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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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573rd MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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THURSDAY

JUNE 10, 2010

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ROCKVILLE, MARYLAND

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The Advisory Committee convened at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:30 a.m., Dr. Said Abdel-Khalik, Chair, presiding.

COMMITTEE MEMBERS PRESENT:

SAID ABDEL-KHALIK, Chair

J. SAM ARMIJO, Vice Chair

SANJOY BANERJEE

DENNIS C. BLEY

MARIO V. BONACA

MICHAEL CORRADINI

DANA A. POWERS

HAROLD B. RAY

COMMITTEE MEMBERS PRESENT: (cont.)

MICHAEL T. RYAN

WILLIAM J. SHACK

JOHN D. SIEBER

JOHN W. STETKAR

NRC STAFF PRESENT:

DEREK WIDMAYER, Designated Federal Official

ED ROACH

JEAN-CLAUDE DEHMEL

HOSUNG AHN

TOM NICHOLSON

RICHARD RAIONE

CHARLES ADER

DONALD DUBE

SUNIL WEERAKKODY

MICHAEL SCOTT

JOHN LEHNING

WILLIAM RULAND

STEPHEN SMITH

TIM COLLINS

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

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

8:27 a.m.

CHAIR ABDEL-KHALIK: On the record. The meeting will now come to order. This is the second day of the 573rd Meeting of the Advisory Committee on Reactor Safeguards. During today's meeting, the Committee will consider the following: (1) Proposed Interim Staff Guidance ISG-013, Assessing the Consequences of an Accidental Release of Radioactive Materials from Waste Tanks and Proposed DC/COL-ISG-014, Assessing Groundwater Flow and Transport of Accidental Radionuclide Releases; (2) Status of Risk-Informing Guidance for New Reactors; (3) Generic Safety Issue (GSI)-191, Assessment of Debris Accumulation on PWR Sump Performance; (4) Future ACRS Activities/Report of the Planning and Procedures Subcommittee; (5) Reconciliation of ACRS Comments and Recommendations; and (6) Preparation of ACRS Reports.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Mr. Derek Widmayer is the Designated Federal Official for the initial portion of the meeting.

We have received no written comments or requests for time to make oral statements from members

of the public regarding today's sessions. There will be a phone bridge line. To preclude interruption of the meeting, the phone will be placed in a listen-in mode during the presentations and Committee discussions.

A transcript of portions of the meeting is being kept and it's requested that the speakers use one of the microphones, identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

At this time we will go to Item No. 8 on the agenda which deals with ISG-013 and 014 and Dr. Ryan will lead us through that discussion.

Dr. Ryan.

MEMBER RYAN: Mr. Chairman, we had a very productive subcommittee meeting a few weeks ago on ISG-013 and 014. And one important area that we dealt with was the function of these ISGs and their intended purpose for license review activities versus the current issue of groundwater contamination at some power plant facilities. So we've separated those two issues and recognize that these two are really intended for a license review activity on the particular topics and I'm sure the staff will fill us in on those details.

But I thought I'd preface our meeting today by keeping that issue separate which we will take up at a later time. But that's not the purpose or function of these two ISGs.

Without further ado, I guess I will turn to you, Jean Claude, or Ed. To Ed Roach of NRO.

MR. ROACH: Good morning. My name is Ed Roach. I'm the branch chief for the Health Physics Branch of New Reactors, Division of Construction and Inspection. And I'd like to thank the Committee for asking us to appear today and presenting these topics.

Again, as Dr. Ryan said, these are based on our lessons learned from the recent COL and certified design reviews we've conducted and where we've identified clarification that was necessary within the guidance for the standard review plan what was reviewed in March of 2007. So these will apply once approved or once finalized to those reviews that come in after that point. So these are lessons learned. And this is how we feel is the best method to present this information where it gets full transparency, review and incorporated into the SRP at a later time. Thank you.

MEMBER RYAN: Okay. Jean-Claude, are you up?

MR. DEHMEL: Yes. Thank you. My name is Jean-Claude Dehmel and I'm a health physicist for NRO. And basically this presentation we split. I will cover ISG-013 for the first five slides and then Hosung will present the remaining of the slides on ISG-014 as well as conclude the presentation.

The purpose of both ISGs is to expand existing guidance by providing additional clarification and technical guidance on the information already contained in the SRP Reg. Guide 2.206 and based on experience that we've had in reviewing currently in-house applications. I'll give you a few examples of some of the issues that we've come across with that respect.

But basically the purpose of both ISGs starting with ISG_013 is provide expanded guidance on the justification of selecting specific tanks that are assumed to fail; evaluate the kind of tank, the tank location and the facility design features that may be used in mitigating the impact of a release; some of the process associated with the radiological assessment in assessing the radiological impact of the failed tank; and also for the purpose of additional guidance on the assignment of tech spec for maximum radioactivity inventory in tank. That is for tanks

that either failed the acceptance criteria and whether or not additional design features should be implemented as part of the design. For example, the addition of steel liners in a cubicle housing tank.

The focus of ISG-014 and the guidance on that, the proposed revised guidance on that, focuses on the radiological consequences analysis namely for the transport of radioactivity from the tank to the point of exposure as well as providing further guidance on the kind of site hydrogeologic features that can be used to characterize and quantify the movement of radioactivity to the point of exposures.

Why are these ISGs needed? Well, because there is again as Ed noted earlier, there are inconsistent guidance within the SRPs, namely Section 11.2 describing the liquid waste management system, BTP 11-6 which essentially forms the basis for analyzing and evaluating the consequence of a radwaste tank failure as well as the interface requirement in Section 2.4.12 and 2.4.13 with having to do with groundwater movement as well as again assessing radiological consequences of radwaste tank failures in the context of applying site-specific features.

CHAIR ABDEL-KHALIK: Could you give us more detail as to the manner in which the current

guidance is internally inconsistent?

MR. DEHMEL: Yes, I have a slide, but basically -- Let me go over those now basically then. This related to the site's experience in reviewing specific applications to date. For example, what has been experienced has been with the kind of assumptions and credits that the applicant has used in applying certain design features and mitigating the impact of a radiological release. The kind of assumption used with respect to the release mechanism and the duration of a release, whether or not it was a prompt release or it was essentially a slow release.

For example, in the context of the BTP and SRP the premise is that it's an abrupt and sudden release of radioactivity. Well, some applicants essentially have assumed protracted release meaning that the tank ruptures and the liquid stays there for months and then slowly slips out of the cubicle or radwaste building into the groundwater and then ultimately impacts an offsite dose.

MEMBER CORRADINI: So it's the assumptions. The inconsistencies could be characterized as the assumptions one has to make to do a calculation.

MR. DEHMEL: Yes. Basically, our intent

is -- or the intent of the guidance has always been this will be a prompt release, a prompt failure of the tank with the near immediate induction of the radioactivity in ground or surface water. Some applicants have looked at this and said, well, we have a tank located in a cubicle. The cubicle has X feet of concrete and so forth and therefore some assumptions were made with respect to slow seepage of the radioactivity through flow joints as well as cracks into the environment.

CHAIR ABDEL-KHALIK: What would be the mechanism for sort of prompt release resulting from instantaneous failure of the tank? Are there sufficient loadings or pressure rises in the tank that would result in prompt failure of a tank?

MR. DEHMEL: Not that I can think of right now. The assumption in the analysis is that you have to make that simple assumption that you have a prompt release of radioactivity into the environment. In other words, unless there are certain features, for example, a steel liner that would be built into a cubicle or a room housing a tank and such that the height of the liner would be adequate such that it would contain the entire volume of a spill tank, the assumption and the guidance right now assumes a prompt

failure.

So we kind of overlook the fact that in real term or in a real world if you had a failure of a tank, it would not be a prompt release. It would be a slow release going to the environment. But for the purpose of the analysis, the purpose of the SRP, the purpose of the BTP 11-6, the assumption is a prompt release of radioactivity.

MEMBER STETKAR: I'm not familiar with the guidance, but there are ways that human errors, for example, could actually release the contents of a tank pretty quickly, not as quickly as a catastrophic failure of the tank itself but release pretty large volume of --

MEMBER RYAN: Faster than a slow seepage.

MEMBER STETKAR: Yes, faster than slow seepage. That's right. So if this is a surrogate for those types of things if they could occur, that's one way without thinking of catastrophic structure failures.

MR. DEHMEL: Yes, because it would be very unlikely that you would have a kind of failure in the building like this that would essentially open up the basement so to speak and allow the tank to --

MEMBER BLEY: Without a driving force.

MR. DEHMEL: Right.

CHAIR ABDEL-KHALIK: So this is a bounding calculation that is known to overestimate the dose but is essentially the guidance given to the applicant.

MR. DEHMEL: Exactly.

MR. ROACH: This is Ed Roach. And just to elaborate a little bit. This analysis was originally contained in the previous version of the SRP in Chapter 15.7.3 which required the analysis of this. At the time, it was the quickest way to convey the activity to the receptor and the mass of failure and there have been examples of where tanks have collapsed due to blocking off the vents or the forklifts or equipment damaging. They haven't resulted in significant releases to the offsite, but those have occurred in the actual industry.

MR. DEHMEL: The other observations we know are in the application, there have been some questions about the kind of source term development that the applicant proposed as well as the distribution of radionuclide. In some cases, some radionuclides, the proposed radionuclides, listed have been somewhat comprehensive. In our cases, there has not been. In other cases, it considered only very long-lived radionuclide. In other cases, it did not

consider all potentially environmentally mobile radionuclides such as Tc-99 and Iodine-129 and so on.

So in light of that, we felt it was kind of necessary to expand the guidance as to the selection of radionuclides and the radionuclide distributions as well as -- The other thing that we're adding to the guidance is the graded approach with respect to the kind of tanks and the kind of radioactive inventory one might expect.

For example, you can look at -- There are two extremes. One set of tanks or a kind of system that would have relatively low volumes, meaning volume inventory, gallons or liters in a tank, but high concentration versus tanks that have very high inventories volume but low concentration. So now we're essentially forcing the staff and the applicant to consider those two extremes and determine which one will be the most limiting.

The other couple issues that I have identified are the point of compliance. Where is the point of compliance in this case? Where is the end user or the most likely dose receptor? Is it at the EAV? Is that a point of use where the water essentially be contaminated, for example, in surface water or stream where that water essentially is being

used as a supply to a water supply system or water distribution system? Or was it simply a well located at some distant location offsite?

And the other thing that we looked at also is the point of compliance, whether or not it includes water. Right now, the guidance the way it is written, the implication, it's only drinking water. Even though there are some footnotes that talk about indirect use of water such as water irrigation for crops and pastures as well as the watering of livestock. So we've expanded the guidance and essentially take that information from a simple footnote to the main body of the guidance both in the SRP Section 11.2 as well as the Branch Technical Position 11-6.

So in those instances we would -- the thinking is we would not apply the effluent concentration limits of Part 20 Appendix B Table 2 concentration, but a dose limit.

MEMBER CORRADINI: I don't think I appreciate what you just said. Can you say it again? I recognize 10 CFR 20 which is a concentration. So now you're saying that you would not do that. You would do what?

MR. DEHMEL: No, we are expanding the

guidance to retain the guidance --

MEMBER CORRADINI: The concentration.

MR. DEHMEL: The concentration itself, the acceptance criteria, that focused on the effluent concentration limits of Part 20 Appendix B Table 2 concentrations.

MEMBER CORRADINI: Right.

MR. DEHMEL: And we're expanding it to actually address or recognize the fact that there may be instances where there would be no consumption of surface or groundwater at a site, but that the impact could occur by this water being used for indirect use such as watering livestock and so on.

MEMBER CORRADINI: Right.

MR. DEHMEL: So for those kind of scenarios the SRP acceptance criteria adopts the 100 millirem per year dose of Part 20 under Part 20.1301.

MEMBER RYAN: Jean-Claude, I think to maybe just simplify it for some of the members if you have a water source that's used indirectly for crop irrigation or food crop irrigation for animals.

MEMBER CORRADINI: Right.

MEMBER RYAN: There's a possibility that you could reconcentrate some of the radioactivity back up a food chain back to human beings.

MEMBER CORRADINI: Right.

MEMBER RYAN: So I think this is kind of closing the loop on is there any possibility for reconcentration pathways versus direct drinking pathways.

MEMBER CORRADINI: And the reconcentration pathways would use this dose limit.

MEMBER RYAN: Would you use the Appendix B as the starting point for the effluent or some calculated number and then a pathway analysis I guess would be the appropriate tool with that reconcentration.

MEMBER CORRADINI: A pathway analysis that looks at this. Okay.

MEMBER RYAN: Does that help?

MEMBER CORRADINI: Yes. Got it. Thank you.

MEMBER RYAN: Yes.

MR. DEHMEL: The pathway analysis now, obviously this would have be to site-specific.

MEMBER RYAN: Sure. Of course.

MR. DEHMEL: So you can see that it presents kind of different challenges, one for design certification application as well as one for a COL applicant with site-specific incident.

MEMBER RYAN: And I think the whole purpose in the ISG is to recognize that a reconcentration pathway needs some attention as well as a different pathway.

MEMBER CORRADINI: Sure.

MR. DEHMEL: Because right now you'll see if you look at the guidance it's only buried in the footnotes. We felt that it was important to elevate this to an equal level.

MEMBER CORRADINI: Okay. Thank you.

MR. DEHMEL: So going over the regulatory basis, these are the three major aspects. One thing we should understand is that there's nothing in the regulation right now that says that one shall evaluate the radiological impact of a failed radwaste tank. It's not contained in the regulations, only in the regulatory guidance, namely Reg Guide 1.206 which is the standard form, as I understand it, for the preparation of COL applications FSARs as well the SRP Section 11.2 and the Branch Technical Position 11-6.

The first four items identified on this slide, namely Parts 52.79, 52.34(a), 50.36(a) and GDC 60 and 61, the focus there is on ensuring that there is adequate equipment to treat and process located waste as well as control releases, control and monitor

effluent releases under normal operation anticipated operational occurrences. There is nothing in there that actually addresses itself to a failure of a radwaste tank.

Part 100.20(c)(3) addresses to the hydrogeologic site characteristics and how this information would be used in the context of the analysis with respect to 2.4.12 and 2.4.13 where, for example, site-specific information would have to be used to assess the consequences in a site-specific application while you can see for DCD the simplest step approach may be used in making some very simple assumptions without having to rely on a site-specific information.

The regulatory guidance, again the focus and this is what the focus of the ISGs, are to revise and expand the guidance and eliminate some of the clarifications. But I think the first two items that we talk about is SRP 11.2 and BTP 11-6, SRP Section 2.4.12 and 2.4.13 on groundwater flow and transport.

Reg. Guide 1.143 addresses itself to minimum requirement for the design features and operation characteristics of the liquid waste management system again for the purpose of treating, storing and providing measures to release radioactive

material in a controlled fashion. And Reg Guide 1.113 and NUREG/CR -3332 and NUREG/CR-6805 address themselves to the radiological assessment of releases as well as modeling and movement and the transport of radioactivity in ground and surface water.

MEMBER BANERJEE: What's the vintage of that NUREG-6805?

MR. DEHMEL: NUREG-3332; '83/'84, something, mid-80s, something like this.

MEMBER BANERJEE: And the dispersion modeling is about the same?

MR. DEHMEL: No, 6805 is a more recent. I think it's 2004. I think we have it somewhere in a prior presentation.

MEMBER BANERJEE: 6805 is 2004.

MR. DEHMEL: I think it's more recent.

MEMBER BANERJEE: 3332 is --

MR. AHN: That describes how we develop the conceptual site model and how we apply the ground or transport process on the consequence analysis. So it's quite general but not specific to this chapter, FSAR chapter 2.4.12 and 2.4.13. That's why we developed some kind of model on this area.

MEMBER BANERJEE: So the conceptual site model takes into account dispersion calculations and

things.

MR. AHN: No. When we usually say groundwater modeling, we have a two-step approach. We use two-step approach. First, we need to develop the conceptual site model. Then if we need it, we need to analyze the transport process using either the analytical equation or numerical equation.

So what is the conceptual site model? The conceptual site model is just the qualitative description of the futures of the hydrogeology or groundwater flow and transport processes. So it's a quite simplified conceptual process of how groundwater flow and how transport occurred from the groundwater. That's the conceptual site model.

MEMBER BANERJEE: So that must be in some way related to the onsite hydrogeological characterization, right?

MR. AHN: True. Yes.

MEMBER BANERJEE: So does that require that you do some sort of exploratory experiments to look at transport using tracers or something?

MR. AHN: Yes. When we analyze radiological consequence in groundwater, it's really a complicated process involved in a lot of different physical processes in groundwater. And do we need

that at the beginning? It'd depending on the site situation. So what we proposed on our guidance is that at the beginning first us a simple, very conservative bounding approach to check the Part 20 compliance. And if the site doesn't meet that compliance, we made other more progressive detailed model to validate the groundwater.

MEMBER RYAN: I would just like to add a couple sentences. It might help Sanjoy. It was published in 2003.

MEMBER BANERJEE: Right.

MEMBER RYAN: I'll give you three sentences of the abstract. The report describes the strategy that embodies a systematic, comprehensive approach to hydrogeologic conceptualization model development and predictive uncertainty analysis. The strategy is comprehensive in that it considers all stages of the model building and accounts jointly for uncertainties that arise at each of them. So I think it's intended to be a pretty comprehensive modeling exercise with uncertainty analysis.

Dr. Nicholson is here who authored it. So if you have any detailed questions --

MR. AHN: My understanding is that that guidance it may be applicable to the unit where there

may be some actual contamination happened. But in this case ESP and COL we don't have any actual contamination. So we just use high conceptual and simply approach for them. If site does not meet, then we made other more detailed methods. That's the basic idea about that.

MEMBER BANERJEE: You'll be going into this in detail in your second part, right?

MR. AHN: I expect that we will be going into this.

MEMBER BANERJEE: So we can hold the questions. But I'd be quite interested to understand how you take into account, say, the ion exchange capability of soil because this has always been a very difficult problem you get.

MR. AHN: That's true. We'll discuss that.

MEMBER BANERJEE: Okay.

MR. DEHMEL: For the record, just to clarify what I said earlier, the NUREG CR 3332 was published in September of 1983 and NUREG CR 6805 was in July of 2003 just to make sure that's correct.

VICE CHAIR ARMIJO: I'd have to ask just a quick question. You talk about this reconcentration mechanism through the food chain. What is the

concentration -- Let's say you've contaminated the groundwater. A big tank leaks. The radwaste tanks leaks. Somehow that liquid goes through the soil, eventually gets into the groundwater. Depending on time and other things, it gets diluted. How do you get the starting point, starting concentrations, of radionuclides to start the reconcentration step?

MR. DEHMEL: The start of the radioactive inventory is basically the applicant has to make a case that (1) the system has been properly selected for the purpose of this analyzed tank, the tank inventory, the nature of the radioactivity. In other words, where does the process fluid that essentially ends up in that tank comes from and what are the characteristics of the radionuclide concentration or radionuclide distribution that are expected or that are assumed for the analysis. That is the starting point.

Then we actually look at whether or not those concentrations, those radionuclides distributions, are adequate or make sense with respect to what's expected of the plant.

VICE CHAIR ARMIJO: I guess I was just following on Dr. Banerjee's question in that you fail a tank. A lot of stuff comes out. It goes through

the soil. Some of it's trapped. Ion exchange and other mechanisms. If some eventually reaches the groundwater depending on time and other things, there's a dilution effect.

MR. DEHMEL: Yes.

VICE CHAIR ARMIJO: Eventually some of that gets into an irrigation system. Cows start eating it and you try and determine if you're meeting your --

MR. DEHMEL: Acceptance criteria.

VICE CHAIR ARMIJO: Yes, your acceptance criteria. I'm just wondering how do you treat that. Is it really that mechanistic? Do you really go through all those steps? Or do you take some really bounding --

MR. DEHMEL: Yes. Basically and --

MR. AHN: I'll explain that process briefly. In conceptual site model, we should describe the transport process through unsaturated -- then saturated -- flow. However, when we make the simple bounding analysis, we just assume that the ruptured tank volume content will instantly reach to the groundwater table that it transports. So when we --

VICE CHAIR ARMIJO: You don't allow for dilution then.

MR. AHN: We consider the dilution, yes.

VICE CHAIR ARMIJO: Okay. But you don't -- But pretty much instantaneously that water without trapping by soil --

MR. AHN: On -- we assume that this instantly go to the groundwater. Then we just assume and analyze the transport in the groundwater flow. That's what we normally use.

VICE CHAIR ARMIJO: Okay.

MR. DEHMEL: Yes. The dilution indicator and retardation are essentially taking into account.

VICE CHAIR ARMIJO: But it all gets to the groundwater.

MR. DEHMEL: Yes. The assumption is that we don't take credit for any kind of filtration that may occur in a building so to speak. In other words, there is an inventory X amount of gallons, X concentration, for these specific radionuclides. That's assumed to instantaneously find its way into groundwater.

VICE CHAIR ARMIJO: Okay.

MR. DEHMEL: From that point on, it's modeled with respect to dilution, dispersion, retardation, that may actually occur in groundwater too and what happens in the environment. For example,

if it goes on to -- If it's crop irrigation and so on, the time it takes from the crop to grow to the time the crop is processed to the time it's eaten and so on. All of these points are taken into consideration to the model.

MEMBER RYAN: East of the Mississippi, Sam, that's not a bad assumption because time in the vadose zone is relatively short east of the Mississippi. If you get out west where you have really big unsaturated zones, then maybe you might want to think a little bit differently about it.

VICE CHAIR ARMIJO: Okay. But I just wanted to know. It's very, very quick. Instantaneous.

MEMBER RYAN: Yes.

VICE CHAIR ARMIJO: Take that volume of water and you put it into the groundwater.

MEMBER RYAN: Yes.

VICE CHAIR ARMIJO: Okay.

MEMBER BANERJEE: But you take ion exchange into account, right?

MEMBER RYAN: Yes. And then all the processes. What I heard them say, once it gets to the saturated zone, all the processes are accounted.

MR. DEHMEL: Including retardation which essentially is one component of ion exchange.

MEMBER BANERJEE: But the problem that --

MEMBER SIEBER: It's a filtration type delay. And the other one is ion exchange in carbonated trash that may exist.

MEMBER BANERJEE: The difficulty that I have with this is as you know you get a front moving, the breakthrough waves that come with the ion exchange process. How do you take that into account? Because in an ion exchange column, this is a major problem to predict this. Now if you know how to do this for groundwater and we can't do it in an ion exchange column, it's sort of an interesting --

MEMBER CORRADINI: He's looking for help.

MEMBER BANERJEE: Yes. How do you do it?

MR. AHN: That part technically is possible. But practically where are most of the traveling occurred? That's the way the vadose zone but it's actually the saturated zone. So when we use kind of a bounding conservative analysis, we just assumed that the ruptured containment directly go to the groundwater.

In reality, there are a lot of different layers of transportation on vadose zone. First, after tank was ruptured, it should penetrate the base met of the tank. That's one six feet of concrete. And after

that, we have like three or four feet of the foundation layer. So we should realize the actual transportation process through that and through the vadose zone. But when we make the conservative bounding analysis we found that everything make a big hole and the containment directly with the water table. Then that's the starting point of our analysis.

MEMBER BANERJEE: Okay. That clarifies certainly the early stage of this. The later stage, the potential that you can get a concentration wave move through the system because of that.

MR. AHN: That's what we considered.

MEMBER BANERJEE: Yes. And that could actually give rise to a period where you have a fairly high concentration which is coming up because of the concentration wave.

MR. AHN: Yes, that's what we compared and --

MEMBER BANERJEE: Yes. That's what I'm asking for help. How do you do that because it seems rather hard to do.

MR. AHN: Yes. There are several different ways we can handle that issue. We can use the simple analytical equation to estimate the front

movement or we can use detailed numerical model to estimate that process. But most of the case during the planning stage we don't use a transport modeling. But we use just simple analytical equation to estimate the transport process.

MEMBER BANERJEE: Then you need some exchange parameters in there, right?

MR. AHN: Yes.

MEMBER BANERJEE: And you measured those for that site or how do you do that?

MR. AHN: No. We just assumed the exchange rate and --

MEMBER SIEBER: Prototype.

MR. AHN: Yes. For transport parameters some of them we make instant measurement. But some we use just a bounding barrier and check the Part 20 compliance and if the site meets Part 20 compliance then we say that --

MEMBER BANERJEE: You have some parameters for bentonite or whatever.

MR. AHN: Oh, yes. For material we should have that parameter.

MEMBER BANERJEE: So you've got that.

MR. AHN: Yes.

MEMBER RYAN: Sanjoy, the other part from

the radiological prospective is probably ten or less radionuclides that are dosimetrically significant and mobile.

MEMBER BANERJEE: Right.

MEMBER RYAN: So the playing field of what you really have to focus on is fairly narrow and focuses on relatively mobile radionuclides.

MEMBER SIEBER: Right.

MEMBER RYAN: That are dosimetrically significant that will drive the --

MEMBER BANERJEE: What are these ten or give a couple anyway.

MEMBER RYAN: Cesium-137, strontium-90.

MEMBER BANERJEE: Okay.

MEMBER RYAN: You know those are two.

MEMBER POWERS: But don't you usually get into troubles with those that are polyvariant and can become colloidal.

MEMBER RYAN: Maybe Dr. Nicholson could because he's studied this.

DR. NICHOLSON: Yes. My name is Tom Nicholson. I'm with the Office of Research. To answer your question, sir, that's part of the characterization process to understand the hydrogeologic units and the metals that are there and

how they interact. And the property you're looking for is called a retardation factor. So the retardation factor you could develop those on a site-specific basis if you choose to and that's why you often will collect core samples, go back to the lab and then by looking at the chemical nature.

And the other gentleman was mentioning colloidal transport. You think of those transport processes for that specific site. So you look at the question of whether it's a fractured rock, whether it's a porous media, the metal that's contained. All of that is part of the characterization process. And that's all described in NUREG/CR 6805. You're looking at alternative conceptual models of how complex or how simple you want to represent the transport mechanisms and you relate it to the chemicals, in this case radionuclides that are moving through those hydrogeologic units.

MR. DEHMEL: For your information, in the back of ISG-013 there's a list that we've included, Attachment A that essentially provides a more specific guidance on the kind of separated radionuclides that should be considered as a minimum in the analysis.

MR. AHN: Presented by the --

MR. DEHMEL: Tritium is in there.

Strontium-90, cesium-137, traditional cobalts, nickel-63, iodine-129 and others.

MR. AHN: Other than that, we are adopted kind of the hierarchical approach to determine which transport parameter are critical on that site. Then based on that information we made a onsite transport parameter. That has to get our onsite measurement process. It's all depending on site-specific.

MEMBER BANERJEE: So that's under this 10 CFR 100 -- the characterization of the site. You measured some of these parameters.

MEMBER SIEBER: Yes, hydrogeologic.

MR. AHN: Yes.

DR. NICHOLSON: Yes.

MR. DEHMEL: Okay. And then as a matter of clarification just to make sure that it is understood because we have gotten some comments as to what was meant by the SRP acceptance criteria. The SRP acceptance criteria really used as a measure, as a gauge, to assess the acceptability of the radwaste tank failure. It's not used for the purpose of complying with the specific requirements of Part 20 either with the effluent concentration limits or for person complying with the dose limit to 100 millirem per year for members of the public.

So what the guidance has done is basically look at kind of logical acceptance criteria and then adopted those for the purpose of assessing the consequence of a radwaste tank failure. So that's a kind of important distinction.

With respect to this slide, this identifies in essence the core elements of the revision of the guidance and explains the clarification with respect to ISG-013. So the focus has been on or is on identifying and selecting the proper type of tanks and identifying the failure mechanisms such as simply an assumed failure of a tank or as was mentioned earlier an operator error that essentially causes the release of radioactive liquid into a cubicle or into a room.

CHAIR ABDEL-KHALIK: Now, you indicated earlier that you look at small tanks where you have fairly high concentrations, large tanks where you have reasonably diluted material. To me it would seem like probably the worst case scenario is not one extreme or the other. It's probably somewhere in between. How do you determine that without analyzing everything?

MR. DEHMEL: Well, it depends. For example, if you have a tank that's inside a building, a radwaste tank, where you have high concentrations

of, say, 10,000, 20,000, 30,000 gallons of water, then you can look at the other tanks that are in the liquid waste management system or radwaste storage building and actually identify based on the original material that has been processed for the system and the end point what are the radionuclides or what is the origin of the source of radioactivity.

With respect to tanks that have -- So for tanks that are in there, you're right in the sense that that tank would be essentially the limiting tank and there will be no other tank. Therefore other tanks where you have large volume and low concentration, in some instances you have tanks that are located outdoors. And there the release mechanism is not to a groundwater body, but to a surface water body. So that's why we're expanding the guidance to consider those two situations where now you have different release mechanisms.

So you can see that the radionuclides for a surface release to a surface water body you might consider a broader suite of radionuclides than you would for groundwater because for groundwater you could essentially exclude radioactive decay to start with, a significant number of radionuclides because they simply won't make it to the outside dose receptor

before an outdoor tank and a surface release pathway. Then the suite of radionuclides would have to be by definition a lot more comprehensive because there the transfer mechanism is going to be fairly rapid and taking credit for decay would be questionable in some instances.

That's why we are essentially trying to bucket those two extremes. So you could conceivably look at for example a BWR site where you would have two analyses, one for the condensate storage tank outside and then another analysis for a radwaste tank inside the radwaste building.

CHAIR ABDEL-KHALIK: Okay.

MR. AHN: On that issue, on ISG-014, we describe that the determination of tank failure sequences is critical. It's based on the consequence at the receptor point. That's what was described on our finding.

MR. DEHMEL: All right. And continuing on, looking at the kind of credit that may be assumed for passive and durable mitigating design feature, for example, right now the guidance exclude the use of coating essentially as being a design feature that one might apply for mitigating the release of releases. So the application of a steel liner built into a

cubicle or room to a height that would contain the entire volume of a tank that's a credible design feature that would be used for mitigating the impact.

The kind of assumptions and the level of conservatism that may be applied in the analysis, development of radioactive source by specific tanks, radioactive transporting of ground or surface water, the release pathways and offsite exposure scenarios, again here for example differentiate the two between a groundwater where you have or surface water where you have direct consumption of water versus when you have an indirect consumption of water. No drinking water pathway where the water is used to irrigate crops, pastures or water livestock.

And then the aspect of addressing and setting up tanks specification of maximum radioactivity concentration levels for a system or an analysis either the tank or the site that fails to comply with the SPR acceptance criteria.

And then finally the last one is for the staff on how to prepare the specific language in the SER based on the review of the analysis of the applicant's information and how one would essentially conclude that the analysis and the information presented in the FSAR is acceptable for those

different case conditions.

And I'm going to pass it over to Hosung on ISG-014.

MR. AHN: From this side, I will briefly what kind of process we used in FSAR 2.4.12 and 2.4.13, radionuclide transport and consequence analysis in there. And obviously the major objective of this consequence analysis in 2.4.13 or even FSAR 11.2 is to check the Part 20 compliance and determine whether the site is suitable in terms of the radiological contamination or not. That's the major objective of this analysis.

In general, we already discussed that radiological groundwater transport process estimation is quite complicated and need a lot of onsite data. So most of the FSAR section describes very detailed on this process and it needs a lot of time and effort in preparing that FSAR and also for the step it takes a lot of time and effort to review that FSAR and determine the safety determination of the radioactive contamination.

So we proposed this kind of structure the hierarchical approach so that at the beginning we used the very simple bounding calculation of radiological contamination and the check Part 20 compliance. And

if they meet they may start an analysis. Or if they don't meet then we may adopt a more detailed and more realistic transport mechanism and check the Part 20 compliance.

And at the end if they don't meet the Part 20 compliance what we can do. We can suggest a technical specification to limit the tank volume or tank -- or we can suggest the mitigation design feature. So that's the kind of consequence analysis process we are looking for.

MEMBER CORRADINI: So can I get back to your -- So just from your logic standpoint of your last box, you allow it to be no. Is it really never a no? I mean it seems to me that since this is coming in with a new application they're going to have to do something. Whether they do a better calculation or a better design modification so that it complies, is that the essence of this?

MR. AHN: Yes, that's the essence. So even before doing the consequence analysis we're supposed to look at whether that proposed plant mitigation design feature on radwaste system or not and if they meet them then we skip that.

MEMBER CORRADINI: I understand. So just from a standpoint of just good practice and operating

plants, are there analogues out there or benchmarks of plants that are currently designed that meet all this without going through the analysis so if I have a series of design rules or design arrangements I'm pretty well assured that I'm going to meet this? Do you know what I'm asking?

MR. AHN: I think the units some of them they already make this kind of analysis and they said that the site is safe, plenty safe, on this. They haven't similar approaches before.

MEMBER CORRADINI: Okay.

MR. DEHMEL: These requirements are not new. They've been in for a while.

MEMBER CORRADINI: Right.

MR. DEHMEL: So all the plants that are operating if you were to go to the FSARs you will find the analysis either in chapter 11.2 or most likely in 15.7.3 where this was -- where these analyses were initially required or situated in the guidance both in Reg Guide 1.70 as well as in the SRP.

MEMBER CORRADINI: Maybe then I should ask the question this way. Is the fact that you've added an indirect pathway concern going to change anything or are you just closing a potential loophole that probably won't change how the design is done?

MR. DEHMEL: What we are doing with the indirect pathways, the indirect pathway was always identified in the guidance. But it did include the level of detail, the level of -- the consideration in structuring the analysis the way it has been done for releases to groundwater. So what we're doing essentially is providing additional guidance.

So if a plant had a situation where they have an indirect exposure pathway at that particular time that requirement is identified and flagged in the SRP as well as in the guidance. And therefore they had to address it. At that point, how this was addressed was essentially depended upon what kind of information was included in the application at the time and the staff's evaluation of that for that analysis submitted by the applicant.

MEMBER CORRADINI: It's not your anticipation that this will change how a design is done. This is essentially making sure that this indirect pathway does not create an issue that may have been missed. Do you see what I'm asking?

MR. DEHMEL: Well, I can't speak what has been missed because you're asking would I have reviewed all the prior applications and the answer is no. I'm working on only new applications.

MEMBER CORRADINI: But in the subsets that you have looked at.

MR. WIDMAYER: Dr. Corradini, I think what would happen is that they adjust the tech spec on the concentration in the tank. You would anticipate it would change the design.

MEMBER CORRADINI: Okay.

MEMBER SIEBER: Either effect it or regulate it.

MR. DEHMEL: And one option would be to change the design.

MEMBER SHACK: People choose generally to add mitigating features or to go to more sophisticated calculations.

MEMBER CORRADINI: I bet I know.

MR. AHN: It could be both, yes. In terms of --

MEMBER SIEBER: Red pencil lead.

MR. AHN: In terms of the groundwater transport analysis first we identify what is the most critical conceptual site model or pathway. That's what we needed to identify then. We also need to identify what would be the alternate possible pathway. So in extreme case of pathway, it could be changed to a different direction. So we look at all different

potentials on that and what would be the most critical pathway and what would be the consequence of that pathway. That's what we analyzed for that.

MEMBER CORRADINI: Okay. Thank you.

CHAIR ABDEL-KHALIK: That doesn't answer Dr. Shack's question though.

MEMBER SHACK: But I know it.

MR. RAIONE: This is Richard Raione. I'm the Chief of the Hydrologic Engineering Branch. In terms of NRO there is on DCD ESBWR that presents design mitigating features up front and real high tech things such as double walls, spill prevention countermeasures, plans, you know, berms that contain 100 percent the spill. And it would be advantageous if perhaps in the other design centers the vendors look at that type of up front environmental protection to help mitigate anything happening with the groundwater.

MEMBER SHACK: Okay. But the answer is that not everybody has done that.

MR. RAIONE: That's correct. Only one design center at this point and of course North Anna the ESBWR is out. So at this point it's Fermi.

VICE CHAIR ARMIJO: Yes. It just seems that that's something you can inspect, something you

can maintain, where these calculations could change over time. Rules could change. Phenomena could be discovered. And that would go through all of this stuff all over again.

MR. DEHMEL: Well, if a design --

VICE CHAIR ARMIJO: I don't know what -- I'm talking practicality. You know, how would you spend your money. Putting it into a mitigating design feature or doing a lot of characterization and an analysis and everything else that still may be subject to challenge later on as you --

MR. DEHMEL: If I understand your question, I think if you're talking about a change in procedure or a change in a design that may occur and be implemented after the application has been approved when a plant is starting to operate, there are procedures and requirements in the regulation that forces at that point the operator, the licensee, to actually look at whether or not those changes introduce safety issues that essentially either need to be revised or evaluated against a prior criteria that were contained in the prior version of in this case the final safety analysis evaluation report, analysis report.

So there's a process by which if, for

example, the liquid waste management system is changed and a new kind of tank is introduced or the driving of the equipment or components is different, they would have to go back and look at all the prior analysis that supported the initial design and conclude that the changes do not alter the prior conclusions and the prior results of the analysis.

VICE CHAIR ARMIJO: No, I understand that.

MR. AHN: So let's jump to the next page.

CHAIR ABDEL-KHALIK: Yes.

MR. AHN: On ISG-014 it's quite extensive getting into how we collect onsite data and how we analyze the groundwater flow and transport. And we can summarize that ISG scope in here. First, we clarify the review area and the review interface in SRP 2.4.12 and 2.4.13. We found while we are reviewing ESB and the COL application that there are some inconsistency between current SRP and RG 1.206 especially on the review area and interface. We clarified that issue ISG-014.

Second, we reconciled the difference between SRP 2.4.13 and SRP 11.2 and Branch Technical Position 11-6, clarifying the conservatism in defining a base hydrologic condition. That base hydrologic condition means what is the gradient of the

groundwater we used in transport analysis, what kind of flow rate we should use in surface water contamination -- so we clarified that issue on the ISG.

MEMBER BANERJEE: Is this done -- construction might change the groundwater pattern somewhat, right?

MR. AHN: That's true and we analyzed -- we postulate what -- I mean we used the FSAR construction information. But if they change the construction from the license condition, they should reanalyze this.

MEMBER BANERJEE: And is this only based on analysis or is there something done post-construction to verify that?

MR. AHN: Yes. When we simulate groundwater flow and transport in the consequence analysis we analyzed based on the future construction and operation condition. So when we use the model, we calibrated and verified the model on the current condition. Then the prediction is purely future condition --

MEMBER BANERJEE: And then it is verified after the construction.

MR. AHN: There is no -- I don't think we

verify it. We are talking only about the licensing issue.

MEMBER BANERJEE: Right.

MR. AHN: So in the future if they change the condition they should reanalyze this.

MEMBER BANERJEE: So you feel that your model can take into -- So you've characterized the site let's say. I'm trying to get the process clear in my mind. You characterize the site before, let's say, presubstantial construction. Now you have a predictive model which takes into account the effective construction which may or may not be significant. I have no way to know. How do you know at the end that your predictive model is right?

MR. AHN: It's based on model calibration at the verification process.

MEMBER BANERJEE: Has there been then some verification showing that these models are --

MR. AHN: I think it's critical -- It is impossible because there was no previous history on the tank rupture scenario.

MEMBER BANERJEE: I'm only talking about groundwater for right now, not the --

MEMBER SHACK: He wants to inject some tracers and --

MEMBER BANERJEE: Yes.

MEMBER CORRADINI: He's looking for an experiment.

MEMBER SHACK: You're pretty transparent.

MEMBER BANERJEE: I'm pretty transparent.

MEMBER SIEBER: We never did that.

MEMBER RYAN: I would say the tendency, Sanjoy, just from my own experience is to use a conservative assumption that kind of maximizes the transport of the radionuclides of interest to some point of interest and then the dose is assessed. And if that dose is compliant the need for more detail and experimentally driven modeling isn't necessary. If there's a question that a conservative assumption that's conservative but reasonable gets you to some point where you're really concerned about the dose then you kind of have to go back and revisit.

MEMBER BANERJEE: I was sort of looking at the little cartoon in the previous slide I think.

MEMBER RYAN: Yes.

MEMBER BANERJEE: If you go back to that. Then I see the more complex transported area with the question mark. So that's what I want to know.

MEMBER SHACK: He has a big question mark.

MEMBER BANERJEE: Not a big. Small

question mark.

MEMBER CORRADINI: Yes. Right.

MR. ROACH: This is Ed Roach. Again as you move into the combined operating license scenario, many of the applicants have committed to establishing an operational program under the radiation protection program addressing the groundwater protection program and it's part of their licensing. It's in their FSAR. It's NEI --

MEMBER BANERJEE: But that sounds better to me.

MR. ROACH: NEI 08-08a and as part of that operational program there is an activity or an area where they have go back and evaluate their conceptual site modeling impact of construction on that conceptual site model that was developed as they ascertained the groundwater situation. And as part of that our intent at this point is to include that as part of our inspections and operational programs will need to go to the sites that are being --

MEMBER RYAN: Ed, correct me if I'm wrong. But I think that program would tend to include things like just simple water level measurements and where are the flows, where are the directions and all that kind of basic hydrologic behavior.

MR. ROACH: That also is --

MEMBER RYAN: You know, on which you can then superimpose a transport model.

MEMBER SIEBER: You limit the amount that you can store in the tank and you start processing it where there are levels of concentration.

MEMBER RYAN: Yes.

MEMBER SIEBER: There's all kinds of steps that you could take.

MEMBER RYAN: One thing to keep in mind which I'm sure you realize is this is a very large construction. So when you begin to take the step out and rebuild it again you are going to change whatever you've found at the beginning.

MEMBER SIEBER: That's where we used to call it pencil-pushing. But more sophisticated analytical techniques type device.

MR. AHN: So one clarification of the limitation of this ISG-014 is that it's covered only at the planning stage and for the operating it should have used different strategy.

So, first, we specified that we should give credit for the mitigation if the applicant has already mitigative design features so that it can skip the radwaste contaminant consequence analysis.

And the next one we proposed practical guidance to meet the requirement of onsite hydrogeology measurements specified in 10 CFR Part 100.20. Part 100.20 is very broad and it just requires in it onsite hydrogeology characterization to analyze the radiological consequence analysis. However it doesn't specify any of the extent of the measurement or frequency of the sampling. So we tried to clarify that kind of issue in ISG-014.

The next one is the --

CHAIR ABDEL-KHALIK: So what have people been doing prior to this point, prior to this practical guidance?

MR. AHN: This guidance will apply only the COL or ESP after this was offered. So previously we analyzed -- I mean we reviewed case by case. But it's quite similar of which we used.

CHAIR ABDEL-KHALIK: I'm trying to get to the point of where does this practical guidance come from?

MR. AHN: It's based on our experience of reviewing ESP and the COL. And some of the ESP or COL application, they already follow this direction. And some may not. So for example on one COL site we issue almost RAIs on hydrogeology area, but almost 60

percent of those RAIs come from this FSAR 2.4.12 and 2.4.13 groundwater area. So what our intention is we need some kind of a clear guidance on this onsite measurement. That's what we addressed.

MEMBER RYAN: Said, excuse me, the sites that have an existing reactor or two are obviously going to be better schooled than sites that are starting with a new clean site. So I think you'll see a wide range of people who are better prepared to add a unit than start with new units in terms of this geohydrologic question. So it's probably a wide range of sophistication in how they're addressing this question at this point.

VICE CHAIR ARMIJO: But operating plants by and large do all of this stuff already or most of it.

MEMBER RYAN: Well, it gets you to one level or another but across the --

VICE CHAIR ARMIJO: Is the answer no or yes?

MEMBER RYAN: -- tritium questions that have occurred over the last few years have gotten people awake to these kinds of issues. That's for sure.

MR. DEHMEL: All plants that are operating

have had to address the existing requirements, not what's in ISG-013 or 014, the existing requirement.

MEMBER RYAN: Yes.

MR. DEHMEL: In Reg Guide 1.70 as well as the SRP as it was structured then in the applications. New plants, new applications have also had to address this requirement, these requirements, under the current guidance. Plants that will be submitting application after ISG-013 and 014 are finalized and formalized will have to meet the new requirement. So there are some existing requirements and some guidance as we're discussing in here where in a way we're kind of addressing a delta.

It's not we're starting from scratch. Right? I mean keep that in mind. We're not essentially starting from scratch with no guidance whatsoever. What we're trying to do is we recognize the existing guidance as -- It's not clear. It's not complete in some instances. It used to be elaborated upon. But it's for the purpose of knowing what the applicant needs to do and also for the staff to review the obligations and actually come up with the right conclusions in the SERs.

MEMBER SHACK: Are there any new requirements here or did you just do it all before

through RAIs?

MR. AHN: Yes, I think that's --

MR. DEHMEL: That's right. We've done a lot of stuff to RAIs. But the challenge for the staff is that when we initiate an RAI the immediate response from the applicant is well, I don't see this in the SRP. I don't see this in the reg guide. So that's why there's a need to expand the guidance so it's clear. Everybody understands that we've expanded on the guidance and we've expanded on what the interpretation of the guidance means and how it's going to be concluded in a safety evaluation report. That's the purpose.

MR. AHN: Actually, that question is similar to what NEI or industry asked, commented, on.

MEMBER SHACK: I'm sure they did.

MR. AHN: This is not -- There is no new requirement. But most of this ISG just clarification or reconcile of the existing guidance. That's what I can say.

MR. RAIONE: This is Richard Raione. Another thing to answer your question is it was kind of interesting. But when an applicant provides the conceptual site model you want your plausible groundwater pathways to be consistent with that. And

you don't want to pick a receptor point for instance that's up gradient. In one case we actually had that provided to us and the applicant because hey, look at that short distance. We're trying to be conservative.

But you still need to reflect current and predicted conditions. So one thing the guidance does I think is provide a lot more information on how important the conceptual site model is, what are your release scenarios in the future?

And if you've got a quarry adjacent to your site and it's pumping, what if that quarry quits pumping? What does that do to the groundwater flow directions, etc.? So that part I think will be quite useful because we were getting too many discrepancies and nothing -- it was just well intentioned but there were -- If you've got a primary groundwater flow to the east, why would you model the exposure to the west? It wasn't consistent. So this will help.

MR. AHN: Let's keep on going. The next item is we provide guidance in developing the conceptual site model and the groundwater flow models. Especially for groundwater flow model, it's not a requirement. But the onsite hydrogeology is completed. The groundwater model is the only way to predict future condition after construction. So

sometimes applicant needs to develop groundwater flow model. But that's quite expensive and time consuming and a lot of activity needed.

So what is the approach stopping of this modeling and analysis? That could be one of the critical issues in 2.4.12 and 2.4.13. That's why we developed that kind of guidance in here.

MEMBER BANERJEE: And you have some standard approved models that you would accept an applicant using properly of course.

MR. AHN: In fact, there are a lot of industry guidance or --

MEMBER BANERJEE: You have specific approved models.

MR. AHN: We have specific for these 2.4.12 and 2.4.13. That's why we developed this.

MEMBER CORRADINI: I didn't understand the answer to his question. Can you repeat?

MEMBER RYAN: Hosung, I think Sanjoy is asking what specific modeling tool do you recommend. Do you recommend any specific?

MEMBER BANERJEE: Or have approved.

MEMBER RYAN: Or have approved. They haven't backed up Mod flow/mod path. You can use what you want, but you have to meet the thinking in 6805.

MR. AHN: In general, most case they use the Mod flow/mod path with some simple model. But in our guidance we do not specify which model the applicant should use or which one is accepted. We just use generally described what kind of calibration criteria is acceptable or how they modify. We generally described that.

MEMBER BANERJEE: So you have sort of specified the criteria for acceptability.

MR. AHN: True. Yes.

MEMBER BANERJEE: But there are -- I guess this is a little different from other things. But the applicants don't submit to you models which you then review and --

VICE CHAIR ARMIJO: Licensing topical reports.

MEMBER BANERJEE: Yes, there are no topicals.

MEMBER CORRADINI: That's what I was waiting for.

MEMBER RYAN: Just to pick on 6805 a little bit, there is a chapter Mathematical Conceptualization and Quantitative Exploration of Hypothesis. So I think the structure of how to do the assessment is certainly laid out in 6805. But the

specific calculational -- was not.

MEMBER BANERJEE: So is the acceptability criteria laid out more or less?

MEMBER RYAN: Yes, I think it is.

MEMBER BANERJEE: Yes.

MEMBER RYAN: Is that a fair assessment?

DR. NICHOLSON: This is Tom Nicholson, Office of Research. 6805 goes to the process of how you first develop a unique site conception model. Okay. That describes the hydrogeology in detail and also asks for alternatives. And then once you have the conceptual model defined and its suite of alternatives then you ask the question what numerical code or analytic solution would best represent the conceptual model and alternatives that I have formulated.

Now these generally are available. The U.S. Geological Survey has developed models and other groups. You choose that model and here's the tough part. The parameter estimation. You have to have site-specific values to put into those models. Then the question is how do I make sure that that numerical model or analytic model is appropriate. That's when you get into your calibration of the model against measurements. Monitoring is extremely crucial. What

are the water levels? How does groundwater recharge affect that site? Are there perch water systems? A variety of questions that are unique to that site.

MEMBER CORRADINI: And that requires them to have monitoring ahead of time I assume.

DR. NICHOLSON: Yes.

MEMBER CORRADINI: So that I guess is going to go to one of your dashes down there that there's I'll call it tunable parameters that are going to have to be site-determined.

DR. NICHOLSON: Right. And so you go through this and each site is different and so therefore you cannot use a so-called list of acceptable. You go through this process because you want to make sure that your models reflect as best as possible those site-specific features. And you're correct. You do it prior to construction and then what you would anticipate following construction. And that's why these monitoring programs are so crucial.

MEMBER BANERJEE: And these is post-construction monitoring.

MEMBER SIEBER: Yes.

DR. NICHOLSON: Yes.

MR. AHN: So, as Dr. Nicholson said, everything is depending on the onsite condition and

how we determine the acceptability of the consequence analysis and modeling is really depending on meeting Part 20 compliance or not for this particular case.

And last one, as I described in previous slide, we recommend a hierarchical approach for consequence analysis or determining the specifics for transport parameter sampling or groundwater modeling. So that's what we proposed on ISG. Next.

And the final resolution, we already got comment from industry through NEI and their comments are quite extensive but it's quite constructive. So once we go through -- After this HRS and if we have some comment, we will finalize our ISG-013 and -014 based on those comments. We all update our SRP section 2.4.12 and 2.4.13 and 11.2 based on this ISG in the future.

And the current -- this ISG, the base guidance will be applicable to all COL and ESP license applications submitted after the issuance of this guidance. So that's all I need to tell you. Are there any questions?

CHAIR ABDEL-KHALIK: The site-specific parameters that were referred to earlier are these time-invariant over a 40 year period?

MR. AHN: There are two different source -

- two different kind of data. One is the static hydrogeologic data including the hydrogeologic transport parameter or flow parameter. That's the static data and we collect that data.

The other part is the transient data like what would be the water level and the gradient of the groundwater flow and that will impact on the transport process. So we should have -- We should collect data on that. Then how we credit it in the future is based on either modeling or based on the variance of the data. We can predict the future condition. That's what it normally is.

MEMBER RYAN: I think to me the point that you're asking is that the construction will impact the hydrogeology.

MEMBER SIEBER: At the surface.

MEMBER RYAN: At the surface. And the near surface.

MR. AHN: Yes.

MEMBER RYAN: I mean maybe the top 40 or 50 feet. Who knows? I mean some reconstructions are going on right now of base soils and so on.

MR. AHN: Yes.

MEMBER RYAN: So local to the plant itself you'll see a change. But as you go to, say, the

property boundary and then beyond I view that you're adding an infinitely dilute radionuclide load into an existing view of hydrological systems. So the trick is how you get the near site hydrology to match up to a more not really regional but more far-afield geohydrology for the adjacent areas to the site. Does that help your question?

CHAIR ABDEL-KHALIK: I understand, but if you go down to the transport processes themselves, the governing transport parameters, are these time-invariant?

VICE CHAIR ARMIJO: The geology is invariant.

MEMBER RYAN: I would say yes. In the further away field, the answer is yes.

MR. AHN: One critical transport parameter we recorded is distribution coefficient or the so-called K value. That's depending on the pH of the contaminant or temperature or different geochemical property. And sometimes it may be time dependent or depending on the contamination. So how we analyze that during the planning situation, we used a very conservative parameter of this based on measured data as well as the radiation values and we used the conservative bounding analysis to check the Part 20

compliance.

And you mentioned how we incorporate the -- frame the structure on groundwater contamination. We use groundwater modeling approach to predict that future impact. For example, for some sites, they proposed the retaining wall around the plant so that they can prevent the groundwater flow or seepage. We analyzed that situation through groundwater modeling. So we account that.

MR. DEHMEL: One point that we mentioned earlier and that essentially I think we ought to bring up now in light of the design questioning which I think is important and relevant. But remember that this is an analysis at one point in time.

CHAIR ABDEL-KHALIK: In time.

MR. DEHMEL: Right. So we recognize that. But if you look at the SRP 2.4.12, 2.4.13, to some extent BTP 11-6, there's a focus on the level of conservatism, the nature and the assumptions that are there to essentially capture these uncertainties.

And, for example, let me read to you some of the verbiage that currently used in 2.4.13 that would essentially be used to capture these uncertainties. For example, it says, conservative assumptions such as the most adverse contamination,

extreme event or the most severe natural phenomenon.

So we're trying to essentially provide guidance to ourselves and the applicant trying to say, what do we mean by this and to what extent can we apply these kind of extreme conservative assumptions in trying to capture these uncertainties that we just can't -- that we just don't know at this point?

And so there is some value in applying some conservative assumption. The question is to what degree, to what extent, do we carry this to an extreme which no longer makes sense. So I think that the points that you are raising are obviously very valid. But we understand them and the idea was put our arms, a bracket, around this and trying to say, okay, yes, we have to instill some degree of conservatism of the analysis and here is the envelope, so to speak, of what would be considered acceptable. But anything above and beyond that is not credible or essentially sets up for a failure, automatic failure. You can never demonstrate compliance with the acceptance criteria.

So although we do understand some of the information presented in the application in 2.4.12 and 2.4.13, that is the information the applicant provides. That by definition is not a complete and

concise history of the hydrogeological characteristics and future hydrogeological characteristics of the site.

So in trying to, essentially, bracket this, we require the applicant to apply some degree of conservatism. The question is what should be the envelope for that.

CHAIR ABDEL-KHALIK: I'm trying to get to the point whether future monitoring would allow you to determine whether or not you indeed were conservative in the very beginning and how would you go about doing that?

DR. NICHOLSON: That's a very good point and the question is you're basically asking the question how valid are the models that you're making that you're making future predictions on. And so therefore the monitoring becomes extremely important.

There are three things that the OECD/NEA has talked about, features, events and processes. So the question is when you did your characterization and your modeling did you adequately represent those features, events and processes. You brought earlier the time-dependent and independent. That's why we ask for its seasonal understanding of flow because obviously during different times of the year you have

different groundwater flow conditions.

The relationship between groundwater and surface water is also extremely important. And when you construct a site, you often will make changes. You often will lower the groundwater table that was much higher prior to construction. That has to be brought into the modeling and then you have to say, yes, in fact if you put in slurry walls or whatever the design feature that may make a permanent change to the -- and the flow conditions and that's why monitoring is so important to understand those, as Dr. Ryan says, the site-specific nature of the groundwater in comparison to the more regional setting.

And we get information from a variety of sources. The USGS provides very good information to us when we ask what is the regional setting. And then the site-specific obviously that's the licensee's responsibility.

CHAIR ABDEL-KHALIK: Thank you.

MEMBER BANERJEE: But I guess if I understood the point, let's say things like the pH and so on change over a period of time. So it's not just the groundwater flows. But the KV values and so on, these will change as well. And clearly you are trying to bound this in some way in your initial analysis.

So you probably tried to take the worst cases and see what happens and do some sensitivity analysis. But what I think Said was asking is there in the monitoring program something which would allow you to validate this as time goes on.

DR. NICHOLSON: Yes. Water quality is a big part of groundwater monitoring. For instance, I've been involved with the Indian Point facility up there when they had releases of strontium-90 and tritium. It was extremely important that the water quality reflect not just water levels, the pressure transducers, but also dissolved oxygen, pH, temperature, all those major ions and cations and to understand. And then what is the possibility that they may change depending upon changes to the groundwater flow conditions. And so, yes, that is part of the monitoring program.

MR. AHN: I have one comment on monitoring. At the early stage of developing this guidance, we consult with our OGC on whether we should include that kind of a groundwater monitoring in this guidance or not and they said, well, if they meet the Part 20 compliance that requirement may not meet it in here. But that is already addressed on NEI 08-08 requirement. So that's that part.

And in practicality we have been reviewing four years P and 15 COL applications so far. We're still reviewing COL applications.

Are there any sites that does not meet Part 20 compliance. There is one site. Bellefonte is some special case. But all other sites they meet Part 20 compliance at the receptor point. So we believe that the contamination in groundwater from the accident scenario may not critical. But still we need to define -- we need to characterize the onsite hydrogeology. So that's what we're addressing.

MEMBER BANERJEE: Going back to this point, I think we go back to even my original question about the computation and numerical methods and models. If I understand with Bellefonte there was a model used initially anyway to do the calculations and NRC had some staff with some disagreement with it and so on.

And how does your guidance now preclude that happening? Are you giving some guidance which will --

MR. AHN: I don't know the detail on the Bellefonte site issues. So I cannot comment on that. But I think --

MEMBER BANERJEE: Something was used which

was not acceptable in some way. That's the impression I had, though we were not told the details. And maybe Mike knows this in more detail.

MR. RAIONE: This is Richard Raione. The Bellafonte review for Section 2.4 hasn't started yet because we had a QA audit. We had to remove the NOVs. That review hasn't been scheduled yet. So I guess it's coming down in the near future.

From recollection here, the primary topic of interest with Bellefonte was their PMF. It's a large resource system. I forgot now. Forty-two dams, etc. To clarify on potential for 2.4.13 topics with Bellefonte, we don't have enough information to perform the analysis. The potential here would be though that some of the domestic wells offsite to Bellefonte theoretically could be impacts. So we're going to have to look at that very closely.

Most of these sites as you know are large acreage sites. These tanks are located ten feet from the property boundary. That affords some natural barrier as it were. Bellefonte will have to be looked at very closely.

The reason this guidance, to answer your question I think better, will help fine-tune Bellefonte's internal analysis. I had mentioned

earlier there was some confusion with some of these applications in terms of what's really required. How is the conceptual site model consistent in terms of looking at plausible groundwater pathways where it can be more than one as you can imagine depending upon the different hydrologic settings.

We're not necessarily just looking at groundwater either. You could start off with an instantaneous injection to the uppermost aquifer and, of course, that could end up recharging a service water feature.

So I think this guidance will most like streamline the review process as it relates to Bellefonte. And it will also highlight to the applicant what if there are some problems. What are some things we need to look in at up front besides tech specs? Perhaps site mitigating features up front.

I kind of marvel. You know the petroleum industry has underground storage tanks. They did cathodic protection when they went to a more of an above-ground storage tank perspective, double wall tanks, etc. There are some things here I think that would be quite beneficial in an ESBWR-type of setting where hopefully perhaps some of these other vendors

will look at the other four design centers within NRO and start looking at this thing.

VICE CHAIR ARMIJO: Yes. To that point, I really want to make sure I understand. In this chart, it shows that if you put in mitigating design features, double-wall tanks, berms, other things, does it really save you a lot of analytical work and characterization work or whatever?

But what else does it -- What else do you have to do in order to get credit for those things? Is there some inspection program you have to do periodically or -- I'm just trying to understand the benefit at least to the --

MEMBER BANERJEE: There seems a box.

VICE CHAIR ARMIJO: It looks like a yes to the end which sounds great but.

MR. DEHMEL: To answer the question, for the ESBWR, the installation of liner has been introduced as an ITAAC in the design. So it is captured in Chapter 1 of the application.

VICE CHAIR ARMIJO: Okay. It turns into something that you inspect later.

MR. DEHMEL: Yes, it turns into something that you have to actually confirm that it's installed.

VICE CHAIR ARMIJO: But the design is a

bona fide solution and you don't have to go through the conservative equations and transport calculations and --

MEMBER RYAN: Yes. I think if I recall, Sam, in the radwaste chapter they made, the applicant made, that point as well. That's why they did it because it did short-circuit them to this is a solution for this potential risk.

MR. SACHS: Yes. That then --

MEMBER RYAN: I was going to say we're really coming close to another schedule item. So I want to just in the next couple minutes wrap up.

VICE CHAIR ARMIJO: That's all I wanted. That was my only question.

MEMBER RYAN: For any final questions.

MR. AHN: I think one critical comment on the mitigation design feature. That's mainly on the DCD decision and even though the site mitigation design feature they should have done some left-hand side onsite characterization including the hydrogeologic parameter or certain conception with the SP requirement.

VICE CHAIR ARMIJO: Yes. I understand that. But I just want to know that -- My personal view is mitigating design features are the way to go.

But if there's no benefit from a regulatory standpoint or cost standpoint, nobody will do it. It looks like there's some benefit.

MR. DEHMEL: Yes.

MEMBER RYAN: Okay. Any other questions or comments?

(No response.)

Gentlemen, thank you very much for an informative presentation and your other points as well. I think we're scheduled to consider letter-writing on this topic at 4:30 p.m.

With that, Mr. Chairman, I'll turn it back to you.

CHAIR ABDEL-KHALIK: Thank you. Perfect timing. At this time, we are scheduled for a break. We'll take a break until 10:15 a.m. I would like to warn you however that in the intervening time there may be a fire alert and if the fire alert were -- We're off the record.

(Whereupon, at 9:56 a.m. the above-entitled matter went off the record and resumed at 10:58 a.m.)

CHAIR ABDEL-KHALIK: On the record. We're back in session. At this time we'll go to Item No. 9 on the agenda, Status of Risk-Informing Guidance for

New Reactors. As you know, this item was originally scheduled for 10:15 a.m. until 12:00 noon. Since we lost 45 minutes from that time we will go until 12:30 p.m. with your presentation.

MEMBER STETKAR: Great.

CHAIR ABDEL-KHALIK: So Mr. Stetkar will lead us through this presentation. John.

MEMBER STETKAR: Thank you, Mr. Chairman.

And to make the introductions as brief as possible, let me just alert the Committee that what you're going to hear this morning has recently changed in terms of its potential priority for the Commission. So although this is still a briefing meeting, we may be asked to write a letter regarding this. So just keep that in mind.

With that introduction, I'll turn it over to Charlie Ader who will give us a little more background.

MR. ADER: Yes, this is Charles Ader with the Office of New Reactors.

As John said, when we talked to you last, we felt, the staff, this would be a policy decision for the Commission. As it evolved through the process, there was a view that we were aligned enough with Commission guidance that we would make this just

an information paper and that's what you have in front of you is an information paper that talked about three options that staff considered, status quo option, a change in risk metrics and then the option we're recommending to modify guidance to try to maintain, reasonably maintain, the level of safety of the enhanced designs.

Further reflection, and this has been evolving just over the last month from going from a policy paper to an information paper. Further reflection, the decision was made that this is something that the Commission really would want to weigh in on and we're going to turn it back into a policy paper.

The options, the paper that was concurred upon by office directors and regional administrators was actually a policy paper and it had three options which are now just this is what staff considered. So those will go back to the options.

The paper will not have any additional substance to it. It will be reformatting. There were some editorial changes that will go back. And I apologize to the Committee because I know they like to see the document that will be going to the Commission.

Given the nature of the policy issues

here, I am assuming that the Commission is going to want to write a letter on this because the Committee has been very active in safety goal and this type of policy. So we can talk at the end, but we're prepared to support the Committee for whatever they would need to generate a letter.

And with that, I'm going to turn it over in the interest of time to Don Dube and Sunil on the evolution of our thinking from when you last heard from staff.

MR. DUBE: Thank you, Charlie. I'm Don Dube, Office of New Reactors and my friend and colleague, Sunil Weerakkody, from NRR. The meeting purpose Charlie has pretty gone over it. So I'll skip through here pretty quickly, but it's to provide you a briefing on the status of this Commission paper.

I'll skip the agenda. This is a repeat slide from probably a year ago. But just to refresh everyone's memory, there's a number of risk-informed initiatives for new reactors. Definitely risk-managed tech specs, the US APWR for example and the COL applicant, Luminant for Comanche Peak 3 and 4, expressed interest in risk-informed completion times, and a surveillance frequency control program. There are other initiatives. Electric Power Research

Institute has a working group interested in risk-informed, in-service inspection of piping and we hear through the grapevine interest in perhaps special treatment requirements or 5069. That's what's driving, has been driving, this effort for the last year or so.

When we reviewed these applications, it raised questions regarding what risk metric acceptance guidelines should we use. Should we use the same for new reactors as current reactors? Should they be different? And then upon second thought also what about the impact on the reactor oversight process? So those are the two main themes that we'll discuss over the next hour or so.

There has been a lot of stakeholder engagement. I'm not going to go through every bullet. But last week we had our third public meeting on the topic and while the options and the approach have evolved, I mean we've tried to stay engaged to the extent possible.

We had a briefing before the full ACRS a year ago and then the Subcommittee on Reliability and PRA in June of 2009. There were views from industry and the Union of Concerned Scientists. And we also had presentations at some of the public fora such as

the Regulatory Information Conference and American Nuclear Society annual meeting. So we have tried to keep stakeholders engaged throughout the process even though it's been a long process so far.

This is a key slide because it discusses how the staff's views have evolved and when I say staff I'm talking at the widest possible level. If you look at the transmittal letter to the ACRS staff, you'll see that it was concurred upon by the major offices, NRR, NRO, kind of unofficially Office of Research, but also most importantly all four region administrators and their staff. So that took some effort.

But I think there's a pretty wide consensus on the proposed approach. And maybe that's why it is a little bit of a general approach, but nevertheless I give a lot of credit to my colleague, Sunil, for bringing together wide variation of opinions sometime in reaching this consensus. So there was definitely no early staff consensus on the approach.

Initially, we were concerned with Reg Guide 1.174 and some of these potential options. You may recall the relative versus absolute change in core damage frequency, large release frequency. But most

recently certainly in the last six months or so perhaps less concern with the numerical guidelines and more on, I'll use this quote straight from some of the Commission documents and rulemaking language ensuring that the level of enhanced safety believed to be achieved with this design will be reasonably maintained. You can find language to this effect in the rulemaking, for example, on the advanced boiling water reactor rule language and somewhat similar language in some of the other certified designs.

And also to a large extent implementation of what is called in the rulemaking 50.59 like process for new reactors. There is as you're aware 50.59 for operating reactors and a process for making changes in tests at facilities and for new reactors it's codified within the rule for each of the certified design and it is called a 50.59 like process. And it mirrors very closely 50.59 for operating reactors, although it has two additional aspects related to ensuring that there's no substantial increase in the frequency or consequences of ex-vessel severe accidents. So that is something that is already in the rules for the certified designs.

And so the staff's views have evolved to perhaps working with this 50.59 like process perhaps

to broaden it, to incorporate some of the concerns about maintaining an enhanced level of safety. So there is staff consensus at a high level as I said across the agency including all the regions.

The next three/four slides I'll try to go through and make up some time. Fortunately I highlighted in red the really appropriate phrases that implement or that address the staff's concern. This is taken from a Commission paper 20 years ago now. The Commission stated and I'm going to just read the red quote here, preservation of the severe accident, human factors and operating experience insights that are part of the certified design. That's the Commission's concern in a nutshell.

And similar language in the Statements of Consideration and again we're just using the ABWR as an example, but you could find similar language in the other designs. And again I'm not going to read the entire paragraph. All of these quotes are in the draft paper. But I'll highlight the red here which says, in adopting a rule that the safety enhancement should not be eroded significantly by exemption request, the Commission recognizes and expects that this will required careful analysis and sound judgment, especially considering the uncertainties in

the PRA and the lack of a precise, quantified definition of the enhancement. But again very similar language, probably a few different words but maintaining the enhanced level of safety, not eroding significantly this enhanced level of safety.

Similar language again just continuing in the statement of consideration for the ABWR, again I'll just read the first sentence more or less, the Commission on its part also has a reasonable expectation that vendors and utilities will cooperate with the Commission in assuring that that level of enhanced safety believed to be achieved with this design will be reasonably maintained for the period of certification including renewal.

And so those thoughts there in those three slides is how the staff's views have evolved perhaps not so much on the numerical risk acceptance guidelines, although it is important. But more so perhaps on finally coming to a definition, if you will, of what it means to maintain the enhanced level of safety. And in a sense that would be part of the charter I think going forward would be what does it mean to maintain this enhanced level of safety putting it in the form of changes to a reg guide or reg guides and we haven't thought of the exact process yet. But

one can envision either amending, supplementing Reg Guide 1174 or a parallel reg guide or working with some documents, the industry documents in particular, that the staff necessarily endorses in its own reg guides anyhow. So there's a number of avenues this could eventually take.

Just a refresher, I mean there are a number of current regulatory guides for risk-informed initiatives. I won't go through them all because some of these were discussed a year ago. But the Reg Guide 1.174 is sort of the umbrella reg guide and then there are specific reg guides for risk-informed in-service testing, inspection and what have you.

And a key principle, Reg Guide 1.174, is that when proposed changes result in an increase in core damage frequency or risk, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement.

Again emphasizing Reg Guide 1.174 and I've highlighted again the key words. There are five principles for risk-informed decisions and only one of them really is related to changes in core damage frequency or risks that are small. I mean the proposed change must meet regulations unless it's specifically an exemption request, consistent with the

defense-in-depth philosophy, maintain safety margins, small increase in risk and that performance measurements strategies for monitoring performance. So those are five key principles and the numerical metrics if you will of a small increase is only one of the five.

You've seen these two graphs on multiple occasions. This is from Reg Guide 1.174 to refresh your memory that these are guidelines, not go/no go acceptance criteria. But changes are defined based on a baseline core damage frequency and a change in core damage frequency and depending on where that hypothetical change lies generally Region I area no changes would be allowed. Region II are considered small changes. One would track cumulative impacts. And Region III are very small changes. And there's more flexibility with regard to when these changes would be allowed based on some baseline core damage frequency.

It's obviously a logarithmic scale. My understanding is that most applicants for risk-informed efforts generally have been in the very small region. So it's pretty rare to be in Region II. And there's a parallel graph for large early release frequency, but the baseline values and the X axis and

the change in LERF are one order magnitude different from the Y axis, I mean, from the core damage frequency plot.

Again, in Reg Guide 1.174, the risk acceptance guidelines pretty much said all this. Rely on a baseline as well as a change. Increases should be limited to small increments. And the thresholds to some extent related to backfit regulatory analysis guidelines but certainly related to, tied strongly, to the Commission Safety Goal Policy Statement.

So what brought us --

MEMBER STETKAR: Don, it might be worth that you go back to that last slide, just highlight that last subbullet on the basis because that probably has --

MR. DUBE: Change in -- right here?

MEMBER STETKAR: Yes. That probably has a bit of bearing on what we're discussing here.

MR. DUBE: Good point. Certainly when the current generation of plants that generally have core damage frequencies, I'm just going to use a round number, in 10^{-5} range, some higher, some lower. But I think median value around there. When one starts setting thresholds out to the 10^{-6} and recall even 10^{-7} level of change in core damage frequency, some argue

that we're considering the uncertainties in PRA.

One is at the threshold in terms of the resolution of the PRA models. I mean there are sequences and contributions that are left out of the model that are more than the deltas that one is talking about. And so one will hear as part of the various arguments for against absolute versus relative change that in sense that also kind of sets what is believed to be this, you know, why these graphs are cut off where they are. Thank you.

MEMBER STETKAR: Thanks. That helps.

MEMBER CORRADINI: That I am -- I'm left. I don't get it yet. So can you say it a different way? Are you saying that if I'm at 10^{-5} and I --

MR. DUBE: One's baseline is here, yes.

MEMBER CORRADINI: Right. And I suggest a change and do an analysis and find that the delta of that analysis is 10^{-7} I really don't believe 10^{-7} because I could be an order of magnitude off on 10^{-7} delta. Is that what you --

MR. DUBE: Kind of. I mean --

MEMBER CORRADINI: I'm just trying to --

MR. DUBE: Right. Yes, we're talking about a one percent change and these values are typically unknown to factors of three core damage

frequency.

MEMBER SIEBER: Or more.

MEMBER CORRADINI: Generous.

MEMBER STETKAR: Well, and just the resolution of the model, the level of detail in the model might -- You might be missing things from the model that if they were included would have a larger effect on the thing that you supposedly met.

MEMBER CORRADINI: I understand. Okay. So you don't even talk about the upper left -- the upper right one. I'm kind of more interested in the lower left one where I would expect the uncertainties are even bigger relative to --

MR. DUBE: Yes.

MEMBER CORRADINI: Does the same thing --

MR. DUBE: I'll increase the uncertainty for Dr. Shack's interest to an order of magnitude or even more.

MEMBER CORRADINI: Okay. Fine. Thank you.

MEMBER STETKAR: Recognizing that most folks don't have a full scope Level 2 PRA anyway. So the things that you're measuring for large early release frequency are even more of a surrogate for reality in that space.

MR. DUBE: Okay.

CHAIR ABDEL-KHALIK: Are you implying that if some new reactor designer comes with a CDF with 10^{-7} we shouldn't believe that?

MR. DUBE: No, I don't believe I'm saying that. It's just that --

MEMBER POWERS: There is no --

MEMBER STETKAR: I just wanted Don to highlight that point because it relevant to that exact type question.

MEMBER POWERS: There is no reactor currently proposed that can be located on any site in the United States that would have a 10^{-7} CDF.

CHAIR ABDEL-KHALIK: Because of seismic.

MEMBER POWERS: Sure. A 10^{-7} seismic event is an astronomical event.

MEMBER RAY: Darn right.

MEMBER BLEY: Don, can I take you back to -- You became with an explanation of this change and focus to retaining the enhanced safety of the new plants. And then you started getting into more specific things. Two questions. One, the specific things you've gotten into I don't think have changed because of that, have they? The ones you've already talked about.

MR. DUBE: In what sense?

MEMBER BLEY: Has that change in focus on preserving the enhanced safety of new reactors affected any of the criteria you've talked about?

MR. DUBE: No.

MEMBER BLEY: Since you introduced that concept?

MR. DUBE: No.

MEMBER BLEY: If we come to any where that's induced a change shine a light on them. Second question --

MEMBER RAY: Before you go to your second, should they have made a change which I think is really what you're asking? Should there have been a change in the thing you talked about so far as a result of the changed focus or are you raising that as a question implicitly?

MR. DUBE: I -- Go ahead.

MR. WEERAKKODY: If I understand the question correctly, I think you're asking a fundamental question as to why we are here today which is --

MEMBER RAY: That's what I thought.

MR. WEERAKKODY: Because it has significant policy kind of implications.

MEMBER RAY: Right.

MR. WEERAKKODY: We've been asking that same question from ourselves.

MEMBER BLEY: May those are two different questions that they both are related to. With that change in philosophy, it shouldn't have changed any of the criteria you're talking about. Mine was has it changed any.

MR. WEERAKKODY: It has not.

MEMBER BLEY: My second question is has that concept of that change in focus been introduced in any public session so far and have you had comments on it?

MR. DUBE: Yes, we had a -- The draft Commission paper was issues on May 12th I think. And we had a public meeting last week on it.

MEMBER BLEY: Okay. Any comments on that change in focus?

MR. DUBE: If I can be generous I was amazed that when we went around the room and I specifically looked at the wide view of stakeholders there was no general opposition including Dr. Ed Lyman from the UCS if I can put words in his mouth. He did not have any fundamental concern with the approach proposed --

MEMBER BLEY: And none from industry?

MR. DUBE: -- by the staff.

MEMBER BLEY: Okay. Go ahead. I'm sorry. I just wanted to know why you told us all that in the beginning.

MR. ADER: Don, if I can add, there was some views that the current guidance has enough safety nets in it that would prevent a significant degradation in the level of safety that's been certified. I think that's something what our proposal is. We need to test that and explore that.

The chart Don has on his slide that he has up on the screen now shows a hypothetical that I could envision you could have a change of a relative large nature that would be off the graph. We need to modify it.

So the answer is, no, we haven't modified 1.174 yet, but a proposal is if the Commission agrees with us we would be moving forward to look at those documents with this concept of --

MEMBER BLEY: To see if it leads to changes.

MR. ADER: Right.

MR. DUBE: Right.

MEMBER BLEY: I just wanted the context. So that helps me.

MR. DUBE: There was a very excellent suggestion and I'd like to give credit to the person who brought it up, but again I think it may have been Rick Wachowiak from GE who said one aspect that one might do is to come with a wide spectrum of possible changes that one would see at a plant over its lifetime, you know, power uprate change to the --

MEMBER BLEY: Specific examples of changes.

MR. DUBE: Yes. Change to the steam system, power conversion system, feedwater system and test the existing guidance out there to see if there are gaps.

This next slide I'm pushing Dr. Powers' 10^{-7} limit here. So pretend that there's a new small reactor on --

MEMBER POWERS: This particular line you're saying that the design is a CDF. It's a hypothetical thing, but it certainly excluded the site. Now your next statement that 7×10^{-8} is a significant increase, I cannot understand at all.

MR. DUBE: I didn't say significant.

MEMBER POWERS: I can't even tell whether it's law.

MEMBER CORRADINI: That's a lawyerly

answer.

VICE CHAIR ARMIJO: He didn't say it was wrong. He just said it was an increase, 70 percent increase.

MEMBER POWERS: Well, the point is that back at the beginning the Commission was careful to point out that you need to consider the uncertainties in the CDF and you've echoed them here. And so there's no way to put 7×10^{-8} in any kind of context at all. It's just a number until I know what the uncertainty on that CDF is up there.

MEMBER CORRADINI: Can I ask Dana a question? Because you said something in the previous discussion that I thought we had -- that it was kind of a -- that once you put a new design on a site regardless of site in the U.S. seismic will tend to create a lower bound on the CDF. That's what I --

MEMBER POWERS: It is pretty hard to get below 10^{-6} as a round number.

MEMBER CORRADINI: Okay.

MEMBER POWERS: Because the problem is the uncertainties in the magnitude of the earthquake are so large by the time you get down to that probably that you're probably talking about a magnitude eight to nine earthquake which it's never designed for at

that probability. So it's very difficult to get below 10^{-6} on any real site.

MR. DUBE: Yes. Your point is well taken and I won't disagree. There are large uncertainties. But let's just say hypothetically that the baseline internal events with core damage frequency is 10^{-7} and there are three/four new reactor designs where there is around the case. And they may propose a change to the feedwater system that would isolate feedwater for --

MEMBER POWERS: And I can't possibly evaluate those things because until they come in and tell me my CDF is 1 X 10^{-7} plus or minus three times, ten times, I can't tell whether 7 X 10^{-8} is -- that's probably in the grass for 1 X 10^{-7}. I think just the omission uncertainty on that is probably at a factor of three.

MR. DUBE: I'm going to beg to differ in a few aspects in a sense that sometimes one can measure a delta CDF just as well as the baseline CDF in the sense that you may have a change that affects one or two real dominant sequences and you don't have to evaluate 30 or 40 initiating events and thousands of sequences and tens of thousands of cut-sets to quickly draw the conclusion that I may not have a major

mitigating system for a number of very key initiating events and reach the conclusion that for particular risk-significant sequences: Station Black, loss of feedwater at a Boiling Water Reactor, that some changes even though there's uncertainty on the baseline or a number of sequences could have a large relative impact.

MEMBER POWERS: 10^{-7} core damage frequency. See, you don't have risk-significant sequences because significance then has to be related on an absolute scale and at 10^{-7} it's not risk significant period.

MR. DUBE: Okay.

MEMBER RAY: Dana, maybe I don't understand but if nevertheless you're trying to preserve what you sold the first time isn't it significant in that context?

MEMBER POWERS: Yes. I mean if you're doing that but if you're saying --

MEMBER RAY: Because that's what I'm most focused on is you sold me something and now you changed it.

MEMBER POWERS: Yes, you're the buyer and I'm the outside observer. So I don't care what you paid for it.

MEMBER RAY: I'm not the one who paid for it. I'm somebody who lives down the road, you know.

MEMBER POWERS: Well, it could be you pay for it in a strange sense.

MEMBER RAY: So I mean I think that's what he's saying that makes sense to me.

MEMBER STETKAR: Because somebody who lives down the road can't do anything about that seismic. But they can be concerned that you might be changing the way that you operate the plant or maintain the plan or things like that that --

MEMBER RAY: You sold me one thing and now you're giving me something else.

MEMBER STETKAR: -- could be eroding my confidence in your safety.

MEMBER POWERS: But if he tells me that I have 10^{-7} core damage frequency and he jacks it all the way up to 2 X 10^{-7} he has not changed my risk at all. Zero change in my risk.

MEMBER RAY: Okay. I mean I accept that. But, nevertheless, at some point you get into a public domain in which you sold something and now you're changing it. And I think the words that we started out with because they're understandable by people in the public. I'm going to preserve what I

sold and licensed here period.

MR. DUBE: All of this discussion is extremely valuable and that is the reason why again this is a hypothetical example and this is where we were a year ago. And this is the reason why the proposed approach is to basically get away from making changes to this set of graphs and emphasizing more the preservative level of safety and not worried about 10^{-7} or 10^{-8} or 10^{-9} or whatever threshold one might set for the new reactors.

MEMBER POWERS: The question I will ask you is as they shuffle the deck a little bit and, yes, you lose a little on the cod but you gain it back on the mackerel on things and it's all in the noise. Have I cost you anything?

MEMBER RAY: No, but I guess the question is, Dana, can I be sure that you're not blowing smoke in my ear when you do that.

MEMBER POWERS: Well, you know if I was doing it I'm blowing smoke in your ear.

MEMBER RAY: Is it credible? And I think that's part of what we have to look at.

MEMBER POWERS: You have to look at it in detail. You just can't tell from the numbers.

MEMBER RAY: I'm not quibbling about that.

I was only trying to say at least that perspective of we sold you something and we're going to preserve through its life in terms that are meaningful to you as the guy down the road. That's what I'm looking at. That's all. I'm not trying to argue with your point at all.

MEMBER POWERS: I mean the concern I have is, okay, this guy has given up a little bit to operational convenience and reduced the worker exposures for some reason on one thing and says, okay, I'll give it back for you on the quality of my digital control system or something like that. And, yes, overall when I calculate the number it changes from 1 X 10^{-7} to 2 X 10^{-7}, numbers that I don't believe either one of them. So I don't think we've lost anything here.

MEMBER RAY: You know, it's a fair point.

MEMBER STETKAR: Let's see if we get Don through because we do need to get to the main points.

MR. DUBE: Okay. Sunil will cover the next one because this related to the Agency's response to either incidents or conditions. So I'll let Sunil take over for this part.

MR. WEERAKKODY: Thank you very much. My name is Sunil Weerakkody. I'm the Deputy Director Fire

Protection, NRR. On this effort I am speaking on behalf of Fred Brown. He's the Division Director in charge of the Reactor Oversight Program. But I'm really glad to be here on something other than fire like Mr. Shack said. I spent a lot of time with you last year and you helped us out on fire stuff. So don't plan to come back here for awhile.

But having said that, let me come to the example that's in front of you and what I want to convey here is first after I give you a 30 second summary of what MD 8.3 is. MD 8.3 is NRC's management directive that we would like to follow to the letter if we can when an incident or event happens in one of our plants and what it tells the staff basically, this particular management directive directs the staff in terms of what type of test points the agency should have for particular events.

And if you look at the first word there after the one in pink, IIT, okay, that's the highest level. I don't think and anybody in the audience --

MEMBER POWERS: Tell me what IIT stands for.

MR. WEERAKKODY: IIT that is Incident Investigation Team. We have done that at TMI and I don't think -- Fred, have you ever done that IIT after

that? I don't think so.

PARTICIPANT: Yes, there were a couple. We haven't done one for quite a while though.

MR. WEERAKKODY: It's very infrequent and we get to those if we have a site area emergency or if we have a situation where one of the safety limits of the tech specs are reached or we have a very complex event that the agency doesn't really understand. I don't have the exact wording here. But that's another criteria.

Other than that, when we decide whether we are going to do an augmented inspection or a special inspection or no additional inspection it's determined primarily by the conditional core damage probability. And what graph shows is if a steam generator tube rupture happens in one of our current operating reactors the type of range we would end up with and as you can see we'll be looking at AIT. And this will be a time where just like BP when the public will be watching us, how we're responding in commensurate with their understanding of the significance of the event. So if we have a steam generator tube rupture, we will go forward with the AIT.

But as you can see on the new -- for a new plant, we are likely to end up in the range that you

see there which could range from in some cases for no additional inspection or a special inspection. To preempt some of the hard questions I might get, I'm not here to tell you that this is right or wrong. There's only one thought I want to leave with you and that is does the Commission or does the staff have an issue that needs to be carefully deliberated with significant enrollment of the stakeholders.

MEMBER RAY: Yes. The same event at a current plant would result in a different response than at a new plant. Does that make sense?

MR. WEERAKKODY: Right. So one of the members might say, hey, so what's the problem? Another member might say, it is a big problem. I'm going to agree with both of them.

But you understand my point. I think at some point in time before the NRC staff expends a lot of energy to bring the organization to discuss this issue and come to a solution that is good for all that's the question. Should we be talking about this or should we be in a mode where we just don't do anything and when something happens on a reactive mode address these procedures. That's all I have to say on that slide. Is the next one mine?

MR. DUBE: Are there any questions?

MEMBER RAY: I would just not on tube rupture but on loss of offsite power my reaction is a new reactor in a place that has a loss of offsite power is safer than one that doesn't and perhaps that was part of the basis on which you located or picked that.

MR. WEERAKKODY: I agree with you, sir.

MEMBER POWERS: But you agree with everybody.

The point you make is a sound one that I like. I like your logic there. But on the steam generator tube rupture the logic breaks down.

MEMBER RAY: I didn't pick that one.

MEMBER POWERS: I noticed you didn't. Now I'm asking you to tell me about the steam generator tube rupture.

MEMBER RAY: Yes. That's a failure of a piece of important equipment.

MEMBER POWERS: Loss of defense-in-depth.

MEMBER RAY: Right. Yes indeed. And so we should deliberate later and not slow down John's.

MEMBER POWERS: We tell these guys they only get half the time. So we have lots to discuss.

MR. WEERAKKODY: And I will not take even half of that time.

MEMBER STETKAR: But we had our own incident response that cut into their time. Let's see if we can go on through.

MR. WEERAKKODY: Thank you.

MEMBER POWERS: But that is, by the way, a very, very important slide that just got turned off.

MEMBER RAY: Yes, it is.

MR. WEERAKKODY: He created it. I'm presenting it. Thank you, Don.

MEMBER POWERS: And you agreed with him, right?

MR. WEERAKKODY: I agreed with him.

MEMBER BLEY: And if I understand what you guys told me about 20 minutes ago if the Commission gives you the go-ahead to examine this issue, this is one of those issues that you'll delve into.

MR. WEERAKKODY: That's right. There are applicable issues that in the ROP area my boss here has that needs to be revisited and this is just one of them.

MR. DUBE: So the next half dozen slides -- Go ahead.

CHAIR ABDEL-KHALIK: Let's go back to the previous slide. I do understand the difference between the conditional core damage probability for a

steam generator tube rupture in current reactor versus new reactor.

But what if the procedure for handling steam generator tub rupture from both cases? What if you're directly venting to the atmosphere? That's how we depressurize the primary, for example, by directly venting to the atmosphere in a new reactor design during the steam generator tube rupture. Would this picture remain the same?

MR. DUBE: It might change because, this is a -- given a tube rupture and no other failures this is a range of values that I found for conditional core damage probability. If there were subsequent failures this could shift to the right. I mean the actual event could shift to the right because you're getting closer to having a core damage event. It's like an accident sequence precursor analysis.

CHAIR ABDEL-KHALIK: But that's a design characteristic. Design-specific thing. How to response. How to depressurize the primary by venting through the second. We know that ahead of time.

MR. WEERAKKODY: Are you saying that this is normal planned event at the plant?

CHAIR ABDEL-KHALIK: No, I'm not saying that. I'm saying that this is part of the emergency

operating procedures.

MR. WEERAKKODY: Okay.

CHAIR ABDEL-KHALIK: That in the event of a steam generator tube rupture in some plant design this is how we depressurize the primary by venting --

MR. DUBE: Yes. We're not questioning that I don't think.

MR. WEERAKKODY: No, we wouldn't question the EOP. But I think to the extent I understand the fact that there has been an event such as a steam generator tube rupture in the respect that they're following the EOP you would get into the question of what should be the analysis test response.

MEMBER POWERS: See, the problem you're having here, Said, is that there's a long plot. You need a conditional probability of violating 10 CFR Part 100.23. Okay. And you need a conditional probability of radionuclide release up here. And then what you would see is in the case of your venting thing that you would probably move the new Rx SGTR. It might even go to the right of current Rx SGTRs.

CHAIR ABDEL-KHALIK: That's where my concern is.

MEMBER POWERS: Yes. It's just the wrong units up there.

MEMBER RAY: I think that's the point is you're talking about with offsite dose consequences would you still ignore it. The answer is hell, no. You wouldn't.

CHAIR ABDEL-KHALIK: That's right.

MEMBER POWERS: There's presumably a third dimension that comes out here which has some metric on radionuclides release which you don't have on this slide.

MEMBER RAY: Yes.

MR. DUBE: Good thoughts. To keep on schedule because John keeps waving me forward.

MEMBER STETKAR: We've got to get to the show.

MR. DUBE: Yes. So there's really basically three approaches. You may recall a year ago we had option 1 and 1a and 2 and 2a and 3 and it got to the point where it couldn't be handled and the decision was made across the agency that really it came down to three fundamental options. One is to treat new reactors exact same as current reactors. Not even change a single guideline. The other extreme would be make changes to the numerical acceptance guidelines and ROP thresholds and sort of in between.

So I'll quickly go through the two extreme

examples and then the approach that the staff is proposing. And so the first is no changes to the current regulatory guidance or status quo. So it provides incentive to build reactors with enhanced severe accident safety features. If they all fall to the left side of this graph, then so be it. Just a hyperbole.

And applicants and licensees who invest in and maintain additional safety features would have more flexibility. They'll have more flexibility for their four train system to take one train out of system at any time, keep it out for maintenance, still have three trains available. So they would have more flexibility with regard to risk-managed tech specs, various operational flexibilities, online maintenance and what have you.

The staff concluded that this approach did not meet the expectations in that the approach may not prevent significant decrease in the enhanced safety through changes to the licensing basis and particular plant operations over the plant life. I mean without examining the full spectrum of possible changes and doing little exercises we're not sure that -- We're not going to say that it doesn't, but it may not maintain this enhanced level of safety.

And, in particular, my colleagues in NRR and DIRS, the approach may not provide for meaningful oversight that supports NRC's response and inspection. Sunil showed this example and went through this.

This is just one of several examples that we went through and in the interest of time we didn't go through them all. But there are a number of issues in the significance determination process where significant equipment could be out of service for or found to be in a degraded state retroactively for significant periods of time and the response would remain in green band if you will. And again, in the interest of time, we won't go into all those details.

MR. ADER: Don, if I could. I just wanted to mention. The paper we originally had as a policy paper this was option one and the words and the rationale are going to be pretty much the same. It's just going to be repackaged as an option. So the next one you'll hear will be another option and then the recommended option.

MR. DUBE: Right. Option three, I'm skipping to the screen, would be to modify the risk-informed guidance to include a new lower risk metric for the ROP and changes to the licensing basis. And we already talked about with the red X on the graph

and the concerns regarding that. It would support the Commission's expectations that new plants have enhanced safety and advanced reactors have enhanced margins of safety. But the staff believes the approach actually goes beyond the Commission's expectations by effectively requiring this continued maintenance of enhanced margin of safety.

It's a delicate balance where the Commission has stated in several policy papers that they expect new reactors to be safer. But they also carefully use words such as not mandating or requiring. So we've been walking this fence here for the last year and a half or so. But I guess in effect we feel that it goes beyond the Commission's expectations.

And it may be inconsistent with the Commission's Safety Goal Policy Statement and certainly the statement on the regulation of advanced reactors in 2008 that -- this is from actually not the language but some of the background discussion -- the policy statement does not state that advanced reactor design must be safer than the current generation of reactors.

CHAIR ABDEL-KHALIK: I guess I'm trying to understand your delicate treatment of the word

require. And if I look at slide no. nine your read statement said the safety enhancement should not be eroded. I mean the verb should, isn't that a requirement, should not be eroded?

MR. WEERAKKODY: It is not. In the regulatory language, first off, the word shall is the requirement as opposed to the word should. Should is not a requirement. Shall is.

And the second thing what you're looking at is --

CHAIR ABDEL-KHALIK: So if they had said the safety enhancement shall not be eroded, then you would have interpreted it differently?

(Simultaneous speaking.)

MR. WEERAKKODY: I'll say that it's a caveat. Now this is -- You're not looking at the rule language. You're looking at the statement of consideration supporting the rule. In terms of the hierarchy, it's one step below. So if the rule said shall, that's a requirement.

CHAIR ABDEL-KHALIK: Okay.

MR. ADER: Sunil, if I can. With the new designs, as you know, they're certified by rule. So there is a rule for that design. This statement was explaining the change process to what would be the

rule. And the Commission said they would not approve exemptions that resulted in a significant decrease. So an applicant could come in, reference one of the certified designs, request an exemption and this statement in relation to exemption requests.

The other slide Don had then talked about the Tier II information, the stuff that the licensees could change under a 50.59 like process. And that's where they said they expect the industry will cooperate and maintain the level of safety that they'd come in and sold to the public.

CHAIR ABDEL-KHALIK: Okay.

MR. DUBE: Thank. Good questions. We have struggled with this.

So I guess I'm on the fourth subbullet. It would create a -- This is the extreme example of changing numerical guidelines. It would create a risk-informed framework that in effect is inconsistent with the underlying technical basis for the current threshold that are derived from the Commission Safety Goals and implemented in Reg Guide 1.174. These are the Commission Safety Goals, the quantitative health objectives and then surrogates where one demonstrates, for example, that if one had generally speaking a baseline to the -4 core damage frequency that that

would meet the latent cancer fatality objective as a surrogate. Or if one had 10^{-5} large early release frequency generally speaking with some margin one would have a reasonable assurance that one would meet the early fatality aspect of the quantitative health objective.

We significantly decreased these thresholds. It wouldn't affect being consistent with the technical basis for the Commission's Safety Goal Policy Statement which is implemented in Reg Guide 1.174. It took us awhile to come around to thinking this thought process. But I think that's how we --

MEMBER POWERS: In this particular option on the numerical guidelines, have you thought about exploiting the lovely words that appear in 1.174 of increased management attention?

MR. DUBE: Yes. Exactly.

MEMBER POWERS: You can leave the goals alone, but you can change the threshold for increased management attention.

MR. DUBE: Exactly. I have a paper that I didn't distribute which would how to implement this and maybe you got a hold of it. No, that is actually one of the things that -- implementing aspects that is down the road. But that's one of the things that

we're considering. Thank you.

And the last bullet is very important I think. You could have unintended consequences in that new reactors with enhanced safety features would have less operational flexibility than the current fleet of reactors. You can envision I'll call them just Plant A and Plant B. Plant A is a current generation plant, two or three trains of safety injection and so forth. Plant B is the new reactor, significantly lower baseline risk, four trains of safety injection, four trains of aux feedwater, four emergency diesels and a backup Station Blackout. And if one had strict numerical guidelines the older plant would be able to implement risk-managed tech specs and the newer plant with more safety features, more trains, could actually be more restricted and could have less operational flexibility if one weren't careful.

CHAIR ABDEL-KHALIK: Not if those limits are absolute.

MR. DUBE: Yes, even if they're absolute.

CHAIR ABDEL-KHALIK: I can see where that would be the case if those limits are relative values. But if they were absolute values, I just don't see it.

MR. WEERAKKODY: Do you mean absolute

values that are different from new reactors?

CHAIR ABDEL-KHALIK: Delta. The deltas are specified as absolute values rather than fractional values of the base CDF.

MEMBER SIEBER: Right.

MR. DUBE: Well, it would all come down to where you drew those thresholds, but.

MEMBER POWERS: I'm sure I see that.

MR. DUBE: Yes.

MEMBER POWERS: It seems to me that when you get down to these lower numbers that if you change the numerical guidelines in any way that you would interfere on what it calls operational flexibility.

CHAIR ABDEL-KHALIK: Not if I set those limits as absolute values of delta.

(Simultaneous speaking.)

MEMBER RAY: -- same for each.

CHAIR ABDEL-KHALIK: Right.

MEMBER RAY: Rather than a -- But you don't want to do that.

CHAIR ABDEL-KHALIK: -- but that's what -- You modify the risk-informed guidance to include the new lower risk metric. That didn't say that these are relative changes, right?

MR. DUBE: It's general.

CHAIR ABDEL-KHALIK: Right. But the intent is to use absolute values of delta.

MEMBER SHACK: But if the absolute value of delta is 10^{-8} or 10^{-7}.

CHAIR ABDEL-KHALIK: Then you would be far more restrictive on reactors with higher ones.

MEMBER SIEBER: Can even -- higher.

MR. ADER: Just to clarify. The changes we're talking about here is four new reactors. We were not looking at going back and changing --

CHAIR ABDEL-KHALIK: I understand.

MR. ADER: -- current operating reactors.

MR. DUBE: And the challenge is that not all new reactors are the same. We do have some of the more evolutionary designs. I'll just name them because they're straightforward, EPR and APWR, which have active systems like the current generation but more of them. But they tend to have core damage frequencies more towards the bottom of the range of the current fleet. And then one has the passive designs, ESBWR, AP1000 and others that are being proposed which are an order of magnitude of more even below that. And if one had an absolute threshold we can't design it I don't believe to encompass this wide range of variation even within the new reactors

because they do span a wide range certainly for internal events core damage frequency. And a lot of these --

And I understand there is a flaw on seismic core damage frequency. But a lot of the kinds of programs that you have usually the deltas are going to -- the impact on seismic is neutral and a lot of the deltas really you're using the baseline internal events, maybe fire to some extent. And so to come up with a threshold that can span this wide range -- we thought about it for a year -- it would be tough.

VICE CHAIR ARMIJO: Okay.

MR. DUBE: Which comes to you know it's like Goldilocks, too hard, too soft, just right or too hot, too cold, just right. A approach selected by the staff or selected by the staff identified specific changes to the risk-informed guidance for changes to the licensing basis that prevent a significant decrease in the level of safety. Now that's a lot of words, but it really comes down to defining for once what does that mean, what does the Commission mean, by preventing a significant decrease in level of safety. It may be quantitative. It may be qualitative.

And then in the ROP aspect identifying specific changes to the risk-informed guidance for the

ROP to provide for meaningful regulatory oversight.

And then the next couple slides we'll try to get a little more specific. I only have a few more slides. So if you can hold on maybe we'll have quite a bit of time for discussion.

For changes to the licensing basis, it's evaluated how to modify the guidance to prevent this significant decrease in a level of safety. Whether one might supplement the CDF and LERF acceptance guidelines, we haven't thought about it. Maybe there's a speed limit aspect which is you know if a plant has a core damage frequency baseline of mid 10^{-7} range. We wouldn't worry about small changes above that. But there's some level at which the staff would start getting nervous. And to use what Dr. Powers said exactly in Reg Guide 1.174 enhanced management oversight may be appropriate. That's one possible avenue that's an implementation detail.

Whatever approach we would utilize takeover involvement. So if the Commission said go with this option right tomorrow, you know the work is still ahead of us. Much more work than we've done to date quite frankly.

But involvement in the evaluation and development of detailed changes, one thing that was

suggested at the public meeting last week which I thought was an excellent example was come up with some number of changes that are possible over the life of the plant and exercise the current guidance and see if there are gaps that need to be filled. A very good example. Perhaps having a tabletop exercise, multi-day workshop with some of the SRAs from the region and industry and other stakeholders.

Evaluate the proposed changes to the guidance. Ensure that the changes don't create unintended consequences. As creating disincentives for safety designs. If we are restrictive then why? To what benefit is it to the vendors to have extremely safer designs but have less operational flexibility doesn't make a lot of sense.

But there's also concern about if one is not careful and I didn't show you an example in the interest of time. But one could go through a significance determination process, show where a passive feature could be in a degraded state for a significant period of time and based on change of core damage probability still remain a green. So one would want to make sure that whatever approach we have would not allow the degradation of passive safety system performance.

And then these rules in Section VIII.B.5.c of the Design Certification Rules as I mentioned before talk about ensuring that there's no substantial increase in the probability of consequences of ex-vessel core damage events. Perhaps we could work that into this overall process going forward.

I'll hand it over to Sunil for ROPs a little more discussion.

MR. WEERAKKODY: Yes. I spoke about Management Directive 8.3 Incident Investigation before. This is you could say the second big aspect, in fact a very important aspect, where this agency has made significant strides in using this information in our reactor oversight process. What you're going to see over the next couple of slides is a following.

Before we come into this Committee and developing the paper, we had a number of meetings with the regional management, the RAs and the deputies, the office director of NRO, the office director of NRR. The focus of this discussion was in the event the Commission tells us go do good. In other words, go look at these procedures, these guidelines, and look at the kind of things we need to do to tweak them for our new reactors. If that's what the Commission wishes us to do, then there will be certain

considerations that the agency -- when I say the agency, the RS, DRS, office directors -- would consider.

Now one of the things I want to point out before I go bullet by bullet except for the first one all of the other ones start with the word evaluate. Because we understand -- I think the key there is we understand that to get to a point that is good for all of us that we should evaluate a number of things before making up our minds.

The first item there, utilize stakeholder involvement in the evaluation and development of changes to the guidance, this is the definite one. We do plan if the Commission approves that we go forward with these procedures and guidance documents we plan to keep our internal and external stakeholders engaged. That's definitely going to happen.

The next one, evaluate the criteria for plant placement in the action matrix to assess..., I'm not going to read that sentence. I kind of run out of wind. But let me just speak to it. What we do in our oversight process is that we look at the inspection findings that are coming out of plants and their significance.

And also we look at what we call the

performance indicators. You know these could be things like the number of trips, their system availabilities. For each plant, we look at for a given time period what those numbers are and based on those we put them in action matrix in that order of performance.

So the idea here is we want to go and see for the new reactors whether anything has to be tweaked in the thresholds, the different way the plants could get into the action matrix and how the agency responds. So that's what that means.

The third bullet, evaluate the merits of developing additional criteria, for example deterministic, change in risk, to support NRC's response to findings and performance trends. And one of the things, again you may already know this. But if you don't just to refresh as compared to the licensing area where you look at 1.174 you see the CD and delta CDF, delta LERF. But then there's a bunch of other criteria, the defense-in-depth, safety margin and a couple others I can't remember.

But when you go to ROP what you find is it's more numerical driven relatively. Okay. So given that when you have -- I think this kind of goes to some of the points that Dr. Powers mentioned. When

the numbers are very, very low for plants whose PRA, one could say, has some level of academic, meaning you don't have a lot of operational experience and could be high uncertainties you have to evaluate whether in lieu of, in addition to, the numerical criteria whether we should be a little more relying on the deterministic.

Again, I emphasize the word evaluate just to show that it may be necessary. It may be not. But it's in play.

Evaluate any potential ROP changes to avoid unintended consequences such as creating disincentives... I'm not going to spend a lot of time on that, but this basically emphasizes that in the minds of the RAs and the office directors we find that it is very important that when we have tweaked these we've got to be real cognizant of the fact that if a licensee expends investments to design a new reactor they should get something back for it.

Consider a need to risk-weight or otherwise weight findings associated with passive systems to reflect the difficulty of recognizing the degradation of passive systems. Again, I might need a little bit of help from Don on this one, but my understanding on this one is in new reactors you have

some components that are of different nature which could lead to sequences that we don't know yet. So there should be a consideration for that when we revisit our ROP.

And the next bullet is a very important one. Continue to independently assess licensee performance in the areas of safety culture since safety culture addresses common underlying factors that affect plant safety. You know I can recall when we scheduled like a one hour meeting with the four regional administrators and the two office directors. You know one thought hey, you've got all of these things currently in the ROP that are called cross-cutting, you know, things like human performance, things like safety-conscious work environment. That has some relevance to what we call today, you know, loosely I'm using the word safety culture here.

So the important thing that was pointed out is it is a leading common cause type indicator. So when we move forward on evaluating this guidance, we want to continue to independently assess. Again, these are not done deals. We want to look at that up closely.

Evaluate maintaining or changing the current thresholds for green, white, yellow, red risk-

significant findings and performance indicators. Again, the word I want to emphasize is evaluate because if I speak to three different people outside the agency they will have three very good ideas. So what needs to be done is and Don pointed this out and one of the external stakeholders pointed out there needs to be some discussions, some examples, some settings to see does the current criteria give us sufficient for meaningful engagement or do we need to make changes?

And the other point is this is more of a broader point, one of the things that in the ROP we do is we always keep an eye on an ongoing basis is there a need to revisit them. Are there gaps? So when we take on a deliberative attempt to tweak or modify the existing guidance for new reactors we might find things that are applicable and relevant and useful to our operating reactor. So that's another thing that we would need to keep an eye.

So those are the fundamental things that the agency's senior management thinks that we should take under serious consideration in the event our bosses on the 18th floor and the 17th floor says go forward and tweak or modify the guidance.

MR. DUBE: Thanks. I only have two

slides. So I'll wrap up in 30 seconds. We're not going to go through the backup slides.

So we mentioned light water reactor risk profiles generally have lower or new water light water reactors generally have lower risk profiles. The original, the early, staff concerns were with risk metrics. So that's why the title for some of these discussions was risk metrics for new reactors. But it's evolved to be more of a concern with assuring the enhanced level of the accident capability, perhaps how we implement this 50.59 like process. And we're prepared to engage stakeholders.

And real quickly, the steps would be to issue the final Commission paper, engage stakeholders regarding specific changes, proceed with evaluation of applications for risk-informed initiatives which are coming and will be coming real quickly once a couple of plants get their COLs. And then a parallel effort, maybe more extended, because there was more time and maybe different sets of issues. But it's a parallel effort to address ROP issues.

That's it.

CHAIR ABDEL-KHALIK: If you go to slide 21, would you agree that this is just a punt?

MR. DUBE: That is a polite way of putting

it, yes.

MEMBER CORRADINI: I thought you were going to go back to Goldilocks. But I was waiting for you would characterize it.

MR. ADER: No, people have made that comment. It looks like we're just kicking this can down the road because when we were here last year we were talking about should it be LRF or LERF. And there was still a lot of work. The devil's in the details. But until we had alignment on what the guiding principle we're trying to accomplish I don't think we would have made the progress that we hoped to make in the future if the Commission agrees with it because there was status quo.

A lot of people came at it from the point of view, well, we need to change the metrics. We need to make them lower was kind of the initial reaction by a lot of individuals. Others were status quo. You have the safety goals. You should treat them alike until we have alignment. So it doesn't seem like a lot of progress. It seems like we put off a lot of the tough issues. But until we have alignment of what that principle was, what we were really trying to accomplish, I think we would have expended more staff effort working to different ends and we would have

been arguing over LRF, LERF, without having agreement of what we were trying to accomplish.

MR. DUBE: And added to that, I mean if one were to go with the middle option, Option 2 if you will, it means definitely not status quo. I mean there will be changes and not significant changes to the risk metrics. So we wouldn't be changing those couple graphs necessarily for new reactors, wouldn't use large release frequency or some other hybrid metric. But we would rely more on defining what it means to preserve the enhanced level of safety, maintaining the enhances level of safety, identifying specific reg guides where there are gaps, identifying where there might be new reg guides and changes to the ROP.

MEMBER CORRADINI: So can I press the point that Said had.

MR. DUBE: Go ahead, Mike.

MEMBER CORRADINI: So actually Sunil used the words. You pointed to verbs. So I look at all the verbs as whether we're going to think, we're doing to do, or we're going to cogitate a little bit like just sit around. So I see a lot of thinking. The doing part is to develop guidance and the utilized stakeholders. So are you going to go back? You used

the example of one of the stakeholders giving the suggestion of actually consciously suggesting a lot of surrogate changes in evaluating. If I'm sitting at 10^{-6} for the CDF or 10^{-7} for the LERF, what the sphere is of influence of all these changes?

So is that going to be a definite do? Because that to me actually seems like a very reasonable way to just start the process.

MR. DUBE: I mean I don't know if I would use the word definite. But it's an excellent idea.

MEMBER CORRADINI: Okay. And then what are you thinking about -- That's the third bullet. What are you thinking about under the sixth bullet? That's what I didn't catch about develop guidance to implement design certification rules?

MR. DUBE: I don't have it before me, but it's actually in 10 CFR Part 52. For each certified design, it's actually codified in rule and VIII.B.5.c states those exact words that I mentioned before. No substantial increase in the probability or consequences of ex-vessel severe accidents. No one has defined that yet.

MEMBER CORRADINI: And that's what you're going to do.

MR. DUBE: Well, it could be part of -- In

a larger framework, yes, it could be part of the effort.

MR. ADER: There are actually two efforts and the one Don mentioned is unique for Part 52 that it has that change process for those features that were added for ex-vessel severe accidents.

MEMBER CORRADINI: Don't make it worse.

MR. ADER: Don't make it worse. No significant. And they realize with the uncertainty I think they put a significant decrease.

MR. DUBE: Substantial decrease.

MR. ADER: Substantial decrease. But there's the other 50.59 like change process that applicants and licensees can take departures. It reads much like 50.59 and if you look at the current guidance that's been endorsed, NEI guidance, they have examples of frequencies of accidents. That process needs to be defined as well. And there's a working group that's already starting up.

MEMBER CORRADINI: Okay.

MR. ADER: NEI I think is looking at their document to see if they need to supplement the -- And I don't remember the number of NEI document that's the 50.59 guidance. But they need to supplement it for 50.59 like process for Part 52 given the lower risk

numbers.

My concern is there could be changes. If we don't look at it, there's a potential that changes could be evaluated that we can take a departure and it would never even come into staff to look at for a license amendment. So it's something that I believe needs to be looked at.

MEMBER CORRADINI: Okay. Thank you.

MEMBER RAY: Does safety-related versus important-to-safety play any role in your thinking about this?

MR. DUBE: Not necessarily, no. Because with the passive plans you have kind of an in-between regulatory treatment of non-safety systems which is kind of in-between safety-related and non-safety. It's really --

MEMBER RAY: Well, that's something that we stumble over often and we're told stay away from things because it's not safety-related.

MR. DUBE: No.

MEMBER RAY: It does seem to play a role.

MR. DUBE: I don't get hung up on that personally.

CHAIR ABDEL-KHALIK: I'm just still struggling, trying to find out what on this slide that

goes beyond what's in the SRM on SECY 93-077 and/or the statement of consideration for the ABWR design certification. What's new here?

MR. DUBE: The bottom bullet.

MR. ADER: Don, if I can.

MR. DUBE: Yes, go ahead.

MR. ADER: What we're trying to do is implement those statements, make them come true, I think. I think where there's a concern of the staff that the current guidance as written would not necessarily maintain the level of enhanced safety that these new plants are providing. Some will argue that we're not going to go out and take out a fourth train. And I don't think people are going to do that either and some of it's tiered to one. So you're not going to change it unless you go by rule.

But the current guidance as a lot of us read it could allow some changes that would have a significant, maybe it's an internal event CDF change that would pass under the radar screen with current guidance as written.

MEMBER SIEBER: And then it could dribble down to the current --

MEMBER RAY: You say somebody's not going to go out and take out a fourth train. Clearly,

that's true, but you know when you're managing a plant, you can treat it as an installed spare, too. So it makes a big, big different whether you've got spares in the warehouse and people to run in and put them in place on a weekend. Or you say when it's out of service it's out of service. I'll go buy another one. So it does make a difference.

You can't assume because it's there it's going to be in service because there's a cross to keeping it in service.

MEMBER POWERS: The whole design philosophy, the EPR, is to be able to take that fourth train and treat it as there was an installed spare.

MEMBER RAY: I know, Dana, and that's why I like the words in the early slides in which we said, if you're selling a safer plant, then we're going to make sure you keep it a safer plant. But it doesn't happen by itself. It doesn't happen just because you put it there.

MR. ADER: So what I see on the slide you referred to earlier is staff going and looking at the various guidance documents 1.174 to see if they will make the Commission's expectations, at least, help make them come true, and do we have a risk-informed regulatory process that will bring things in for

enhanced attention by the NRC or at least bring them in for a review so we can try to again maintain that enhanced -- I use the words reasonably maintain or not have a significant decrease in the level of safety performance that these plants seem to exhibit.

MEMBER RAY: Let me try one more time on my thing that you don't get hung up over because I'm glad you don't -- wish I didn't. But in trying to think through requirements or assumptions about operability do you assume there are any constraints on the important-to-safety stuff that will keep it in service?

MR. DUBE: Well, many of the plants -- We didn't show an example here, but some of the plants have investment protection --

MEMBER RAY: Right.

MR. DUBE: I don't know the word allowed outage time but unavailability. And we actually used one of our SPAR models of a particular new reactor and exercised a number of hypothetical what-ifs to see if we could get ourselves -- one could get themselves in a situation of having some of these non-safety but important-to-safety extended period of time and push some of the 10^{-6} delta core damage probability limits and we couldn't come close with reasonable

combinations of equipment out of service.

Now granted this was a couple of day effort with one plant model and only a dozen or so combinations. But it gave us some encouragement that perhaps you know we have controls or if there are gaps, there's not a heck of a lot of them. But what we need to do is more fully exercise these what-ifs, you know, possible examples of changes that might be made over a plant lifetime to make sure that there are no gaps.

MEMBER RAY: Thank you.

MEMBER STETKAR: Anything else?

MEMBER SHACK: Just one other thing. You know, when you're looking at some of these plant changes, I think you want to look at some of these requests, too. I mean suppose an ESBWR did come in and ask for a risk-informed tech spec. What would it look like? Or you obviously just hit up all against back stops. So there is a mechanism there for that.

MR. DUBE: Right.

MEMBER STETKAR: Don, Sunil, thanks for the presentation. Thanks for accelerating it, too. You did well.

MR. DUBE: Thank you.

MEMBER STETKAR: To fit the time

constraints. There's obviously a lot of interest among the Committee members.

Regarding whether we write a letter or not, I guess that's something that we need to deliberate probably later this afternoon.

CHAIR ABDEL-KHALIK: If it were to happen, I suspect it would be in the July time frame.

MEMBER STETKAR: Yes. You're planning on sending this up in August, right?

MR. ADER: As an information paper, we would have probably started sending it up next week.

MEMBER STETKAR: Right.

MR. ADER: But recognizing that you would probably want to write a letter we're anticipating that, we're hoping that, the August time frame, late July/August, we could send up the paper with whatever comments that the Committee has.

MEMBER BLEY: I guess we need our own discussion about that. I'm a little hard pressed to think of what we'd say.

MEMBER STETKAR: Yes. Let's have that discussion, but later.

(Simultaneous speaking.)

MR. ADER: Recognize that granted some of the devil is going to be in the details. And we

revise 1.174 or supplement it those documents would be coming back.

MEMBER STETKAR: That's true, although I think the Committee's -- I don't want to put words in the Committee's mouth. I think we need to discuss it internally because there's obviously a lot of interest. There's probably diverse opinions. So we need to deliberate a little bit about this internally.

And with that, Mr. Chairman, I will turn it back to you either 24 and half minutes later or five and a half minutes early.

(Simultaneous speaking.)

CHAIR ABDEL-KHALIK: Thank you. We are in recess until 1:00 p.m. when we go to Item No. 10 on the agenda. So unfortunately we have a reduced lunch time window. Off the record.

(Whereupon, at 12:21 p.m., the above-entitled matter went off the record and resumed at 12:59 p.m.)

CHAIR ABDEL-KHALIK: On the record. We are back in session. At this time, we'll consider item no. 10 on the agenda, Generic Safety Issue GSI-191 and Dr. Banerjee will lead us through this discussion.

Dr. Banerjee.

MEMBER BANERJEE: Thank you. Most of the members, of course, know about Generic Issue GSI-191, Assessment of Debris Accumulation on PWR Sump Performance. Last time we were briefed on this, I think was I asked Mike about it was October 2008. And we wrote a letter at that time.

And just to summarize very briefly before handing this over to Mike, what we wrote in our letter I think is still fairly germane. I'll give you the main points.

(1) The first point was that significant progress had been made towards resolving GSI-191.

(2) That all licensees at that time had installed significantly larger sump screens and some had undertaken further action such as changing fibrous insulation and chemical buffers. That has, of course, advanced.

(3) Nearly all licensees had conducted some form of head loss testing for their new screen systems. The staff had developed adequate guidance to support its review of these tests.

(4) The fourth was the prototypicality of these tests was something that the guidance was addressing.

(5) That there had been an adequate

guidance developed to support chemical-reaction effects.

(6) Programs had been put in place to determine the amount of debris and chemical products that passed through the sump screens as well as the effects on core cooling. However, guidance should be developed to ensure that these tests cover a wide enough range of conditions to support the staff's review of in-vessel downstream effects.

(7) That the staff had proposed a systematic process which actually amounted to a framework to close out GSI-191.

So that was essentially our letter and its major conclusions. Since that time many things have happened and Mike Scott will brief us about this. No letter is needed. So I'm going to leave it in your capable hands, Mike, to tell us what to do.

I have also given each member a copy of the SRM that was put out on May 17th which has five points which I think Mike will probably refer to or do during his talk. If not, I have them listed and we can go over it.

MR. SCOTT: It's certainly on my mind.

MEMBER BANERJEE: All right. Go ahead.

MR. SCOTT: Good afternoon. I'm pleased

today to brief on the status of Generic Safety Issue 191. I'd like to be able to report to you today that everything is on schedule just as we said it was in late October of 2008 when we met with you last. Instead I'll tell you where it really is which is not exactly where we wanted to be at this time.

Our purpose today is to provide background, status, path forward and key messages for this issue. Dr. Banerjee mentioned that we did not request a letter. Of course, it would be up to the Committee if you thought a letter would be appropriate at this time. The staff is working on the SRM that you referred to. So we are considering path forward and recommendations to the Commission. So we are not specifically asking for a letter at this time.

Background. Just briefly, of course, we opened GSI-191 to address the sump performance issue. Generic Letter 2004-02 was the document that requested licensees to perform detailed evaluations of their strainer performance getting away from previous assumptions that were nonmechanistic and having to do with the sump could survive a 50 percent blockage. And Generic Letter 2004-02 was said go forth and evaluate what your performance would be based on a mechanistic evaluation of how much debris could get to

the sump. And that's what licensees started doing at that time.

There was great emphasis at the time Generic Letter 2004-02 was issued and subsequent to that to get the strainers larger. It was widely considered that the strainers needed to be a larger size. This was discussed with the ACRS at that time and all parties involved I believe concurred that the right thing to do was to make the strainers larger soon. And that choice was made with recognition that the evaluations intended to show that the strainers were of adequate size would be going on at the same time that the strainer modifications were going on. And obviously that has potential detriments for issues resolution because they can find that the strainers were not in and of themselves enough to resolve this issue.

And we could and in fact did find significant questions and concerns about the practices that the licensees used to do the testing which has led to some round and round discussions with the staff which I'll talk about. But I think everybody agreed at the time that it was appropriate to go ahead and make the strainers larger recognizing that potential impact.

And so the licensees indeed made their strainers much larger and as the slide says one to two orders of magnitude and the largest strainers are on the order of about 6,000 or more, 7,000 square feet of surface area. So very, very large. And those who have dealt with this issue before are of course very familiar with what I'm talking about.

Since 2007 as Dr. Banerjee indicated we issued review guidance in early 2008 regarding various aspects of the strainer problem that had not previously been addressed in the staff's guidance and safety evaluations and those were with regard to head loss testing practices, coatings and chemical effects.

The testing has posed a set of challenges that I think most of you are pretty familiar with. Unfortunately of course you can't test this system in the plant with debris in it obviously. So you have to do it at a remote vendor facility. And the vendor facilities are taking a section of strainer, a mock-up of the strainer basically, putting it in a test tank and sending debris to it. There are so many aspects of this issue that weigh upon how much debris actually gets to the strainer and you're trying to model it in a remote facility. You can imagine that it leads to lots of questions and it did.

So we asked RAIs in the dozens of the licensees and their vendors regarding their test practices and that started really mostly in 2008, although we had interacted with them in 2007 and earlier. The final RAI or the final supplemental response to the generic letter were due to us at the beginning of 2008. So that's where we got heavily into this review of the test practices which led to additional questions and additional interactions with the licensees.

Also in 2008, the staff came to the ACRS regarding in-vessel effects after its review of WCAP-16793 which is a topical report speaking to in-vessel effects and ACRS asked a number of great questions to the staff that led us to go back and reconsider our own precepts about in-vessel effects which led us to ask additional questions of the industry which they responded to and that discussion goes on today as I will talk about in a few minutes.

Another subject that has come up was with regard to assumptions about zone-of-influence. Zone-of-influence is the volume around a hypothesized break within which insulation would expect to be disturbed, knocked off the pipe and be available to transport to the sump. The staff's safety evaluation in 2004

contained guidance for this subject. The licensees who -- Some licensees attempted to credit a much smaller ZOI which has had effects that I will talk about on this slide.

Basically, licensees with a significant amount of fibrous and particulate insulation sponsored reports and testing done by Westinghouse and a lab to attempt to justify with jet impingement testing a greatly reduced zone-of-influence. Those reports were referenced in the licensee's submittals, though were not submitted to the NRC staff for review.

Nevertheless we asked to look at them and we did that in 2008 and 2009 and identified a number of questions and issues associated with the jet impingement testing that was done. We spent a lot of time interacting to attempt to resolve those questions. We basically said towards the end of 2009 that we need to put this thing to resolution either -- you know basically Owners' Group come in and make your best case why we should accept these reduced zones of influence. And just parenthetically the reduced zones of influence would reduce the volume potentially affected by the break by over 90 percent. So we're not talking a small effect. And the staff considered therefore there needed to be a pretty high standard of

evidence that this zone-of-influence testing was adequate and we had a lot of questions about whether it really was adequate.

VICE CHAIR ARMIJO: Well, I just wanted to get clear. Was the reduced zone of influence based on a reduced break size? Was that their thing or was it a pressure thing?

MR. SCOTT: They actually had a nozzle test rig and they put a sample of insulation at the out -- of the rig and it had I believe a blow-out plug. So it was a jet impingement test that was intended to --

VICE CHAIR ARMIJO: Just straight jet impingement test. So for a given break size the zone of influence --

MR. SCOTT: Would be much potentially. They attempted to justify that -- The staff had in 2004 read the safety evaluation that said, based on the information that we have available now previously jet impingement testing, this is a conservative reasonable zone of influence for this and it's material specific. Some materials are much more resistant to this than others.

So we had those -- Those numbers were available to licensees, but there was a belief in the

industry that those numbers were unduly conservative. So they sponsored additional testing to attempt to show that the numbers were in fact overly conservative.

VICE CHAIR ARMIJO: Okay.

MR. SCOTT: And the results they came up with indeed reduced the zone of influence by again, the volume, by over 90 percent since it's a spherical assumption that's made here. And we asked questions about that jet impingement testing. And I can't get into too much detail about it today because it is proprietary. Suffice it to say we asked and I think this fourth bullet here speaks to that. They found a design error, the vendor did, with the test loop and we ended up concluding because of the design error and the various unsolved questions that we had about the testing that we could not accept the reduced zone of influence that was proposed.

MEMBER BANERJEE: Let me say that if you want we can at some point close the meeting because if you want to understand the details of why the staff came to that conclusion which I know about and which I agree with.

CHAIR ABDEL-KHALIK: Is Mike prepared to --

MR. SCOTT: I have various staff here that are indeed prepared to address that in detail if you wish to take the time to do that today.

MEMBER CORRADINI: But I guess I want to ask a general question before we close down. So it's not pipe size. It's more the methodology of how the test was done in reference. So is it fair to say that the zone of influence that you were expecting to use in these to estimate the debris inventory going in is definitely conservative and the experiments that were done by this group were clearly not conservative. But it was unclear how they properly scaled. Is that -- What was the reason to reject the test?

MEMBER BANERJEE: That's the question. If you want to answer, I think --

MEMBER CORRADINI: That requires a closed session?

MEMBER BANERJEE: We might need to close the session.

MR. SCOTT: There were specific issues that we had with the test configuration and the way the test was done and issues such as how you scale --

MEMBER CORRADINI: Okay.

MR. SCOTT: -- the testing up to the plant size. There were various specific technical questions

that I think probably we need to discuss in a closed meeting.

MEMBER CORRADINI: But is it fair to say though that the original zone of influence calculation that licensees are using to estimate their debris volume they have to deal with is definitely conservative?

MR. SCOTT: And you're speaking here of the safety evaluation zones of influence, right?

MEMBER CORRADINI: Well, whatever they used to determine their debris volume for the GSI --

MEMBER BANERJEE: The original guidance.

MEMBER CORRADINI: The original guidance.

MR. SCOTT: We believe the original guidance is adequately conservative. I don't want to say because I don't necessarily believe it to be the case that it is, for example, grossly conservative or highly conservative. There is various data. It's not crystal clear as to just how conservative it is.

MEMBER CORRADINI: Has that data been -- Well.

MEMBER BANERJEE: We've looked at it, Mike.

MEMBER CORRADINI: Okay.

MEMBER BANERJEE: We've looked at it.

We've written on it.

MEMBER CORRADINI: Okay.

MR. SCOTT: Yes, that was in 2004.

MEMBER CORRADINI: And so the Committee feels at that time that adequate is the proper characterization of adequately conservative.

CHAIR ABDEL-KHALIK: If we are to go into a closed session, I would prefer that we do it towards the end of the presentation.

MEMBER BANERJEE: To you, Mr. Chairman.

CHAIR ABDEL-KHALIK: Thank you. So let's proceed.

MR. SCOTT: Okay. I think we got most of the way through this. We sent a letter to the Owners' Group in early 2010 that said we don't accept this testing and they are attempting to come in to talk to us about a new test protocol and also a new analytical method to use the test results to calculate zone of influence. That will be a likely extended discussion before we could get to the point of accepting that.

MEMBER POWERS: Mike, since the screens are by and large installed and larger based on the guidance debris, what is motivating the industry to keep hammering away on this testing?

MR. SCOTT: The plants that have higher

amounts of fibrous material I believe would conclude that they will struggle to show adequate strainer performance even with larger strainers based on the assumptions, the ZOIs, that we put out in 2004. There is wide variance in the industry about the plant configuration. Some of them started this problem with virtually no fibrous insulation and they're done or effectively done.

MEMBER POWERS: Yes.

MR. SCOTT: And others started with just the opposite with a large load and honestly where we are today is that we are down to less than half, as I'll talk about, the plants remain unresolved. But those by and large are the plants that are challenged by having a larger amount of this material in their plant.

MEMBER POWERS: I understand.

MEMBER RAY: Before you move on, I know we're talking zone of influence. But you have mentioned material here a couple of times. And the slide does, too. Is concrete scouring included in this testing or in the scope of what we're talking about?

MR. SCOTT: I'm going to ask for staff to speak to that because I don't want to misstate this.

John Lehning of the NRC staff.

MR. LEHNING: This scouring of concrete is not something that's included in the source terms that the plants are using, the operating reactors are using. And the reason is that we don't think that that source term is a very large and we have been using conservative values for particulate for coating and for other materials that are in the plant condition. And we believe that those values of conservatism and those values are very significant compared to the amount of concrete particulate that might get destroyed.

MEMBER RAY: Thank you.

MR. SCOTT: And, John, that's addressed in our safety evaluation. Is it not?

MR. LEHNING: I don't believe that concrete particulate is specifically called out in the safety evaluation at all. That was a judgment that we made in coming up with the safety evaluation guidance. But I don't believe it's in the safety evaluation.

MR. SCOTT: Okay. Thank you.

MEMBER CORRADINI: Are we allowed to discuss in open session the number of plants that are on this borderline that you discussed because of the zone of influence?

MR. SCOTT: Sure.

MEMBER CORRADINI: That kind of follows up Dana's.

MR. SCOTT: That's public information. There are 69 PWRs and as one of my later slides says the staff considered 39 of the 69 to be effectively complete. And I say effectively because of this in-vessel issue which we'll talk about. But barring that issue, 39 of 69 are done. Of the remaining 30, probably and I'm not precisely sure here, but in the vicinity of 15 or 20 have credited either this reduced zone of influence or have credited debris settlement that is in the test room allowed debris to settle out. And that leads to additional questions. So it's one or the other or both of those things. So the bulk of the ones that remain have one of these issues going on with them.

MEMBER CORRADINI: And the order of magnitude of -- Well, I guess I want to get an idea. Is there a metric to decide how close they are to a concern? I mean the NPSH I assume is the final metric. But in terms of zone of influence or debris and debris at the target location are they far and away? Because you mentioned that the zone of influence change was a 90 percent change which is a

fairly order of magnitude change? So are we talking factors of two? Factors of ten?

MR. SCOTT: Factors of two on the head loss?

MEMBER CORRADINI: Yes. That gets them into difficulty. That's what I'm trying to --

MR. SCOTT: I kind of hesitate to try to characterize that. You have a situation --

MEMBER CORRADINI: Is it all over the map? Is that a fair way to --

MR. SCOTT: It is all over the map and again we're talking about a case where there is limited modeling because of the complexity and variety of issues involved here.

MEMBER CORRADINI: Okay. Fine.

MR. SCOTT: So it's difficult to say, for example, the impact of an additional pound of insulation getting to the sump on the head loss. It's very difficult to predict. So I'm a little reluctant to try to characterize that.

MEMBER CORRADINI: Okay. That's fine.

MR. SCOTT: John Lehning, do you want to add something? It looks like you're up there.

MR. LEHNING: No, no. I think you said that right. I was going to say it really varies from

plant to plant. In some cases, extra debris may not have a huge impact. In some case, small amounts of debris to cover the strainer completely could have a really significant impact. And so we can't give a really specific answer to that question.

MR. SCOTT: Okay. Moving on --

MEMBER BANERJEE: Mike, when we come towards the end and show you the process for closure. They have a slide where I think you'll see that the process is fairly robust, I mean.

MEMBER CORRADINI: I understand. I remember that we reviewed that before.

MEMBER BANERJEE: Yes.

MEMBER CORRADINI: Dr. Shack said something. So if I measured in terms of a percentage of open area available is that another measure or? I'm looking for a metric that kind of encapsulates all of this.

MR. SCOTT: I believe that with the safety evaluation assumptions that the plants that we're talking about here will not have any open area on their strainer. Now that doesn't mean they have unacceptable head loss. They can have a full filtering bed of debris and still have acceptable heat loss depending on the plant.

MEMBER CORRADINI: Okay. But the reason they're getting near the ragged edge is because they essentially have debris everywhere on their screens.

MR. SCOTT: I think that most of the plants in this situation certainly if they use the safety evaluation assumptions which again some view to be overly conservative I believe that the result they would obtain would be a fully covered strainer.

MEMBER CORRADINI: Okay. Thank you.

MEMBER POWERS: Mike, at the last meeting, we learned that even being close to the limit on that positive suction head was not necessarily a good thing. Have you factor -- When you decide on the acceptance criteria for the net positive suction head allowable, have you factored in the wearing of rotor blades?

MR. SCOTT: I don't know the answer to that off the cuff. Does staff have an answer to that?

MR. RULAND: Dr. Powers, please repeat the question.

MEMBER POWERS: It will be a struggle for me to do that. Last month, we were discussing credit for overpressure and we learned that when pumps operate with what is -- the manufacturer declares adequate net positive suction head but are close to

that limit that they get a wearing of the impeller that of course degrades the performance over sufficient periods of time. And I'm just wondering when you set your acceptance criteria for having adequate net positive suction head do you take into account this impeller wearing effect in setting that acceptance criteria?

MEMBER BANERJEE: Do you understand the point, Mike?

MR. SCOTT: Yes, I understand the question. I don't have the answer to it.

MR. DURHAM: We'll see if --

MR. SCOTT: It looks like one of our staff members, Steven Smith, is going to come up and provide an answer.

MR. SMITH: Yes. We compared only against the required net positive suction head. I've been in some of the meetings where some of the other NRR folks have discussed the potential wearing that can occur with up to maybe 1.6 times required. We only compare against the manufacturer's net positive suction head which would be basically one time. So we don't take that into account.

MEMBER POWERS: Having learned about this stuff should we?

MR. SMITH: I think this is something new that we have to consider.

MEMBER POWERS: Yes.

MR. SMITH: This problem was before we knew about this phenomenon.

MEMBER POWERS: I understand.

MR. SMITH: So we haven't incorporated it into our guidance.

MEMBER POWERS: It seems like I would put that on my to-look-at list.

MEMBER BLEY: And that would include coordination with the other folks we met with because as I recall they had on their ticket to try to investigate the length of time it might take to get to any substantial damage or degradation under those conditions. So I think if you guys would work together that would be --

MR. RULAND: Since -- This is Bill Ruland, Division Director from DSS. Both of these organizations work for me.

So we will do whatever coordination we need to do. Without belaboring the point of getting to discussion about the erosion rates and those kinds of things, we'll factor that in.

MR. SCOTT: It's a fair question to ask.

Something to bear in mind here is that there are many subparts of determining acceptable performance for this issue and there is a viewpoint in the industry that the staff expects conservatism in each and every one of them and I'll talk about that a little bit. But what we try to do here because we know the difficulty of this issue is to reach a holistic conclusion and this would be potentially an input to that review.

MEMBER POWERS: I suspect, I'm just guessing, those plants that you think are resolved will be resolved even in the 1.6 kind of criterion. Those that are in trouble will be in trouble even at the 1.0 criterion.

MEMBER BANERJEE: I suspect, Dana, that you -- That is correct. Those who make it probably make it.

MEMBER POWERS: Big time.

MEMBER BANERJEE: Big time. Those who don't, don't make it big time. So I think this is --

MEMBER SHACK: Binary decision-making.

MEMBER BANERJEE: All right. Let's go on, Mike.

MEMBER CORRADINI: Can I just ask one other thing since I think Dana's point is well taken

here. Is there anything on the staff's side to look at the zone of influence and decision if adequately conservative is potentially highly conservative or analyzed in that regard in terms of source term of debris?

MR. SCOTT: One of the actions that's the Staff Requirements Memorandum put on our plate was to -- Let me get the words exactly right here. Determining the realistic zone of influence and the need for additional testing.

MEMBER CORRADINI: Okay.

MR. SCOTT: So there is actually -- You could resolve that in a couple of ways. One is to let the industry do it which they are working on. And the other is to sponsor it ourselves.

MEMBER CORRADINI: Okay.

MR. SCOTT: I believe that either way that's a significant amount of time involved to get to the endpoint on that, if we're going to change the ones we have now. I believe the staff would support the following view.

We don't believe when the final answer is obtained that we're going to see a much smaller ZOI than we have now. That's just our view based on what we know about the current situation and what we've

observed from observing the testing and reviewing the analysis that the industry has proposed. Our belief is that we're not going to end up with a 90 percent smaller volume or anything close to it. But that's not a final.

MEMBER POWERS: I mean because it is a spherical zone of influence it doesn't take much smaller to change loading by quite a bit.

MEMBER CORRADINI: Yes. That's what I --

MR. SCOTT: I understand that, recognize that. We don't believe they're going to end up being a lot smaller than they are now. But that's to be validated.

MEMBER BANERJEE: Mike, ACRS looked at this in a fair bit of detail and there is a lot of documentation available. And if anything they went the other way. And there is a lot of stuff around which I can make available to you. This was before I was on the Committee.

MEMBER CORRADINI: Right.

MEMBER BANERJEE: My predecessors took a very close look at this.

MEMBER CORRADINI: To the extent though that I think the staff is looking at or deciding to have the applicants look at essentially what Dana said

that was learned from the BWR community I think to look at this to see how far you are from -- it's still worthwhile to at least review.

MEMBER BANERJEE: But again look at the evidence. If anything it's the other way unfortunately.

MR. SCOTT: And that's sort of a similar perspective to our own.

MEMBER CORRADINI: So one other question. The plants that -- the 39 versus the 30 to use that -- mainly got it by replacing insulation or mainly got it by increasing area or some combination of the two.

MR. SCOTT: I would say it would be most accurate to say some combination of the two. Those plants that started out with low amounts of fibrous insulations which means high amounts of reflective metal insulation had a relatively easy time with this issue. Some plants recognizing the challenges posed by the high amounts of fiber have made or are going to make the changes to RMI.

However, it is also correct to state that some plants that have a fairly significant amount of fibrous insulation have shown adequate strainer performance. There are a number of different strainer designs out there. There are many different sizes of

strainers. The plant configurations are very different one to another. This is an extremely plant-specific issue.

MEMBER CORRADINI: Yes.

MR. SCOTT: So it's difficult to get to one.

MEMBER CORRADINI: So it's not fair to say -- Then it wouldn't be fair to say that going more to RMI type, the non fibrous insulation, is a way out of this from a practical modification standpoint.

MR. SCOTT: I think that modification by removing fibrous insulation and replacing it with reflective metal is a way out of this problem.

MEMBER CORRADINI: Okay.

MR. SCOTT: That entails cost obviously. Financial cost. And exposure to cost that were spoken to at the April 15th Commission brief and are reflected in this Staff Requirements Memorandum that we are to take a look at.

MEMBER CORRADINI: Thank you.

MR. SCOTT: We don't, of course, direct any particular solution.

MEMBER CORRADINI: Sure.

MR. SCOTT: We simply say you need to show adequate performance and with an adequate test and an

adequate method of evaluating it and once you have your methods down then your results tell you what you need to do. And there are sometimes options and removing insulation is not the only option, although for some plants it may be the only real practical one.

But I don't want to leave you with the idea that you can't succeed at this issue unless you get rid of all your fibrous insulation because there are plants that have succeeded while not removing much or all fibrous insulation.

Okay. The next issue in-vessel effects. I talked a little bit about this before. We had Revision 0 actually submitted in 2007. ACRS had concerns with it. Staff asked questions about Revision 0. And that ended up sending in, the Owners' Group sent in Revision 1 for our review of this topical report.

And we had questions about that. And so we sent those out to the industry and they have subsequently responded. We pushed them to do additional testing. A limited amount of testing had been done and this is sort of similar to the strainer testing in that obviously you can't test in the plant. So you take a mock-up of a fuel assembly. You put it in a test rig. And you run debris up against

basically the way the debris would come in through the ECCS system into the test rig and evaluate the head loss against criteria for the fuel for the vendor fuel types.

So there has been a substantial amount of testing. Now the testing -- And again we're going to verge here on proprietary. So I may have to say separate discussion here. But I'll go as far as I can here.

There are two vendors of fuel in the United State for PWRs, Westinghouse and AREVA. And the testing initially focused on Westinghouse fuel and there was an assumption I think on the part of the Owners' Group and even on the staff's part that the vendor fuels would behave the same way or very similarly and that based on the test results that were obtained for AREVA in 2010, early 2010, that did not turn out to be the case. So that's the latest hurdle that has been put in the way of resolution of this issue.

Most parties believe that the difference in behavior between fuel types is related to the design of the fuel. But there are enough uncertainties about that especially given the fact that the two fuel types were not tested in the same

facility that the staff strongly advised the Owners' Group to run what we call a cross test. Take one guy's assembly and put it in the other guy's test rig and see what happens.

One of the vendors has agreed to do that. The other has not. And we are currently discussing at a management level that situation.

CHAIR ABDEL-KHALIK: Discussing is a good idea.

MR. SCOTT: Discussing it in a management level.

CHAIR ABDEL-KHALIK: No.

MEMBER CORRADINI: Because that's a foregone conclusion.

CHAIR ABDEL-KHALIK: The cross testing. This is not a joke.

MR. SCOTT: I understand.

CHAIR ABDEL-KHALIK: Is that a good idea? Can you assure the integrity of these experiments when self-interest is involved?

MR. RULAND: Typically when these tests are performed, when they were originally performed, the NRC staff observed these tests. And it would be the intention of the NRC staff to observe any cross test that would be performed. So we'd be taking

whatever precaution. We believe we're independent and we've demonstrated that in the past. And so what observations we make will be the observations we make about the tests.

VICE CHAIR ARMIJO: Are you convinced that the reproducibility is established in the test? Let's say one was satisfactory. One was not. That the satisfactory one was done more than a few times would give you reproducible results. I'm not so sure.

MR. SCOTT: There were a number of tests done for each of the vendors. So, yes, we are --

VICE CHAIR ARMIJO: So you have real confidence that they really are behaving differently either because of the test setup or the design of the fuel or some combination of that. But there are really two different results that were kind of unexpected.

MR. SCOTT: Well, let me go back a little further and this will address your question further. As I think Bill Ruland said, we have closely evaluated, observed, the test rigs which are substantially identical. We tasked the Owners' Group with coming in with an evaluation of the differences between the test rigs, again, from the perspective of identifying whether it is in fact a design issue which

they claim, they the Owners' Group, or whether there's a possibility that there is a test issue impacting this.

And they came in with a few minor differences and we've considered those. We believe as they believe that it is likely a design difference. But we are not --

VICE CHAIR ARMIJO: A fuel design difference.

MR. SCOTT: Yes. I'm sorry. Yes. A fuel design difference. But we would like to reduce the uncertainties involved with that by running this cross test to in fair part take the question off the table as to whether there is an undetected, an unknown unknown difference between the test rigs that's causing this impact. We don't think that's what it is. But we want to eliminate it as a source of uncertainty.

VICE CHAIR ARMIJO: Will we ever review this at this level of detail the kind of fuel testing that's done?

MEMBER BANERJEE: Of course.

MR. SCOTT: Yes, we will be coming before you I believe in -- the last time I heard it was October-ish of this year, again, assuming that this

issue gets resolved and we can go forward with the safety evaluation. We do have a draft safety evaluation, but it has open items in it awaiting resolution of this question, particularly this question.

We're not fully comfortable with where this is. Again, the data shows one thing, but we want to be largely confident that there's no test issue here, test configuration issue. So assuming that the Owners' Group eventually manages to work around to agreeing and the vendors involved to agree to run the test, then we will I believe taking a look at the test plan and we'll be observing the test and we've already observed the test rigs. We believe they're very similar.

MEMBER BANERJEE: Again, if you want more details at the end we can close the meeting and they can tell you more about that.

VICE CHAIR ARMIJO: Yes. I would like to find out.

MR. SCOTT: Okay. So our goal is to have a safety evaluation out in 2010. The current timeline makes that's very challenging because we're coming to you with a draft safety evaluation out in the fall sometime and then there needs to be time for your

review and your letter. So trying to get all this done by the end of the year because of what's transpired will be very challenging. But that's still our goal.

MEMBER BANERJEE: There are always surprises.

MR. SCOTT: Yes. And that's the nature of this and look at the bottom bullet of this slide. There it is. Every time we turn around there are surprises.

So why is this issue so -- Why is it still around a decade after, over a decade from, when GSI-191 issued? Why are we still here? This slide speaks to some of that.

There are numerous phenomena involved. We talked about some of them, the debris generation itself, zone of influence assumptions, how you characterize the debris, how do you treat latent debris, you know, the debris that's in the plant and not necessarily in the insulation on the piping, how is it transported. I talked about some licensees have attempted to credit settlement of debris in the test flume, but then the burden is on them to show that that settlement is representative of what would actually happen in the plant. And that's proven

challenging.

Strainer head loss and vortexing. There are various calculations involved there in the testing itself. Chemical effects that we talked about with the Committee a number of times. I think we believe we have a handle on that now and despite our expectation a couple years ago the chemical effects would be the long pole in the tent so to speak. GSI-191 we don't currently see that as the case. Licensees know how to evaluate it and they are evaluating it. And then there's the in-vessel effects issue.

It's also a problem and I referred to this earlier because there are no reliable models for some aspects of the problem. It would be very useful to us to have models. We have attempted to develop some over the years, but we have not had substantial success in developing models because of the complexity of this issue. It makes it very difficult to predict what any delta in the conditions is going to have as an impact on the problems.

A little bit goes a long way. That's bullet number three. Small amounts of certain materials make a big difference potentially to the strainer performance. You have a slowly increasing

head loss and add a little more debris and you continue to see a slowly increasing head loss. And then you get your filtering bed and the head loss goes way up. And that point is difficult to predict.

And the last bullet that I mentioned before and that Dr. Banerjee referred to is that we've had all kinds of surprises. Our initial expectation in a number of aspects of this problem have not been born out. And that has caused us to have to come up with plan B and plan C and so on.

MEMBER POWERS: I presume that you would be suspicious of massively parallel computer calculations of this particular --

MR. SCOTT: Well, that would certainly need a lot of validation.

Because there's not a good track record with that in the past. But if you have something in mind.

MEMBER POWERS: Yes. The ability to test facilely.

MR. SCOTT: Dr. Banerjee mentioned we had a simple graphic here on our review and closure process. And here's the good news. This process works and the previous processes did not. I mentioned that in 2008 we got the supposedly final supplemental

responses, reviewed them, had a number of issues with them, issued RAIs and the licensee responses came back and we looked at them and in many cases they did not answer the question that was asked. And in fair part we attribute that to the degree of difficulty of the technical issue involved here.

So we came up with, okay, this isn't working. Now what are we going to do? So we basically came up with what we call the interactive review process and the interactive review process is somewhat resource intensive. But it basically required the licensee and the staff to sit down over the draft RAI responses and review them in detail and carefully record any issues that exist with those draft responses. So then when the licensee sends in the final responses there's a high confidence factor that the staff will find them acceptable.

We've done that. It works. It results in challenging all-day phone calls or even more than one day, day and a half calls, and face-to-face meetings. It is bringing these plants to closure one at a time. And again closure with an asterisk because of the in-vessel effects issue.

The other somewhat different approach that we have taken to try to reach closure here we refer to

on this slide as Integration Review Team. The industry has stated at various times that the staff is piling conservatism on conservatism in its review of this issue. I talked about all the various review areas. Debris generation, debris transport, heat loss and vortexing, NPSH, every one of those areas has a staff reviewer who does a detailed review of it. We have put a rather large level of detail into our review here because of the factors that I talked about on the previous slide.

So the assertion has been made that you staff people you want them to be conservative in each and every area. And if they're conservative in each and every area, then the end result is hugely conservative. And this was the assertion that was made in the April Commission brief.

Over a year ago, I think actually two years ago, we recognized the potential for that to occur and so we instituted this IRT or Integration Review Team. And what that involves is after the staff has done their detailed reviews and generated proposed RAIs, then the IRT which is made up of three senior level people here on the staff not directly involved in the reviews, but nevertheless knowledgeable about the sump issue, sit down as a team

and review the staff's inputs in each of the areas that I talked about of which there are actually a total of about a dozen. And then the IRT weighs whether given the conservatisms and the potential nonconservatisms and uncertainties whether the licensee has shown that its strainer performance is adequate. And then it was intended to take the excessive conservatism piece off the table.

This process also has worked, although it has limitations. It works well when the licensee reduces the number of open questions or unresolved RAIs to a very small number such that it is clear to this objective team that overall the strainer performance evaluation is conservative and therefore the strainer performance can be relied on. In those situations, it works. It has worked again and again. We have considered plants done with this even though there are some potential nonconservatisms or uncertainties in their resolution.

On the other hand, if a licensee has 35 or 40 questions about their strainer performance and the staff would not be asking these questions if we didn't think they were potentially significant, it is very difficult for the staff to then balance those 35 or 40 against the 35 or 40 conservatisms and conclude, yes,

they're done. Remember no model here. So it's very difficult to make that balancing act if they have a lot of questions.

We use as shown in this graphic the processes in concert. We use the interactive review process to reduce the number of open issues to a small number and hopefully small and less significant and then we can use the IRT to say, yes, there's done. And this process does work. And it has worked. That doesn't mean however if the plant has a large amount of fibrous insulation that this is an automatic path to resolution with the plant in its existing condition.

Recent developments. As we talked about, we briefed the Commission on GSI-191 on April 15th of this year. Licensee -- there were three stakeholder people Licensees were two of the three and the stakeholders came in basically and said to the Commission that their view is that GSI-191 is no longer a safety issue and that the staff is in pushing for near-term closure of this issue with consideration of, for example, our rejection of the ZOI reduction reports that are push for closure would result in -- well, the statement was made -- replacement of effectively all the fibrous insulation at some of

these plants. Now, we don't necessarily believe that to be the case, although some plants might indeed need to take it all out. And as a result there would be a large radiation exposure to plant personnel. Those statements were made to the Commission. And the Commission has subsequently asked us to evaluate those and we are doing that.

Another activity that occurred or another proposal that came in right about the same time as that Commission brief was a proposal that the staff allow application of leak-before-break to sump performance evaluations. And I'll talk about that specifically in an upcoming slide.

So we got the staff requirements memorandum that I believe Dr. Banerjee said he provided to all of you. We are tasked to report to the Commission by August 27th of this year on a number of aspects and approaches to closure including the realistic ZOI that we already talked about, the application of GDC-4 which we will talk about, how we resolve in-vessel effects, to what extent we can risk-inform the resolution and that discussion includes the proposed 10 CFR 50.46(a) rule, alternative regulatory treatment of in-vessel effects which we have interpreted to mean the potential for carrying that as

a separate issue and resolving it separately from strainer performance.

MEMBER CORRADINI: Can you say that again? I didn't understand that phrase. So what do you interpret that to mean again? I'm sorry.

MR. SCOTT: Alternative regulatory -- In other words, split this out as a separate issue.

MEMBER CORRADINI: Okay.

MR. SCOTT: I'm sorry.

MEMBER BANERJEE: In other words, close off.

MEMBER CORRADINI: Declare a victory and then declare a new problem.

MEMBER POWERS: And start over.

MEMBER SIEBER: Right.

MR. RULAND: Hopefully we wouldn't have to start over.

MEMBER BANERJEE: I don't think the staff is going to go for that. Carry on.

MEMBER CORRADINI: I just wanted to understand what it meant.

MR. SCOTT: That's our interpretation.

MEMBER CORRADINI: Okay.

MR. SCOTT: And then I already talked about the dose impact. Again, assertions were made

that a large dose would be incurred to remove insulation on the assumption that you have to remove it all. So we've been tasked to evaluate that as well.

We are developing requested information and we'll be obviously making a recommendation to the Commission in late August. So that's what we're all about right now.

The other thing that's actually not mentioned in here is that the staff requirements memorandum says continue working the plant specific issue resolution process that we're already doing. So while we're working on this -- While a fair number of the staff are working this SECY paper to provide the options and the recommendations to the Commission, the others are continuing to work with the plants and we are continuing to achieve closure of them one at a time.

MEMBER BANERJEE: Are you going to say something about the last error in the SRM, first, with regard to the BWRs but of course that's not all that important? But that cryptic statement should consult with CRGR as appropriate to assure compliance with the backfit requirements. What does that mean in your view exactly?

MR. SCOTT: That was an expression of sensitivity to whether we have gone beyond the point where we should be consulting with CRGR before we pursue our current path on issue resolution. In other words, the CRGR was consulted back in 2004 for the generic letter. Have we gone beyond that because additional issues have come up that are briefly referred to the generic letter but whose significance was not known at the time of the generic letter? And now chemical effects have been found to be a problem. In-vessel effects have been found to be a problem. And we have not gone back to the CRGR since 2004.

So there is a sensitivity here as to whether we should do that. And so we are in fact going to consult with the CRGR and baseline ourselves as to where we are now with regard to backfit.

MR. RULAND: Mike, could you explain just a little bit about what CRGR is and what its role is?

MR. SCOTT: Okay. I'm sorry. The CRGR stands for the Committee to Review Generic Requirements which is intended to provide appropriate oversight of staff attempts to backfit onto the industry.

MEMBER CORRADINI: So that means -- I'm still not sure that some of us appreciate this. So

what?

MR. SCOTT: I guess the bottom line is we will go to the CRGR and we will ask them for their input on whether we need to be invoking the backfit rule for 10 CFR 50.109 which contains requirements for analyses for the staff to proceed along a given path that we proposed to take that could potentially result in licensees having to making plant changes.

MR. RULAND: In simple terms, if a requirement -- there are certain exceptions to the backfit requirements to do cost/benefit analyses and those exceptions typically are you don't have to do a cost/benefit analysis if it's required for compliance or if it's required to assure reasonable assurance of adequate protection. Otherwise the staff is required to be able to show that it is a substantial safety benefit to backfit a licensee for a certain set of modifications.

So what was posed to us we believe in this question is given all the modifications that have already taken place are we now at a point that we need to relook at the backfit rule and whether or not additional modifications vis-a-vis dose and cost associated with insulation whether the backfit rule is in play now. So staff to make sure that we're still

on solid ground we're going to meet with the Committee to review generic requirements prior to the Commission paper going out.

MR. SCOTT: Just for additional perspective Generic Letter 2004-02 was issued under that backfit compliance exception that Bill Ruland is talking about.

MEMBER CORRADINI: So just to be clear, following the instructions from the Commission or the Commission directive, it would go back. It would get looked at. Then all current changes that have been already instituted will be added up compared to what might have to be done to determine whether you have to essentially to relook at the backfit.

I don't -- I understand what you're said. I'm just trying to understand how this all plays out.

MR. RULAND: Exactly how this is going to play out is something we're going to have to develop.

MEMBER CORRADINI: Okay. Thank you.

MR. RULAND: Basically the staff is going to develop a strategy about how we're going to answer this question. And it would be premature at this point for us to say how we're going to answer it.

MR. SCOTT: But those changes that have been made to date have been made. So the question is

this whole series of question exist because the staff took a view in early 2010 that we needed to bring this issue to closure for all the licensees. And we took a strong point of view on that and considered various regulatory paths forward that were of concern and that potentially could result in additional plant changes. And the Commission has asked us to provide them as you can see from these information points here. They've asked us to provide them the information for them to make a policy decision as to whether the path the staff took before or some other path would be the best one to go forward. And this backfit is a part of that.

MEMBER CORRADINI: Thank you.

MR. RULAND: Just if I mean, Mr. Chairman, just add one specific item to this matter. The staff was intending to use a certain type of letter that's in license conditions in 10 CFR that would require licensees to respond to us about how they were going to bring this to closure. And those letters were drafted and we were moving forward with those letters. And we even described that approach in the Commission meeting.

And the reason we were taking that approach is we were asked by our management we want to

get this thing, attempt to get this issue, closed in 2010. And that was our vehicle to do this.

MR. SCOTT: And it's actually specifically addressed in the staff requirements memorandum. Those are -- The rule that he's referring to is 10 CFR 50.54(f) and the second paragraph of the SRM says, don't do that until you get further direction from the Commission. So we are holding those up awaiting that direction. And there's a process to clearly go through to get there.

MEMBER CORRADINI: Thank you.

CHAIR ABDEL-KHALIK: What is ACRS' role in responding to or evaluating or reviewing whatever you come up with on these issues?

MR. SCOTT: The ACRS has no specified role in the SRM. I'm sure I'm not telling you something you don't already know. Clearly, you can write a letter on it if you choose.

CHAIR ABDEL-KHALIK: Okay.

MR. SCOTT: I think we've talked about this one. Moving on.

CHAIR ABDEL-KHALIK: So does the time line allow for you to present sufficiently detailed and well formulated answers to these various issues for ACRS review to afford us the opportunity to comment in

writing on your response?

MR. RULAND: No. We have a very short time line for this Commission paper that the Commission has imposed upon us. And if you work backwards, it's the end of August. So basically the end of July this has to be in concurrence which essentially means by the end of this month the staff will have completed the formulation of our response.

CHAIR ABDEL-KHALIK: That, of course, does not prevent us from commenting after the fact.

MR. RULAND: That's correct. Thank you, Mike.

CHAIR ABDEL-KHALIK: Thank you. Please continue.

MR. SCOTT: Okay. Where are we? A lot of this we already talked about. Thirty-nine of 69 are basically done. That number goes up two or three plants a month. However, we are getting down to the challenging plants here. So it may be one of those asymptotic kind of curves.

MEMBER RAY: Excuse me. This doesn't include certified designs that are --

MR. SCOTT: No. This is only existing operating reactors.

MEMBER RAY: Yes.

MR. SCOTT: We are closely integrated with new reactors. They sit in on our meetings. We are sending a person to observe a foreign strainer test in support of their work. So we are integrated with them, but it's a separate proceeding.

MEMBER RAY: Well, what everyone said about time lines is of some interest to me in particular because of new reactors.

MR. SCOTT: Right.

MEMBER RAY: So I was trying to get at whether you were focused on that at all. It sounds like that process is just observing what you're reporting to us today.

MR. SCOTT: Is there someone from new reactors in the audience that would care to speak to this?

MEMBER SIEBER: No.

MEMBER RAY: I asked but they don't want to speak to it. That's okay.

MEMBER BANERJEE: You don't want to put them on the spot right now.

MR. SCOTT: So clearly as you're aware the sump performance issue is being evaluated by new reactors people and I believe for some of the plants it is one of the more thorny issues to address. But

I'm really not prepared to go much beyond that other than to say we talk to them a lot and they talk to us a lot.

MEMBER RAY: Okay.

MR. SCOTT: I think that would be a separate briefing.

MEMBER BANERJEE: In the interest of time, we might need to take that up separately.

MEMBER RAY: That's fine. I just want to be clear.

MR. SCOTT: Okay. I think all the rest of the bullets on there we've talked about. Refinements. We've talked about -- Refinements are sort of a word that I tend to use to talk about we're not real happy with the assumptions that are made and the evaluation methodology. How can we change them to remove conservatisms because that's what these refinements are about?

We talked about the jet impingement testing, the third bullet, already. I said we would talk about leak-before-break and 50.56(a). So to talk about leak-before-break, I think we already mentioned that the industry proposed that we reconsider GDC-04 application to some performance evaluations.

What you see in the second bullet is a

literal quote from the regulations regarding application of leak-before-break. This has been sought in the past with regard to treatment or use for sump performance evaluations and the NRC has twice previously rejected it. We took the position that the credit sought was not consistent with the Commission's intent when it approved the rule. And so we denied it.

Now in 2010 the industry has come in again to ask for this approval. And as you know it's in the Commission's staff requirement memorandum. So we will be reporting to the Commission on it.

Why have we in the past had concerns about it? The original intent was to allow removal of specific equipment, pipe whip restraints, whose presence was adverse to being able to adequately inspect the pipes and whose presence was not considered to be necessary.

If credit for sumps were allowed, it would remove some break locations from consideration for sump evaluations. That's good potentially for licensees that have fibrous insulation remaining to the extent they can take some of those insulation configurations off the table for this issue.

MEMBER CORRADINI: So can you just

illuminate for some of us that don't have background why some because of where the pipe restraints are relative to the break location? I don't understand why it's some.

MR. SCOTT: It says some break locations. Okay.

MEMBER CORRADINI: Yes.

MR. SCOTT: In order to -- And you'll mine my database pretty quickly here. But in order to achieve credit for LBB the licensee must provide assurances that in fact it will be validate that there will not be a break. High confidence there will not be a break. And so they need to get that. They need to submit that to the Commission for approval to have credit for it. And it's somewhat plant-specific, although there are limitations on it.

VICE CHAIR ARMIJO: But I thought that was really dependent on the properties of the material, the ductility in the material that defined whether you had a leak-before-break situation or a brittle.

MR. SCOTT: The material is part of it. The inspection requirements are part of it and geometry.

MR. RULAND: And whether there is an active degradation mechanism that hasn't been fully

addressed.

VICE CHAIR ARMIJO: Yes, like IGSCC, PWSCC.

MR. RULAND: Right.

VICE CHAIR ARMIJO: That's been -- Those have been the reasons why we had pipe cracking and I'm just wondering what is the industry trying to say. Just that would just reduce the number of locations that they could possibly exclude from this risk.

MR. SCOTT: That's correct.

VICE CHAIR ARMIJO: Or it would reduce the size of the break.

MR. SCOTT: No, they would take some breaks off the table. And it is depended on the size of the pipe.

VICE CHAIR ARMIJO: Sure.

MEMBER CORRADINI: So the basis by which you rejected this one and they tried this twice before was?

MR. SCOTT: It was we looked at the statements of consideration that the Commission had issued with the regulations and based on our views of what the Commission intended which again it was almost like removing those pipe restraints was almost a guaranteed safety benefit. And this is not a

guaranteed safety benefit. You could argue that it is removing some defense-in-depth and that was the staff's view of it. And the staff looked at the guidance from the Commission and concluded that was what the Commission had in mind and the staff had concerns about it as well and therefore we did not accept it.

MEMBER BANERJEE: Mike, there is also, I mean, for your information letters from various groups who show that things have leaked and nothing has been done and there's all sorts of issues here which I think the staff's position is fairly extensive.

MEMBER CORRADINI: I understand. But the staff position -- I understand that I guess, but the staff position is there was no accrued safety benefit from this request. Whereas in the piping restraints there was an obviously accrued safety benefit. Is that what -- I want to make sure --

MR. SCOTT: I guess that's a fair way of saying it. Yes. I believe that would be adequate.

MR. RULAND: In addition, the staff believes that at this point if you were to use credit for leak-before-break it is a policy issue that would have to be approved by the Commission.

MR. SCOTT: And clearly this SECY would be

a vehicle for that to happen.

MEMBER CORRADINI: Okay. Thank you.

MR. SCOTT: So we are evaluating this. We also -- In addition to getting the input from the Nuclear Energy Institute we got an input from the Union of Concerned Scientists with a somewhat different view and we're evaluating that, too. And we're taking a look at it from the staff's experience with this issue, as was referred to the various material issues that have come up over the past few years, and taking all that into account. And we will make a recommendation to the Commission on this and all the other items that are out there.

Obviously, since we've rejected it twice for what we thought were good reasons at the time it's not a trivially-easy matter to approve it at this time. But we are taking a fresh look at it.

Now I'm going to talk about 50.46(a) which is the risk-informed ECCS regulations that are approaching final rulemaking. The existing regulations, of course, require evaluation of a double-ended guillotine break of the largest pipe in the RCS as a design basis LOCA accident. And it must include, you see, the things on the slide here, assumption of loss of offsite power, worst single

failure and credit only for safety-grade systems. The last one kind of tends to be key in this discussion which we'll talk about.

The proposed risk-informed regulations would change the side of the largest pipe break that must be evaluated as a design basis LOCA which is referred to as a transition break size. For breaks larger than that, the evaluations could be performed with realistic inputs, no longer require assumption of a single failure, without assuming loss of offsite power and taking credit for non-safety equipment.

How can this play out in the sump problem? One example would be sump plants have a backflush capability that's non-safety grade. And so there would be potential here incorporating that. So there is potential use to the licensees if this rule is issued and I think my next slide speaks to the --

MEMBER BANERJEE: So the break size is not going to make a huge difference. It would be primarily the non-safety grade equipment used from what I can see there.

MEMBER SIEBER: Right.

MR. SCOTT: You may well be right with that. There is already a risk-informed alternative to the deterministic evaluations in our safety evaluation

that we issued in 2004. So this was already open to the licensees. Now there are some differences between where this proposed 50.46(a) would go and where the previous rule or previous guidance went with regard to that subject.

The exact amount of benefit that this would have for the licensees (1) is plant specific depending on the plant situation and (2) is under current discussion within the staff. So I can't convey to you a staff position today as to our views on the usefulness of this. I may be useful for some licensees.

You may be interested to know that the industry having suggested leak-before-break to us, having heard the subject of 10 CFR 50.46(a) come up at the Commission meeting, sent another letter and said we think that LBB is the better choice here because it's much nearer term than would be this new proposed rule. Although it says here on the slide the staff expects to send a proposed rule to the Commission in December of this year, the final rule, the question remains as to whether there would be need to be implementation guidance. And again there are differing views on that subject that we're trying to work out now within the staff.

VICE CHAIR ARMIJO: I just want to make sure that I understand. One of the numbers I've heard on the transition break size for the 50 --

MEMBER BANERJEE: Fourteen inches.

VICE CHAIR ARMIJO: It's 17 I heard. But let's say it was 17 versus a 28 inch pipe. That surely would have a huge difference on the zone of influence, wouldn't it, and the amount of debris generated?

MR. SCOTT: Yes, potentially so. But here's one of the issues that comes up. There has been a -- Licensees tend to -- Or maybe it's licensees, maybe it's industry, tend to take the view that if we can fix the double-ended guillotine break assumption here, that we'll get done with this strainer problem and we can declare victory. The problem is as I referred to several times earlier in the presentation a small amount of this debris can go a long way.

VICE CHAIR ARMIJO: Yes.

MR. SCOTT: And so it is possible that a large-small break could cause strainer performance issues. So we can't conclude that hey, if we can just take double-ended guillotine break off the table, we're done. We're not prepared to go there. And

again there are voices who say, this is not a safety issue anymore. You should be walking away right now. We're not prepared to go there.

MR. COLLINS: This is Tim Collins from the staff. The proposed 50.46(a) still requires that licensees demonstrate the ability to mitigate a double-ended guillotine break. It's just that there's relaxed smaller -- in the analysis. So the largest break size would still need to be addressed under 50.46(a).

VICE CHAIR ARMIJO: But I thought the largest --

MR. SCOTT: Potentially not under LBB.

MR. COLLINS: Well, LBB is a different issue.

MEMBER SIEBER: That smaller break size doesn't necessarily mean that a proportionately smaller amount of debris generation because blowdown is extended for longer periods of time and some of the debris generation comes from the fatigue of the components and so forth. It takes some time.

MR. SCOTT: That's a part of the picture. The other part is that that even if it does result in less debris you get this potential thin-bed effect that we've observed. Less could be worse potentially.

MEMBER SIEBER: Depending on the composition.

MR. SCOTT: And depending on the strainer and all these other things. See, that's one of the thorniest parts of this issue is just --

MEMBER SIEBER: Right.

MEMBER BANERJEE: I think we're going to have to keep moving, Mike.

MR. SCOTT: I think we're almost done.

MEMBER SIEBER: Yes.

MR. SCOTT: Okay. So path forward. We talked the uncertainties in strainer performance have challenged closure of this issue for some plants. Again, we're over halfway done. We're approving one or two plants per month moving forward. That rate may drop off especially pending the resolution of the path forward as we talked about with Commission guidance.

The staff believes that inadequate strainer performance can challenge long-term core cooling and maintenance of core integrity. When you take that into account along with the uncertainties that we've talked about we are not to the point of agreeing with the assertion that was made in the Commission meeting of April 15th of this year that GSI-191 is not a safety issue and we should be just

done with it. We would love to be done with it. We're not at that point yet. We are at that point for many plants but not for all of them.

We will continue consistent with Commission direction our successful plant-specific issue resolution process. We believe we have a good process and it's working.

We do need to resolve the in-vessel effects issue. I've talked to you about the challenges that stand in the way of that. We are working as best we can to resolve those and get that in front of you because you will be on our critical path soon for that.

After all of the licensees have received closure letters, then we will close this issue. Our most recent objective had been to close it in 2010. And that will now no longer happen. When we will close it depends on our path forward as determined by Commission direction.

And the last bullet simply speaks to we will close the issue for each plant when they have a good test and evaluation method and they have exercised that method and they have determined from that method what modifications, if any, are needed to the plant to achieve closure and they have made an

appropriate commitment to make those modifications. And then we will track them to closure.

So what I mean by that is we may close. Optimistically we might close GSI-191 in 2011, but some of the plant modifications will go out. Because if you need to replace insulation, it takes multiple outages to do it. Once we have the methods down and the commitments down, then we will declare this issue resolved and will track the commitments until they're all accomplished.

I think we've already talked about all this. So I stand ready to answer your questions.

MEMBER BLEY: How many have you closed?

MR. SCOTT: Without asterisks zero. With asterisks, 39.

MEMBER BANERJEE: Without the --

MR. SCOTT: The asterisks is the in-vessel effect.

MEMBER BLEY: Right.

MR. SCOTT: If you leave that aside, 39 of 69 are good to go.

MEMBER BANERJEE: But if you guessed, if you want my guess, the ones which they've been able to close will also be -- such a big issue.

CHAIR ABDEL-KHALIK: In-vessel effect.

Just a guess.

MEMBER BANERJEE: Maybe not for all.

MR. SCOTT: Just to give you a perspective, we went to Germany two weeks ago to talk to the German, the GRS organization over there, about this issue and the way they resolved it in Germany. Their strainers are significantly smaller than the ones here. And they have actually multiple methods of backflush some of which might be a little hard to buy into here for various reasons.

But their view was that making strainers larger and this is clearly the case. A larger strainer means more bypass all else being equal. And they were worried about the in-vessel effects issue. And so they've taken a somewhat different path. Smaller strainers, backflush capability.

And so it is true that solving the issue on one side may --

MEMBER RAY: Lead to another problem.

MEMBER BANERJEE: But if you have seen the backflush tests which I have they are not all that convincing. This cake falls off and then comes right back.

MR. SCOTT: It does. When you do the backflush --

PARTICIPANT: Also dump it somewhere special.

MR. SCOTT: The actual backflush event itself also increases the bypass, of course. So the German approach is not to do that until they absolutely need to do that. But they do have the capability?

VICE CHAIR ARMIJO: What have the Swedes done? Much of this problem occurred in Swedish plants, the earliest one that I remember. That was in BWRs. Okay.

MR. SCOTT: There has not been a challenging event to the PWRs of course.

VICE CHAIR ARMIJO: Have they modified their PWRs?

MR. SCOTT: I --

VICE CHAIR ARMIJO: Do they have any?

MEMBER POWERS: No, they haven't.

MR. SCOTT: I can't answer that question. That's one international organization we've not met with. We've met with the French, the Japanese. We've been Taiwan and various organizations. But I can't say we've talked to the Swedes.

MEMBER POWERS: They fixed Barseback by closing it down.

MR. SCOTT: I believe they have --

MEMBER BANERJEE: It's more like Salem from what I've seen.

MR. SCOTT: We would like to hear their latest developments. We attempted to arrange a three-party meeting when we went to German meeting. But they were unable to attend.

MEMBER SHACK: The Germans usually leak-before-break, don't they?

MR. SCOTT: They have their own version.

MEMBER SHACK: Their own version of it.

MR. SCOTT: It's not exactly the same.

MEMBER SHACK: Right. It's not the same, but I mean it's not a double-ended guillotine break. Just an offset break.

MR. SCOTT: Yes. Steve Smith, where are you?

(Simultaneous speaking.)

MEMBER BANERJEE: A little earlier you wanted to close the session.

MR. SMITH: The Germans use for the ZOI side they use a 0.1 area, the full area of the pipe of the largest pipe. So it's similar to what we're recommending for the 50.46(a) rule, similar break size, about 11 inch internal diameter.

It depends on if you have a really large loop pipe it might be bigger. And a smaller loop pipe would be smaller. But they ratio the area of the pipe.

MEMBER RAY: Before you go, could I ask. I didn't want to take time on my question about scouring. But could the staff recommend to a read-on reference for this conclusion that we're conservative with regard to scouring? Concrete scouring I'm talking about.

MR. SCOTT: If we have a reference, yes, we will do that.

MEMBER RAY: Okay.

CHAIR ABDEL-KHALIK: We do have ten minutes and if Members wish, we can close this session and hear about the discrepancy in the testing between the two vendors.

MEMBER BANERJEE: The two issues --

CHAIR ABDEL-KHALIK: And there may be another issue also that needs to be discussed in closed session.

MR. SCOTT: The other one you considered was the ZOI test.

MEMBER BANERJEE: Well, one was the ZOI and the other was --

MR. SCOTT: The in-vessel which was what he was referring to.

MEMBER BANERJEE: So both of them now if you --

CHAIR ABDEL-KHALIK: I think that would be appropriate at this time.

MEMBER BANERJEE: Now who is going to make sure that only --

MR. ROACH: I was going to say it may be a problem because we didn't anticipate doing this in advance. So it wasn't --

VICE CHAIR ARMIJO: We've got a lot of folks out there.

MR. ROACH: Also I would say given the variety of folks in the room it's going to take a more than a few minutes to ascertain who can be here and who shouldn't be.

MR. SCOTT: We could take an early break and come back.

MR. ROACH: Unless it's absolutely necessary, I would recommend against it unless --

MR. SCOTT: We will, of course, be coming back to you in the fall to discuss these subjects in detail.

VICE CHAIR ARMIJO: If you have some test

reports or documents that you could just send us we can read it.

MR. SCOTT: I can certainly send you the staff's letter to the industry where we cited our reasons for rejecting the ZOI reports.

VICE CHAIR ARMIJO: That would make me happy.

MR. SCOTT: Okay.

MEMBER CORRADINI: And the in-vessel effects you're still analyzing.

MR. SCOTT: Yes.

MR. RULAND: In addition if I may.

CHAIR ABDEL-KHALIK: One at a time please. Go ahead.

MR. RULAND: Thank you, sir. In addition, the staff has not accepted either of the issues that the industry has proposed, either the cross test or the ZOI. So it's not a question of --

CHAIR ABDEL-KHALIK: That's fine. Given the complications we will forego the closed session option at this time. So it's still in your hands, Dr. Banerjee, to find out if there are any additional questions.

MEMBER BANERJEE: That's up to the --

VICE CHAIR ARMIJO: I would still like the

documents whatever your staff letter or whatever, just get copies of that. The status of what your position is.

MR. SCOTT: The ZOI rejection letter is what we can send you.

VICE CHAIR ARMIJO: Yes. Appreciate that.

MEMBER POWERS: That would be useful.

MR. SCOTT: Okay.

MEMBER POWERS: Said, we can just ask for if Mike can come back and it doesn't interfere too much in their pressure to meet the Commission's deadline to give us another informal discussion much like he's done here on those particular items where the session has to be closed.

CHAIR ABDEL-KHALIK: During the July meeting.

MEMBER POWERS: During the July meeting. I don't know how much it interferes when presumably we would look for nothing more than just this kind of informal discussion.

CHAIR ABDEL-KHALIK: And it would be focused and short. But we will discuss offline. It's not a given --

MEMBER POWERS: Thank you, Mr. Chair.

(Simultaneous speaking.)

CHAIR ABDEL-KHALIK: One at a time please.

MEMBER BANERJEE: Okay. Questions. Anybody with any questions?

MEMBER RAY: I got one request outstanding. Sort of like Sam I guess I would like to pursue further the issue of scouring. It came up in another context and the response wasn't very satisfying. So I'm just trying to find out if there's some better information available.

MR. SCOTT: We will get you what we have.

MEMBER CORRADINI: So from a timing standpoint, Mr. Chairman, I don't know whether to address to Sanjoy or to you, the Thermal Hydraulics Subcommittee or the full Committee. I guess it seems to me given the short time line you have laid out which is by the end of June you're going to know what you want to do and then go into concurrence. By the end of July, it will be done with concurrence and it will go into the Commission. The Commission is going to get it in August. Where in that is it logical for us to hear what they're suggesting in terms of their response to the SRM so that we can then if we choose to write a letter, at least, put some sort of some advice on paper?

MEMBER BANERJEE: I don't think we can do

anything that affects their response clearly.

MEMBER CORRADINI: Clearly. But I'm asking where should we enter into it given their rapid need to respond.

CHAIR ABDEL-KHALIK: Let us discuss this issue internally.

MEMBER CORRADINI: Okay.

CHAIR ABDEL-KHALIK: As to how we're going to approach this rather than in this forum.

MEMBER CORRADINI: That's fine. But I do think we have to do something once we see their --

MEMBER BANERJEE: Let's discuss it separately.

MEMBER SIEBER: We'll decide.

MEMBER BANERJEE: But first I'd really like to thank you, Mike. This was very, very -- You gave a very succinct report of what's going on and it was very informative. Liked it a lot and thank you also, Bill. So we are very happy with hearing from you on this.

MR. SCOTT: Thank you. Pleased to be here as always. Would you like me to be available for this follow-on discussion that you're going to have among yourselves in case you have a question for me?

MEMBER POWERS: I don't think it's

necessary.

CHAIR ABDEL-KHALIK: That is not necessary.

MR. SCOTT: Okay.

CHAIR ABDEL-KHALIK: I think we know your time constraints and therefore we will discuss it internally as to what our next step will be. Okay/

MR. SCOTT: Okay.

CHAIR ABDEL-KHALIK: Thank you very much.

MEMBER BANERJEE: Thanks, Mike. And I guess I'll hand it back to you, Mr. Chairman.

CHAIR ABDEL-KHALIK: Okay.

MEMBER BANERJEE: Before time five minutes.

CHAIR ABDEL-KHALIK: Thank you. We will recess until 2:45 p.m. At that time we will be off the record.

(Whereupon, at 2:22 p.m., the above-entitled matter was closed.)

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Presentation to the 573rd ACRS Meeting

ISG-013: "Assessing the Consequences of an Accidental Release of Radioactive Materials from Liquid Waste Tanks"
&
ISG-014: "Assessing Groundwater Flow and Transport of Accidental Radiological Releases"

June 10, 2010

Jean-Claude Dehmel (NRO/DCIP/CHPB) &
Hosung Ahn (NRO/DSER/RHEB)

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Introduction (1/2)

- ISG-013 Purpose (SRP 11.2, BTP 11-6, and SRP 2.4.13)
  - Justify the selected tank and tank radioactivity inventory
  - Evaluate tank, tank location, and facility design features that may mitigate the impact of a release
  - Conduct a radiological assessment of the postulated failure of a tank containing liquid waste on surface and ground water
  - Assign TS for maximum radioactivity inventory in tank
  - If facility design or site fail acceptance SRP criteria, applicant can:
    - > upgrade the tank and tank room designs, or
    - > reduce TS limits on tank's maximum radioactivity inventory

- ISG-014 Purpose (SRP 2.4.12, SRP 2.4.13, and RG 1.206)
  - To clarify FSAR 2.4.12&13 radiological consequence analysis in groundwater in order to more efficiently meet regulatory requirements.
  - To reconcile the inconsistencies between the existing guides
  - To provide practical guidance in reviewing:
    - * Base hydrologic condition
    - * Hydrogeologic characterization
    - * Pathways and receptor
    - * Groundwater modeling

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Introduction (2/2)

- Why are these ISGs needed?
  - Guidance difficult to implement based on experience in reviewing ESP/COL applications
  - Current guidance is internally inconsistent between SRP Sections 2.4.12 & 2.4.13 and SRP 11.2 & BTP 11-6
  - Clarify technical guidance and regulatory requirements in applying SRP Section 11.2 with BTP 11-6 and SRP Sections 2.4.12 and 2.4.13 for the review of associated FSAR sections
  - Reconcile differences in existing guides to facilitate applicant‘s efforts in responding to regulatory requirements and guidance
  - Facilitate and expedite the staff’s review of related FSAR sections of ESP/COL applications

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Regulatory Basis

- 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 establish on-site hydrogeologic characters
- 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
  - NUREG/CR-6805, as it relates to the development of conceptual site models
- 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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ISG-013 Interim Guidance

- Proposed ISG-013 clarifies guidance on:

  - Selection of system tank(s) and failure mechanisms
  - Credit for passive and durable mitigating design features
  - Conditions that envelope site characteristics
  - Application of assumptions and level of conservatism
  - Development of radioactive source term for tank(s)
  - Radioactivity transport in ground or surface water
  - Release pathways and offsite exposure scenarios
  - Acceptance criteria and exposure pathways
  - Tank specifications on max radioactivity concentration levels
  - Language used in SER evaluation findings

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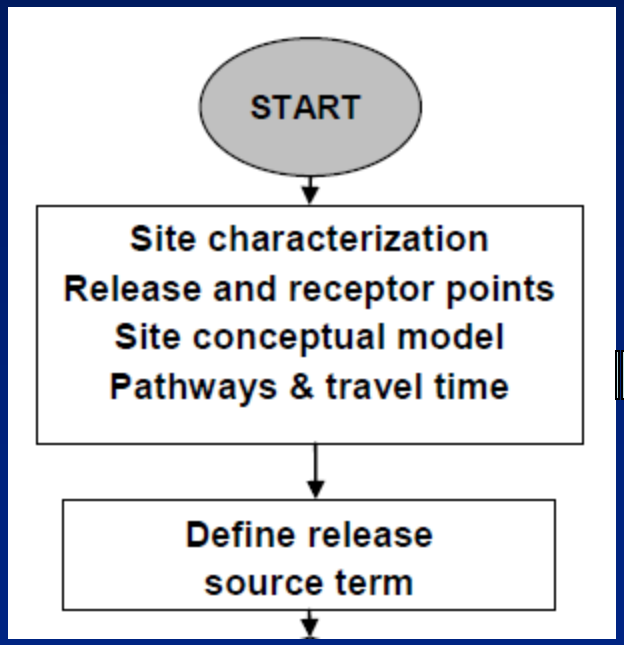
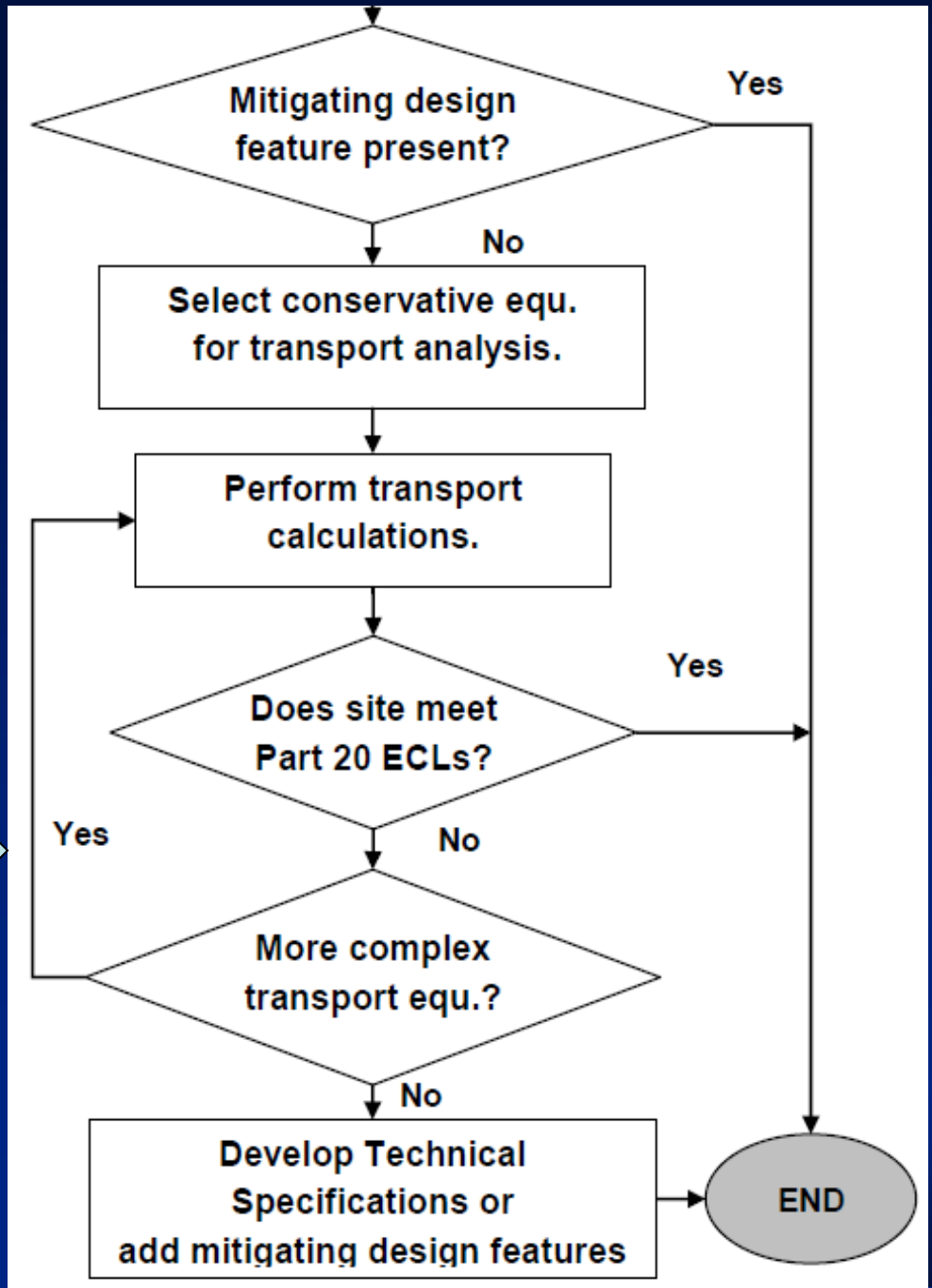
ISG-014: Radiological Consequence Analysis in Groundwater





* ECL: Effluent Concentration Limits

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ISG-014 Topics

- Clarify the review areas and review interfaces in SRP 2.4.12&13
- Reconcile the differences between SRP Sections 2.4.13 and 11.2, and clarify the conservatism in defining a base hydrologic condition
- Provide the guideline for choosing the potential receptor locations
- Credit for mitigating design features in SRP 2.4.13 consequence analysis
- Propose practical guidance to meet the requirement of on-site hydrogeology measurements specified in 10 CFR 100.20(c)(3)
- Provide guidance for developing conceptual site models, and groundwater flow models.
- Recommend a hieratical approach for :
  - Radiological consequence analysis in FSAR 2.4.13
  - Determining species for transport parameter (K_d) sampling, and
  - Groundwater flow modeling

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Resolution and Applicability

- Final Resolution:
  - Reviewing 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
  - Updating SRP Sections 2.4.12, 2.4.13, and 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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Risk-Informed Guidance for New Reactors

Advisory Committee on Reactor Safeguards

Contacts: Donald A. Dube, Office of New Reactors, (301) 415-1483
Sunil D. Weerakkody, Office of Nuclear Reactor Regulation, (301) 415-2870

June 10, 2010

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Meeting Purpose

- **Briefing on the status of risk-informed guidance for changes to the licensing basis, including operational programs, and to the Reactor Oversight Process (ROP) for new light-water reactors**

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Agenda

- **Risk-informed initiatives for new reactors**
- **Status of stakeholder engagement**
- **Evolution of the staff's views**
- **Approaches considered**
- **Next steps**

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Risk-Informed Initiatives for New Reactors

- **In the near term, risk-informed applications have been proposed:**
  - **Risk-Managed Technical Specifications**
    - **Risk-informed completion times**
    - **Surveillance frequency control program**
- **Longer term initiatives (post-COL) may include:**
  - **EPRI research program on risk-informed inservice inspection of piping**
  - **Special treatment requirements (10CFR50.69)**

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New Reactor Implementation Issues

- **Review of these applications raised questions regarding the appropriate risk metric acceptance guidelines for implementation of risk-informed initiatives for new reactors, as well as thresholds in the ROP**

Stakeholder Engagement

- February 12, 2009 interoffice memorandum and white paper from Executive Director for Operations on options for risk metrics for new reactors (ADAMS ML090150636 and ML090160004)
- First public meeting, February 18, 2009, to engage stakeholders and obtain their feedback on the issues and potential options (ML090570356)
- 2009 Regulatory Information Conference presentation
- Nuclear Energy Institute (NEI) white paper to the ACRS staff, March 27, 2009 (ML090900674).
- ACRS briefing on April 3, 2009 (ML091030667)
- ACRS Subcommittee on Reliability & PRA briefing on June 2, 2009, with views from industry representatives and the Union of Concerned Scientists (ML092040138)
- Second public meeting, September 29, 2009, that focused on the potential issues associated with the ROP (ML092780211)
- Staff presentation at American Nuclear Society 2009 embedded topical meeting, November 17, 2009
- Third public meeting, June 3, 2010, that summarized the draft Commission paper

Evolution of Staff's Views

- **No early staff consensus on approach**
- **Initial staff concerns with risk acceptance guidelines for changes to the licensing basis (Regulatory Guide 1.174), and potential options (*relative* versus *absolute* change in core damage frequency (CDF) and large release frequency (LRF))**
- **More recently, less concern with numerical guidelines and more on**
  - **"Assuring that the level of enhanced safety believed to be achieved with this design will be reasonably maintained"**
  - **The implementation of 50.59-like process for new reactors**
- **Staff consensus on high-level approach across the agency including all regions**

Staff Requirements Memorandum on SECY-90-377

- The Commission approved a process similar to 10 CFR 50.59 for making changes to Tier 2 information between combined license (COL) issuance and authorization for operation
- The Commission stated that "the staff should ensure that this process requires preservation of the severe accident, human factors, and operating experience insights that are part of the certified design"
- Under Part 52, the process for changes and departures for each certified reactor design is found in Section VIII of the appendix that contains its design certification rule

Statement of Considerations for ABWR Design Certification

"The Commission recognizes that the ABWR design not only meets the Commission's safety goals for internal events, but also offers a substantial overall enhancement in safety as compared, generally, with current generation of operating power reactors…The Commission recognizes that the safety enhancement is the result of many elements of the design, and that much but not all of it is reflected in the results of the probabilistic risk assessment (PRA) performed and documented for them. In adopting a rule that the safety enhancement should not be eroded significantly by exemption requests, the Commission recognizes and expects that this will require both careful analysis and sound judgment, especially considering uncertainties in the PRA and the lack of a precise, quantified definition of the enhancement which would be used as the standard."

Statement of Considerations for ABWR (cont.)

"The Commission on its part also has a reasonable expectation that vendors and utilities will cooperate with the Commission in assuring that the level of enhanced safety believed to be achieved with this design will be reasonably maintained for the period of the certification (including renewal). This expectation that industry will cooperate with NRC in maintaining the safety level of the certified designs applies to design changes suggested by new information, to renewals, and to changes under section VIII.B.5 of the final rule. If this reasonable expectation is not realized, the Commission would carefully review the underlying reasons and, if the circumstances were sufficiently persuasive, consider the need to reexamine the backfitting and renewal standards in Part 52 and the criteria for Tier 2 changes under section VIII.B.5."

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Current Regulatory Guidance for Risk-Informed Initiatives

- **Regulatory guidance associated with risk-informed initiatives for currently operating reactors are based on Commission's Safety Goals (e.g., RG 1.174, 1.175, 1.177, 1.178, 1.201)**
- **A key principle of RG 1.174 is that "when proposed changes result in an increase in core damage frequency or risk, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement"**

From RG 1.174

- **Five principles for making risk-informed decisions**
  - **The proposed change:**
    - **Meets current regulations (unless exemption request)**
    - **Is consistent with the defense-in-depth philosophy**
    - **Maintains sufficient safety margins**
    - **Results in an increase in CDF or risk that is small and consistent with the intent of the Commission's Safety Goal Policy Statement**
    - **Will be monitored using performance measurement strategies.**

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From RG 1.174

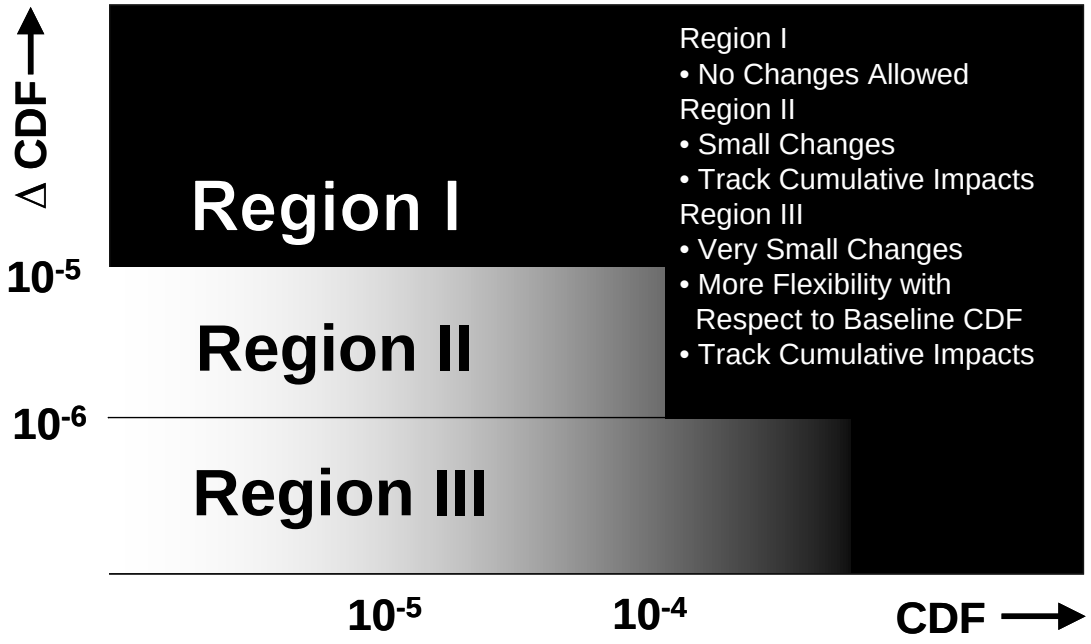

Figure 3. Acceptance Guidelines for Core Damage Frequency (CDF)

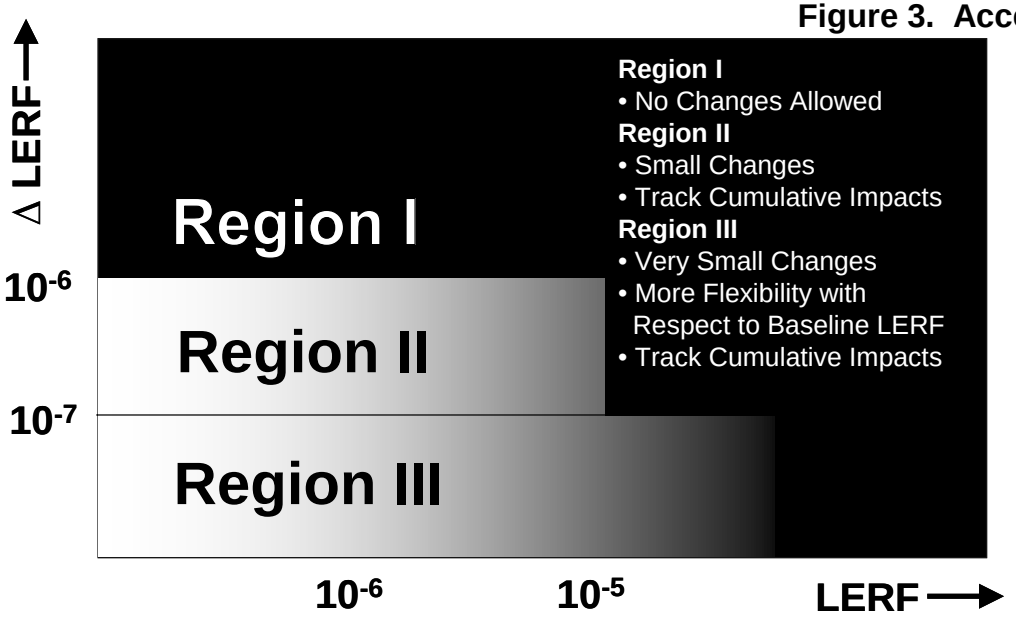

Figure 4. Acceptance Guidelines for Large Early Release Frequency (LERF)

Current Regulatory Guidance for Risk-Informed Initiatives (cont.)

- **Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis"**

- **Risk-Acceptance Guidelines:**
  - **Baseline risk metrics of CDF and LERF**
    AND
  - **ΔCDF and ΔLERF due to change**

- **Basis:**
  - **Increases should be limited to small increments**
  - **CDF threshold related to backfit regulatory analysis guidelines**
  - **ΔCDF limit based on *absolute* change and set close to limit of resolution of PRA models**

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Fundamental Issue before the Staff

- **Current guidance could allow large relative changes to CDF and containment performance for new reactors**

Hypothetical Example

- A new reactor design has a baseline CDF of 1×10^{-7} /yr
- A proposed design change results in a CDF increase of 7×10^{-8} /yr (70% increase).

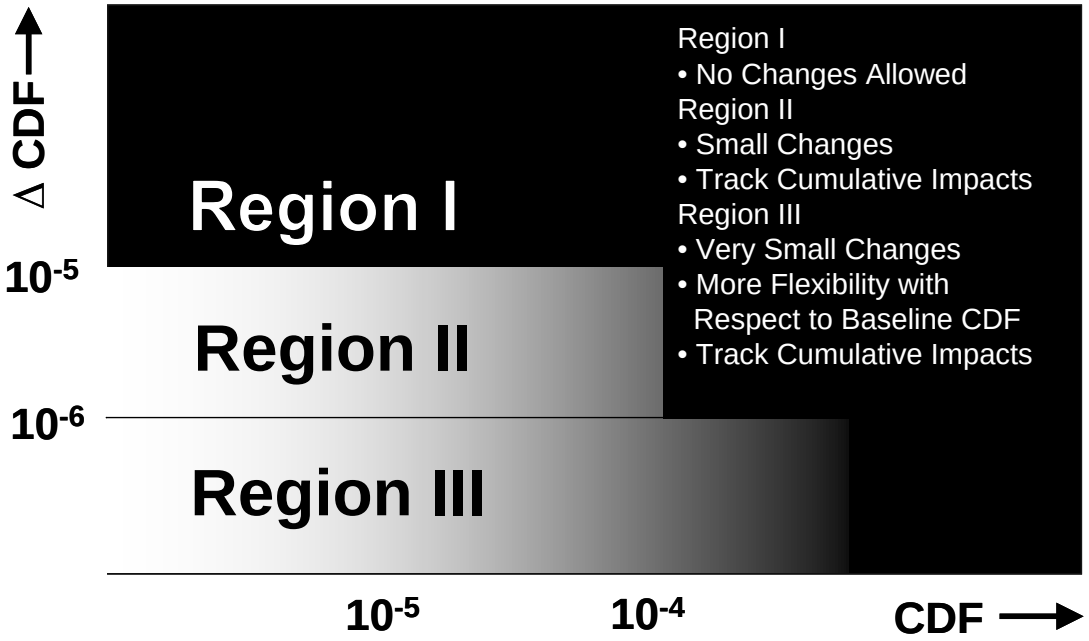
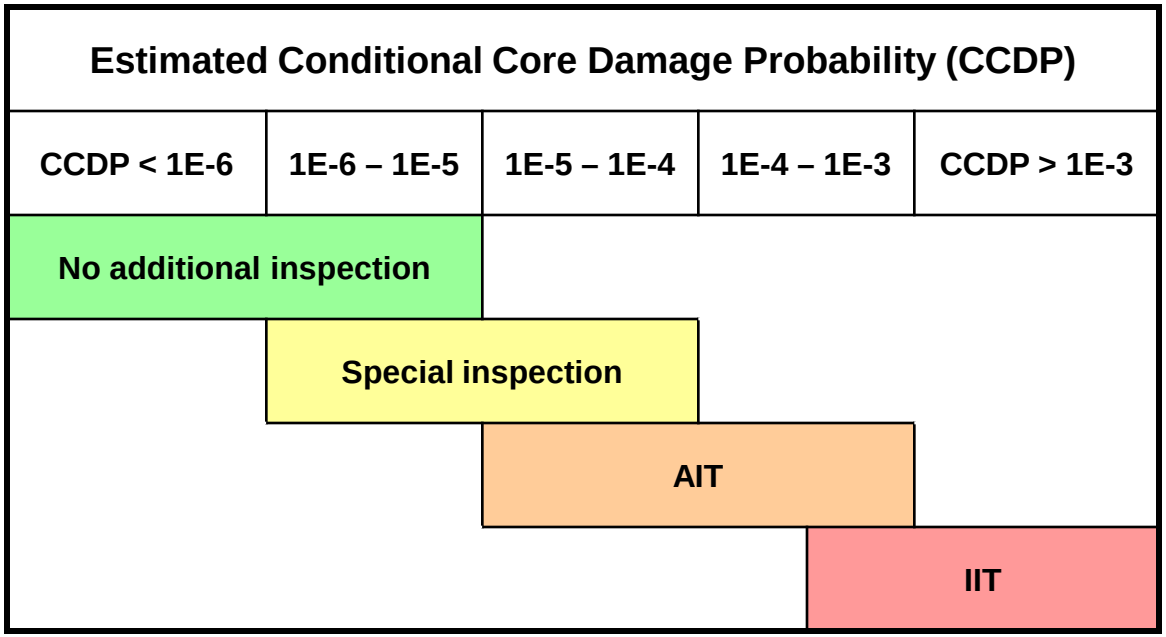


Figure 3. Acceptance Guidelines for Core Damage Frequency (CDF)

Example: MD 8.3 Incident Investigation



New Rx SGTR

Current SGTR

New Rx LOOP

Current LOOP

Approaches Considered

- **No changes to the current regulatory guidance, or *status quo***
  - **Provides incentive to build reactors with enhanced severe accident safety features**
  - **Applicants and licensees who invest in and maintain additional safety features have more flexibility to operate the plants with a reduction in regulatory interactions**
  - **The staff concluded, however, that this approach did not meet Commission expectations in that this approach may not prevent significant decrease in enhanced safety through changes to the licensing basis and plant operations over plant life**
  - **In addition, this approach may not provide for meaningful regulatory oversight that supports NRC's response and inspection**

Approaches (cont.)

- **Modify the risk-informed guidance to include a new lower risk metric for the ROP and changes to the licensing basis**
  - **Supports the Commission's expectation that new plants have enhanced severe accident safety performance and that advanced reactors provide enhanced margins of safety**
  - **Approach goes beyond the Commission's expectation by essentially *requiring* the continued maintenance of the enhanced margin of safety**
  - **Approach may be inconsistent with the Commission's statement on the Regulation of Advanced Reactors in 2008 that the "policy statement does not state that advanced reactor designs must be safer than the current generation of reactors"**
  - **Would create a risk-informed framework that is, in effect, inconsistent with the underlying technical basis for the current thresholds that are derived from the Commission Safety Goals and implemented in RG 1.174**
  - **Could have unintended consequences in that new reactors with enhanced safety features would have less operational flexibility than the current fleet of reactors**

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Approach Selected by Staff

- **Identify specific changes to the risk-informed guidance for changes to the licensing basis that would prevent a significant decrease in the level of safety of the new reactor over its life**

- **Identify specific changes to the risk-informed guidance for the ROP to provide for meaningful regulatory oversight**

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For changes to the licensing basis and operational programs

- **Evaluate how to modify the risk-informed guidance to prevent a significant decrease in the level of safety provided by certified designs**
- **Evaluate how to supplement the CDF and LERF acceptance guidelines to recognize the lower risk profiles of new reactors**
- **Utilize stakeholder involvement in the evaluation and development of detailed changes to risk-informed regulatory guidance**
- **Evaluate the merits of developing additional criteria (e.g., deterministic, defense in depth) to support the change process**
- **Evaluate proposed changes to guidance to ensure that the changes do not create unintended consequences such as creating disincentives for safer designs on the one hand, or allowing degradation of passive safety system performance on the other hand**
- **Develop guidance to implement Section VIII.B.5.c of the design certification rules**

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For changes to the ROP

- **Utilize stakeholder involvement in the evaluation and development of changes to the guidance**
- **Evaluate the criteria for plant placement in the action matrix to assess whether the current process would ensure that operational performance that results in significant reductions in the level of safety provided by the certified design is fully understood by the licensee and NRC and is effectively corrected**
- **Evaluate the merits of developing additional criteria (e.g., deterministic, change in risk) to support NRC's response to findings and performance trends**
- **Evaluate any potential ROP changes to avoid unintended consequences such as creating disincentives for safer designs on the one hand; or allowing degradation of passive safety system performance on the other hand; or diverting the attention of NRC inspectors from issues of higher safety significance on currently operating reactors**

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For changes to the ROP (cont.)

- **Consider the need to risk-weight or otherwise weight findings associated with passive systems to reflect the difficulty of recognizing the degradation of passive systems**
- **Continue to independently assess licensee performance in the area of safety culture since safety culture addresses common underlying factors that affect plant safety**
- **Evaluate maintaining or changing the current thresholds for green, white, yellow, red risk-significant findings and performance indicators, given that low-risk designs may rarely if ever cross the current white threshold**
- **Consider the advantages and disadvantages of applying any potential changes to the ROP to currently operating reactors**

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Summary

- New light-water reactor risk profiles generally lower than currently operating reactors
- Early staff concern with risk metrics for changes to licensing basis and ROP thresholds
- Staff's concerns have evolved to those of how to
  - assure enhanced level of severe accident capability is maintained
  - implement a 50.59-like process
- Staff prepared to engage stakeholders to develop appropriate guidance

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Next Steps

- **Issue final Commission Paper**
- **Staff to continue to engage stakeholders regarding specific changes to industry and NRC guidance documents**
- **Staff to proceed with evaluation of applications for risk-informed initiatives for new reactors**
- **Parallel but extended effort to address ROP issues**

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Back-up slides

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Relevant Commission Policy Statements

- **Severe Reactor Accidents Regarding Future Designs and Existing Plants (1985)**
- **Regulation of Advanced Nuclear Power Plants (1986 & 2008)**
- **Commission Safety Goals (1986)**

Commission's Safety Goals (1986)

- **Commission's SAFETY GOALS specify how safe is safe enough**
  - **Qualitative safety goals**
  - **Quantitative health objectives**
  - **General performance guideline for staff examination**

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Risk Metrics for Operating Reactors

– **Core Damage Frequency (CDF) < 10^{-4} /yr**

  - **Surrogate for latent cancer fatalities in the Commission's quantitative health objective (QHO)**

– **Large Early Release Frequency (LERF) < 10^{-5} /yr**

  - **Surrogate for prompt fatalities in QHO**

Commission's Expectations for New Reactors

Severe Reactor Accidents Regarding Future Designs and Existing Plants (1985)

The Commission "fully expects that vendors engaged in designing new standard (or custom) plants will achieve a higher standard of severe accident safety performance than their prior designs."

Regulation of Advanced Nuclear Power Plants (1986)

"Furthermore, the Commission expects that advanced reactors will provide enhanced margins of safety and/or utilize simplified, inherent, passive, or other innovative means to accomplish their safety functions."

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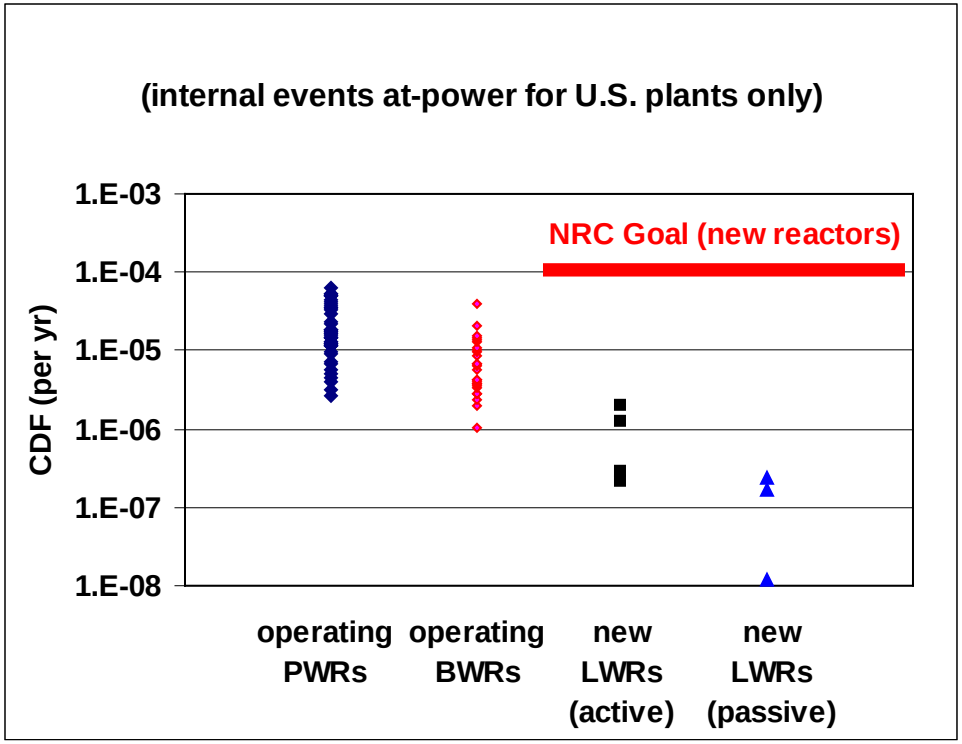
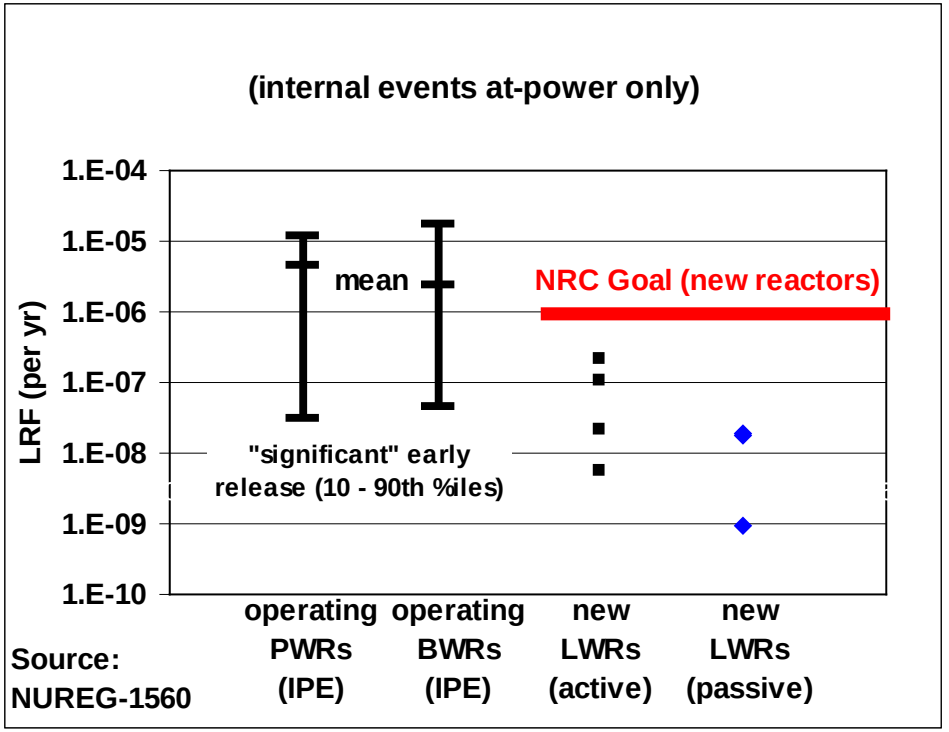
Risk Goals for New Reactors

- **SECY-90-016 Staff Recommendations**
  - **CDF < 1 x 10^{-5} /yr**
  - **LRF < 1 x 10^{-6} /yr**
  - **CCFP less than approximately 0.1**

- **In the associated SRM, the Commission disapproved the use of CDF <1 x 10^{-5} /yr and approved:**
  - **CDF < 1 x 10^{-4} /yr**
  - **LRF < 1 x 10^{-6} /yr**
  - **CCFP less than approximately 0.1**

CDF and LRF by Plant Type





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Status on Resolution of Generic Safety Issue (GSI) 191 Pressurized Water Reactor Sump Performance

Presented by:
Michael Scott
Office of Nuclear Reactor Regulation

Presented to:
Advisory Committee on Reactor Safeguards
June 10, 2010

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Purpose of Brief

- Provide background, current status, planned path forward, and key messages on GSI-191 and Generic Letter (GL) 2004-02

Background

- NRC opened GSI-191, Assessment of Debris Accumulation on PWR Sump Performance, in 1996, and sponsored new research in the late 90s for PWRs
- GL 2004-02 requested licensees perform detailed mechanistic evaluations of emergency core cooling system (ECCS) and containment spray system (CSS) functions and make modifications as needed by December 31, 2007
- NRC staff and ACRS concluded that near-term action to make PWR strainers larger was prudent
- Licensees increased strainer sizes by 1-2 orders of magnitude

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Developments Since 2007

- NRC staff issued revised guidance in early 2008 regarding head loss testing, coatings, and chemical effects
- In many cases, licensee GL responses did not provide detail sufficient to determine that testing and evaluation methods were acceptable, resulting in a large number of requests for additional information (RAIs)
- ACRS questions regarding a 2008 draft safety evaluation for in-vessel downstream effects caused the staff to re-examine its views on the subject
- The NRC staff raised concerns regarding industry zone-of-influence (ZOI) testing

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Zone of Influence

- Some licensees had sponsored jet impingement testing intended to justify reduced ZOIs for specific insulation and coatings
- NRC reviewed the reports and found issues
- Extended discussions were held to resolve issues – some were resolved, others not
- In late 2009, as a result of NRC questions, industry identified a design error with the test loop used for industry ZOI testing - so reduced industry ZOIs were undercalculated
- NRC informed industry that we do not accept the subject reports for insulation and inorganic zinc coatings
- Industry considering additional testing and analysis – could raise additional questions

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In-vessel Effects

- Industry submitted Topical Report WCAP-16793 Revision 1 to address in-vessel downstream effects
- NRC issued RAIs to industry – responses received
- Testing has shown that the two vendors' fuels appear to behave very differently in response to debris intrusion
- NRC believes "cross-testing" would likely show whether the difference is related to fuel design or is a testing issue
- NRC continuing to work with vendors to resolve the unexpected difference in behavior
- NRC working to issue safety evaluation in 2010

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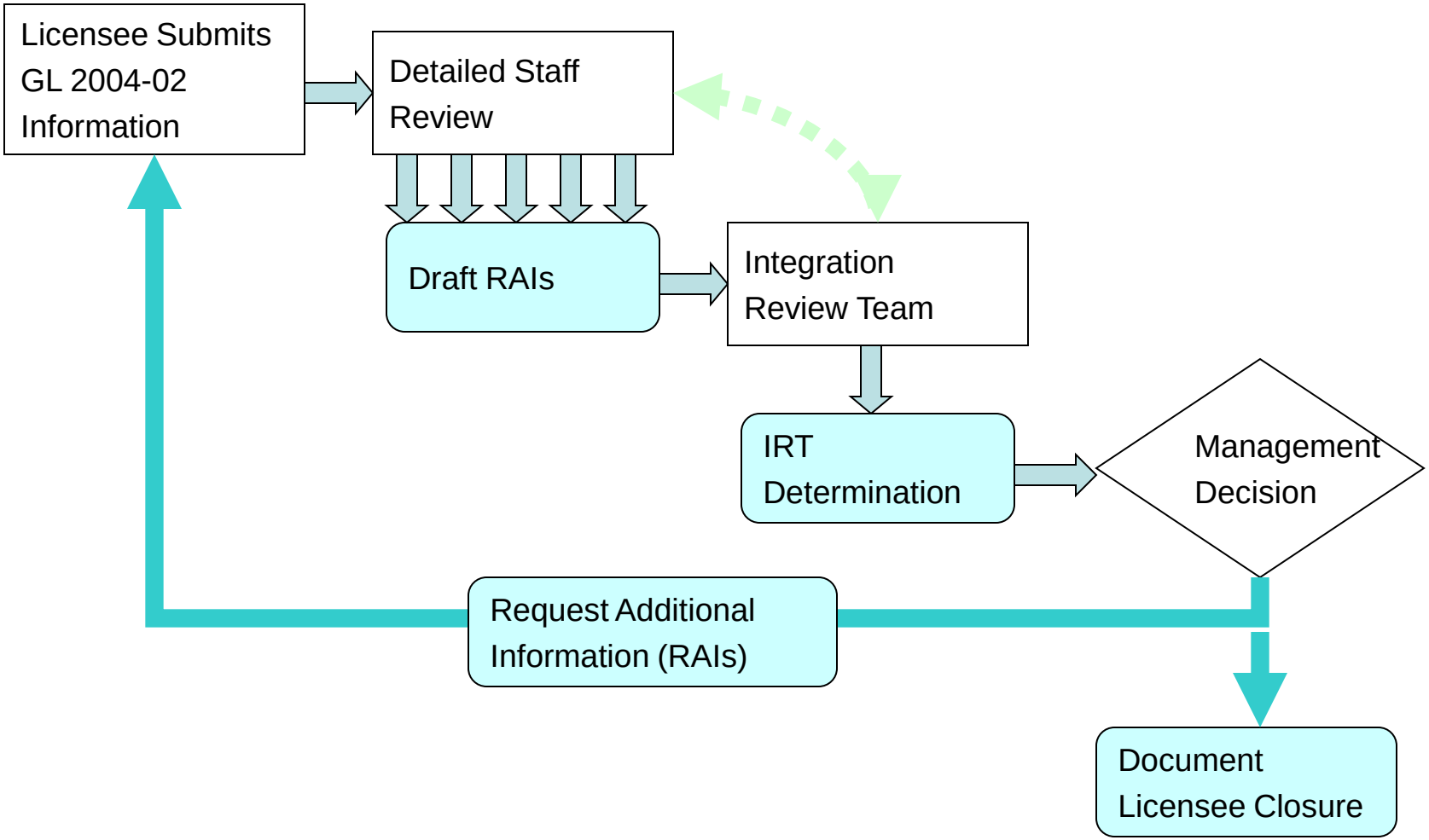
Sump Issue Challenges

- Numerous phenomena – e.g., debris generation, zone of influence, debris characterization, latent debris, debris transport, water hold-up, strainer headloss and vortexing, chemical effects, and downstream in-vessel effects
- No reliable models for some aspects of strainer performance evaluations, so licensees rely on complex scaled-down testing
- Small amounts of certain materials can be very problematic for sump performance
- Head loss behavior is non-linear so margins are difficult to predict
- Testing frequently has resulted in surprises

Review and Closure Process



Recent Developments

- Staff and licensees briefed Commission on GSI-191 status on 4/15/2010
- Licensee presenters stated view that GSI-191 is no longer a safety issue and that staff plans for near-term closure would cause
  - Replacement of effectively all fibrous insulation
  - Large radiation exposures to plant personnel
- Nuclear Energy Institute has proposed that staff allow application of General Design Criterion 4 (leak-before-break) to sump performance evaluations

Staff Requirements Memorandum

- Staff should not issue letters under 10 CFR 50.54(f) pending further Commission direction
- Staff should report to Commission by 8/27/2010 on potential approaches to closure, including:
  - Realistic ZOI
  - Application of GDC-4
  - In-vessel effects
  - Risk-informed resolution (e.g., 10 CFR 50.46a)
  - Alternative regulatory treatment of in-vessel effects
  - Dose impact of resolution options
- Staff is developing requested information and proposed path forward

Resolution Status

- The staff has concluded that strainer performance has been adequately demonstrated (except for in-vessel effects) for 39 of 69 U.S. PWRs
- NRC staff expects some “high fiber” plants may require additional testing and/or modifications to satisfactorily address the generic issue – NRC refusal to accept ZOI reductions has challenged these plants
- NRC staff providing options and recommendations to the Commission to support decision-making on path forward

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Refinements

- Leak-before-break
- Risk-informed ECCS regulations
- Jet impingement testing (already discussed)

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Leak-before-break (LBB)

- Industry has proposed that NRC reconsider application of General Design criterion 4 to sump performance evaluations
- “Dynamic effects associated with postulated pipe ruptures in nuclear power units may be excluded from the design basis when analyses reviewed and approved by the Commission demonstrate that the probability of fluid system piping rupture is extremely low under conditions consistent with the design basis for the piping”
- NRC staff had twice previously rejected application to sump evaluations

Leak-before-break (Continued)

- Original intent of LBB was to allow removal of specific equipment (pipe whip restraints, etc.) whose absence would potentially enhance safety
- If credit sought and approved, could remove some break locations from consideration for sump evaluations
- Major challenge to approve this credit for sump performance evaluations

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Existing ECCS Regulations

- Existing regulations require evaluation of a double-ended guillotine break of the largest pipe in the reactor coolant system as a design basis loss-of-coolant accident (LOCA)
- Performance demonstration for design basis LOCAs must include
  - assumption of loss of offsite power,
  - assumption of the worst single failure, and
  - credit only for safety-grade systems

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Proposed Risk-informed ECCS Regulations

- Proposed risk-informed ECCS regulations would change the size of the largest pipe break that must be evaluated as a “design basis” LOCA (“transition break size”)
- For breaks larger than the transition break size, evaluations can be performed:
  - using realistic inputs for strainer performance
  - without inclusion of a single failure
  - without assuming that offsite power is lost and taking credit for non-safety equipment

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Proposed Risk-informed ECCS Regulations (cont'd)

- Transition break size for PWRs is defined in 10 CFR 50.46a as the "largest attached pipe to the reactor coolant system" (pressurizer surge line)
- If implemented, rule could assist some licensees, though they would still need design basis analyses for smaller breaks, which could pose problems
- NRC staff expects to send proposed rule to the Commission for approval December 2010

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Path Forward

- Uncertainties in strainer performance have challenged closure of the debris clogging issue for some plants
- Inadequate strainer performance can challenge long-term core cooling and maintenance of core integrity
- Plant-specific issue resolution will continue, consistent with Commission direction
- In-vessel effects issue needs to be resolved
- After all licensees have been issued closure letters, GL 2004-02 will be formally closed
- Some plant modifications may need to be made after planned issue closure – NRC will track all commitments to completion

Conclusions

- NRC closing GSI-191 one plant at a time – over half complete (with exception of in-vessel effects)
- Remaining plants are generally those with most fibrous and particulate insulation
- NRC staff providing options and recommendations to support Commission direction on path forward