underlying regulatory bases; and a review of issues and bases for the proposed update; some of the core elements of the proposed interim guidance with selected points of emphasis, which I am going to go over. And we are also going to look at whether the revised guidance affects the areas of review and interface with other SRP sections in the context of Section 11.2 and BTP 11.6.

And then, finally, an approach -- the approach that we are thinking about in finalizing

ISG-014, with -- obviously, integrated with the comments and resolution of issues on ISG-014, given public and industry comments, any comments that this has generated.

So why is this ISG needed? This ISG is needed because of inconsistent and incomplete guidance within SRP Section 11.2, BTP 11.6, and the interface with SRP Section 2.4.13.

In the context of BTP 11.6, the issues are associated with the scope of acceptance criteria and consideration for design features that may mitigate the impact of a release, definition, and selection of all site dose receptors, and assume release scenarios and potential impact on surface water bodies and direct exposure pathways.

On the development of radioactive source term, there is a need to provide further guidance on the selection of radionuclide and radionuclide distributions, selection of plant systems, and tank assumed to fail, processes by which radioactivity is assumed to be released in the environment, and clarification on the degree of conservatism that would need to be applied specifically between BTP 11.6 and SRP Section 2.4.13.

Just as an example of some of the issues

that we found in reviewing design certification and COLA applications, some of the things that we kind of stumbled across and had to deal with with the applicant involve assumptions and credits for mitigating design features, assumptions on the release mechanism and duration of the release, source term development, and assumed radionuclide distributions, determining the point of compliance in the context of both SRP sections, and whether the point of compliance includes drinking water.

These slides identify the applicable regulatory requirement and regulatory guidance. It should be noted that there are no requirements in the regulation that specifically forces the applicant to actually do that kind of analysis. It is all inherently contained within the SRP NUREG-0800, Section 2.4.13, and 11.2, and BTP 11.6.

CHAIRMAN RYAN: Jean-Claude, isn't that a fairly narrow view of the world, though? I mean, you know, a powerplant has a water permit for some local government unit. And I just wonder how we can recognize that they have other obligations that impact on what they do in this meeting the NRC obligations? You know, I mean, my simple-minded view is that 25 millirem is the dose number we use for NRC

calculations, but very quickly at the Franz plus one foot it is four millirem. So how can we look at the NRC requirements in isolation of the others?

MR. DEHMEL: Okay. Let's --

CHAIRMAN RYAN: I know that is the million dollar question right out of the box.

MR. DEHMEL: Yes. But we should maybe go back and understand the underlying premise of how this accident scenario, this consideration, came to being. It is there purely for two things.

One of engineering analysis of the design features of the building, and if there were -- if there were a major malfunction of the equipment, if it were to fail and there were to be a leak, ultimately that information, the purpose of that information is to actually set a tech spec on the amount of radioactivity on that particular tank for the assumed dose receptor locations, such that if you had radioactivity in that tank and it leaked you wouldn't exceed the tech specs and the dose that was applied at the particular time.

CHAIRMAN RYAN: So 25 millirem.

MR. DEHMEL: No. So right now -- right now, the way it was always set up, if you go back to 1975, in the SRP and Reg Guide 1.70, it was always

based on the effluent concentration limits of Appendix B2, Part 20.

And so with the various successions over the -- the various revisions of the guidance, the SRP, the Reg Guide 1.70 and 1.206, and now the revised SRP and BTP, the dose is still based on -- or the main acceptance criteria surveys on meeting the effluent concentration limits of Appendix B2, Part 20, Table 2, Column 2.

So currently it is 50 millirem, if you were just to look at the effluent concentration limits of Part 20, and it is for that sole purpose. So basically, in the context of 11.2, and BTP 11.6, it is viewed as an engineering analysis for the purpose of specifying specific tech specs for the amount of radioactivity you might have or might be allowed in a tank that we are "limiting" for the purpose of storing radioactive liquid waste.

CHAIRMAN RYAN: In your view, does that cover not only the accident scenarios like you describe but the slow, ongoing leakage scenarios?

MR. DEHMEL: No, absolutely not. It presumes a pump failure or pump release. That's it.

CHAIRMAN RYAN: So there immediate observation, and some action would be taken --

MR. DEHMEL: Exactly.

CHAIRMAN RYAN: -- to address it right away.

MR. DEHMEL: Exactly.

CHAIRMAN RYAN: That's the assumption.

MR. DEHMEL: This does not deal at all with slow, protracted leaks on pipes and other parts of the facility and buildings. It is -- those aspects are currently captured in Part 20, 1406, and associated requirements of the design criteria that, you know, there should be no unmonitored and non-controlled releases.

So the evolution of the BTP and how it evolved essentially was for -- well, it initially was in Chapter 15, and later on it was thought that, well, this is not a design basis type of accident, so it was moved into Chapter 11.2. And we have a parallel scenario for the failure of the gas -- the gaseous waste management system, where you -- if you have a PWR, you have delay tanks, or you have BWR, you have charcoal delay bed, there is an analogous analysis just for that purpose as well.

So those -- in the context of 11.2 and BTP, it is that it is really addressing, you know, kind of an assessment of the engineering capabilities

of the building, of the facilities. And then, given that, one would assign a tech spec either on the gas delay tank -- on the gas decay tank or the gaseous waste management system or in the liquid rad waste tank.

CHAIRMAN RYAN: Okay.

MR. DEHMEL: So it is kind of disconnected and divorced with the current issues with what we see and we read about, all the tritium leaks and so on.

CHAIRMAN RYAN: Okay. That needs to be rethought.

MR. DEHMEL: That's one option. The one that we, the staff, are confined to the context of how this -- these requirements evolve. The thinking about the ISG-013 and for ISG-014 is that we are thinking about restructuring or providing more information, more guidance, in the original intent of 2.4.13, original intent of SRP 11.2, and BTP 11.6.

What you're talking about is going beyond what were -- the intent of those -- of the requirements or guidance in the SRP. And that essentially is something that would require perhaps some additional licensing, you know, review -- in other words, it's above the technical staff's consideration. It would be an issue, for example, for

NRO, or DNRL would have to tackle and address.

MR. ROACH: Mike, this is Ed Roach again. Along that line, the low activity, large volume tank is another failure that, you know, we think needs to be addressed as part of this, because there are tanks that -- say a condensate tank on a facility that could develop a leak and fail, and that may be an insidious leakage into the groundwater as opposed to the catastrophic failure.

There have been questions asked about that in various applications. So those questions are being asked at the application level, and using 10 CFR 20.1406, and Reg Guide 4.21 as the basis for that.

CHAIRMAN RYAN: Yes.

MR. ROACH: Again, having reviewed this, this does come from the evaluation section of the former standard review plan 15.7.3, "Postulated Radioactive Releases Due to Liquid-Containing Tank Failures." And this had I think its nexus in the fact that many of the original sites had refueling water tanks located outside of the auxiliary building and were subject to either a vehicle accident and subsequent catastrophic dump into the storm sewer.

So we -- that got carried into the March 2007 version in Chapter 11 of the BTP.

CHAIRMAN RYAN: Yes.

MR. ROACH: And so in our reviews we found areas for improvement, and that's our -- that has been our direction, yes.

CHAIRMAN RYAN: Kind of leaving 1406 aside I guess is really what you're saying.

MR. ROACH: Although I think -- this is Ed Roach again. I think in the ISG-014 there is some discussion of the 20.1406 features that could be used to mitigate the consequences or the likelihood of it making it to the groundwater/surface water.

CHAIRMAN RYAN: I mean, I guess you could make an argument that the catastrophic values in the -- you know, truck crashing into a tank or whatever it might be, are not as important as the incipient slow leakage.

MR. ROACH: I think -- and this is where the paradigm diverges here -- is that in the realm of safety, the concern is the dose to the receptor at that point, and then the 20.1406 tends to be the residual radioactivity, because it is -- to have enough activity into the environment to give that dose to the receptor is very difficult. I don't disagree with the fact that it is something we additionally need to look at, because it is putting something in

the groundwater that doesn't belong there. So --

CHAIRMAN RYAN: It is a dose issue, because, you know, I guess even though the NRC doesn't -- may not agree with the numerical model, or may -- I don't know -- but for groundwater it is four millirem.

MR. ROACH: We are going to change that.

CHAIRMAN RYAN: So very quickly you've got a situation where you're at a licensed facility, everything is rosy with 25 millirem, or whatever number you want to, you know, apply. If you get off the fence, you're not longer in that regime. You can -- I mean, you could make an argument either way. Well, it was compliant when it left or it's compliant now, it is compliant here, and it's not the same standard going forward, so it doesn't comply. I'm sure you've heard all of that before.

MR. ROACH: Yes. Just for -- yes. Just for clarification, the four millirem limit you speak of is from the --

CHAIRMAN RYAN: From the EPA with drinking water.

MR. ROACH: -- drinking water.

CHAIRMAN RYAN: Yes.

MR. ROACH: Okay. As opposed to a radiological effluent or --

CHAIRMAN RYAN: Right.

MR. ROACH: -- environmental monitoring type, yes, okay. I concur, I agree with that. And the fact that once radioactive effluents are released into the groundwater, essentially the mitigation opportunities are very difficult. And the likelihood of you recovering that and minimizing the dose, making it ALARA offsite, are what I would consider difficult.

CHAIRMAN RYAN: Okay. Again, I'm just trying to understand, you know, how that context is -- I know there is a task force that is kind of wrestling with those questions, but it is not unrelated to these two ISGs.

MR. ROACH: Yes.

CHAIRMAN RYAN: I don't --

MR. ROACH: I will agree with you that it is not unrelated, because it is central to everything we think of right now. But in the case of --

CHAIRMAN RYAN: How it's related is yet to be determined.

MR. ROACH: Exactly.

CHAIRMAN RYAN: I'll agree with you as well, so --

MR. ROACH: Yes. That's how we are trying to --

CHAIRMAN RYAN: Yes.

MR. ROACH: -- evaluate that piece of it.

CHAIRMAN RYAN: Okay. Thanks. Sorry, Jean-Claude.

MR. DEHMEL: That's quite all right.

Now, I mean, we understand the issue that you're bringing up. The only thinking -- the thought right now is that you may have to find another vehicle with which to deal with this. You know, the use of BTP 11.6 and 2.4.13 may not be the appropriate vehicle for this, so we may have to develop -- we would have to -- if we were going that way, we probably would have to develop another section in the SRP that would essentially address the issues with slow protracted releases from piping and equipment that leak over the years.

MR. WIDMAYER: I guess I got confused -- as Ed pointed out, when I read ISG-014, and all of a sudden 20.1406 came up, I really could not figure out what was going on. And it was difficult to understand the nexus of the two, and whether or not 20.1406 is relevant or irrelevant or --

MR. DEHMEL: In the context of BTP 11.6 and Section 11.2, for the purpose of this presentation, no, it's not relevant.

MR. WIDMAYER: For yours. But what about for Hosung's?

DR. AHN: This is Hosung Ahn. Before I developed the ISG-014, we consulted with OGC on whether we included 20.1406 on this or not, and OGC said that we should separate that from this guidance, because this is only for the safety and that may be handled on IRG-4.21 and the NEI-0808. So they said that it's better to separate that. That's what I wrote.

MR. RAIONE: This is Richard Raione. One other point may be that what may help to clarify this is ISG-014 really looks at the physical processes, the physical hydrology or physical hydrogeology to derive projected concentrations at offsite locations, the receptor points, etcetera, maybe more than one. So that may be one way to look at it.

We are differentiating from health physics and pure hydrology, looking at release scenarios. When you look at the overall context, though, I can understand -- where ISG-014 and 013 don't address chronic sort of impacts, we are looking at acute -- if I could use that terminology -- and it's just looking at one potential theoretical release scenario.

There are several that of course are being

looked at now. How to tie them all together, what to integrate, what not to integrate I think is the difficult question to answer.

MR. DEHMEL: Okay. So, again, going back to -- so the current requirements are contained in SRP Section 11.2, BTP 11.6, and also in Reg Guide 1.206.

As I mentioned earlier, the accident failure scenario considerations were initially contained in Chapter 15 of the SRP, and the FSAR, but it was later on thought that this would be more like an anticipated operational occurrence as opposed to a design basis accident, so it was moved in Chapter 11.2.

There is additional guidance provided in NUREG-0133. This is the document that basically forms the basis of the ODCM that is dated October 1978. And with NUREG-0133, this is when -- the first appearance of the assignment of a technical specification on the amount of radioactivity that would be allowed in a specific tank outside of containment.

Now, as part of the effort that led to the March 2007 revision of the SRP, we, the staff, identified working on revising Chapter 11 and looking at Section 2.4.13, and we identify a number of inconsistencies and issues that we wanted to address.

But at the time, there was a concern that the NRC should not change its licensing basis. And, in essence, we were told at that point, given that we are in the process of preparing a revised SRP and new Reg Guide 1.206, at the same time applicants were cranking out design certification application, that at that time the NRC should not be changing its licensing basis work. So we were essentially throttled back and trying to make certain changes to the SRP and the associated guidance.

So this slide identifies an example of issues forming the basis of the update. The main point of these slides -- and we'll see that they are carried on later on. The main point of these slides are plant design features and actual or assumed site features. So this is essentially now a cross-connection or an interface between BTP 11.2 and SRP Section 2.4.13.

Application of conservative versus average assumptions in formulating the accidents and conditions, the use of passive and durable mitigating design features, tank selection and failure mechanisms, radionuclide mobility, gradient application of simple to more complex transport models, and that is going to be addressed in more

detail during the next presentation, and a need for expanded scenarios to differentiate drinking and non-drinking water pathways.

So this is the first of three slides addressing the core elements of the proposed revised guidance. On failure mechanism, the proposed guidance provides clarification and justification of the postulated failure, addresses more specifically tank selection and location, indoors versus outdoor, ranking the tanks in terms of activity and inventory against volumes, and whether the release is surface bodies or groundwater.

This essentially is an illustration or our further clarification, further point of what Ed mentioned earlier, is that now we are -- with the revised guidance, we are forcing the staff and the applicant to look at two different types of inventories -- large volume and low activity, low volume or high activity. And the idea is to capture the kind of tanks that would be the most limiting.

For mitigating design features, the expanded guidance focuses on the use of passive and durable design features, with the ability to contain the entire tank volume and the capability to spill liquids through an appropriate system or tanks.

For radioactive source term, the emphasis is on justification of the selected tank, and its liquid inventory, irradiated material inventory, distinction between short and long-lived radionuclides with respect to surface, or groundwater impacts and environmental mobility.

The guidance has been expanded to now consider the fact that -- because typically the thought was this -- the major impact would always be groundwater, a pathway. And as a result of that, the analysis tended to exclude short-lived radionuclides and focus on the longer-lived radionuclide.

Now, we have added a new dimension to the requirement by adding surface pathway, where now you want to consider both short-lived and long-lived radionuclide. Well, for groundwater pathway, the focus will still be on longer-lived radionuclide, unless it can be shown that there is some enhanced mobility of the radioactivity, and, therefore, one might retain a number of radionuclides.

CHAIRMAN RYAN: Why doesn't it show tritium on there?

MR. DEHMEL: Hmm?

CHAIRMAN RYAN: Why isn't tritium on the list in the last -- I know this is long-lived and

environmentally mobile, but tritium --

MR. DEHMEL: Oh, no. Tritium -- sorry, tritium is there.

CHAIRMAN RYAN: Okay.

MR. DEHMEL: Yes, tritium is there. Yes, it's not listed there, but if you look at ISG-013 we have a table in the back.

CHAIRMAN RYAN: It is there?

MR. DEHMEL: It is there, absolutely.

CHAIRMAN RYAN: Okay. That is a promise, okay. I was going to say, that's your number one friend if you are trying to do some modeling.

MR. DEHMEL: Yes.

CHAIRMAN RYAN: Okay. Fair enough. Very good.

MR. DEHMEL: Yes. The thought was that, you know, it's like tritium we would be expecting anyway. So these are other radionuclides that we don't see being considered in the application. For example, DC-99 and INL-129, we don't see these being essentially included in the applications.

CHAIRMAN RYAN: Well, but, you know, we just accept the fact tritium is going to be there I guess. I mean, it can be there in fairly large numbers, but, again, that to me is a significant

potential for discontinuity between what a groundwater standard might be, what a local standard might be, versus drinking water versus an NRC dose-based or risk-informed release criteria. Twenty thousand picocuries per liter is of no consequence in a license situation. It is four millirem for an entire year of drinking water.

So how do we deal with that discontinuity? I guess that's the sort of central question I keep coming back to when I think about this. The structure of the analysis isn't as problematic as the potential disconnect between two rules of what is okay.

MR. DEHMEL: The requirement to address the other regulatory requirement -- and if you look at the drinking water standard -- if you have -- if a leak were to occur from a tank, it were to fail, it does not absolve the applicant or the operator to actually consider all other regulatory requirements.

CHAIRMAN RYAN: NRC regulations to.

MR. DEHMEL: Yes, all other regulatory requirements, in addition to NRC. So the operator or the applicant is bound by a number of things. One is to confirm that all NRC regulatory requirements are met, and then consider other federal regulatory requirements.

For example, the EPA drinking water standard is not specifically addressed in the regulation the same way 40 CFR 190 is. But it is embedded in the offsite dose calculation manual. That makes reference that if you have a drinking water pathway near the site, that you should apply the drinking water standards, and look at the impact of the release and see whether or not there are any implications on their drinking water standard. So that's addressed in NUREG-1301 and 1302.

CHAIRMAN RYAN: And, of course, those --

MR. DEHMEL: It's not embedded in the regulation.

CHAIRMAN RYAN: And some states deal with that in an even more specific way. They say it is a drinking water source or a potential drinking water source. So potential resources are also protected sometimes at the local level.

MR. DEHMEL: Yes. Yes, that's right. There are other states -- that's right. Right. So --

CHAIRMAN RYAN: Particularly out west it gets very complicated, but, you know, it's just somewhere I see that, you know, meeting one requirement doesn't necessarily get you to where you are meeting other or all requirements.

Anyway, go ahead. I'm sorry I interrupted.

MR. DEHMEL: No, it's all right.

This slide addresses the two other elements. The first one provides clarification on approaches used to describe the transport -- the transport of radioactivity in ground and surface water, with the emphasis being on the assumed or known facility and site features, the mechanism that would impact the direction of travel, dispersion of the radioactivity to an outside dose receptor. And, again, that aspect will be presented later on as part of the presentation with -- on ISG-014 in greater detail.

The second one focuses on exposure scenarios and acceptance criteria, with the distinction being made on whether the scenario involves direct or indirect exposure pathway. The exposure pathways are direct consumption of ground or surface water. The indirect pathways include the consumption of fish from impacted surface water bodies, and food product impacted by crop and pasture irrigation and livestock watering.

It was felt that we should provide more guidance in ISG-013, because in the prior guidance the

indirect exposure pathways were always being treated as a footnote in the guidance, in what used to be 15.7.3 and even in the 1981 version of the SRP. So we felt that it was important to bring this -- essentially make it a co-equal with respect to the impact on drinking water.

So for direct exposure pathways, the adopted acceptance criteria are the effluent concentration limits of Part 20, Appendix B, Table 2, concentrations, applying some of the ratios to all new radionuclides, all identified radionuclides. And for indirect exposure pathways, the adopted acceptance criteria is 100 millirem dose limit from Part 20.

Again, this is in parallel with what is done for a similar accident in Chapter 11.3, the annealed gas system. It is also 100 millirem. Again, it is an acceptance criteria applied to a specific event. It is not a demonstration -- it is not a requirement demonstration with Part 20 requirements or Part 50, Appendix I.

So one point I want to reiterate here, the SRP acceptance criterion should not be construed as a demonstration of compliance with Part 20 per se. Rather, they are used as a measure of radiological impact in assessing the consequences and the

acceptability of a tank failure, with the understanding that if you were -- if a scenario were to occur or a situation were to occur where one would exceed the 100 millirem or the effluent concentration limits of Part 20, Appendix B, there are two issues, two options there.

One is to change the design such that one may include, for example, install liners in the rooms and cubicles where the tanks are located, such that there would be no such release. And the other one is if there were a release, let's assume the design was not upgraded, then there would be a tech spec imposed on the total inventory of radioactivity and the radionuclide mix for that particular tank. It's the most limiting tank.

This leads to this slide here. So the first one -- the first item here is -- places the emphasis on the staff to confirm that the applicant's assessment or results are used to specify maximum quantities of radioactivity with a limiting tank or tanks, and identify whether the radioactivity -- the rad inventory or concentration limits are based on direct or indirect exposure pathways.

The revised guidance would identify the operational program and procedures in assuring that

the implementation of the tech specs stays current in light of the result of the current line use senses, or the period line use senses that are conducted.

The second part of the slide proposes a revision to the evaluation finding used by the staff in the conclusions sections of the safety evaluation report. So the evaluation findings would be revised to reflect the revised guidance, meaning the final version of ISG-013 in this case, and the wording and the format with regards to findings would be consistent with current practices in the other SRP sections. So this is kind of standard blurb that would be applied.

CHAIRMAN RYAN: How would you get to -- I'm struggling with drinking water versus non-drinking water pathways.

MR. DEHMEL: Because if you were to go back and look at kind of the history of 15.7.3 and BTP 11.6, the main focus was always on drinking water. And in variant footnotes, it said -- if I can find an example here -- original footnote, here is a perfect example of a 1981 SRP, so it focuses on groundwater, and then it says -- the footnote says, "Supply means as well as -- means a well or surface water intake that is used as a water source, with direct human

consumption," and then it says, "or indirectly to animal, crop, and food processing."

CHAIRMAN RYAN: Okay. So this was --

MR. DEHMEL: So --

CHAIRMAN RYAN: -- written before EPA came into existence.

MR. DEHMEL: Yes.

CHAIRMAN RYAN: The definition is different.

MR. DEHMEL: We understand. We understand.

CHAIRMAN RYAN: Yes. So I guess I'm struggling with -- that doesn't help me very much, because I know there is something that supersedes that. I mean, you know, it's not a matter of technical regulation or technical aspects of regulation. It is what the law says groundwater is. It is now defined.

You can tell me if I'm wrong. I mean, I'm just trying to understand how we fit together some of these, you know, now 30-year old guidance documents into a regulatory structure that has evolved pretty substantially.

MR. ROACH: This is Ed Roach again. In working with Jean-Claude on this topic, I will tell

you that we have had a meeting with the EPA where they have come in and talked about their possible revision to 40 CFR 190, and their discussion of possibly incorporating groundwater in that part of the rule. But they're at the very early stages, and they haven't seen anything that is going to drive them that way unless it's a real push from the NRC.

Now, getting back to what Jean-Claude -- the approach we're taking is the approach we have taken for many years as far as the effluent releases, and looking at groundwater as being the offsite -- understanding that that is offsite and that's when the -- you start interfering with the EPA. You are still required to meet the EPA guidance, whether or not you have a license to operate a facility under the NRC.

So that doesn't go -- I was actually looking in here to find out where that statement is in Part 52, because I believe I read that earlier. That's what I was looking for.

CHAIRMAN RYAN: Okay.

MR. DEHMEL: I think we understand the disconnect. We were well aware --

CHAIRMAN RYAN: Oh, sure. Sure you were.

MR. DEHMEL: The question is, you know, if we are going to go along the line of -- that you would

like us to see, it's a major revision of the regulation, of the requirements that are identified in the SRP and in the reg guide. So somebody would have to essentially direct us to do this, because right now we have kind of a, you know, technical and regulatory straitjacket on.

MR. ROACH: That's the ACRS.

(Laughter.)

CHAIRMAN RYAN: No. You know, and again, I'm not trying to pick a fight here. Just -- I'm trying to understand how we deal with what is an obvious disconnect to me. I mean, it just seems clear that it's not well aligned.

Now, you know, I mean -- and I have bumped into this a couple of other times. You know, for example, if you have a spill inside the plant, my God, we're clean it up right then and there. You know, if I have a spill outside, I would log it in the logbook and I'm done. You know, that to me doesn't seem like the same ALARA practice. Just an example. So that's why I'm struggling with it. Press on.

MR. ROACH: Yes. I --

MR. RAIONE: Be careful what you say.

(Laughter.)

MR. ROACH: Yes, I -- I don't think we're

here to pick a fight either, and the obvious disconnect between, you know, evaluating to the groundwater four millirem per year standard, as opposed to the effluent standards of Part 20 and 10 CFR Appendix I, and the other guidance we use, is -- it has been there, and we haven't necessarily resolved that disconnect.

We understand that at the site boundary we treat it as -- if you exceed the limits at the site boundary by finding it in a well, then you are in EPA space. The operator is held liable for that.

CHAIRMAN RYAN: Okay.

MR. DEHMEL: This slide addresses the areas of review and interface contained in SRP Section 11.2 and BTP 11.6, with other SRP sections.

So, basically, the areas of review -- acceptance criteria, technical rationale, review procedure sections of the SRP and BTP, will be updated to reflect a final version of ISG-013 and 014. So this is essentially a simple editorial fix.

The interface pointers identified in Section 11.2 and BTP 11.6 would remain -- would remain the same, and there would be no changes with respect to the revisions of ISG-013 and 014.

So with the resolution of the

applicability of the two interim staff guidance documents, just, again, as a reminder, those were issued in two Federal Register notices on February 24th of this year. The comment closing -- public comment date was on April 24th. We have received some comments from NEI on behalf of the nuclear industry. We were told that the comments reflect expert from -- with utilities.

COL applicants are putting applications together, as well as the engineering and the construction firms, who actually are about to build these plants. So we have yet to evaluate the comments. And as I had mentioned, we may be receiving some other public comments.

So the resolution of both ISGs, or in this case ISG-013, will take into account whatever, you know, public comments we have received, as well as comments from ACRS. They are going to be closely coordinated to make sure that we have no conflict between ISG-013 and ISG-014.

And then, the applicability of the revised guidance will take effect once those two documents are issued as final documents. You know, they will be posted again in the Federal Register, and also posted on the NRC website as final.

And that's all I have.

And then, the last slide, which you -- documents the full citation, since we abbreviated a lot of the designations.

CHAIRMAN RYAN: Okay. Thanks.

MR. DEHMEL: Further questions?

CHAIRMAN RYAN: No. You don't get a lot when you have one member sitting here, so --

MR. ROACH: Can I just clarify, Mike? This is Ed Roach again. If I were to characterize your concern, it is, how do we address the obvious disconnect between the drinking water standards and the Part 20, Table 2, Appendix B limits used for the evaluations?

CHAIRMAN RYAN: I think it is just a slight -- it is not just the drinking water standard or any other applicable -- and it might be a plant-specific, local requirement, because some of those are, you know, even different from the EPA.

So, you know, it -- and it's broader than that, too. There's -- you know, the 1406, it looks farther ahead to decommissioning questions. So somehow all of that has got to come together into one coherent plan.

Now, it may not necessarily mean the

evaluation numbers. I think, Jean-Claude, you very clearly pointed out that different evaluations have different purposes. So we are not looking at necessarily real doses to real people. We are looking at, you know, accident situations, theoretical doses, and some structure of how that assesses properly the risks that might be involved.

So I am completely understanding of that, but at some point, you know, it seems that communicating all of these different bases to the public is very tough. High is a four here and 100 there and 25 there, and, you know, what's going on? You know, so somehow we've got to either roadmap these differences carefully and explain them, or develop some consistencies, or both, to be successful moving forward.

The tritium task force is a good example there. You know, we were talking about all of these numbers, and lots of plants spent lots of money putting in lots of holes.

So, you know, that's really my concern is, how do we get to some consistent picture of how all of the risks that are involved here are assessed? And, clearly, pre-construction axial analysis is one venue; operations with, you know, ongoing, routine,

authorized releases is another; undetected releases during operations is another.

Then, we get to the extended operations questions, you know, the integrity of underground systems, and all of the rest, and ultimately we get to decommissioning where we've got a new set of numbers to work with. And, you know, in some cases, you know, undetected -- previously undetected groundwater contamination, Yankee Rowe for example.

And we've got two plants that are licensed, you know, wrestling with it right now that may have impact on their licenses. So somehow there has got to be some coherence put to all of that. "Because it has always been this way" doesn't do me a lot of good.

MR. ROACH: That is usually the term that puts the hair up on the back on my neck, so my sense is that the focus here for Jean-Claude was to explain what we are trying to do with ISG-013. And the tritium task force in the previous 2006 published document on lessons learned from undetected leakage, the tritium groundwater, they opened our eyes, and we used those lessons learned to formulate the guidance for 1406.

But there are many other, you know, daily

issues that come to light about tritium at one plant or another that we look at that, and then drag that back to new reactors. But from the agency's viewpoint, we would need to really define what the expectation is for the licensees and step in as the regulator and demand compliance.

CHAIRMAN RYAN: So I guess it gets really to the question of, you know, do you feel like ISG-013 and 014, and the revisions you've made, have taken a step toward getting at these tougher, more complicated questions?

MR. ROACH: Fourteen probably discussed -- links 20.1406 more to it. I thought on 13 we were much more focused than the --

CHAIRMAN RYAN: Addressed the accident --

MR. ROACH: -- the issues -- yes, the accident analysis and the issues we have uncovered in the course of our lessons learned from doing the reviews.

CHAIRMAN RYAN: And that is fair enough. I mean, I appreciate that. But, you know, and that's a reasonable conclusion for us to take away. Your purpose wasn't to pull it all together and address some of these other questions, although --

MR. ROACH: And I have yet to see the

final document from the tritium lessons learned task force that just came out. So I understand there will be a recommendation or two for NRO, and -- but I'm not sure what other ones will be agency-wide.

CHAIRMAN RYAN: Okay. Thanks.

MR. DEHMEL: One fix would be to put ISG-013 or BTP 11.6 back in Chapter 15. This way it will be clear not to be confused with the other requirements in Section 11.2 of the SRP, which essentially is more traditional requirement, Part 20, drinking water standard, and all -- you know, and all of these other --

CHAIRMAN RYAN: Well, that's a good point.

MR. DEHMEL: You know, and this way it is understood what the purpose of BTP 11.6 is all about. It is "an accident," an analysis -- an engineering analysis that will be used to assign concentration in the -- in a specific tank, not to be confused with the other requirements that are identified in 11.2.

CHAIRMAN RYAN: Yes, that's a good point. I mean, in essence, what I'm taking away from your comment is that ISG-013 is really designed to set tank limits more than anything else.

MR. DEHMEL: Right.

CHAIRMAN RYAN: Is that fair? Is that a

fair conclusion?

MR. DEHMEL: Yes, that's correct.

DR. AHN: It is my pleasure to present on ISG-014 to ACRS Subcommittee members on radiological protection and the nuclear material. And recently we have -- radiological containment in groundwater has become a hot topic here at the NRC, so I think this topic may be very interesting to everybody, including the ACRS Subcommittee.

Okay. My name is Hosung Ahn. I am a hydrologist with Hydrology Engineering Branch of NRO. And in developing this ISG-014, many of our staff hydrologists have made -- including Mark McBride, Joe Giacinto -- he is in the back -- and Dan Barnhurst and Nebiuy Tiruneh, and Richard Raione -- he is my branch chief -- and also Goutam Baachi, he is in the back.

In addition, when we developed this ISG-014, we discussed it a lot and worked together with the health physics group, including Ed Roach and Jean-Claude and Steve Schaffer. He is also in the back.

And we also communicate with a lot -- we also communicate with OGC a lot, because we have so many issues on our -- so many topics and issues on our -- in reviewing FSAR with our team. And eventually we

issued RAIs and open item on those sections when we reviewed the FSAR. That's why we initiated this ISG development, and we tried to clarify those kind of issues.

Once we developed this ISG, we also distribute this draft guidance to other offices, including NRR and OGC and Research. And we also get a lot of good comment and good constructive suggestions from them. So this is our draft final version of ISG.

So this guidance is -- as I mentioned before, this guidance is needed in reviewing the new reactor licensing applications, especially for FSAR Section 2.4.12 and 13. So I am going to start with a brief introduction of why we are -- need this guidance. Richard Raione already mentioned that, but I will clarify that a little bit.

Then, I will also introduce how this ISG is related to the existing guidance that are polarized in that. Then, I will also introduce the regulatory requirement and existing guidance with what are the major issues on our SRP areas. I'll introduce that.

Then, I will also explain what we are currently doing for identifying the groundwater pathway and how we approach it, the proposed radionuclear consequence. And based on that

explanation, I may explain the proposed ISG on each subtopical area, including onsite hydrogeology, a screening method for measuring geochemical property, or groundwater modeling, including conceptual site model and as well as a numerical -- mathematical numerical model. Then, how we propose the higher consequence analysis. So that's pretty much the scope I will present.

And I present a simple graphic showing the groundwater content map from there -- how we postulate groundwater pathway. On this example, groundwater system is quite simple and stationary, so we can easily postulate groundwater pathway. However, in some cases it is not as simple, and sometimes we use the groundwater model. So I will explain that later in detail.

As an introduction, why we needed this ISG? On FSAR 2.4, that is the hydrology chapter, it consists of about 14 sections, and especially it is dealing with groundwater. And for the safety groundwater issue, we have several different concerns there, and one is the -- what is the impact of groundwater to the plant and other outside users? That is one of the critical groundwater issues.

And the other one is, what is the maximum

groundwater level? That is one of the design conditions on the design certificate. So depending on the design certificate, the site should meet maximum groundwater level.

And the last one is the groundwater contamination issue. That is what we are handling on this ISG-014.

So FSAR 2.4.12 and 13, we have items including SRP 2.4.12 and 13, as well as we have the guidance on RG 1.206 that describes how we handle those topics.

However, there are requirements, but guidance sometimes is not clear or the guidance is very limited on specialty areas. That is why we try to develop this new interim staff guidance.

So the goal of this interim staff -- the purpose of this interim staff guidance is provide supplemental guidance on existing guidance of SRP 2.4.12, 13, and RG 1.206. Instead of repeating current guidance, we are going to supplement this guidance. That's the purpose of this ISG.

Regulatory basis, I think most of them Jean-Claude already introduced, but let me just make a brief introduction. Regulatory basis for FSAR 2.4.12 and 2.4.13 are the 10 CFR 20.1403 and 1302 for dose,

and we also used Part 20, Appendix B, for effluent concentration limit or the so-called ECL.

Then, for the COL requirement, Part 52.79 describes that area. Then, one of the problematic areas is the Part 120. Part 120 is for the -- establishing onsite hydrogeologic characteristic. That statement is very broad, but we don't have detailed guidance. That's why we -- I introduced that Part 120 more in detail on the issue area.

Then, regulatory guidance, as I mentioned, SRP Sections 2.4.12 and 13 for groundwater flow and transport, as well as RG 1.206. Then, we also used SRP 11.2 and Branch Technical Position 11.6, as well as ISG-014 for accidental release scenario.

So we postulate accidental release scenario, then we took that -- we take that scenario, then we -- the radiological consequence analysis in groundwater. That's what we do.

And this ISG handled the following specific topical area, including hydrogeologic-based condition, hydrogeologic characteristic -- that means the onsite hydrogeologic characteristic. Then, we propose the guidance on conceptual site model as a pathway and the receptor point. Then, we made the guidance on hierarchial consequence analysis on this

ISG-014.

So what other issues -- there are many issues, but I summarized those issues in four different categories. First, we don't have detailed guidance for Part 20(c)(3). I quote that on there, and it's really like -- that is important to hydrogeologic radionuclide transport, and must be obtained from onsite measurement. So this is the requirement for onsite hydrogeologic characterization.

And this -- they give some specific example, like such as soil, sediment, and rock characteristic, and absorption and retention coefficient that is related to decay venue. And groundwater velocity as well as distance from the nearest body.

So they gave a specific requirement, but we don't have specific guidance on what extent or what frequency we should obtain those -- the onsite hydrogeology. So that's one of the biggest issue -- biggest topic on FSAR 2.7.13. And when we reviewed FSAR over those sections, we issued virtually a lot of RAIs and sometimes a lot of open items. That's why we developed this guidance, and we tried to clarify some of those issues.

The second issue is there are some

inconsistencies in SRP 2.4.13 and Section 11.2, especially on what kind of base hydrogeologic condition we should use when we do the consequence analysis. In specific, on SRP 2.4.13, it describes that we should demonstrate thoroughly conservative assumption.

However, if you look at SRP 11.2, it specifies that it should be based on the average hydrologic condition. What -- I mean, the hydrologic condition may be pressure test or flow or groundwater level. So there are some differences in what we should use on 2.4.13. That was the issue. So we are going to clarify that issue.

Or so -- even between the SRP 2.4.13 and 2.4 -- between 2.4.12, 13, and RG 1.206, there are slightly different definitional review areas or acceptance criteria. So we tried to clarify and reconcile those kinds of inconsistency issues.

And, finally, SRP 11.2, FSAR 11.2, is dose-based consequence analysis. However, we used the concentration based -- consequence analysis in 2.4.13. So it is -- I clarify it in ISG.

And the first issues are absence of clear guidance or limited guidance on groundwater pathways, reviewing groundwater pathway, identifying receptor

point, and analyzing radionuclide consequence analysis, as well as numerical and conceptual model development.

So, first, I will provide some -- an example of how we postulate conceptual site model, and from there how we identify groundwater pathway as an example. First, the conceptual site model is a qualitative description of the important future event and process of groundwater flow and transport. That is the definition.

And on the right-hand side, I present a simple conceptual site model on groundwater, and on the right-hand side how we postulate the conceptual site model or pathway on the special dimension.

If you look at -- on the right-hand side of the graph, we first need to identify the location of the source that is on the bottom -- the nuclear island. From there, how the containment is -- does containment go through the groundwater? Then, it may go -- end up to the pond, then it will go down through the creek, then eventually go to the river.

So that's the way we normally generate the pathway. In some cases it is simple, in some cases it is not simple, and sometimes we need to rely on detailed ground or a numerical ground -- or a model to

postulate, especially the groundwater pathway.

And one of the issues on there is that, what is the receptor point? It looks like it's simple to pick the receptor point, but in reality it may not. So that's why I introduced that, how we -- on ISG how we defined the receptor point.

A receptor point -- on ISG we defined the source of the part of the water located in the offsite unrestricted area, and the definition of "unrestricted area" is Part 20.1003.

On this left-hand side, the red line on the northern side is the site boundary. So we should look at where is the public water use location outside of this boundary. For this example, that is the Savannah River, and actual receptor point is about 30 miles downstream.

But they just choose the Savannah River on that point -- on that point as a receptor point conservatively. So they make conservative consequence analysis, and check with ECL whether they meet the Part 20 compliance or not.

Then, when we reviewed that, we look at the -- what would be the potential future receptor point. When we look at that, we found that --

CHAIRMAN RYAN: You are not going to be

able to stand and point. You'll have to tell us, because if you get away from the microphone, he can't hear you.

DR. AHN: One corner of that creek area, that is owned by --

MR. WIDMAYER: You can use the arrow from the mouse.

DR. AHN: Yes.

MR. WIDMAYER: The white one.

DR. AHN: Okay.

MR. WIDMAYER: There you go.

DR. AHN: That point. That area is accessed by public land. So, and that is usually used by -- used for recreation purpose and sometimes there are a lot of the cars parking on there, and they may try to use the creek water as a drinking source.

So what we think -- in the future we set the point for that area. So when we did 2.4.12 safety evaluation, we choose that point as the receptor point and estimate dose consequence and checked the Part 20 compliance. So that's one example.

Where is the receptor point? Sometimes it can arguable, and what we recommend on this ISG is may use conservatively on upstream point as a receptor point.

CHAIRMAN RYAN: Yes. And that could change in the life of the plant. I mean, you may have groundwater withdrawals that are closer than you ever modeled in the licensing phase. And, you know, your area around the plant has developed, and now you've got new withdrawal points for groundwater. So there's lots of possibilities where that could shift.

DR. AHN: Yes. Yes, that's what we -- yes. That's why when we choose the receptor point, we should consider all of the future scenarios.

CHAIRMAN RYAN: I mean, again, you just said they picked the Savannah River, or they did. I sure wouldn't pick the river. I would pick about 100 feet into the river.

DR. AHN: Yes, yes. That point is --

CHAIRMAN RYAN: Yes, that's fine.

DR. AHN: -- potential future. So, or, in fact, when we estimate dilution, we actually don't have a measured flow on that creek point. So actual Part 20 compliance point is more upstream on that area, the creek area, on that site. We have to measure the flow, so we call that as a pseudo-compliance point, and we use that point as a -- to protect the Part 20 compliance.

So there are a lot of different ways we

can apply conservatively -- we can select the receptor point conservatively. So we describe that on our SRP.

In general, pathway on the surface water may be easy, but groundwater pathway -- identifying groundwater pathways are not easy, so sometimes we need to use the numerical groundwater model to postulate pathway.

So once we identify a pathway and the travel time through that -- each of the pathway, then we can easily estimate the consequence -- radiological concentration on the -- at the receptor point. Then, we compare that with the ECL barriers. That's what we normally do on 2.4.13 analysis.

Then are the radiological consequence analysis for 2.4.13. We can just detail the flow transport model, but problems that -- we have so many radionuclide species. For example, for the AP1000 we have almost 53 different species, and the consequence analysis of each and every radionuclide is nearly impossible. That's why we proposed a simple hierarchial approach for this consequence analysis.

So on the right-hand side of this flowchart, we identify -- first, we collect all available hydrologic or hydrogeologic data, and based on that we make onsite characterization of the

hydrogeology and identify release and receptor point.

Then, we develop site conceptual model and the identified pathway and estimate travel time. So those belong to FSAR 2.4.12.

Then, on FSAR 11.2, they define "release scenario" and "source term" on there, and we took that information to -- then, we made radiological consequence analysis.

So first step we look at is whether this selected design certificate has mitigation design future or not. That is only prior to the repeat rad waste management system tank sample component.

So if they have mitigation design futures present on there, for example, ESBWR, they -- we approve that they have the mitigation design future criteria. Then, we skip consequence analysis and wrap up the 2.4.13 analysis. If they do not, then we do the consequence analysis.

First, when we do the consequence analysis, we may try very conservative and simple equation, simple transportation equation, and make transport calculation and estimate the concentration at the receptor point, then compare it with Part 20 ECL failures.

And if they meet -- if they meet Part 20

ECL compliance, then we can stop the analysis, or, if they do not meet, then we will look at more detailed and complex transport equation, and check whether they meet Part 20 compliance or not.

And if we use the most complex equation, most detailed equation and still they don't meet the Part 20 compliance, then we recommend to develop a technical specification. Mitigation design future is what we recommend, and the -- to handle that part.

So that is the -- what we proposed on ISG-014.

CHAIRMAN RYAN: Do you recommend specific modeling tools or techniques? Or do you just leave that to the applicant?

DR. AHN: No. We leave that to the applicant. But, in general, we use a simple analogy calculations to estimate the peak concentration at the receptor point. So it is like an expression model, and we applied 53 different --

MR. SIMMONS: So very simple. You have to --

DR. AHN: It's very simple. However, we can also use like an offsite model or other model. That's possible. Nobody did it that way.

MR. SIMMONS: Okay.

DR. AHN: So as for post-ISG, let's explain on this specific pathway.

CHAIRMAN RYAN: I'm going to ask, is this a good time to take just a five-minute break? Because being only one person, I can't take a break and not stop. So if we could just take a five-minute break, and we'll come back.

(Whereupon, the proceedings in the foregoing matter went off the record at 2:17 p.m. and went back on the record at 2:20 p.m.)

CHAIRMAN RYAN: Okay. We'll open the record. And thank you, Dr. Ahn, I appreciate your patience.

DR. AHN: Okay. Let's talk about onsite hydrogeology. That is the compliance of Part 120.

As I mentioned before, the regulation is very broad, and we don't have specific extent on the frequency of the onsite measurement. That's why we tried to provide the same specific guidance on this onsite measurement.

The first one, applicant must collect sufficient onsite hydrogeologic data to predict pathways and travel time. And that's the main purpose of this measurement.

And second, the consequence analysis in

FSAR 2.4.13 should be based on a long-term annual average of hydrologic condition, to remain consistent with SRP -- FSAR 11.2.

Even though we specify long-term annual average, it is easy to estimate peak failure conservatively. So most of the estimates, peak failure, and if they meet Part 20 -- okay, ECL compliance, then it is okay. There are rooms to have more detailed analysis on there.

The long-term groundwater -- when they are -- especially for the new site, they don't have long-term data. So how do we define "long-term annual average"? Sometimes it is problematic. So we recommend that applicant may use either indirect method based on the transportation method or correlate -- statistical correlation method to set up the long-term average condition. And then they can estimate the consequence, they can do the consequence analysis. So we gave some latitude on there.

Then, hydrologic parameter should be representative -- for example, the pumping test or slow test is one good example. And still some applicants are relying on slow tests. But when we do the groundwater model, slow tested data is almost useless, so we recommend to use kind of the pumping

test.

CHAIRMAN RYAN: I would agree with that.

DR. AHN: It's very simple. I give some guidance on there.

And next is dealing with the K distribution coefficient. And when we review the -- first, let me explain it. Measuring K_d value is quite challenging, because we have so many different radionuclide species, and sometimes measuring short half-life radionuclide is problematic.

So we should -- we cannot measure the K_d value for each and every species, so we should screen them based on the risk-informed approach. I explained that a little bit in detail. However, the sample for K_d value measure should be fairly representative conditions. Then, it should be -- sometimes the applicants say that -- they take the rock sample and they crush it and they measure the K_d value. But how that is represented in the field condition, that is a question I will -- we will give specific guidance.

And for each identified pathway, at least -- or through representative samples for K_d values should be taken? That is the minimum, and we can -- applicant can measure more than that. The reason why

I -- we put that way is that even three -- two to three samples for -- for example, if you have four pathways and 10 species, you should take a lot of samples. Of course, they take time, and that's why we may provide some minimum guidance for that for K_d sampling?

CHAIRMAN RYAN: So what is the minimum guidance for K_d sampling?

DR. AHN: At least two or three samples around the pathway. That's what we believe is the minimum guidance.

CHAIRMAN RYAN: Okay.

DR. AHN: There are -- I will introduce how we apply a screening approach for K_d sampling. I mention this characterizes -- the K_d value is challenging, because there are so many species. And for some short-lived K_d, you combine the K_d barriers, it's very challenging.

So we need to be selective to estimate the K_d barriers. So one of the recommended methods -- or it's -- we have already used that kind of screening approach to identify the species for K_d, then measure the K_d barrier.

First, we may use only decay and dilution process, and check Part 20 compliance. And if they

don't -- if a species doesn't meet Part 20 compliance, then we may choose to send for the -- and estimate K_d values. So that's kind of a simpler approach to select a species for K_d sampling.

And an example of how we combine different transport process and screening the radionuclide species, then determine which species we need to sample, and the major K_d barrier. That's one reason for -- of the higher -- use of the hierarchial approach.

Then, how we review groundwater modeling and pathway. The applicant was -- developed a conceptual site model of groundwater flow and transport. And the guidance in -- guidance for conceptual model is given in NUREG/CR-6805, or there are a lot of different guidance. So we can use that.

Then, identifying pathway in the -- measure the considerable uncertainty of the model, uncertainty of the data, as well as uncertainty of the scenario -- the conservative scenario as well as the future or use the scenario. Then, we should develop the conservative or the conceptual site model.

If the site is -- site hydrogeology is quite complicated. We can use the micro model, either analytical solution or a numerical model based on the

site complexity and postulate the groundwater pathway.

And Appendix A of this interim staff guidance provides specific guidance for numerical modeling for 12 and 13.

As a consequence analysis, as I mention on page 7, we propose a hierarchial approach for the radiation consequence analysis, as well as determining species for K_d sampling and the groundwater flow model, so to minimize the effort and make reasonable analysis.

And the staff needs to come from Part 20 and this compliance. And this -- the public is -- for the analysis, we analyzed consequence only for direct public oral use. However, I think the FSAR 11.2, they consider both direct and indirect oral use. And if ECL is not met, then staff may recommend to -- recommend that applicant should provide mitigation design futures or technical specification. And that is all belonging to the FSAR 11.2.

The first bullet, check compliance with the provision of EPA's generally applicable environmental validation standard in 40 CFR Part 190. We discussed that on previous presentation, but it is specified on current SRP 2.4.13. And we discussed this issue with OGC, and whether we need to keep this

guidance or not on ISG-014.

And they said NRC doesn't have authority to confirm this one. However, sometimes EPA drinking water standard has -- is more conservative. So when we determine onsite measurement based on the consequence analysis, we may use some more conservative approach, conservative standard, to determine onsite measurement.

This way, we try to keep this standard in here. That may make it slightly different from ISG-013. But as a hydrogeologist, we may apply a more conservative standard and determine that degree of onsite --

MR. BLAIR: But they're both drinking water standards, and they are different by a factor of 12 based on the fact the dose is different by a factor of 12.

DR. AHN: On this particular example, we are concerning the tritium. And ECL tritium barrier is 30,000 picocuries per year. However, EPA drinking water standard is 20,000 picocuries per year.

So EPA is more conservative. And when we decide K_d value estimate, and other onsite characteristics, we try to use the more conservative standard. That's why we keep the guidance in here.

CHAIRMAN RYAN: I'm confused. The dose basis is 50 versus four.

DR. AHN: That's dose, but concentration basis is 30,000 versus 20.

CHAIRMAN RYAN: I understand the drinking water standard is 20, but how do you get 50 millirem from 30,000 picocuries per liter per year.

DR. AHN: I guess it depends how --

MR. ROACH: I think the question is if -- if the EPA standard is 20,000 picocuries per liter, and it still four millirem --

CHAIRMAN RYAN: How does --

MR. ROACH: -- per year --

CHAIRMAN RYAN: How does 30,000 give you 50?

DR. AHN: It doesn't.

MR. ROACH: It doesn't. It is all the constituents of the Appendix B, Table 2.

CHAIRMAN RYAN: I misunderstood. I thought we were just talking about just tritium.

MR. ROACH: I believe Dr. --

CHAIRMAN RYAN: I apologize.

MR. ROACH: -- Ahn is just comparing the tritium values.

CHAIRMAN RYAN: If it was just tritium.

DR. AHN: Yes.

CHAIRMAN RYAN: Okay. I'm with you now. Thanks. Sorry.

DR. AHN: And the applicant may keep the consequence analysis, if they have mitigation design future. That was not specified on the previous SRP 2.4.13, but we include that on our ISG-014. And consequence analysis in 013 is limited to waste management system only, not leak or spills.

Resolution and applicability is covered in previous -- for 013, so that's pretty much what I prepared for the presentation.

CHAIRMAN RYAN: Okay. Thanks. I guess the real takeaway message is these two updates to ISG is really intended to update the calculations and support accident analysis, and that's it. But that leaves us with other challenges in terms of, what do we do beyond that?

MR. DEHMEL: Those challenges remain, no matter what -- this was -- this is always going to be a challenge, in a way.

CHAIRMAN RYAN: It follows my catch phrase that all of the stuff has already been done. So --

DR. AHN: I think that before we develop, we discussed with OGC to -- to estimate the

consequence analysis on two different places, and what is the meaning of that. And OGC said that FSAR Section 11.2 has finality. Then, why we do a consequence analysis in 2.4.13? It's more like how we understand onsite hydrogeology and how we collect onsite data? That's the main purpose of this 2.4.13 consequence analysis. So we developed the guidance on that way.

CHAIRMAN RYAN: Well, and I appreciate the point that you have to understand the site to understand how the water is going to behave. I mean, that's clear. It sometimes takes a little bit more work than you might anticipate, but that's fine.

MR. DEHMEL: Jean-Claude Dehmel. One approach here would be to build essentially walls around each of these requirements -- 2.4.13 and BTP 11.3. I'm sorry, 11.2, BTP 11.6.

One is, if you look at the requirements in Part 100, 120(c)(3), it is a characterization of the site. And so you could confine, you know, 2.4.12 and 2.4.13 in that context.

And then, keep the requirements of BTP 11.6 in the context of whether it should remain in 11.2 or be shifted to Chapter 15, and keep those, in essence, separate, recognizing that the models one

would use to assess the consequence of a tank failure, the guidance could be self-contained in a newly-relocated BTP 11.6, and essentially leave the applicant to provide justification for the groundwater model that may be used for the purpose of the analysis and thereby keeping the two separate and eliminating this confusion.

CHAIRMAN RYAN: It really is a confusion that does need some attention. And I think that's not a bad suggestion, Jean-Claude. I mean, to me, a stylized calculation that is done for an accident analysis, you know, I rammed something into a tank of water, and then the water goes somewhere and I have to assess the impacts, is a whole lot different than what is the true geohydrologic scheme of like the long-term incipient contamination, should it exist?

MR. DEHMEL: Absolutely.

CHAIRMAN RYAN: So I appreciate that. If I heard you right, one of your suggestions is to move the ISG and tie it back to Chapter 15 versus Chapter 11.

MR. DEHMEL: Yes. And if we're going to do that for the rad waste tank failure, we should do it, then, as well as for the gaseous waste management component failure, because this is analogous --

CHAIRMAN RYAN: Yes.

MR. DEHMEL: -- you know --

CHAIRMAN RYAN: You didn't touch on that today, but it's clearly the --

MR. DEHMEL: Yes, right.

CHAIRMAN RYAN: -- atmospheric release version of the same kind of thing.

MR. DEHMEL: So we would move that as well, because the two are synonymous to one another. And the calculational methodology, and so on, is the same, essentially is, you know, a fairly simple approach, you know, some degree of conservatism, and it's simple. It's a very simple analysis.

CHAIRMAN RYAN: And the purpose isn't to assess the consequence. The purpose of it is to set a limit of what can be that tank or that system or that whatever. I think that's really the key to me is it's not so much that you're analyzing a water problem or an air problem. It's that you're analyzing it for the purpose of setting an operational limit, not assessing impacts.

MR. DEHMEL: It hinges on whether or not there are design -- engineered design safety features that would preclude the release to the environment. So if -- for example, we had the situation with ESBWR.

They decided to install liners in the cubicles where the rad waste tanks are located, and thereby they just went away with that analysis.

But they did the counterpart analysis is that -- now, if you have a spill out of the tank into a cubicle, they did the analysis that was contained way, way back when. And, again, the early guidance to staff and the applicant was the volatile component that would be contained in the water would now be released to the rad waste building stack. So they did that analysis as essentially being the alternative analysis assessing the consequences of that. that used to be in the guidance, but it has been dropped.

CHAIRMAN RYAN: Right.

MR. DEHMEL: I don't -- there are a lot of things that have been changed in the guidance that we were not able to identify. These are the things we identified when we started to revise this in March 2007, and we presented those to management, and management said that the NRO had no time to do this, because it was very time-consuming, which was correct -- to trace it and come up with alternative analyses and guidance to the staff and the applicant.

And, two -- and that was the most important factor -- was let's not change the licensing

basis as we are preparing breakout, and as applicants are preparing applications. So we had a March 2007 due date, and we had to crank those out.

So in the context of Chapter 11, the only thing that we were able to do -- expand the guidance on the outside dose calculation manual, expand the guidance on the process control program, expand a little bit more guidance on -- with 40 CFR 190, and then we were able to introduce the newer standard 1813.1 on sampling.

So those were, in essence, the changes that we were able to capture and put into the March 2007 revision of Chapter 11. That's as far as we could go.

CHAIRMAN RYAN: So at this point it remains unattached to the rest of the geohydrologic questions that we have touched on earlier today?

MR. ROACH: And what I would like to do, Mike -- this is Ed Roach again -- is just remind the Committee that about a year ago we did present ISG-006, which described guidance for the staff to review for looking at 20.1406 for the systems and the type of controls and barriers. And that ISG will get wrapped back into Chapter 12 and Chapter 11 and the other appropriate features and chapters in the SRP.

The one that isn't reflected there is it doesn't go into an analysis of groundwater as far as drinking water standards.

CHAIRMAN RYAN: And that would put the engineering side on the front end of what you can do to prevent having 1406 problems.

MR. ROACH: That's correct. That's how we reviewed it, but --

CHAIRMAN RYAN: And it's how do you analyze one if you have one, yes. I remember that, sure.

So I guess, thinking ahead to the presentation for the full Committee, I guess I would make sure that we cover this up front, you know, this issue of what is separate from what, and what the endpoint goals were from the various calculations.

And I will help you remind folks that, you know, this is a different question, and it's not totally unrelated because it's the same site, the same model, and the same kinds of questions will come up. What are you modeling for the licensing purpose -- which is clear now to me -- for an accident analysis or for an operating condition that is discovered? Which there have been a couple of those. Or whether that is a long-term performance question and ends up

connecting to other regulatory settings, which mean differing end dose bases than 10 CFR.

Is that a fair summary?

MR. ROACH: I concur with that. This is Ed Roach again. And I think the point we could do a good job is making clear up front, as you said, where this fits into the scheme, and then what other -- maybe in discussion space what other items are out there. And then, I think it is a fair comment regarding the risk basis for all the different regulations, how do they mesh together? I think that's an issue the agency needs to take on.

I don't know who is going to do it, but it is clearly -- that adds to the difficulty in communicating risk to the stakeholders in the public meetings. And clearly if the science or the calculations say there is minimal risk to the individuals as a result of this groundwater contamination, we haven't been very successful in convincing or communicating that.

CHAIRMAN RYAN: Well, and I think part of it is that, you know, the numbers are just all over the place. When you look at standards versus, you know, what you can actually calculate, and so on, it is just -- it is just tough to get across that, you

know, four, 25, or 100, or some other number, in the context of environmental modeling are all the same number, if that's your final number. And the uncertainties in that sort of a model are pretty significant and hard to reduce without tremendous time and expenditure of resources to do it.

So I appreciate that probably more than most, having done that kind of work at Barnwell for 20 years, including a 15-foot wide infiltrometer that went all the way down to the bottom of the trench.

So, you know, it's fascinating work to do, and, you know, you can come up with better and better models the harder you work at it and the longer you work at it. But, you know, we are kind of addressing different regulatory goals. But the real disconnect, which is bigger than what you -- there was one more rung on the ladder, I think, and that's the interagency connects -- or disconnects. I don't know what to say about that except they're clearly there.

MR. RAIONE: If you are a member of the public, and you are looking at this and the various stages of all the reviews that we are in, and for the majority of cases, if not all of them, we're saying ECLs are fine, and the 2.4.13 scenarios.

And a member of the public would ask the

question, well, but the tritium from the operating plants -- I mean, you guys are looking at this. How does this relate to another picture? And I think doing that tie-in is going to be important. And how you do that -- this is what you had mentioned earlier -- is going to be it is timely.

CHAIRMAN RYAN: It does have implications. Again, the one last time is that the 1406 framework of, you know, what decommissioning is going to look like, you know, and to tie that to extension -- you know, talking 48 on 60, and we even heard 80 talked about once or twice.

You know, it gets to be a very complicated question for how the behaviors of these systems will begin with this longer timeframe.

MR. WIDMAYER: It seems like there was an opportunity at this juncture -- I understand what your pressures were and the timing and everything like that. So that was something that I guess I was a little bit surprised at when I read them was that it seemed like we were missing an opportunity to do some of this. But --

MR. ROACH: Again, I would just state that I think we didn't view it in that framework as much as recognizing that there were opportunities to fix the

standard review plan and make it --

CHAIRMAN RYAN: Right.

MR. ROACH: -- work for both us and the applicants, so that it was pretty clear what they needed to provide. And that's what we were going after at that point.

And I think when we developed the ISG it was probably about a year ago or so -- our draft. And so at that time we were finally getting our hands around the guidance associated with 20.1406 and related documents -- 4.21, NEI-0808 type documents. So, but I agree, we need to look at this in a hard light.

CHAIRMAN RYAN: There was a part 2 and a 1301 that -- you mentioned F.

MR. ROACH: Yes.

CHAIRMAN RYAN: The Commission shall set any other requirement it likes basically regarding effluents, and so on. How about E? In addition to the requirements of this part, the licensee is subject to the provisions of EPA's generally applicable environmental radiation standards in 40 CFR 190, shall comply with --

MR. ROACH: I don't believe 40 CFR 190 talks groundwater.

CHAIRMAN RYAN: No, it doesn't.

MR. ROACH: It just talks about air and --

CHAIRMAN RYAN: Yes.

MR. ROACH: Yes, that's what we have been trying to get to is, do we put that in our regulations?

CHAIRMAN RYAN: Okay. So that's what is kind of being thought through. Okay. Well, I appreciate it. It has been a very informative briefing and afternoon.

Are there any other questions or comments or anything else you would like to add?

(No response.)

Thank you for a great set of presentations and good discussion.

MR. ROACH: Okay. Well, thank you for your patience and --

CHAIRMAN RYAN: And I think, just in closing, our -- my role will be to offer a summary to the full Committee, and then have you come back and do, you know, I am going to guess an hour's worth of some of the presentations that you gave today.

And, again, I would maybe reemphasize the shift on to some of these harder questions that you are fully aware of clearly, and you know all the

history of them, probably better than anybody else at the table will. So if you can, you know, start with those insights, and then define where the ISG-013 and 014 fit in within that greater whirlwind of things, and things that are ongoing, that would really help them I think better understand more quickly what it is you're trying to accomplish with these two ISGs.

MR. ROACH: Okay.

CHAIRMAN RYAN: Is that a fair comment?

MR. ROACH: I'm certainly good with that.

CHAIRMAN RYAN: Okay. And, you know, I think -- while Dr. Ahn and I could probably spend the rest of the day talking about various geohydrologic approaches, maybe -- I'm not sure how much that would add to the sort of more central theme, but we would sure like to hear you -- you know, how does the modeling fit into how you make up some of these? But I'm not sure that too many of the folks would be interested in much of the detail on, you know, the specifics of the model. So just that's one way to conserve some time.

With that, thank you very much for your time and attention and participation. We appreciate it very much.

MR. ROACH: We'd like to thank the

Committee.

CHAIRMAN RYAN: Sure. Are there any other last comments?

(No response.)

We'll close the record.

(Whereupon, at 2:51 p.m., the proceedings in the foregoing matter were adjourned.)

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Presentation to the ACRS
Radiation Protection and Nuclear Materials Subcommittee Meeting:

ISG-013: "Assessing the Consequences of an Accidental Release of Radioactive Materials from Liquid Waste Tanks"

May 18, 2010

Jean-Claude Dehmel
NRO/DCIP/CHPB

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Overview

Contributors: Jean-Claude Dehmel, Steve Schaffer, Edward Roach (CHPB Branch Chief)

- Introduction
- Issues & Basis for Update
- Overview of Proposed ISG
  - Failure and release mechanisms
  - Mitigating design features
  - Radioactivity source term
  - Ground or surface water transport
  - Exposure scenarios
  - Acceptance criteria
  - Specifications on tank concentrations
  - Evaluation findings of COLA reviews
- Area of Review & Interface
- Resolution and Applicability

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Introduction (1/2)

- Why Is This IGS Needed?
  - Current guidance is internally inconsistent between SRP Sections 2.4.13 and 11.2 and BTP 11-6 to SRP Section 11.2
  - Guidance difficult to implement based on experience with reviews of COL applications
  - Clarify technical guidance and regulatory requirements in applying SRP Section 11.2 with BTP 11-6 and SRP Section 2.4.13 for the review of associated FSAR sections
- ISG Purpose
  - Provide guidance to staff and applicants in structuring the analyses of accidental releases from radioactive liquid waste tanks to groundwater or surface water, and
  - Provide clarification in assessing compliance with regulatory requirements and SRP acceptance criteria

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Introduction (2/2)

- Regulatory Basis
  - 10 CFR 52.79 , as it relates to equipment used to control releases
  - 10 CFR 50.34a , as it relates to equipment used to control releases
  - 10 CFR 50.36a, as it relates to technical specifications
  - GCD 60 and 61 (Part 50, App. A), as they relate to the control of releases
  - 10 CFR 100.20 (c)(3), as it relates to hydrological transport of radioactivity
- Regulatory Guidance
  - SRP Section 11.2 & BTP 11-6 for release scenario and source term
  - SRP Sections 2.4.12 & 2.4.13 for ground water flow and transport
  - RG 1.206 Sections 11.2, 2.4.12, & 2.4.13, as guidance to COL applicants
  - RG 1.143, as it relates to the design features of LWMS
  - RG 1.113 and NUREG/CR-3332, as they relate to modeling aquatic dispersion
- SRP 11.2 and BTP 11-6 Acceptance Criteria Adopted from:
  - 10 CFR Part 20, App. B , Table 2, Col, 2 effluent concentration limits, *or*
  - 10 CFR Part 20 limit of 100 mrem for non-drinking water pathways

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Issues & Basis for Update

- Poorly integrated guidance between SRP Section 11.2 (with BTP 11-6) and SRP Section 2.4.13 (plant design features vs actual site features)
- Inconsistent set of SRP acceptance criteria (Part 100.20, Part 20, BTP 11-6) among SRP sections, and description of conditions that envelope site characteristics (conservative vs average conditions)
- Inconsistent guidance in the use of mitigating design features in mitigating radiological impacts (passive and durable features)
- Expand guidance on selection of tanks, failure mechanisms, radiological source terms [nuclides C-14, Ni-63, Sr-90, Tc-99, I-129, Cs-137) and tank selection)], and factors affecting radionuclide transport (enhanced mobility)
- Expand guidance in modeling surface or ground water transport processes from the point of release to dose receptor, including retardation, dispersion, and dilution mechanisms starting with simple models and progressing to more complex ones
- Provide guidance in defining ground and surface water release pathways, exposure pathways, and dose receptors (drinking vs non-drinking pathways)

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Proposed Interim Guidance (1/3)

- Proposed ISG-013 expands and revises:

- Failure mechanisms and radioactivity releases
  - Technical justification for the postulated failure
  - Consideration for indoor and outdoor tanks
  - Ranking of tanks, low-volume & high-activity vs high-volume & low-activity
  - Prompt vs delayed impacts (releases to surface or ground water bodies)

- Mitigating design features
  - Use of steel liners, retention basins, dikes, etc.
  - Capability to retain entire volume
  - Capability to pump liquid to other tanks
  - Passive and durable design features

- Radioactive source term
  - Basis of selected system and tank liquid inventory
  - Radionuclide distribution and concentrations of failed tank
  - Short and long-lived radionuclides vs surface or ground water releases
  - Long-lived and environmentally mobile nuclides (C-14, Tc-99, Sr-90, I-129, Cs-137)

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Proposed Interim Guidance (2/3)

- Proposed ISG-013 expands and revises:

- Radioactivity transport in ground or surface water
  - Release scenario and assumed conservatism (adverse conditions)
  - Influence of plant structures and facilities on direction and travel path
  - Presence of agents at operating sites that would enhance mobility
  - Transport and dispersion mechanisms of radioactivity to offsite receptors
  - Impact of site conditions, water withdrawal rates, drought conditions, etc.

- Exposure scenarios and acceptance criteria
  - Direct pathways, surface water body or well water consumption
  - Indirect pathways, fish, invertebrates, crop irrigation, livestock
  - Reliance on local or regional information and land-use census
  - SRP acceptance criteria taken from Part 20 , App. B ,Table 2, Col.2 ECLs, and Part 20.1301 dose limit to members of the public

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Proposed Interim Guidance (3/3)

- Proposed ISG-013 expands and revises:

- Specifications on tank radioactivity concentration levels
  - Staff to confirm that proposed technical specification limiting radioactivity levels in tanks is consistent with analysis
  - Staff to confirm that FSAR Chapter 16 addresses this commitment in the COL
  - Staff to confirm that the technical specification is supported by the implementation of operational programs and procedures

- Evaluation findings for combined license reviews
  - Staff evaluation findings revised to reflect expanded guidance
  - Evaluation findings updated to address requirements of Part 100.20 (c)
  - Evaluation findings revised to differentiate between acceptance criteria (drinking vs non-drinking water pathways)
  - Evaluation findings updated to address mitigating design features

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Area of Review, Interface

- SRP 11.2/BTP 11-6 Interface with Other SRP Sections:
  - SRP 2.4.12, as it relates to the characterization of ground water
  - SRP 2.4.13, as it relates accidental releases of radioactivity in ground and surface water
  - SRP 3.2.1 and 3.2.2, as they relate to seismic and system quality group classifications of LWMS SSC
  - SRP 9.3, as its relates to plant systems and component interfaces with the LWMS
  - SRP 16, as it relates to specifying maximum concentration levels in tanks
  - SRP 13.4, as it relates to the development and implementation of operational programs in avoiding uncontrolled and unmonitored radioactive releases

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Resolution and Applicability

- Final Resolution:
  - Review and evaluation of ACRS, public, and industry comments on ISG-013 and ISG-014
  - Finalization of ISG-013 and ISG-014 with incorporation of ACRS, public, and industry comments
  - Update SRP Section 11.2 and BTP 11-6 given final issuance of ISG-013 and ISG-014 (as directed by NRO in updating infrastructure documents)
- Applicability to Part 52 COL Applicants:
  - Revised guidance will be applicable to all COL/ESP license applications submitted after the formal issuance ISG-013 and ISG-014

QUESTIONS ?

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Document Citations

- SRP 2.4.12, Ground water
- SRP 2.4.13, Accidental releases of radioactive liquid effluents in ground and surface waters
- SRP 3.2.1, Seismic classification
- SRP 3.2.2, System quality group classification
- SRP 9.3, Process auxiliaries
- SRP 11.2, Liquid waste management system
- BTP 11-6, Postulated radioactive releases due to liquid-containing tank failures
- SRP 13.4, Operational programs
- SRP 16, Technical specifications
- RG 1.113, Estimating aquatic dispersion of effluents from accidental and routine reactor releases for the purpose of implementing Appendix I
- RG 1.143, Design guidance for radioactive waste management systems, structures and components installed in light-water-cooled nuclear reactor power plants
- NUREG/CR-3332, Radiological risk assessment
- Part 50, App. A, GDC 60, Control of releases of radioactive materials to the environment
- Part 50, App. A, GDC 61, Fuel storage and handling and radioactivity control
- Part 100.20, Factors to be considered when evaluating sites
- Part 50.34a, Design objectives for equipment to control releases of radioactive material in effluents – nuclear power reactors
- Part 50.36a, Technical specifications on effluents from nuclear power reactors
- Part 20, Standards for protection against radiation
- Part 52, Subpart C - Combined licenses, Part 52.79, Contents of applications; technical information in final safety analysis report

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Presentation to the ACRS
Radiation Protection and Nuclear Materials Subcommittee Meeting:

ISG-014: "Assessing Groundwater Flow and Transport of Accidental Radiological Releases"

May 18, 2010

Hosung Ahn, Ph.D., P.E.
NRO/DSER/RHEB

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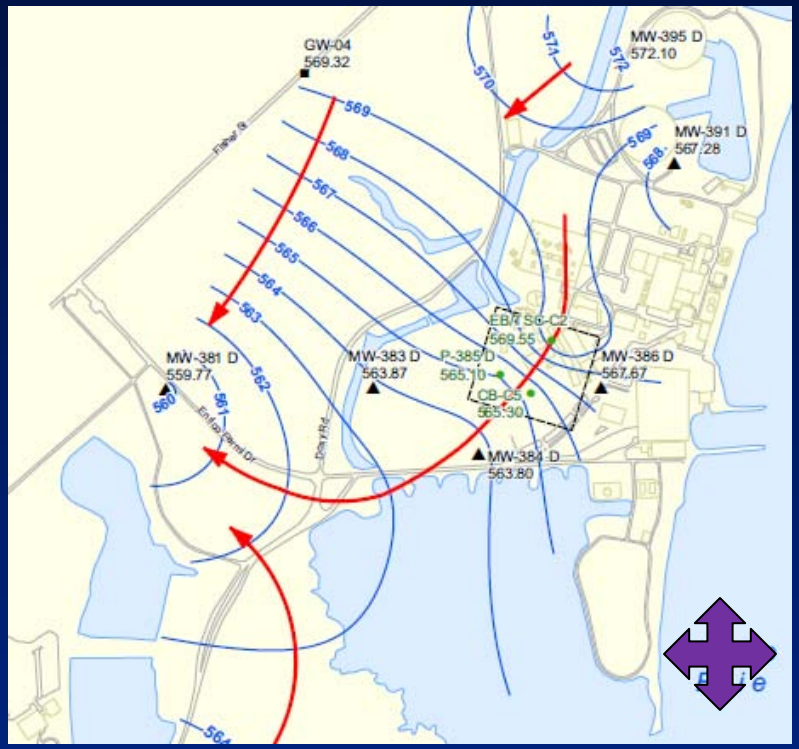

- Introduction
- Regulatory Basis and Guide
- Example of Conceptual Site Model
- Flowchart for Consequence Analysis
- Proposed ISG
  - On-site Hydrogeology
  - Screening Approach
  - Groundwater Modeling
  - Consequence Analysis
- Resolution and Applicability

Contributors:
Hosung Ahn (Lead)
Mark McBride Joe Giacinto
Dan Barnhurst Nebiyu Tiruneh
Richard Raione (RHEB Chief)

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Introduction

- Why Is This ISG Needed?
  - Absence of clear guidance in reviewing FSAR Sections:
    - 2.4.12 (Groundwater), and
    - 2.4.13 (Radiological consequence analysis in groundwater and surface water).
  - The goal of this ISG is to reconcile and clarify FSAR 2.4.12&13 topics in order to more efficiently meet regulatory requirements.
- ISG Purpose
  - To supplement the guidance in SRP Sections 2.4.12&13 in analyzing the consequences of accidental releases of radioactive liquid effluents to groundwater and surface water.

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Regulatory Basis and Guide

- Regulatory Basis for FSAR 2.4.12 and 2.4.13:
  - 10 CFR 20.1301 10 CFR 20.1302 for dose limits
  - Appendix B to 10 CFR Part 20 for Effluent Concentration Limits (ECL)
  - 10 CFR 52.79 for COL requirements
  - 10 CFR 100.20 for establishing on-site hydrogeologic characters

- Regulatory Guide
  - SRP Sections 2.4.12 & 2.4.13 for groundwater flow and transport
  - RG 1.206 Sections 2.4.12 & 2.4.13 for COL/ESP applications
  - SRP Section 11.2 and BTP 11-6 for accidental release scenario
  - ISG-013 for accidental release scenario

- This ISG will clarify specific guidance on:
  - Hydrogeologic base condition - Hydrogeologic characteristics
  - Conceptual site model - Pathways and receptor
  - Consequence analysis

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Issues

- No detailed guidance for 10 CFR 100.20(c)(3):
  "Factors important to hydrological radionuclide transport (such as soil, sediment, and rock characteristics, adsorption and retention coefficients, ground water velocity, and distances to the nearest surface body of water) must be obtained from on-site measurements."

- There are inconsistencies (1) between SRP Sections 2.4.13 and Section 11.2/BTP 11-6 on base hydrologic condition in a consequence analysis, and (2) between SRP and RG 1.206 on the review areas.

- Absence of clear guidance in reviewing groundwater pathways, identifying receptors, and analyzing radiological consequence.

- Limited guidance in reviewing conceptual site model and numerical groundwater flow model.

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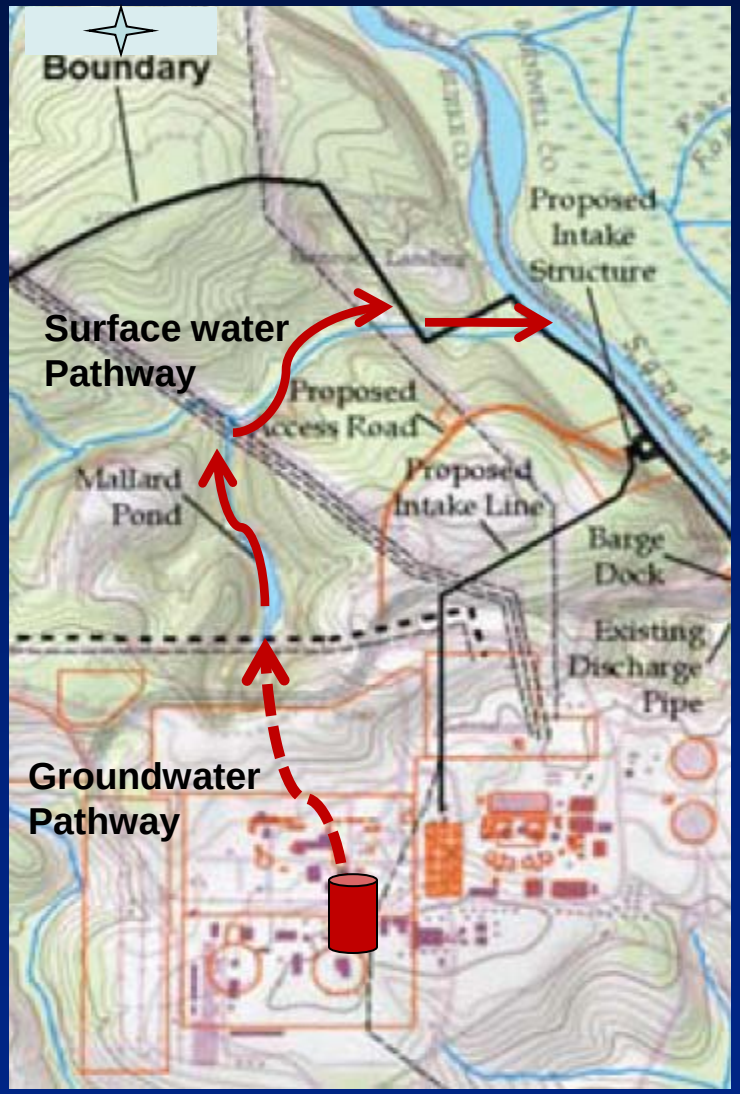
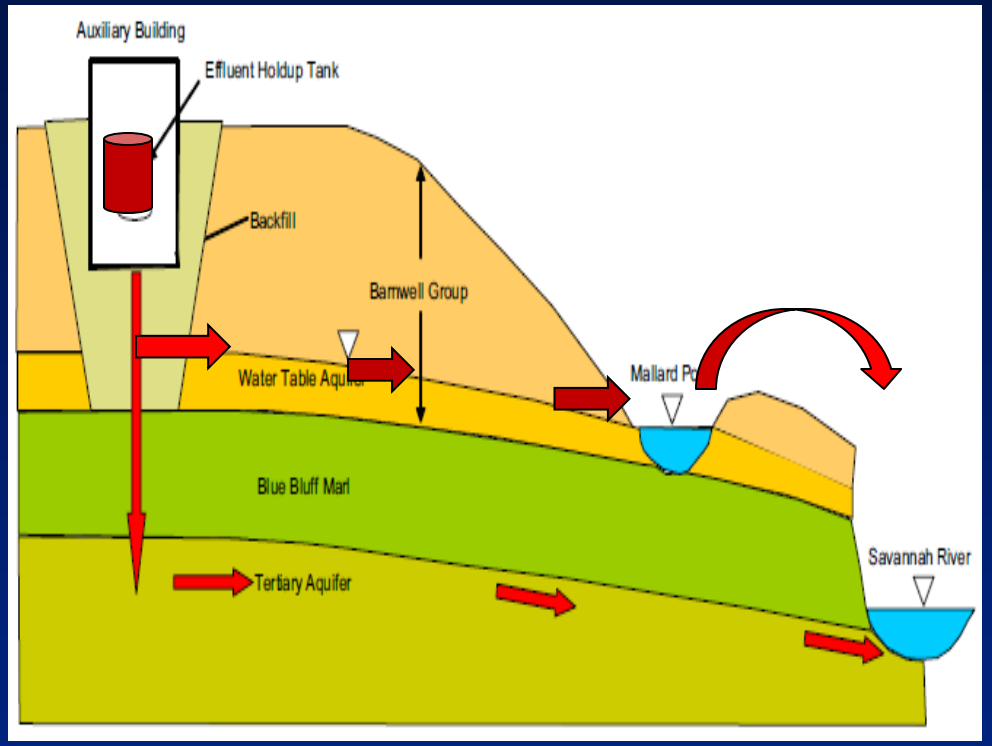
Example of a Conceptual Site Model





Note: CSM is a qualitative description of the important features, events, and processes of groundwater flow and transport.

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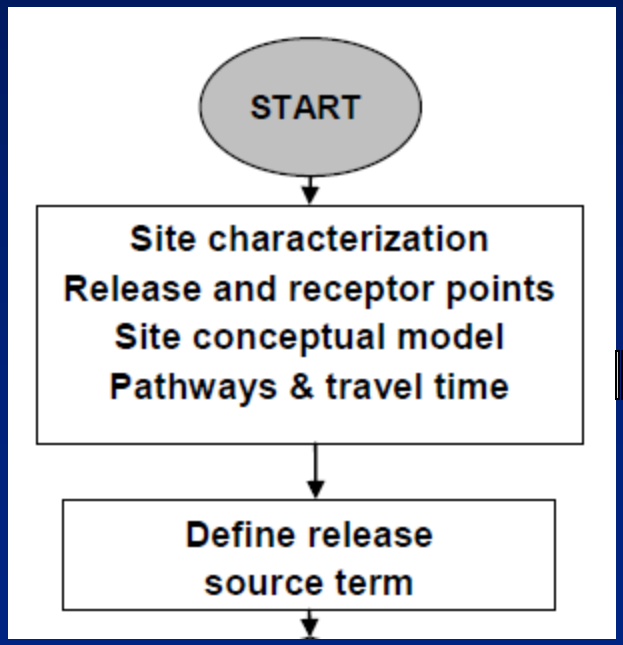
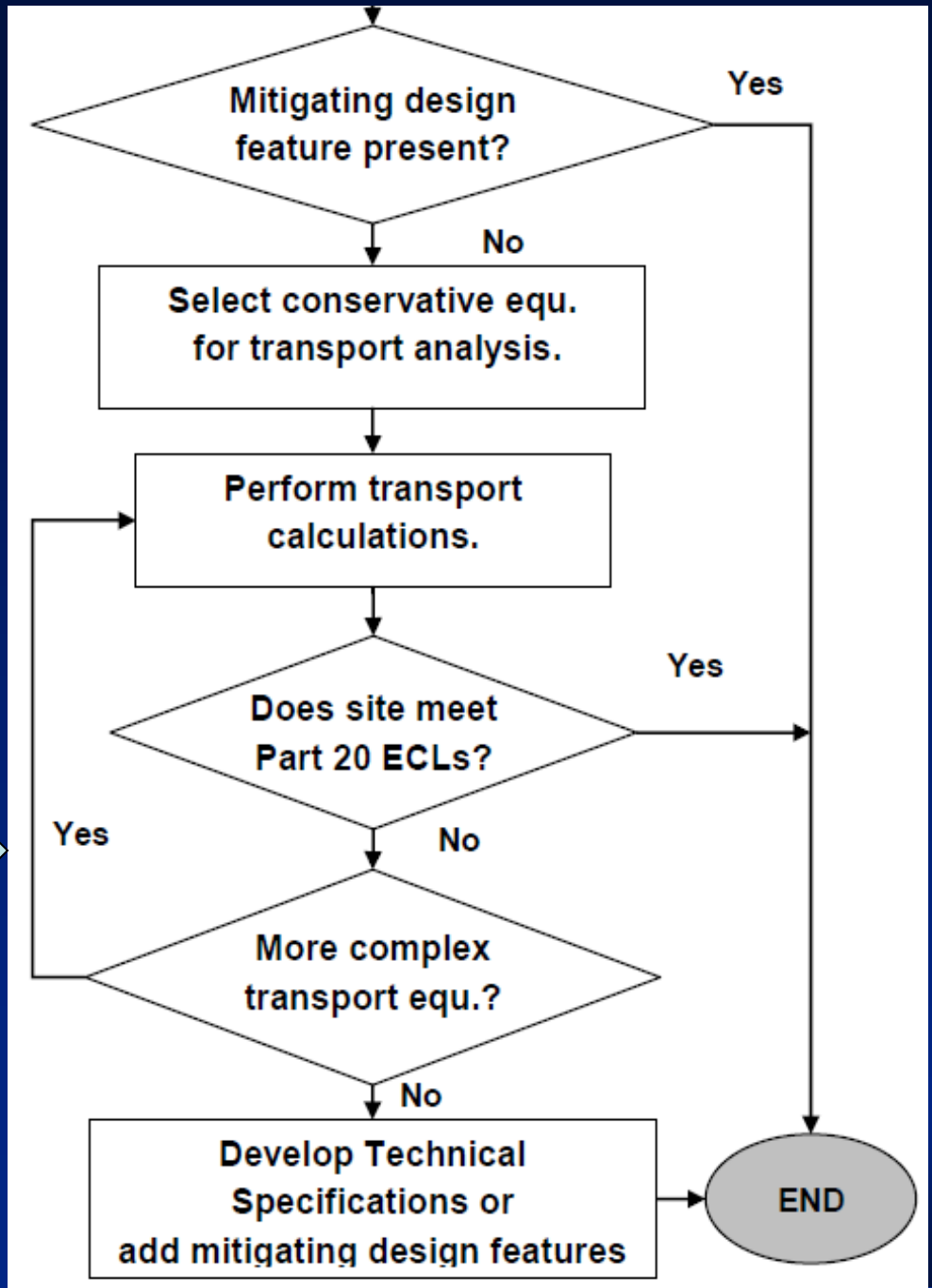
Radiological Consequence Analysis





* ECL: Effluent Concentration Limits

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On-site Hydrogeology

- COL/ESP applicants must collect sufficient on-site hydrogeologic data to predict pathways and travel times accurately in a risk-informed approach.
- The consequence analysis in FSAR 2.4.13 should be based on a long-term annual average hydrogeologic condition.
- Long-term groundwater levels, if not available, could be estimated alternatively using either transposition or correlation methods.
- Hydrogeologic parameters should be representative in space (e.g., pumping test vs. slug test).
- Transport parameters (e.g., distribution coefficient K_d) must be representative of field (undisturbed) conditions, if measured.
- When measuring material K_d values, at least two or three aquifer samples along each pathway should be taken.

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Screening Approach for K_d

- Characterization of K_d values is challenging due to the number of radionuclide species and the intrinsic variability of aquifer materials.
- Determining K_d values for short half-life is generally not practical.
- Could use a screening approach to determine radionuclide species for K_d sampling:
  - Estimate concentrations with only decay and dilution processes (no dispersion),
  - Identify species that exceed the applicable concentration or dose limits at the receptor point.
  - Determine K_d values for the identified species using aquifer material samples collected on-site.
- An example screening approach using different transport processes:
  - Decay only (start with all species)
  - Decay + Dilution (determine species for K_d)
  - Decay + Dilution + Dispersion (could use K_d of zero or real values)
  - Decay + Dilution + Dispersion + Adsorption & Diffusion (need K_d values)

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Groundwater Modeling and Pathways

- Must develop a conceptual site model of groundwater flow and transport: Guidance is given in NUREG/CR-6805 and others.

- Identify pathways and plausible alternatives considering:
  - Uncertainty of the assumptions used to develop a conceptual model
  - Variability and uncertainty in hydrogeologic data and parameters
  - Uncertainty of contamination scenarios and future water uses

- Numerical Modeling
  - Analytical solution could be used for a uniform, steady flow regime.
  - Detailed numerical model must be used for a complex groundwater system or the groundwater system which could be changed by proposed plant facilities.

  - Attachment A of ISG-014 provides guidance in reviewing a numerical groundwater flow model, including acceptance criteria needed for FSAR 2.4.12&13.

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Consequence Analysis

- A hierarchical approach is acceptable and recommended for:
  - Radiological consequence analysis in FSAR 2.4.13
  - Determining specifies for on-site K_d sampling, and
  - Groundwater flow modeling
- Staff to confirm the Part 20 Appendix B ECL compliance against direct public water uses at receptor point(s).
- If the ECL is not met, staff to confirm that applicant provides mitigating design features or technical specifications to limit tank volume and/or concentration.
- Check the compliance with the provisions of EPA's generally applicable environmental radiation standards in 40 CFR Part 190.
- Skip consequence analysis if mitigating design features are found acceptable.
- The consequence analysis in FSAR 2.4.13 is limited to the Liquid Radwaste Management System only.

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Resolution and Applicability

- Final Resolution:
  - Incorporate ISG-013 and ISG-014 in future updates of SRP Sections 2.4.12 and 2.4.13.
- Applicability:
  - ISG-014 is applicable to all future COL/ESP license applications submitted under 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants.”

QUESTIONS ?